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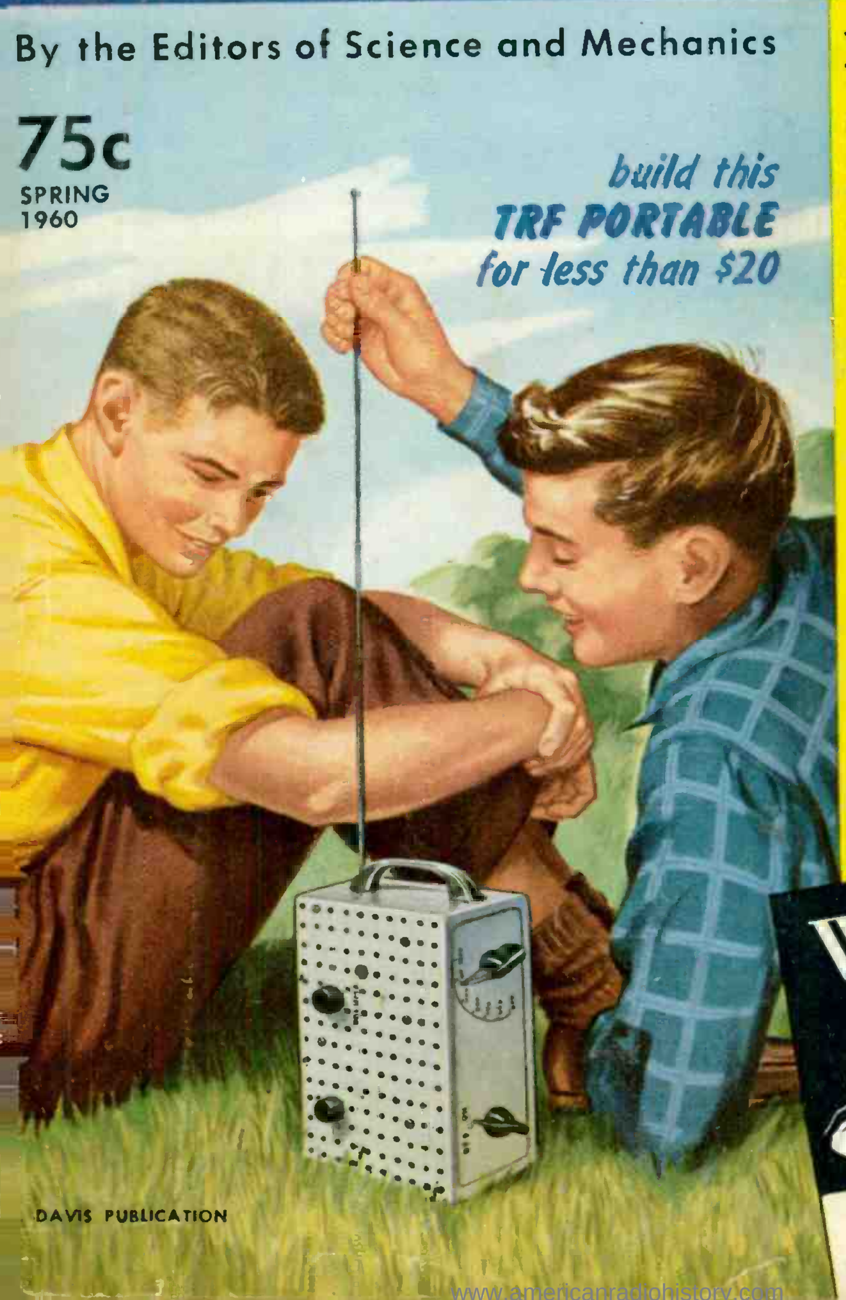

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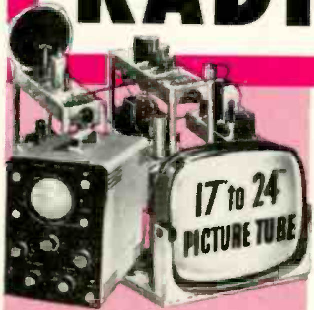
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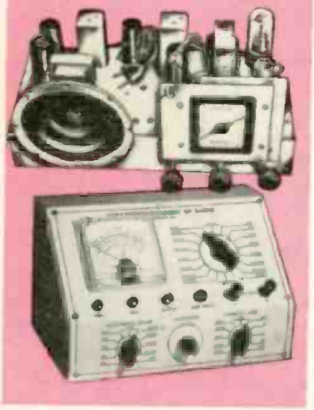


Radio-Television
TRAINING PLAN

RADIO-TV EXPERIMENTER

Spring 1960 Edition

Cover by Harold R. Stluka

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Herb Siegel, Associate Editor, Handbooks
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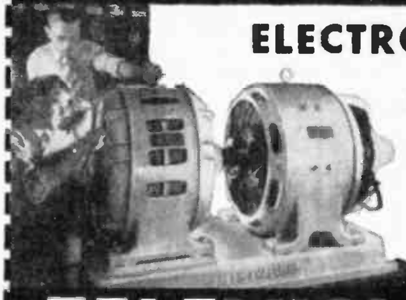


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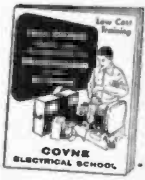

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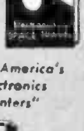

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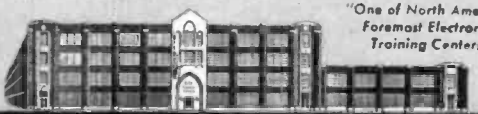

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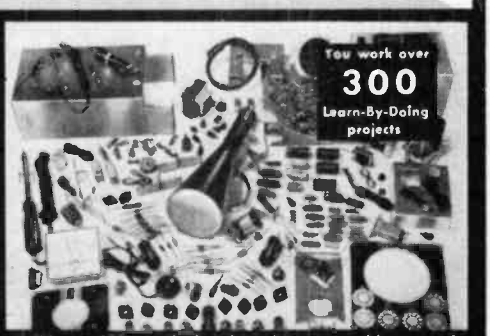

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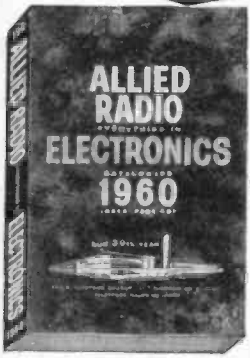
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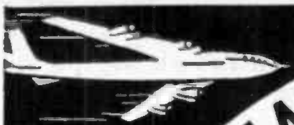

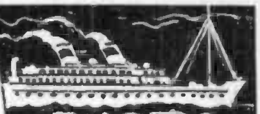

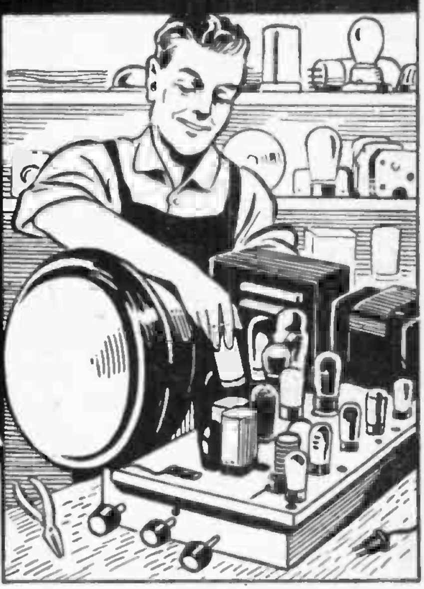


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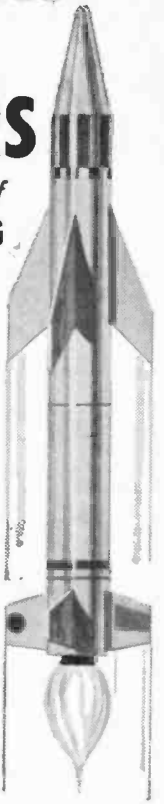

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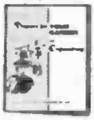

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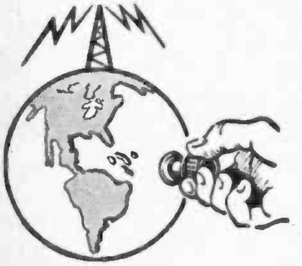

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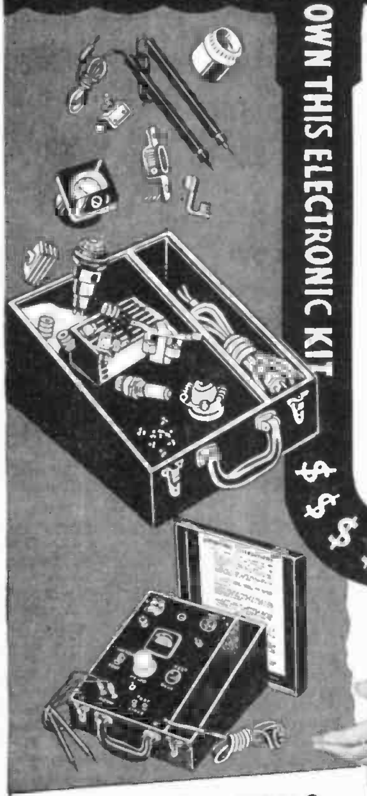

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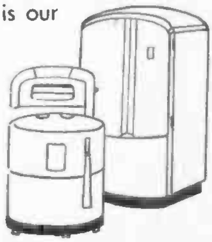

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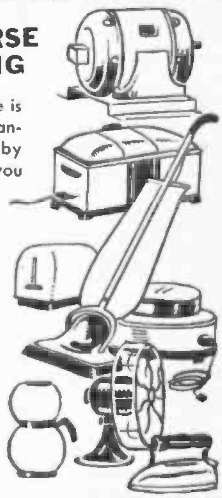

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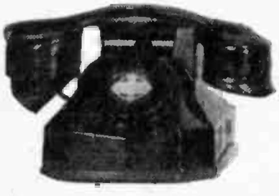

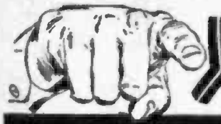


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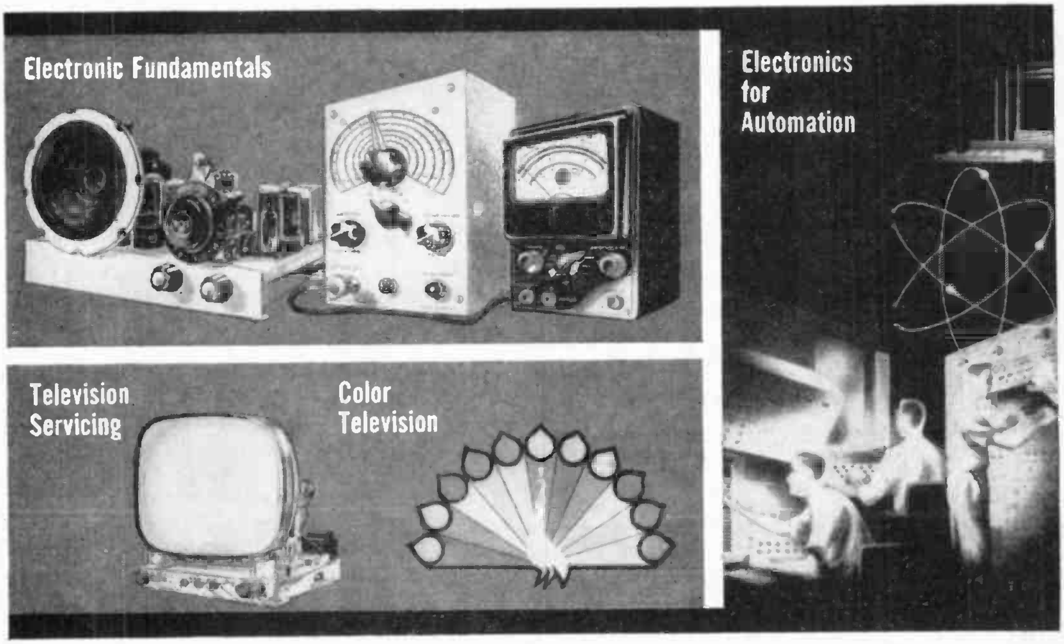

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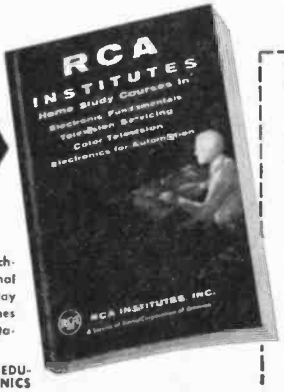

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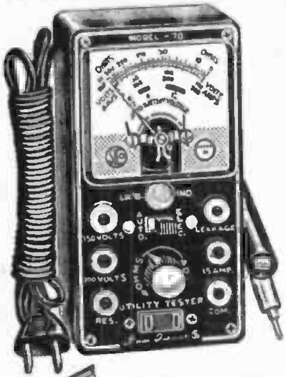

As an electrical trouble shooter the Model 70:

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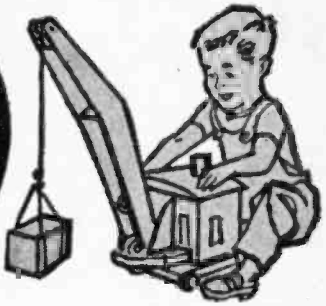

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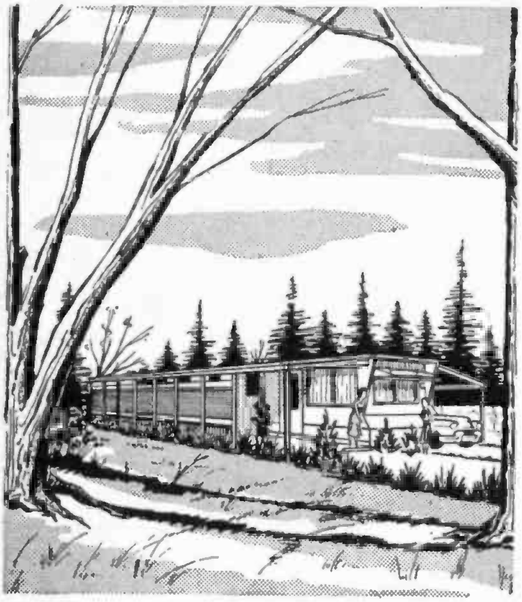

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You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

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You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs on the sets that you construct. You will learn symptoms and causes of trouble in home, portable and car radios. You will learn how to use the professional Signal Tracer, the unique Signal Injector and the dynamic Radio & Electronics Tester. While you are learning in this practical way, you will be able to do many a repair job for your friends and neighbors, and charge fees which will far exceed the price of the "Edu-Kit." Our Consultation Service will help you with any technical problems you may have.

J. Stataitis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend $240 for a Course, but I found your ad and sent for your Kit."

FROM OUR MAIL BAG

Ben Valerio, P. O. Box 21, Magna, Utah: "The Edu-Kits are wonderful. Here I am sending you the questions and also the answers for them. I have been in Radio for the last seven years, but like to work with Radio Kits, and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

Robert L. Shuff, 1534 Monroe Ave., Huntington, W. Va.: "Thought I would drop you a few lines to say that I received my Edu-Kit, and was really amazed that such a bargain con be had at such a low price. I have already started repairing radios and phonographs. My friends were really surprised to see me get into the swing of it so quickly. The Troubleshooting Tester that comes with the Kit is really swell, and finds the trouble, if there is any to be found."

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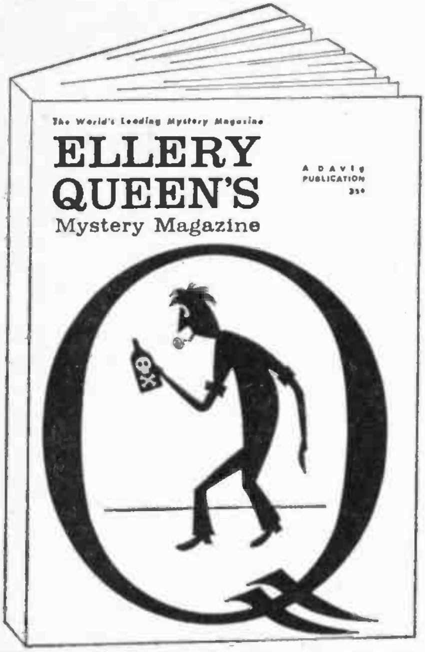
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CAREERS IN ELECTRONICS


Gem
hunter's
guide

Terrific TRF Portable

You'll find the Terrific outstanding from the standpoints of sensitivity, selectivity, tone and volume—and it costs less than $20

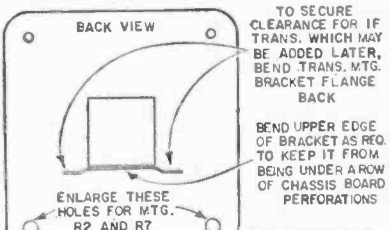
By FORREST H. FRANTZ, Sr.

The Terrific has a reflexed RF-audio stage, transformerless loudspeaker operation, and is laid out for growth to a superhet or communications receiver.

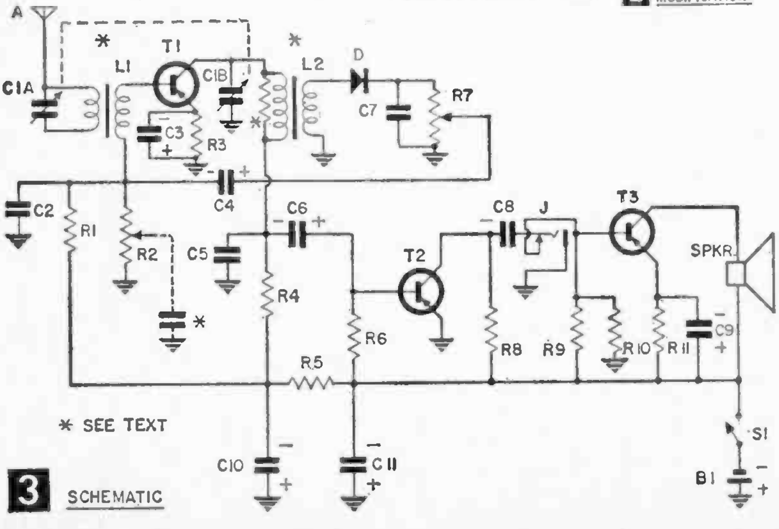
IF YOU want a portable broadcast band receiver, but wish to avoid the cost and complexity of a superhet, the Terrific is the portable for you.

The first transistor, T1 (see Fig. 3.) performs the dual function of RF amplifier and first audio amplifier. The audio signal is introduced to T1 through capacitor C4. The audio output signal of T1 appears across R4 and is transferred to driver transistor T2 through capacitor C6. The RF signal is introduced to the base of T1 and appears across L2 after amplification. The high-Q tuning circuits C1A-L1 and C1B-L2 assure sharp tuning and high gain. Diode D is the detector. It rectifies the RF signal, and capacitor C7 smooths the peaks of the signal to provide an audio signal across volume control R7.

Transistor T2 is the audio output stage driver. The closed circuit jack between the driver and output stage permits headphone reception. The output stage (transistor T3) drives the loudspeaker directly. This stage is operated class A, but current consumption has been minimized. Current drain for the entire set is approximately 20 *ma*. A 45-ohm voice coil intercom-type speaker permits direct drive. Although this arrangement results in a comparatively low efficiency output impedance match, it eliminates the need for a space-consuming transformer or a miniature transformer which would compromise the frequency response and result in poor tone.

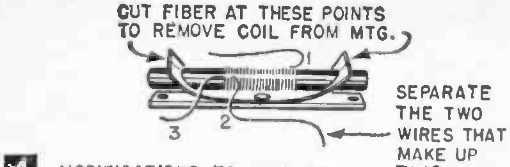


2 LOUDSPEAKER MODIFICATION

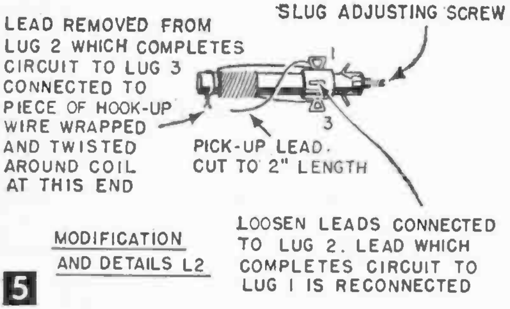


3 SCHEMATIC

Construction. Cut off the shaft of on-off switch S1 at the groove nearest the switch. Cut the shaft of tuning capacitor C1 to a 13/16-in. length. Cut the shafts of the volume control R7 and the control R2 to 7/16-in. lengths. Enlarge the speaker mounting holes on the voice coil connection side of the speaker to ¼ in. and mount R2 and R7 in these holes. Bend out-



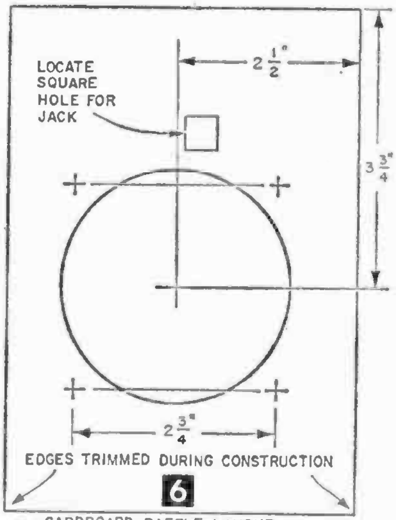
4 MODIFICATIONS TO COIL L1



MODIFICATION AND DETAILS L2
5

put transformer mounting flanges on the speaker up toward R2 and R7 slightly as shown in Fig. 2.

Remove the antenna loopstick coil L1 from its mounting board by cutting into the fiber strip that holds it on the board (Fig. 4). Separate the two leads that are soldered together to form the tap on L1. The wire on this coil is litz wire. Try not to break any of the strands, but if you do, apply solder further back on the lead ends.



6
CARDBOARD BAFFLE LAYOUT

Now disconnect the two leads connected to lug 2 of the interstage coil L2 (Fig. 5) and separate them. The loose lead which makes a complete circuit to lug 1 is reconnected to lug 2. Connect the other lead (which makes a continuous circuit to lug 3) to a piece of hook-up wire twisted around the end of the coil as shown. Cut the antenna pick-up lead soldered to lug 1 of the coil to a length of 2 in. for connection to the stator of C1B when the radio is assembled. Set the slug adjusting screw to protrude ¼ to ⅜ in. out of the coil.

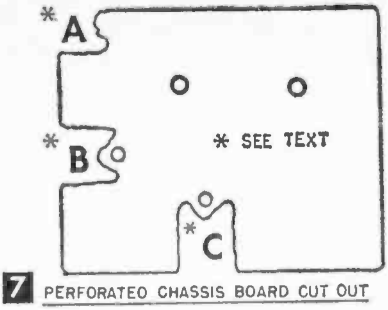
Next cut out and drill the panel and cabinet sides. These should not be metallic since complete metallic enclosure would shield the antenna coil from radio signals. Perforated Masonite was used for the top panel of the original model to simplify construction. Solid or perforated Masonite may be used for the sides. Although the Masonite perforations in front of the speaker are utilized for sound transmission, other perforations must be blocked. A cardboard backing sheet was used to prevent front to back speaker sound interference; Fig. 6 shows the layout. Use a taper reamer to make the larger holes in the Masonite. The metal cabinet back is part of a commercially available cabinet, but you may cut and bend your own if you wish.

Cut the perforated Bakelite chassis board with a hacksaw and pocket knife (see Fig. 7). (Cut-outs A, B and C mount IF transformers if the set is converted to a broadcast superhet or a communications superhet, a procedure to be described in a future issue. They may be omitted if you do not wish to have conversion capability.)

Fasten the cardboard baffle to the perforated cabinet top with Duco cement. Mount the speaker, phone jack, tuning capacitor, and antenna coil as shown in Fig. 8. The side of the speaker on which the volume controls are mounted is held in place by a small metal clamp. This may be made from a strip of metal or by rebending a small bracket. Place enough washers between the tuning capacitor and the Masonite board to obtain a ¼-in. space between them. Fasten the Masonite cabinet front side to the tuning capacitor with a machine screw. Join the two pieces of Masonite to a bracket at the other end. Fasten the antenna coil to the cardboard with Duco cement in the position shown in Fig. 8.

One small piece of perforated Bakelite should be fastened to the antenna coil with Duco, another should be fastened above the speaker clamp with a nut to provide necessary lead tie-down points. Fasten the Bakelite chassis board to the speaker with a machine screw in one of the tapped holes on the back of the speaker. If the output transformer mounting flange on the speaker projects into the chassis board cutouts, bend it further to allow clearance. The chassis screw also fastens a strip of metal ½ x 1½-in. cut from a tin can. This strip is the common ground tie-down point. Cut gashes into the strip along all four sides so that you can crimp wires in place.

Try to make your wiring and parts placement conform as nearly as possible to that shown in Fig. 8 if you wish to convert the set later. Make connections on the chassis board by passing the parts pigtails and wire lead ends through perforations. The tight mechanical fit that results when two or three



7 PERFORATEO CHASSIS BOARD CUT OUT

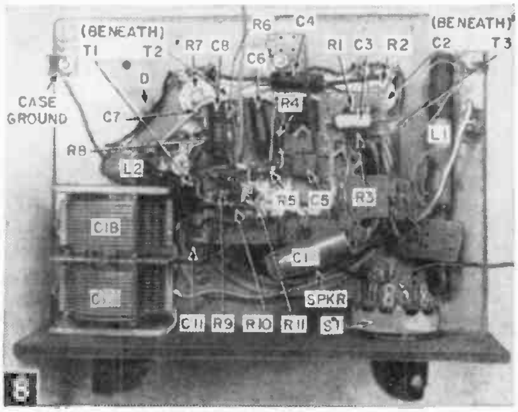
parts pigtails are passed through one hole are very reliable electrically, but solder them for extra assurance. Cut excess lead lengths protruding through the bottom of the chassis board to about 1/16 in. Be careful to avoid passing leads through perforations so situated that leads can short circuit to the speaker frame.

Most of the resistors and capacitors mount above the chassis board as viewed from the back of the set. The transistors mount underneath. Leave transistor T1 pigtails at least an inch long for easy conversion to a superhet receiver later.

Mount the interstage coil, L2, near the back of the tuning capacitor. The resistor shown connected across the primary in the circuit diagram should be connected only if the set oscillates after it has been placed in the cabinet and aligned. It's value will be between 10K and 100K. Orient the coil approximately as shown in Fig. 8. Fasten a piece of aluminum foil 1¼ x 3 in. to the cardboard beneath the coil with Duco cement and make a ground connection to the ground tie-down strip from the bracket at the rear of the panel. Make battery leads about 9 in. long.

Three sections of the on-off switch are unused in this project. (They will be used if the set is expanded.) Set the on-off knob pointing straight up and down when the switch is "off." Then, when the switch is turned "on" it will point to the machine screw adjacent to it. Paint the head of this screw red to make it obvious when the set is "on."

The shaft of the tuning capacitor specified is slotted for a spring type push-on knob. If you wish to use a set-screw type knob, build the shaft up to full round with solder. Regardless of the knob you use, a plastic pointer may be fastened to it. The fine black line on the pointer is made by scratching the line into the plastic with an ice pick and flowing India ink into the scratch.



8

Parts layout of the Terrific.

One of the controls, R2, is used only as a fixed resistance in this circuit. It may be replaced with a fixed resistance of 10K if you don't intend to change the set to a communications superhet receiver later. Or, you may use it as a tone control of sorts by connecting a capacitor of 0.1 to 1 mfd to it as shown in dotted lines on the circuit diagram.

The battery B1 consists of six large penlite cells connected in series to provide 9v. To fasten the six cells together, lay them side by side on a smooth surface and drop a quantity of Duco cement between them. The negative ends of the batteries should be cleaned with a small file before the battery connections are soldered. Use as little heat as possible to solder these connections.

Drill two ¼-in. holes in the metal cabinet back adjacent to the carrying handle to provide access to the antenna and RF trimmers, and drill a hole in the bottom to provide access to the RF coil-adjusting screw.

A whip-type antenna (see Materials List) was used on this set. The antenna is furnished with a jack and plug. Mount the jack and solder the plug into it. The antenna may be screwed onto the plug for non-portable use. For portable use, the antenna is left fastened in the two fuse clips provided on the outside of the Masonite back as shown in Fig. 9. The clip nearest the antenna coil is used for the connection.

To place the radio in the cabinet, place a piece of thin cardboard 2½ x 8½ in. along the rear of the metal cabinet and extending about ½ in. up the sides. Place the 9-v. battery on the cardboard against the cabinet back and ends. Place a strip of wood ¼ in. thick and about 6¾ in. long over the battery. Clamp the strip to the metal cabinet with a screw through the cabinet hole between the batteries. Push the battery leads back into the cabinet so that they won't interfere with the operation of the tuning capacitor. Ease the radio into the cabinet and fasten with self-tapping screws.

Since the radio may be used in the "handle up" or "flat on its back" positions, provide rubber feet for both positions to avoid scratching furniture. (Fasten grommets to the cabinet with rubber-to-metal cement.) Paint or ink the tuning dial calibration on the cabinet front.

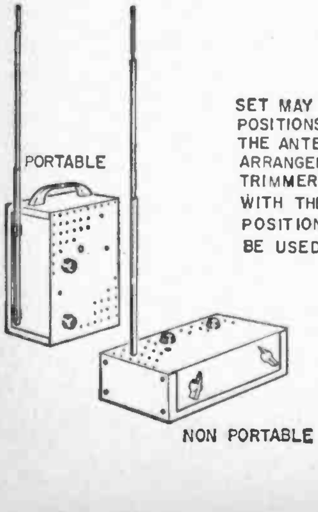
Alignment. Since there's no IF alignment

MATERIALS LIST—TERRIFIC

Desig.	Description
	(½ Watt Carbon Resistors)
R11	270 ohms
R5	470 ohms
R3, R8	1 K
R4, R10	2.2 K
R9	3.3 K
R1	47 K
R6	68 K
R2, R7	10K volume control (Lafayette) VC-34)
C2, C7	.001 mfd. subminiature capacitor (Lafayette C-609)
C5	.01 mfd. subminiature capacitor (Lafayette C-612)
C4, C6	4 mfd., 6v. subminiature capacitor (Lafayette CF-101)
C8	10 mfd., 15v. electrolytic capacitor (Lafayette CF-122)
C3, C9	30 mfd., 6v. subminiature capacitor (Lafayette CF-104)
C10	100 mfd., 15v. electrolytic capacitor (Lafayette CF-126)
C11	160 mfd., 15v. electrolytic capacitor (Lafayette CF-127)
C1A-B	2 gang 365 mmf. variable capacitor (Lafayette MS-142)
T1	Texas Instruments 2N252 transistor
T2	Raytheon CK722 transistor
T3	Texas Instruments 2N185 transistor
D	Sylvania IN 34A germanium diode
B1	battery, 9 volts (6 Ray-O-Vac 7R, Burgess Z or Eveready 915 penlite cells in series)
J	miniature closed circuit phone jack (Telex JPM-01)
L1	antenna coil—see text for modification (Miller 2001)
L2	interstage coil—see special instruction in text (Miller 2002 antenna coil)
S1	4P, 2T switch and knob—use one section for on-off switching (Mallory 32 42J)
SPKR	3½" speaker, 45-ohm voice coil (Quam 3A07Z45)
1	perforated Bakelite chassis board (Lafayette MS-305)
1	perforated Masonite board (Lafayette ML-81)
2	miniature knobs (Lafayette MS-185)
1	knob for tuning dial
1	metal cabinet back (Use back of ICA 29343 or make)
1	handle for cabinet (available in hardware or variety store)
A	whip antenna (Lafayette F-440)

or mixer tracking to worry about, alignment procedure is extremely simple. The preliminary adjustment of L2 described in the construction procedure will cause the set to be nearly in alignment at the low end of the broadcast band when construction is completed. The set should be mounted in the cabinet for final alignment. Align the high-frequency end of the band by tuning in a weak station between 1400 and 1550 kilocycles and adjusting the trimmer capacitors on the side of the tuning capacitor C1 for maximum output. The antenna trimmer will seem to have the greatest effect on tuning. Adjust it till the station comes in at a point on the dial where the RF trimmer tunes the signal to maximum without being all the way in or out. Then tune the set to a weak station between 600 and 700 kilocycles and adjust the tuning slug of the interstage coil L2 for maximum output. Reset the tuning dial to the high frequency end of the broadcast band and readjust the RF trimmer for maximum output.

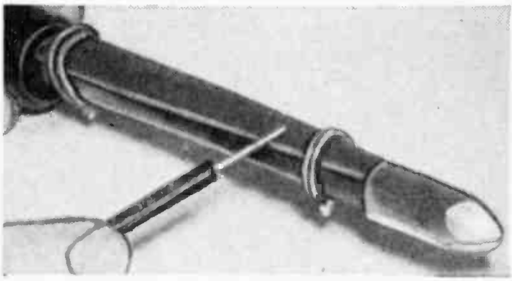
Out of the metal cabinet the receiver may oscillate at the higher frequency tuning capacitor settings. If it doesn't oscillate when you fasten it in the cabinet and align it, this doesn't matter. But, if the set oscillates when fastened in the cabinet, you'll have to take remedial measures. First, check to be sure that the lead from L2 to the collector of T1 is as short as possible and is dressed against the speaker frame. The same applies to the lead to C1B. If the set still oscillates when it's fastened in the cabinet, connect a 100K resistor across the primary of L2 as shown in the circuit diagram. If oscillation still occurs, try 47K, 33K, and 10K, in turn till oscillation is eliminated. In the original receiver, the 100K resistor did the trick.



SET MAY BE USED IN EITHER OF POSITIONS SHOWN BY CHANGING THE ANTENNA MOUNTING ARRANGEMENT. THE ANTENNA TRIMMER SHOULD BE TUNED WITH THE ANTENNA IN THE POSITION IN WHICH IT WILL BE USED MOST FREQUENTLY

9

Iron Does Double Duty



• Quite often a small file is needed to file corroded parts and wires clean before the application of solder. If you want to eliminate the necessity of hunting up such a file every time you have a soldering job to do, attach one to your iron's barrel with heavy solid wire. (You may have to break off the file's tang if it is longer than your iron's barrel.)—J.A.C.

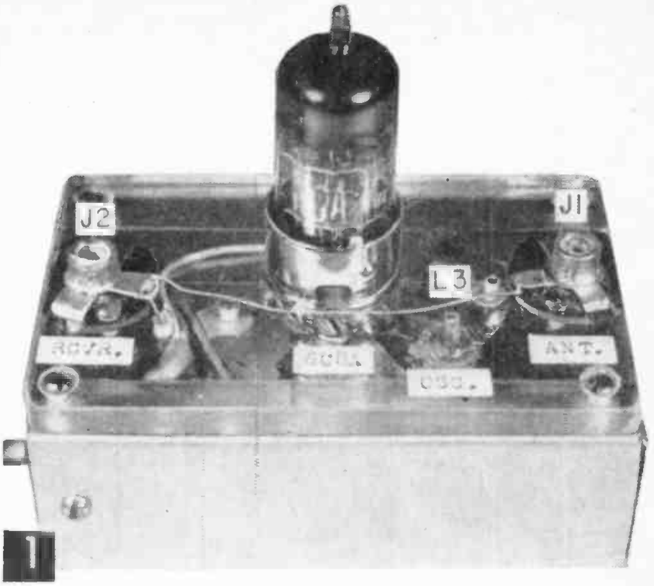
Extending Radio Battery Life

• Many portable battery-operated receivers tend to cease operation long before the batteries have terminated their useful life. This is usually due to the set's oscillator shutting off because of reduced voltages on the tube elements. By increasing the signal feed-back voltage however, the oscillator will continue operation even on reduced voltages. A few extra turns of wire added to the "tickler" winding of the oscillator coil will boost the feedback enough to insure a longer battery life, and considerable saving in replacement dollars.

SIX-METER Amateur Band Converter

If you're a Technician or General Class Amateur interested in six-meter operation, this simple low-cost converter will prove a boon to you for either fixed or mobile use

By JOE A. ROLF, K5JOK



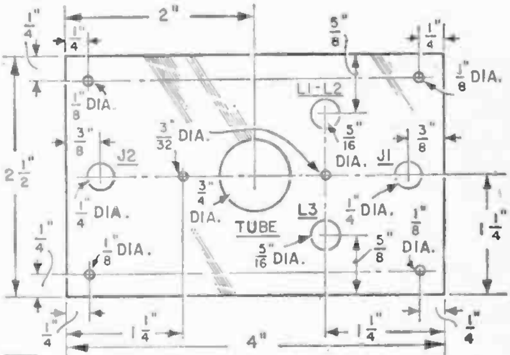
1 Low in cost and simple in construction, the six-meter converter measures only 2½x4 in. when placed in its homemade 1/32-in. aluminum cabinet. With the tube shield in place it is less than 3½ in. high. The cabinet is made in one piece with the exception of the removable end-plate through which the power cord passes.

THIS converter can be constructed with parts from most ham scrap-boxes, but even with new parts its cost will not run much over $5! Naturally, with only one tube, it is not as hot as many commercial multi-tube units, but it will generally hold its own with crystal-controlled converters costing much, much more.

A 6U8 triode-pentode is used—the pentode section as a mixer, the triode as a tunable local oscillator. Tuning is done with the receiver to which the converter is connected, as with a crystal-controlled unit. But with the local oscillator tunable from 47 Mc. to 54 Mc., a number of different intermediate frequencies can be employed.

With a home broadcast or car radio, for example, the oscillator can be set at 49.4 Mc. so that 49.9 Mc. to 51 Mc. is received when the receiver is tuned across the broadcast band. With a simple screwdriver adjustment, the oscillator frequency can be changed for coverage of any desired 1-megacycle segment of the band. When used with a communications receiver, the oscillator can be set at 48 Mc. and the entire six-meter band covered by tuning from 2 Mc. to 6 Mc. This higher IF not only gives continuous tuning, but provides better image rejection than the commonly used lower IF.

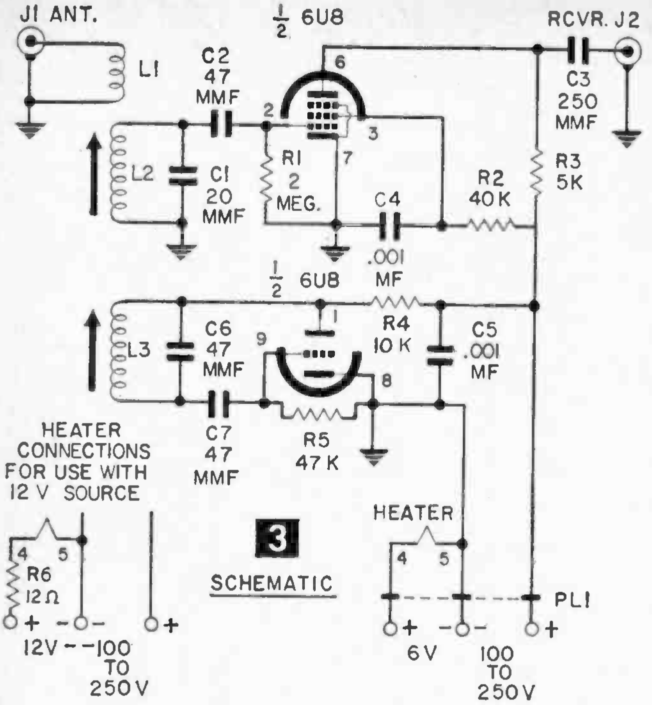
A 2½ x 4-in. piece of ¼-in. Plexiglas, available at hobby shops and many radio supply houses, is used for the chassis. This material can be worked with simple hand tools and greatly simplifies construction. Construction, however, can be modified to allow the use of a mini-box or similar metal box.



2 CHASSIS (¼" PLEXIGLAS)

Details of the chassis are shown in Fig. 2. Screw holes for the tube socket and antenna jacks, J1 and J2, are not shown and should be positioned for the particular sized component used; ⅛ x ¼-in. machine screws mount all parts. By using a 3/32-in. hole, the screws will tap themselves into the soft Plexiglas. The four ⅛-in. holes are for mounting the chassis to its cabinet with ⅛ x ½-in. screws.

The tube socket is placed in the middle of the chassis, the input and output jacks are centered at each end of the chassis, ⅜-in. from the edge. Phono jacks are used and are mounted on top of the chassis with the solder lugs extending through a ¼-in. hole in the chassis. One jack is designated "Antenna Input", the other, "Converter Output." If the converter is intended primarily for mobile use, auto radio antenna jacks should be used in place of the phono jacks for direct connec-



3 SCHEMATIC

tion to the auto radio, or auto antenna.

Mount a three-lug terminal strip on the underside of the chassis between the output jack and tube socket. The ground (B-minus) and B-plus leads of the power cord and R3 connect to this strip. Capacitor C3 connects from the plate lead end of R3 to the lug on the output jack.

The oscillator and mixer coil forms are mounted midway between the tube socket and the antenna jack. It should be noted that two different types of slug-tuned forms were used. These were ¼-in. dia. scrap-box components, one from a discarded BC radio, the other from a TV set. The form for the oscillator coil had a press-in type mounting and was pressed into a 5/16 in. chassis hole and secured with Duco cement. The other, a plastic form, had no mounting clip and was glued to the chassis with the slug screw pointing downward. A hole in the bottom of the cabinet permits adjustment of the slug.

Two dissimilar coil forms were used to illustrate the two methods which can be employed in mounting the coils, depending upon the forms available. In the event your scrap-box does not contain suitable slug-tuned forms, they can be obtained from a radio service shop for only a few cents. Most servicemen save discarded coil forms and you'll probably have several dozen to choose from.

For simplest construction, lay out the converter as shown in Figs. 1, 2 and 4. However, the only critical placement (besides keeping leads short) is in the positioning of the RF coils. The mixer and oscillator coils should be about 1¼-in. apart as there is no oscillator voltage injection other than by the coil coupling, tube capacity, and stray circuit capacity. Any form of direct coupling of the oscillator to the mixer circuit will result in excessive pulling (a change in oscillator frequency when the mixer is tuned). The oscillator has sufficient output for good conversion efficiency without direct connection to the mixer.

The cabinet is a three-sided box of 1/32-in. aluminum (see Fig. 5). The power cord of the unit passes through the removable end of the cabinet without unsoldering the power cord plug. As with the chassis, the ⅛-in. machine screws tap themselves into 3/32-in. holes.

The converter is powered by the receiver with which it is used. Requirements are low; 100 to 250v for the plate supply and 6.3 (at 450 ma.) for the filament. These voltages are obtainable from most receivers with the aid of their schematic. A power cord from the shack's receiver or the auto radio will also prove handy for powering other equipment.

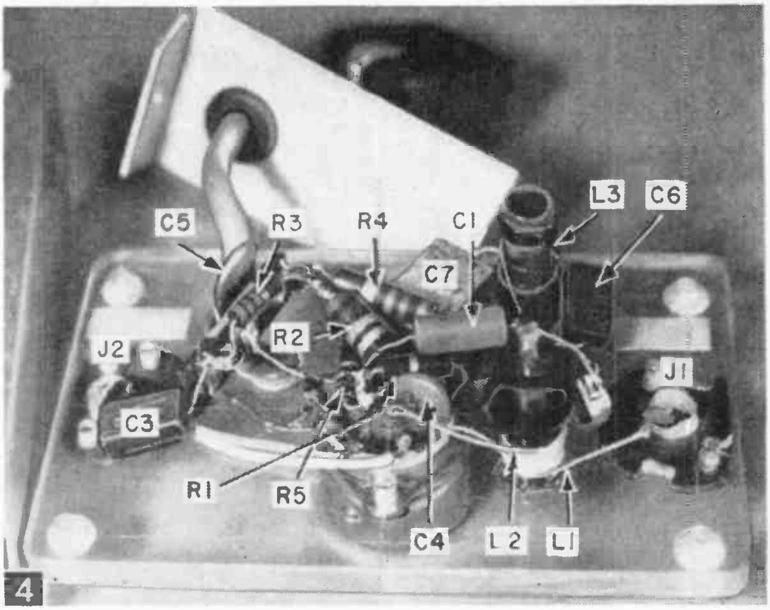
The only difficulty that might be encountered will be with a receiver having 12-v heaters or with an *ac-dc* set. In the case of a 12-v BC receiver or auto radio, the filament dropping resistor (R6) should be added to the circuit as shown.

If used with an *ac-dc* type receiver, B-plus voltage for the converter can be taken from

MATERIALS LIST—6-METER CONVERTER

Desig.	Description
C1	20 mmf. ceramic or mica
C2	47 mmf. mica
C3	250 mmf. mica
C4	.001 mmf. disc ceramic
C5	.001 mmf. disc ceramic
C6	47 mmf. ceramic or mica
C7	47 mmf. mica
J1, J2	standard phono jacks
L1	3 turns #28 DCC wire, close-wound next to grid end of L2
L2	4 turns #28 DCC wire, close-wound on ½" slug-tuned form
L3	3 turns #22 DCC or enamel wire, close-wound on ¼" slug-tuned form (see text)
PL1	3-contact power plug (Cinch-Jones P-303-FHT & S-303-FHT)
R1	2 megohm, ¼ watt
R2	40,000 ohm, ½ watt
R3	5,000 ohm, ½ watt
R4	10,000 ohm, ½ watt
R5	47,000 ohm, ¼ watt
R6	(for 12-v heater source only) 12 ohm, 4 watt
1	6U8 tube
1	small button 9-pin socket, with shield
10	⅛ x ¼" machine screws
4	⅛ x ½" machine screws
1 pc	¼" Plexiglas, 2½ x 4"
1 pc	1/32" (.0312) aluminum sheet, 6 x 7"

An underside view of the Plexiglas chassis showing the placement of components. Three-conductor cable passes through the chassis end-plate.



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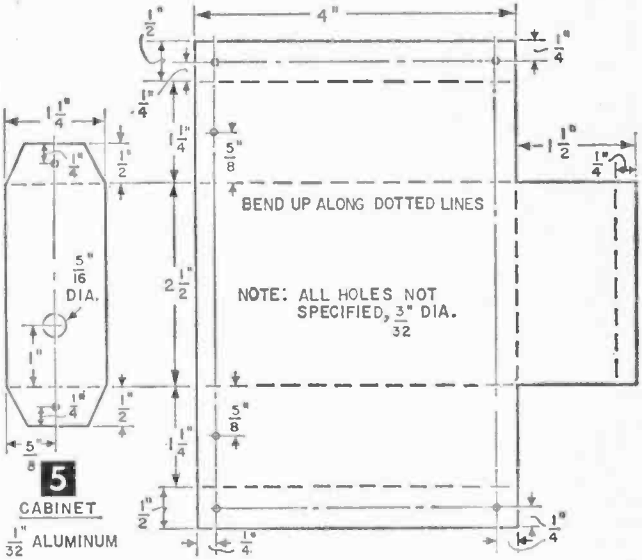
the receiver, but the ground connection of the converter's antenna coupling coil (L1) should be made with a .001 mfd. capacitor. Filament voltage will have to be supplied by an external 6.3-v filament transformer, or a 6-v battery.

A 2-ft. piece of 52-ohm coax connects the output of the converter to the receiver antenna terminals. This lead can be any convenient length, though an excessively long lead will result in some loss of output. The input lead will depend upon the type of antenna used. Both leads should be fitted with phono plugs.

Alignment of the converter is best done with the aid of a grid dip meter. Since this is a popular piece of equipment with hams, you should have no trouble borrowing one if you don't already have one. With power applied to the converter, check the oscillator output with the meter. Output should be from 47 Mc to 54 Mc, or can be adjusted over this range by changing the coil spacing. Once the oscillator is working, adjust its frequency for the desired IF. If the converter is to be used with a BC receiver, for instance, the oscillator should be set 550 Kc below 50 Mc, or at 49.45 Mc. You will not be able to adjust the oscillator to the exact frequency with the meter, but accurate adjustment can be made later.



5 CABINET

1/32" ALUMINUM

Next, adjust the mixer to about 52 Mc with the meter.

With a low IF (such as 550 Kc) some pulling will be noted. This, however, is to be expected at 50 Mc. After the mixer frequency has been adjusted, readjust the oscillator frequency again.

Once the converter has been roughly aligned with a grid dip meter, accurate alignment can be made with the aid of a six-meter transmitter.

While receiving a known, crystal-controlled frequency, adjust the oscillator until the signal is tuned at the proper frequency by the IF receiver. A 50.1 Mc signal should be read at 650 Kc if a BC receiver is used, or at 2.1 megacycles with a 2 megacycles intermediate frequency.

With fixed operation, excellent performance has been obtained with a simple folded dipole, while the use of a two-element beam has shown that the converter has only slightly less gain and sensitivity than a multi-tube converter using a similar antenna system. For mobile operation the converter has been used with a 51-in. BC-type antenna and has given very good performance on both groundwave and skip reception.

Two Transistor Utility Amplifier

By FORREST H. FRANTZ, Sr.

SCIENCE and electronic experimenters need an audio amplifier as a basic piece of laboratory equipment. An audio amplifier is useful for amplifying low audio signals, detecting and measuring low audio and *ac* voltages, signal tracing electronic equipment, and as an auxiliary amplifier to bring earphone equipment signals up to loudspeaker level.

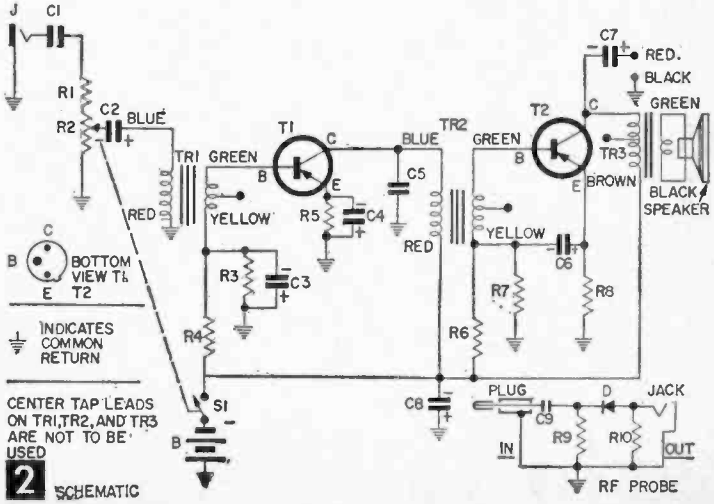
This amplifier will cost about $15 to build. It is a compact, self-contained unit that has its own batteries and loudspeaker; it needs no external power source or speaker. The input impedance is sufficiently high to permit its use with vacuum-tube circuits. Output terminals are provided for connection to an external meter so that a multimeter may be used in conjunction with the amplifier for measuring very small *ac* voltages and for audio signal tracing. An RF-IF probe which extends its use for signal tracing is also described.

1 The utility amplifier can be used with a microphone as above or as a voltmeter audio amplifier.

Circuit Operation. The circuit is shown in Fig. 2. The input signal is introduced at the jack J. Capacitor C1 isolates any *dc* components which may accompany the signal from the amplifier, but passes audio signals. The signal is presented across R1 and R2. Resistor R1 is in the circuit to keep the input impedance high. This introduces some loss, and if the amplifier is to be used with transistor circuits exclusively, R1 may be eliminated, with a direct connection from J to R2 for increased gain. R2 is the volume control, coupled to T1 through transformer TR1. The primary impedance of TR1 is 10,000 ohms, and the secondary impedance is 2,000 ohms. Thus, the input impedance of T1 is reflected back to the amplifier at 5 times its value.

Resistors R3 and R4 bias the base of T1. Capacitor C3 bypasses audio frequency signals. Resistor R5 biases the emitter of T1 and stabilizes operation over a wide range of temperature. Capacitor C4 bypasses audio signals. Without C4, gain would be reduced considerably. Capacitor C5 bypasses high-frequency signals in the collector circuit of T1 which might otherwise cause the amplifier to oscillate. Transistor T1 is coupled to T2 through TR2, an impedance matching transformer. Resistors R6 and R7 set base bias for T2, and C6 bypasses audio frequencies. Resistor R8 provides temperature stabilization for T2.

The collector of T2 is coupled to the speaker through the output transformer TR3. This transformer matches the relatively high collector load requirement (500 ohms) to the much lower (3.2 ohms) speaker impedance. Capacitor C7 carries the output signal from



2 SCHEMATIC

T2 to an output terminal. An
oscilloscope may be con-
minal to monitor the out-
mplifier.
e amplifier may be con-

the collector of
ac voltmeter or
nected from the
put voltage
Constr

structed in the smallest amount of time if all parts are available when construction is begun (see Materials List), and if this work sequence is followed: 1) Prepare circuit board; 2) prepare panel board; 3) mount components on circuit board; 4) wire circuit board; 5) mount components on panel board; 6) wire panel board; 7) mount circuit board on panel board, and make interconnections.

The circuit board as purchased is the right size, but eight of its perforations must be enlarged to ⅛ in. (layout is shown in Fig. 3).

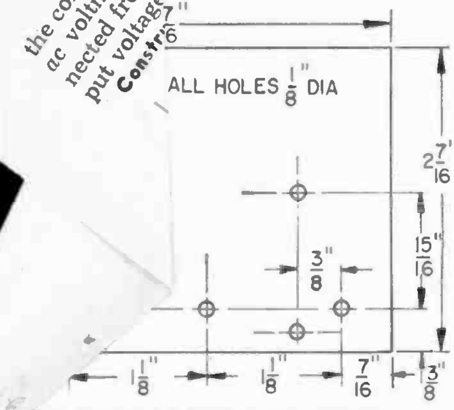
Panel board layout is shown in Fig. 4. The volume and tone of the unit will be improved if a piece of cardboard with a 2⅜ in. dia. hole for the speaker opening is cemented to the back of the panel board. Trace dimensions from the panel board. The center for the speaker hole center is located by tracing the speaker mounting holes through the board onto the cardboard and drawing straight lines through diagonally opposite hole location marks.

Next, mount transformers TR1, TR2, and TR3 (see Fig. 5). Then, mount and wire the remaining components, making wiring connections on the bottom of the circuit board.

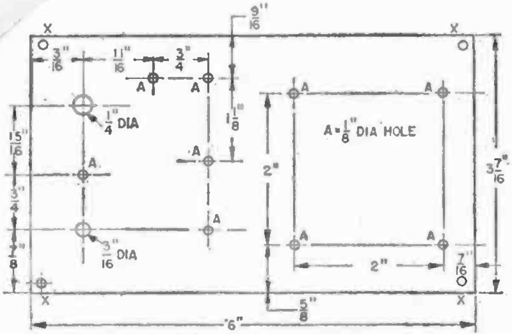
Now mount the components on the panel board and wire as shown in Fig. 6. Cut R2's shaft to a length of 5/16 in. before you mount it. Fill the contact eyelets on the battery holder with solder to avoid later battery contact trouble.

Note that two machine screws (Fig. 6) are 1¼ in. long. These are fastened to the panel board with nuts and lock-washers. One of these machine screws serves for speaker mounting, but both are provided to support the circuit board. A nut is placed on each screw with the top of the nut ⅞ in. from the panel. The circuit board is mounted on these and fastened with a nut on each screw. Don't turn them tight initially. You may want to loosen the circuit board to make inter-connections between circuit and panel board. Interconnections are:

1) TR3 secondary leads to loudspeaker; 2) C7 (negative) to T2 Collector; 3) S to circuit board negative bus; 4) center terminal R2 to C2 negative; 5) battery plus to circuit board common return.

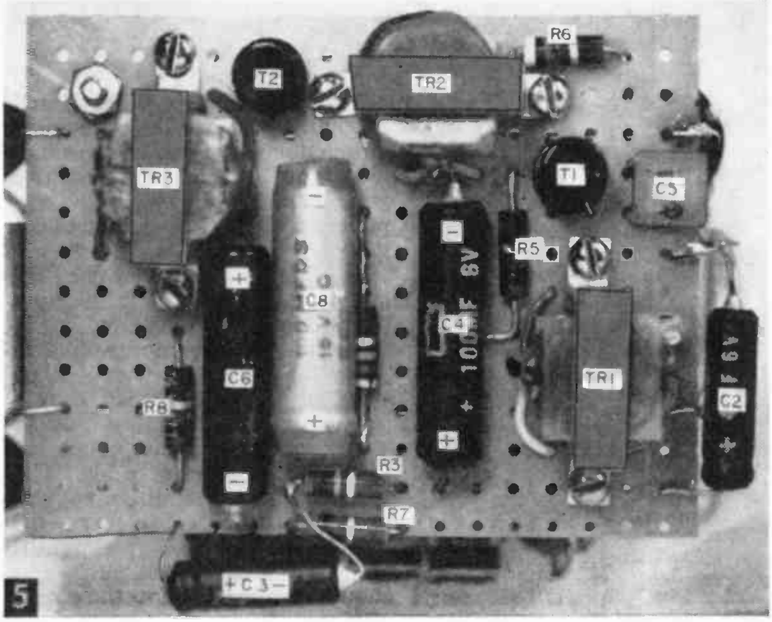


CUIT BOARD LAYOUT (TOP VIEW)



4 CORNER HOLES "X" LOCATED FOR FIT TO CASE

4 PANEL BOARD FRONT VIEW



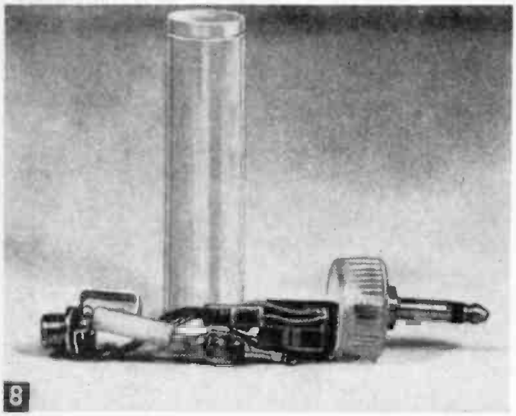
5

Circuit board mountings.

MATERIALS LIST—UTILITY AMPLIFIER

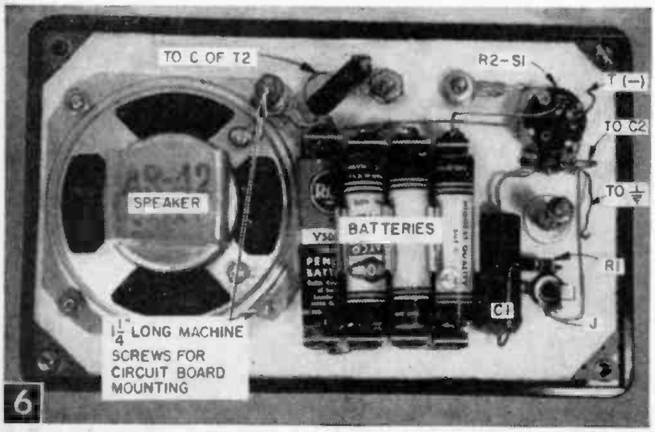
Desig.	Description
	½ watt carbon resistors, 10% plus or minus
R8	100 ohms
R5, R7	1K
R6	4.7K
R3	10K
R1, R4	47K
R2, S1	25K miniature volume control with switch (Lafayette VC-25)
C5	.01 mfd, 75v Ultraminiature capacitor (Lafayette C-612)
C1	.1 mfd, 400v tubular capacitor (Aerovox type P822)
C2	4 mfd, 6v miniature electrolytic capacitor (Lafayette CF-101)
C7	10 mfd, 6v miniature electrolytic capacitor (Lafayette CF-103)
C3	30 mfd, 6v miniature electrolytic capacitor (Lafayette CF-104)
C4, C6	100 mfd, 6v miniature electrolytic capacitor (Lafayette CF-106)
C8	100 mfd, 15v miniature electrolytic capacitor (Lafayette CF-126)
TR1, TR2	10K to 2K driver transformer (Lafayette TR-96)
TR3	500 ohm to 3.2 ohm output transformer (Lafayette TR-95)
T1, T2	2N321 transistor (General Electric)

Desig.	Descriptio
SPKR	2½", 3.2-ohm PM speaker (La
B	6v battery—four RCA VS074 cells series connected
J	miniature jack (Lafayette MS-282
	binding posts (H. H. Smith 220 Re
	battery holder (Lafayette MS-170)
	2⁷⁄₁₆ x 3⅜" miniature perforated bo MS-304)
	3¹¹⁄₁₆ x 6¾" miniature perforated boar MS-305)
	2 x 3¾ x 6¼" case (Lafayette MS-216)
	knob (Lafayette MS-185)
RF Probe Parts:	
R9, R10	15K, ½ watt carbon resistors (10%)
C9	100 mmfd mica capacitor (Aerovox CM-20B-101)
D1	Germanium diode (RCA or Sylvania IN34A)
	miniature plug-plug set (Lafayette MS-370)
	small plastic bottle approximately ½" diameter by 2 long (available at drug store prescription counters)
	(Use Lafayette MS-281 plugs and about 2' of Belden 8411 shielded microphone cable for the input audio test lead)
	All components for this project may be obtained from Lafayette Radio, 165-08 Liberty Avenue, Jamaica 33, New York



8

The RF probe fits in the small plastic tube standing behind it. Below, front panel mountings.



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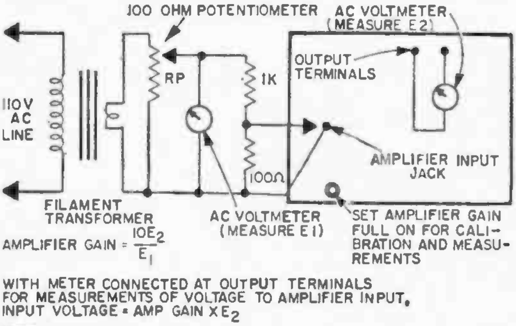


7 CIRCUIT FOR CALIBRATION

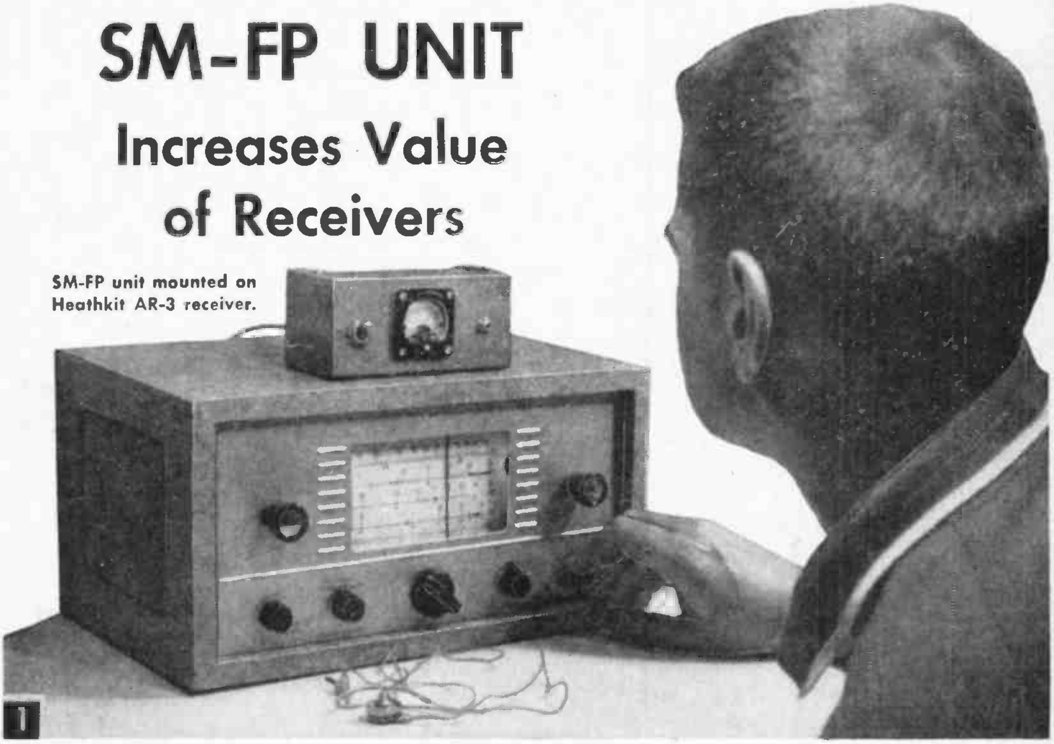
Fasten the knob on the shaft of R2-S1 and turn on to full volume. Touch the tip contact on the phone jack. If everything's okay, you'll hear a faint hum, and you can mount the assembled amplifier in the case to complete the job.

The amplifier may be used for audio signal tracing. The input probe lead is shielded with Lafayette MS-281 miniature phone plugs on each end. The sleeves supplied with the jacks should be replaced with more rugged ⅜-in. Bakelite tubing such as that used on test prods. The center lead attaches to the phone plug shell. A ground lead about 5 in. long equipped with a Mueller Minigator clip should be connected to the shield at one of the plug ends. These plugs are used at both ends to allow easy attachment of the RF probe.

The utility amplifier will drive an *ac* voltmeter. The red and black terminals on the front panel have been provided for connecting an external *ac* voltmeter. This allows the unit to be used for the measurement of small *ac* voltages and to check amplifier gain. To calibrate, use the circuit of Fig. 7. Set the meter to the lowest *ac* scale and adjust RP till the meter reads full scale. Now disconnect your meter and measure E1 with it. The full scale range of the amplifier-meter combination is 10% of E1. Since transformer coupling has been employed without feedback, the amplifier gain varies with frequency. The full scale sensitivity at 60 cycles is less than the full scale sensitivity at 1000 cycles. Be sure to calibrate at the frequency you plan to measure.

The simple RF probe shown in Fig. 8 can be quickly attached to or detached from the input probe lead (described earlier) to trace RF and IF signals. The circuit for the RF probe is shown in Fig. 2. The level of the signal from the RF probe is low, so best results will be obtained if earphones are connected to the red and black terminals on the front panel of the amplifier.

SM-FP UNIT
Increases Value of Receivers



SM-FP unit mounted on Heathkit AR-3 receiver.

1

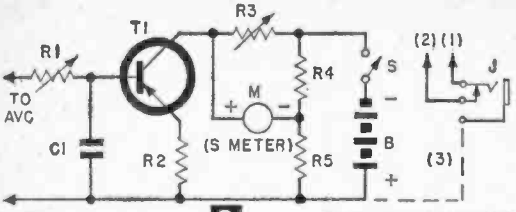
By FORREST H. FRANTZ, Sr.

THE SM-FP (*"S" Meter-Front Phone*) unit increases the utility of your receiver by providing a visual indication of relative signal strength for tuning, logging and comparison purposes.

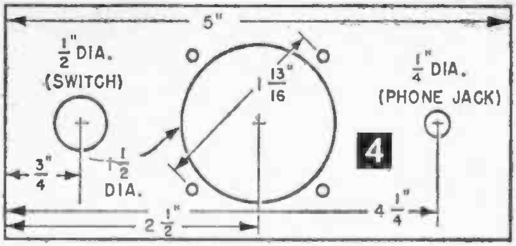
An earphone jack (regular or miniature size) on the front panel of the SM-FP unit allows you to connect earphones at the front of the receiver. No more groping around the rear of the receiver where phone jacks (and hot tubes) are frequently located. I don't know of any receivers with "S" meters which sell for less than $100. The addition of an "S" meter, therefore, adds considerable value to your inexpensive communications receiver. All of these advantages can be yours for less than $10.

The SM-FP unit "S" meter circuit connects to any receiver which has automatic volume control (AVC) without having to make any changes in the receiver circuit; simply tie the input terminals across the outer terminals of the receiver volume control. The secret of this simple universal type of connection? A transistor amplifier for the "S" meter.

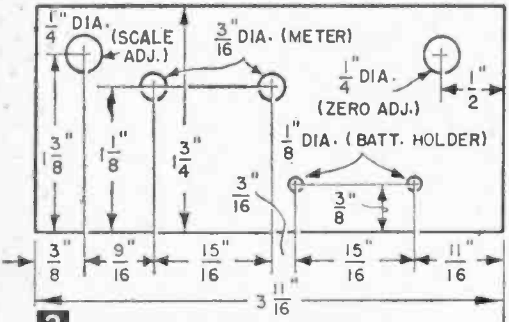
The unit is housed in a Bud CU-2104 Minibox, 2¼ x 2¼ x 5 in. and finished in grey hammertone. (The same size is available in natural aluminum as Bud CU-3004.) The hole layout for the front of this box is shown in Fig. 4. A ⅜-in. dia. hole should be drilled in the center of the Minibox back and two small holes (about ⅛-in. dia.) should be drilled in one side of the back. Location of these holes is not critical; they are provided for the connecting cable and top of set mounting re-



2 BASIC CIRCUIT



FRONT PANEL LAYOUT



3 REAR VIEW OF CIRCUIT BOARD

spectively. Mount the meter on the front of the Minibox.

The perforated Bakelite circuit board should be prepared next. Layout for it is shown in Fig. 3. Use a hacksaw to cut out the circuit board and smooth the edges with a file. All hole centers coincide with perforations.

Mount R1, R3, and the battery holders on the circuit board. Carbon resistors, transistor, and capacitor are fastened to the board by passing the pigtail leads through the perforations. When junctions between parts occur—as with R2 and the emitter of T1—the pigtails pass through the same perforation.

The common bus from the plus terminal of the battery is the long wire running the length of the circuit board in Fig. 5. This bus is returned through the connecting cable to receiver ground. The pigtails of components which return to this common bus are bent back against the board and soldered to the bus. The meter soldering lugs, the switch and the jack are connected while board wiring is in progress. The switch and jack leads should be about 2 in. long to allow positioning in the Minibox mounting holes.

When circuit wiring has been completed, make up a four-lead cable of flexible wire for connection to the receiver. Keep the cable reasonably short. I used a 16-in. cable. It helps to use different colored leads. The leads connect to the plus battery bus, R1 and the phone jack. Since the phone jack shell connection returns to the plus battery bus, three of the four connections may be made to the phone jack as shown in Fig. 5 *if* your receiver is *ac* operated (has a power transformer). Connections for *ac-dc* receivers are discussed below.

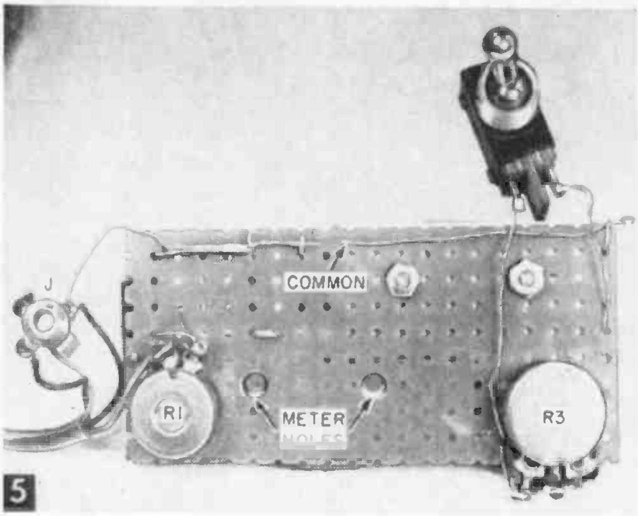
The circuit board is held in place against the back of the meter by the meter connection screws. To assure a good fit and good electrical connections, place cardboard shims between the meter and circuit board as required to elevate the circuit board above the meter binding post studs. Then fasten the binding post screws in place. Fasten the jack and switch on the front panel to complete construction of the SM-FP unit.

To fasten the unit to the receiver, place cardboard shims or use washers to obtain ⅛-in. clearance between the receiver top and the bottom side of the Minibox back. The front of the SM-FP unit slides onto the mounted back. Insert two of the self-tapping screws furnished with the Minibox in the appropriate holes on the top of the case to complete the assembly.

The basic connection scheme for all receivers is the same, but the details obviously may differ. The Heathkit AR-3 receiver to which this unit was attached will be used as an example. The Heathkit AR-3 has an octal accessory socket on the rear of the chassis. Pin 1 of this socket is connected to receiver ground. Pins 2, 4, 5, 6, and 7 are unused. I connected a lead from socket pin 2 to the high side of the volume control of the AR-3. This is my detector voltage pick-up point which feeds to R1, the "S" meter input.

The volume control of the receiver is part of the diode load, and AVC voltage is taken from its upper terminal, the audio component being filtered off by a 3.3 Meg resistor and a .01 mfd capacitor. The correct connection point on practically any receiver may be found by locating the detector load and an RC filter with a 1 to 5 Meg resistor and a .01 to .1 mfd capacitor connected to the load. In most receivers, the volume control is part of the detector load and AVC is taken to the filter from this point. In any event, the detector voltage pick-off may be made without changing any wiring; you simply tap on.

The earphone jack on the Heathkit AR-3 is connected across the output transformer secondary. The third terminal on the jack is connected to the speaker voice coil and feeds the output signal to the speaker. Insertion of the phone plug breaks the connection to the



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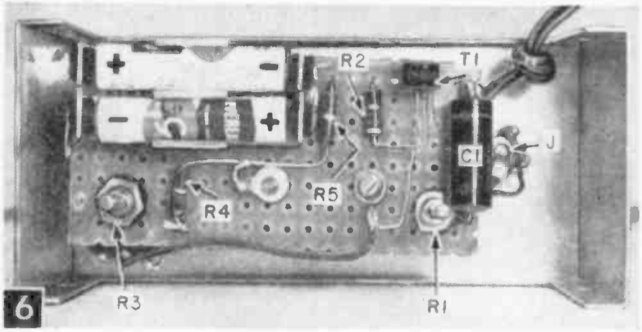
Front view of perforated board.



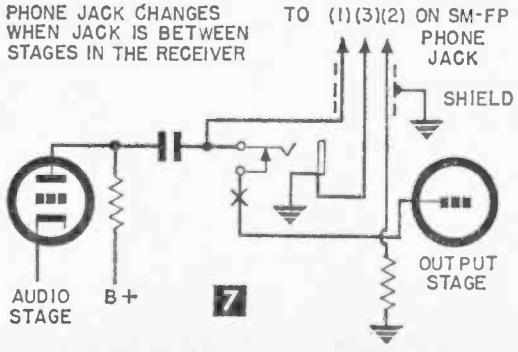
6

Rear view of wired SM-FP unit.

speaker. The phone jack on the SM-FP unit is simply an extension jack.

I disconnected the speaker lead from the jack in the receiver and ran this lead to pin 5 on the accessory socket. I ran another lead from the high side (tip connection) of the phone jack to pin 6 of the accessory socket. These pin connections are connected through a mated plug on the connecting cable to their counterparts on the SM-FP panel jack. I used a defunct octal tube for the cable plug.

Some receivers have the phone jack located between audio stages. A typical arrangement and the required change is shown in Fig. 7. If your receiver has an arrangement of this type, you may have to shield the AVC pick-off lead in the cable to prevent audio feedback. This feedback may occur whenever the phone jack is in a high impedance circuit. But it will rarely ever occur when the phone jack is in the low impedance output transformer secondary circuit as it is in the Heathkit AR-3.



7

A note regarding the ground connection is in order since most inexpensive receivers other than the Heathkit AR-3 are *ac-dc* operated. Chassis ground on *ac-dc* receivers is usually isolated from the *dc* ground which is the common negative return of the set. If you're connecting the SM-FP unit to an *ac-dc* receiver, provide a fifth wire in the connecting cable.

Eliminate the connection between the phone jack and "S" meter common on the SM-FP and insulate the phone jack from the Minibox. This may be done by enlarging the jack mounting hole and using fiber insulating washers. The "S" meter common connects to the *dc* common of the receiver which is usually connected to the negative terminal of the electrolytic filter capacitor or to the "low side" of the volume control terminal. The shell of the SM-FP phone jack connects to the shell of the phone jack on the receiver which is usually at chassis ground. The connections for the other three cable wires remain unchanged.

Adjustment of the SM-FP is simple. Turn the receiver on and tune to a point on one of the short wave bands where there's no station or noise pick-up. Turn the SM-FP on and adjust R3 for zero meter reading. Then tune the receiver to the strongest station you can find. If the "S" meter circuit is working properly, the meter needle will be deflected. Adjust R1 for a meter reading just above the plus 30 db point if you're in a good signal pick-up area, or for an S-9 meter reading if you're in a relatively poor area. Now tune off station to a quiet point and readjust R3 for zero reading. You may want to readjust R1 after you get a better feel for the kind of S readings to expect.

Readings are relative and are influenced by your antenna, the sensitivity of your receiver, the band and the place in the band at which stations are received. The important thing is that the S meter allows you to tune your receiver for maximum input and gives

MATERIALS LIST—SM-FP UNIT

Desig.	Description
R4	100 ohm, ½ w carbon resistor (10%)
R2	470 ohm, ½ w carbon resistor (10%)
T1	2.2K, ½ w carbon resistor (10%)
R5	10K miniature potentiometer (Lafayette VC-32)
R3	1 Meg miniature potentiometer (Lafayette VC-38)
R1	.02 mfd, 200 v capacitor (Cornell-Dubilier Cub)
C1	2N508 transistor (GE)
J	phone jack (Lafayette MS-282 for miniature plug or Switchcraft 11 for standard phone plug)
B	two 1.5 v penlite cells series connected (Eveready 912)
M	S meter, 0-1 ma movement (Lafayette TM-11)
S	SPST toggle switch (Arrow-Hart and Hegeman 20994-BF)
	two-cell battery holder (Lafayette MS-138)
	Minibox case (See Text)
	perforated miniature Bakelite board (Lafayette MS-305) knob (Lafayette MS-185)

you a better estimate of signal strength than you would otherwise have. I point this out to emphasize that critical calibration of the meter is not required. After you've experimented with the S meter and your receiver for 30 minutes or an hour, you'll be able to set R1 for satisfactory meter deflections.

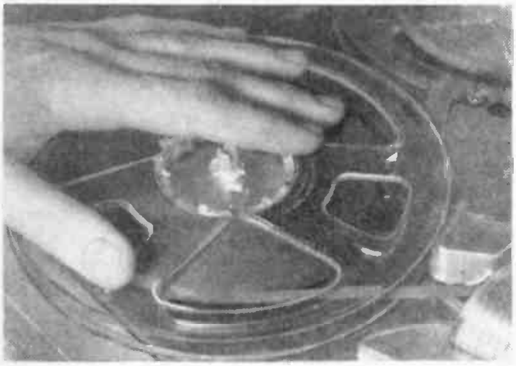
If the zero signal meter reading changes after the receiver has been operating for a few minutes, it's probable that heat from the receiver is causing the drift. Bend the transistor as near as possible to the center of the Minibox to minimize temperature drift. As an additional measure, the distance between the top of the receiver and the bottom of the Minibox may be increased to ¼ in. Of course, you can mount R3 on the panel of the SM-FP unit if you wish, but this permits accidental displacement from the zero setting. This extreme should not be necessary. I might add that I didn't encounter noticeable zero drift with my Heathkit AR-3, but it has a wooden cabinet. I call attention to the possibility because it might occur if your receiver has a metal cabinet.

The "S" meter works in this way: The detection voltage of the receiver is fed through R1 to the base of transistor T1. R1 is an adjustable meter sensitivity control. The combination of R1 and C1 filters audio from the signal and passes only the negative *dc* level of the detection voltage (which depends on received signal strength) to the base of T1.

Transistor T1 is a *dc* amplifier. A very small change of current to the base of T1 is amplified to values as great as 1 ma to drive the S meter. Resistors R3, R4, R5 and the meter form the transistor collector load and meter zero (null) set circuit. Resistor R2 provides *dc* stabilization for transistor T1 to minimize drift and also increases the base input circuit impedance.

Eliminating Tape Recorder "Click"

• Does your tape recorder leave an audible "click" on the tape every time you depress the stop button while recording? Instead of clipping click from tape while editing, eliminate it beforehand by manually rewinding an inch or so of the tape back on the supply spool before starting to record again.—JOHN A. COMSTOCK.



Preventing Shorts on Breadboard

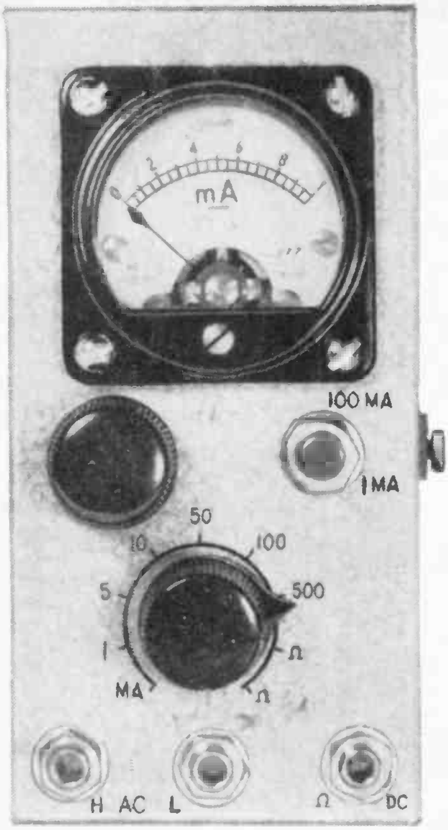
To prevent short circuits on a breadboard circuit, tape the wire leads to the chassis with masking or plastic tape. This will also improve the appearance of the layout and permit easier tracing of the wires.—JOHN A. COMSTOCK.

Signal Boosters for Portables

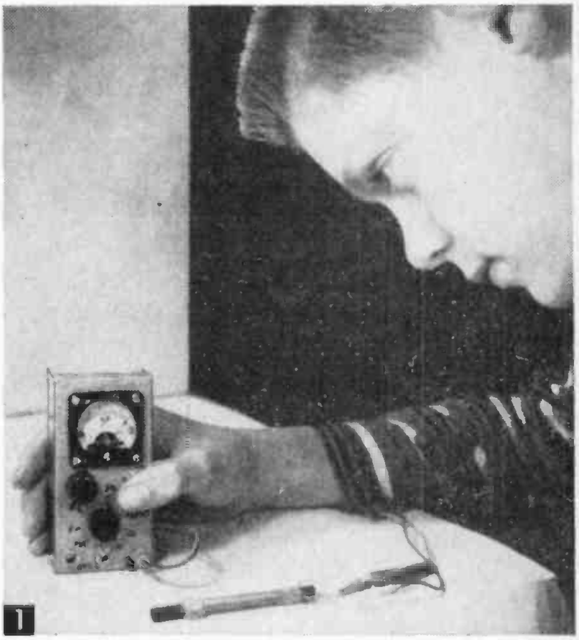
• In many portable radios there is no antenna loop of the conventional type, only a "loop stick." Signal sensitivity on such sets can be appreciably increased by winding two to three turns of insulated wire around the stick, one end of this added wire connected to an outside antenna. No ground is needed. You can also, if the set has a loop, wind a one- or two-turn primary over the loop, giving a step-up in voltage. Finally, if you don't wish to incorporate either of these primaries in the set's cabinet, you can make a one-turn loop of heavier insulated or bare wire stapled to a wood block and hung upside-down over the receiver as close as possible to the set's loop and in the same plane, one end of this heavy-wire loop going to an outside antenna as before.—P. M. ARMSTRONG.

Russia Gaining "Hams"

• If they can crack the language barrier, American ham radio operators may have 25,000 new correspondents by 1961—in the USSR. *Radio*, a Soviet magazine published in Moscow, reports that more than 50 radio clubs in Russia now claim 100 transmitters or more. It said that a drive is in progress to reach a goal of 25,000 Russian radio amateurs by 1961. Russian amateurs will operate in the frequency ranges 3.5 to 3.65, 7 to 7.1, 28 to 29.7, 114 to 146, and 420 to 435 megacycles.



Miniature Multimeter



1

A worthwhile and gratifying construction project for beginning experimenters, this miniature multimeter is also an exceedingly practical piece of test equipment.

This multimeter fits in a coat pocket, has a special meter protection feature and you can build it for about $10

IF ALLOWED only one instrument, most technicians would select a multimeter. With it, you can shoot trouble, learn how electronics equipment operates, evaluate the performance of electronic gear. You can check for shorts or opens, measure *ac* and *dc* volts and milliamperes; and measure ohms. And from these measurements you can compute power, capacitance, and inductance.

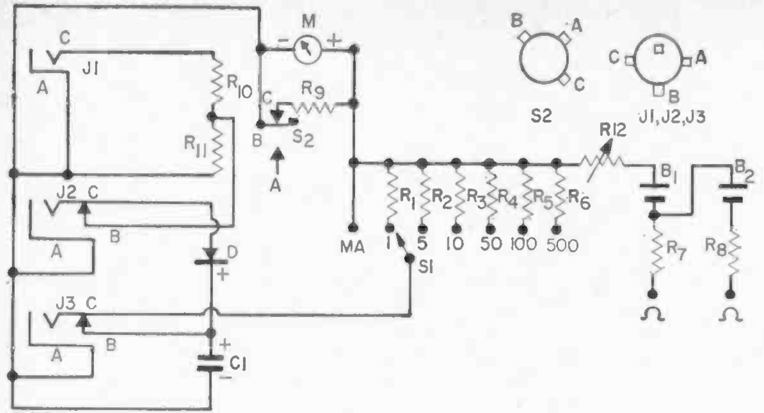
This miniature multimeter is designed to measure a wide range of electrical quantities. Accuracy on the *dc* voltage, milliampere, and ohm ranges is good; accuracy on the *ac* ranges is not quite as good—unless you calibrate the *ac* ranges—but it's adequate for most purposes. The limitations of the meter are reasonable in view of its low cost and small size. These are its ranges:

dc volts:	1, 5, 10, 50, 100, 500
ac volts:	10, 50, 100, 500
dc ma:	1, 100
ohms:	0-50K (1.5K at meter mid-scale) 0-100K (3K at meter mid-scale)

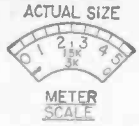
Scale switching is accomplished with range switch S1, the push button switch S2, and by the input jack circuit made up of J1, J2, and J3.

If you buy 1% precision resistors for R1 thru R6, the total cost will be slightly over $10. You can save close to $2 by selecting resistors R1 thru R6 from standard tolerance resistors. Use a Wheatstone Bridge to measure resistance (Wheatstone bridges are available in the science departments of most high schools and the physics departments of most colleges), or use the ohmmeter ranges on a good vacuum tube voltmeter (VTVM) such as the Heathkit V-7A. If you set the zero adjust and the ohms adjust controls carefully for zero and full-scale deflection of the meter, you can select resistors within plus or minus 2% very easily, and you can expect to get close to 1% if you're careful. This method is most accurate near meter center scale.

After you have all of the parts together, drill the chassis box (Fig. 3). Next, letter the front panel with India ink. Wash the box in warm sudsy water, rinse, and dry thoroughly before marking. A piece of thin plastic or clear celluloid cut to fit over the panel markings will assure permanence. Trim the holes with a pocket knife, and while you have

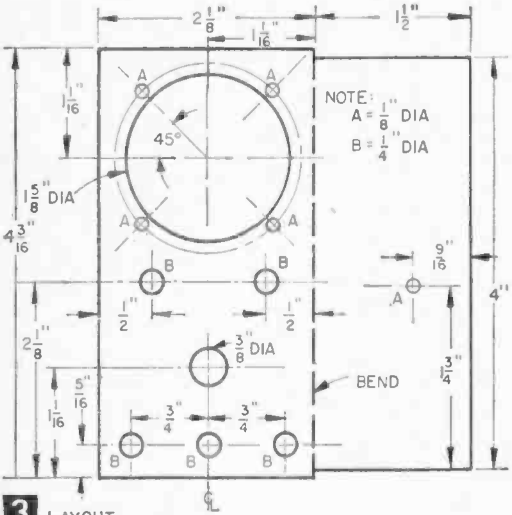


2 SCHEMATIC



RESISTANCE	METER READING (MA.)
200 OHMS	.87
500 OHMS	.75
1 K	.6
1.5 K	.5
5 K	.23
10 K	.13
50 K	.02
500 OHMS	.86
1 K	.75
3 K	.5
5 K	.37
10 K	.23
50 K	.05
100 K	.03

4 OHMMETER TABLE



3 LAYOUT

MATERIALS LIST—MINIATURE MULTIMETER

Desig.	Description
R9	0.67 ohm resistor (6½' of #30 insulated wire)
R1	935 ohm resistor, ½ w, 1%
R2	4,935 ohm resistor, ½ w, 1%
R3	10K resistor ½ w, 1%
R4	50K resistor, ½ w, 1%
R5	100K resistor, ½ w, 1%
R6	500K resistor, ½ w, 1%
R7	1K resistor, ½ w, 10%
R8	2.7K resistor, ½ w, 10%
R11	58K resistor, ½ w, 10%
R10	100K resistor, 2 w, 10%
R12	1K miniature volume control (Lafayette VC-32)
C1	10 mfd, 150 v miniature electroytic capacitor (Aerovox SRE type)
J1, J2, J3	miniature phone jacks (Lafayette MS-282)
S1	single pole, 10-position miniature switch (Grayhill 5001-10)
S2	miniature push button switch (Lafayette MS-449)
M	0-1 ma miniature panel meter (Lafayette TM-400)
D	selenium rectifier (Sarkes Tarzian 50)
B1, B2	1.5 v penlite cell (Burgess #7)
	1⅝ x 2⅛ x 4" aluminum chassis box (LMB-00)
	miniature knob (Lafayette MS-185)
	small standard knob (Lafayette KN-19)
	miniature phone plug (Lafayette MS-281)

the rubber cement handy, cut out and fasten the meter scale (Fig. 4) on the front of the meter glass.

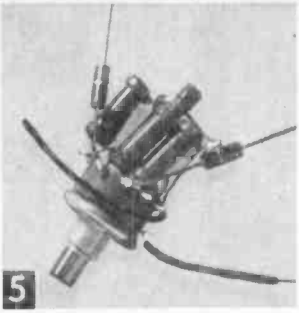
Next, assemble resistors R1 thru R8 on the rotary switch as shown in Fig. 5. This portion of the wiring is shown inside the dotted line on the schematic, Fig. 2. The numbers indicated on the switch contacts correspond to the numbers on the back of the Grayhill rotary switch (S1). Switch position #9 is not used.

Check push button switch S2 to be sure that it makes good contact in the normally "ON" position. If you can detect any resistance at all between these contacts on the low ohm scale of a VTVM, clean and bend them to provide a low resistance contact. Since this switch is in series with R9, the shunt for the 100-milliampere meter range, contact resistance can impair accuracy.

Cut the shaft of potentiometer R12 so that it extends ¼ in. beyond the potentiometer bushings, and mount R12, S2, J1, J3, the meter and the S1-R1 through R8 range switch assembly (see Fig. 6).

Wire from the meter plus terminal to the middle terminal of R12 and from there to terminal 10 on switch S1. Connect a wire to the upper terminal of R12 and let it hang loose for the moment. Connect a wire from the switch arm of S1 to the contact of J3 designated as "C" in the schematic. Connect a 2½-in. length of wire from contact "B" on J3 to the plus terminal of rectifier D. Connect the other terminal of rectifier D to terminal "C" of jack J2.

Next, mount J2 on the chassis, positioning rectifier D as shown in Fig. 7. Note that the terminals are bent to avoid the possibility of a short. The connecting wires hold the rectifier in place. Run a wire from contact "B" on S2 to the minus terminal of the meter. Connect another lead from the meter minus terminal to contact "A" on J3. Now connect the minus lead of C1 to the meter minus ter-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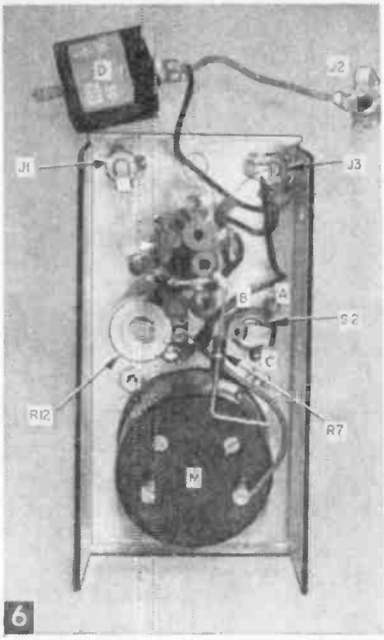

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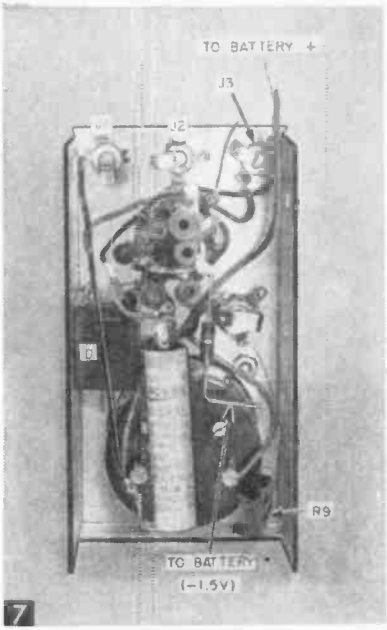


7

Step-by-step construction of multimeter (see text).

minal and the plus lead of C1 to the plus terminal of rectifier D. Place the negative lead of C1 under the negative terminal screw and solder the other two leads to the negative C1 lead. Connect one end of R9 to contact "C" of S2. Resistor R9 is made by folding 6½ ft. of #30 insulated copper wire on itself till it is 1 in. long. Insulate R9 with tape, and tape it to the meter case.

Next, connect R11 from A on J3 to B on J2. Connect R10 from "B" on J2 to "C" on J3. Connect the loose end of R9 to the junction of R1 thru R6 on the switch assembly (Fig. 8). Connect R7 to the terminals at the upper end of the battery holder to form a junction. Connect the loose end of the wire previously connected to the upper terminal of R12 to the remaining plus battery terminal. Connect the loose end of R8 to the remaining negative battery terminal. Then insert the batteries in the holder and fasten the holder to the chassis with a self-tapping screw. If the screw is long enough to threaten the batteries, use washers under its head. Completed construction is shown in Fig. 9. Putting the knobs on completes the work on the front side.

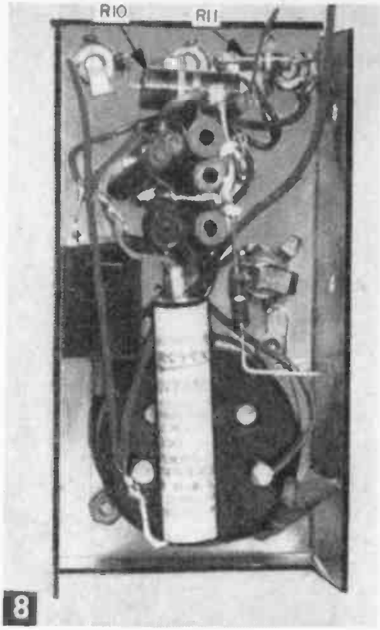
The "A" terminals of jacks J1, J2 and J3 are grounded to the chassis case and therefore connect to each other through the chassis. The test leads connect to a single jack plug. You'll have to ream out the back end of the plastic plug handle to pass the wire through it. I used #20 solid hook-up wire for my test leads. Don't strip more of the wire than you must to solder to the jack terminals, and provide tape insulation if necessary to protect against shorts. The test leads are terminated with Mueller Minigator clips at the other end. A wooden matchstick taped to the clip end of the positive lead stiffens it and allows you to use this lead as a probe.

To measure *dc* volts or ohms, plug the test leads in the ohm-*dc* jack (J3) and choose the range with S1. Use R12 to zero-set the ohmmeter with the leads shorted when you want to make the resistance measurements. *You must depress S2 to get the correct reading.* When S2 is not depressed, R9 shunts the meter to protect it against burnout if you should accidentally select too low a range. When you depress S2 to take a reading, the natural reaction to a pegging needle is to release the button. You're warned of very severe overloads that could damage the meter if S2 were quickly depressed and released by higher than usual readings before S2 is depressed. To measure milliamperes, select milliamperes with S1. The range is 100 ma if S2 is not depressed, 1 ma if it is depressed.

To measure *ac* volts up to 100, plug the test leads into the *ac* low jack (J2) and use the 10, 50 or 100 volt positions of S2. Again, you must depress S2 to get the appropriate reading. You can use the 1 and 5 volt positions on S2, but they're very inaccurate on *ac*. To measure voltages between 100 and 500 volts, plug the leads into the high *ac* jack (J1) and set S1 to the 100 volt setting. Depress S2 to take the reading. Don't change jack plug-in positions with the test clips connected to a voltage!

When you feel sufficiently confident that you won't be jeopardizing the meter by picking a wrong scale or overloading it in some other way, you can change the connection on terminal "C" of S2 to terminal "A." Then the meter will read properly without depressing

S2. If this change is made, S2 is depressed only when the 100 ma range is desired. When S2 is not depressed, the 1 ma range is connected if the range switch is set to ma after the change has been made.



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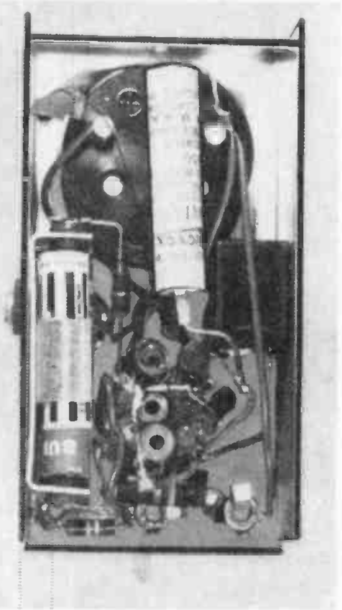

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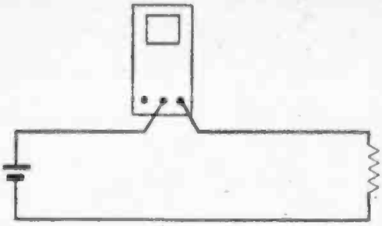
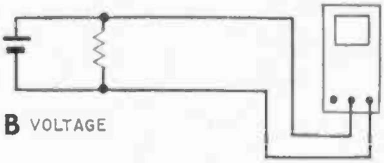
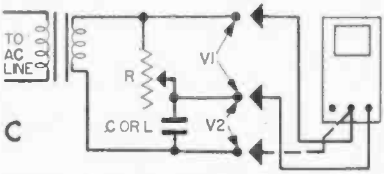


10 A CURRENT



B VOLTAGE



C

CAPACITANCE OR INDUCTANCE (ADJUST "R" UNTIL V1 = V2)

For current measurements, the meter is connected in series with voltage source and load as shown in Fig. 10A. For voltage measurements the meter is connected in parallel with the voltage source or dropping element as shown in Fig. 10B. To determine power, measure current thru the load and voltage across the load. The power in watts is equal to volts times amperes.

To determine capacitance or inductance use the arrangement of Fig. 10C. Adjust the variable resistor till the *ac* voltage across the capacitor or coil equals the voltage across the resistance. Then, measure the resistance. For a capacitor,

$$C = \frac{2650}{R}$$

where C is the capacitance in microfarads and R is the resistance in ohms. For a coil:

$$L = .00265R$$

where L is the inductance in henries and R is the resistance in ohms. This method is approximate. The accuracy is good for all types of capacitors 0.1 mfd or greater except for low-voltage electrolytics. This measurement method should not be used on electrolytic capacitors rated under 100 volts. The scheme is not as accurate for lower than 0.1 mfd capacitance because the capacitive reactance is much greater than the meter impedance. The accuracy of inductance measurements is not too good because of the resistance inherent in the coil which this method assumes as negligible. It isn't reasonable to use this scheme for coils with inductances of less than 100 millihenries. But filter chokes and audio coils may readily be measured using this method.

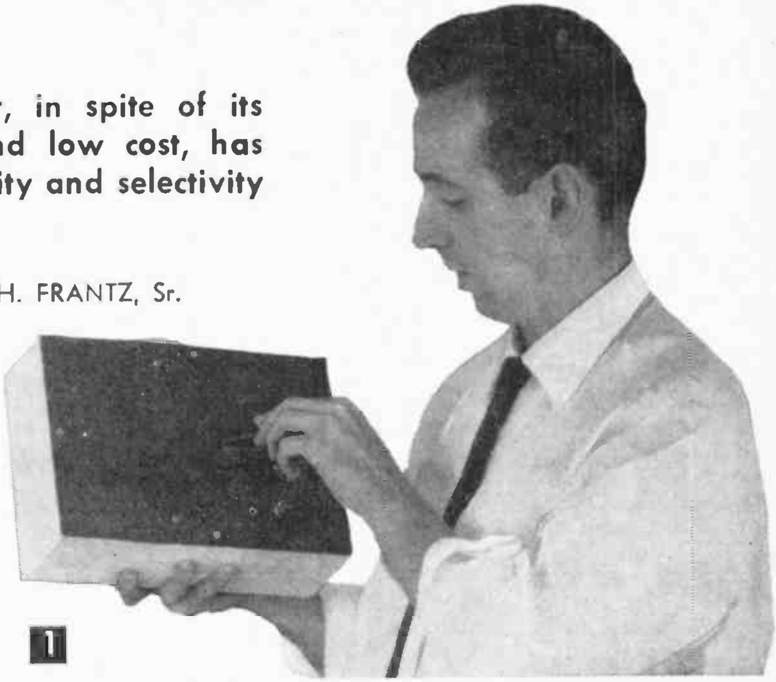
Can the scheme be extended to take in lower inductances and lower capacitances under any circumstances? Yes, but you'd need a higher frequency source than the *ac* line 60-cycle frequency and you'd need a more sensitive meter.

Jacks J2 and J3 perform some of the switching requirements. Contact "B" is connected to "C" in any jack if the plug isn't inserted. If the test lead jack plug is inserted, "B" is disconnected from "C" in that jack. If the jack plug is inserted in J3, *dc* can pass directly into the switch arm of S1. If the jack is inserted in J2, the *ac* input is rectified by D, filtered by C1 and applied to the switch arm of S1 via contacts "B" and "C" on J3. For economy reasons, a half-wave selenium rectifier was employed in this miniature multimeter. This rectifier can't handle voltages much greater than *ac* line voltage. Therefore, the divider consisting of R10 and R11 was provided to reduce the voltage on inputs up to 500 volts for use with the 100 volt range switch position when the jack plug is inserted in J1.—FORREST H. FRANTZ, SR.

Three-Transistor Portable

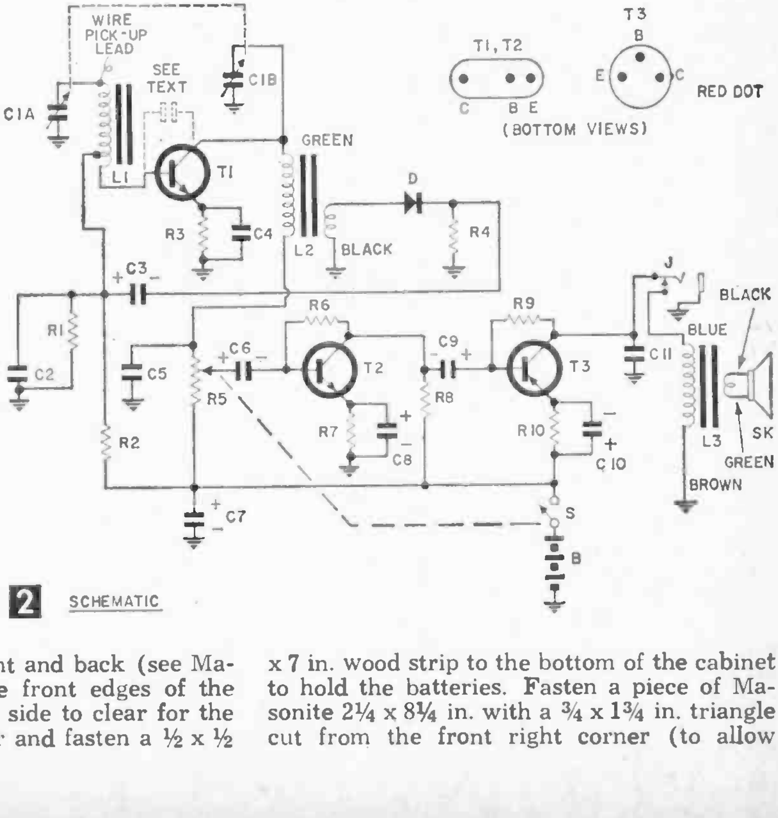
This receiver, in spite of its simplicity and low cost, has high sensitivity and selectivity

By FORREST H. FRANTZ, Sr.



1

Tone of this simple portable is better than that of most small, commercial transistor receivers.

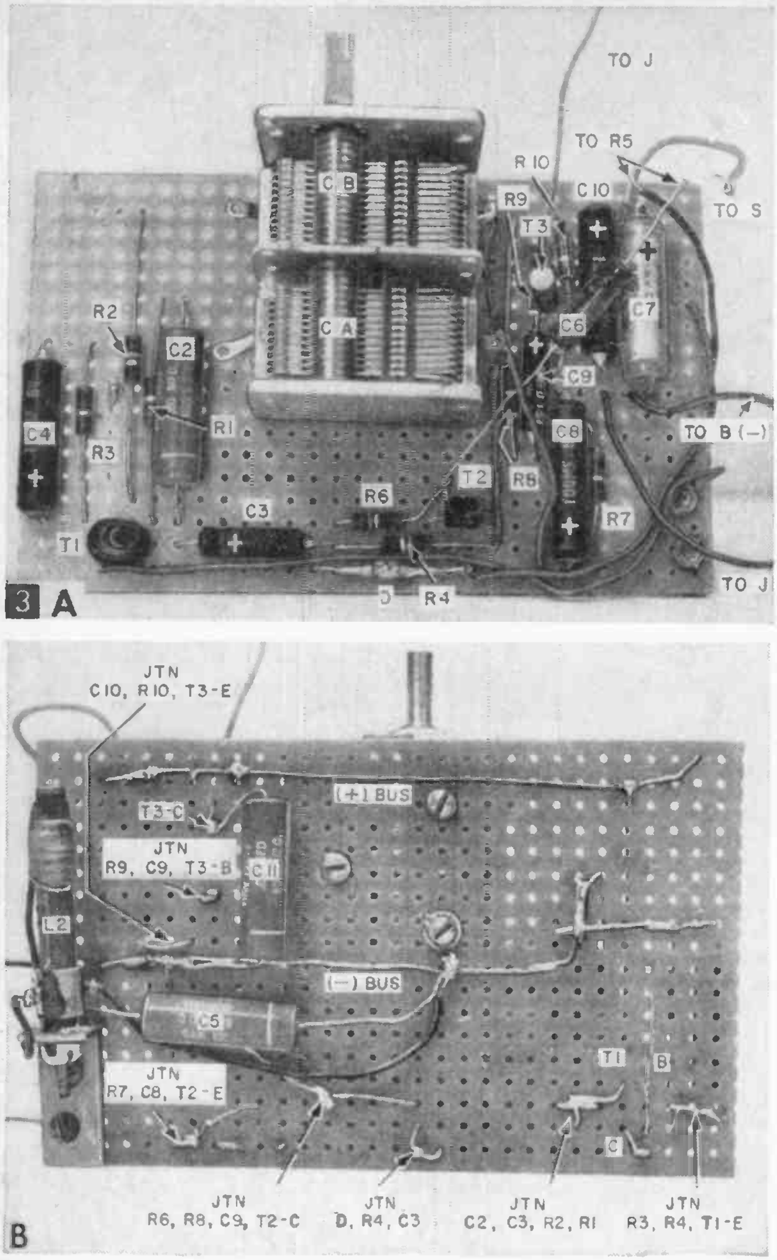


2 SCHEMATIC

HERE'S a simple receiver that will pick up plenty of stations with loudspeaker volume. The circuit (Fig. 2) is novel in several respects. Transistor T1 is employed as a combination regenerative RF stage and stabilized audio amplifier, with base and collector circuit tuned to provide high RF gain and selectivity. The selectivity and gain characteristics are enhanced by capacitive feedback and the hi-Q ferrite antenna coil.

The amplified RF signal is detected by diode D, and the resulting audio signal is fed via capacitor C3 to the base of T1 for a second trip through. Coil L2 looks like a short circuit to the amplified audio signal and the signal appears across volume control R5. Transistor audio amplifier stages T2 and T3 build the signal up to loudspeaker driving level.

Construction. The original three-transistor portable was housed in a "do-it-yourself" case constructed from a length of 1 x 4 with a perforated Masonite front and back (see Materials List). Shave the front edges of the cabinet on the left-hand side to clear for the edges of the loudspeaker and fasten a ½ x ½ x 7 in. wood strip to the bottom of the cabinet to hold the batteries. Fasten a piece of Masonite 2¼ x 8¼ in. with a ¾ x 1¾ in. triangle cut from the front right corner (to allow



Circuit board layout, top (above) and bottom (below).

clearance for the volume control) to the side of the case with a small screw and bracket, and to the bottom of the case with a 1¾-in. screw through a scrap block to complete battery holder.

The receiver proper is constructed in two basic units: circuit board (Fig. 3); and front panel (Fig. 4). The circuit board contains most of the components and fastens to the front panel with two machine screws and nuts terminating on the tuning capacitor frame. The volume control and switch (R5-S), the phone jack (J), the loudspeaker (SK) and ferrite antenna loop (L1) mount on the front panel.

Cement a piece of cardboard to the front panel, making holes as required for mounting parts with a pocket knife. Draw a 5½-in. dia. circle on the cardboard with center at approximate speaker center. Punch holes in the cardboard within this circle with an ice pick, entering from the perforations on the front.

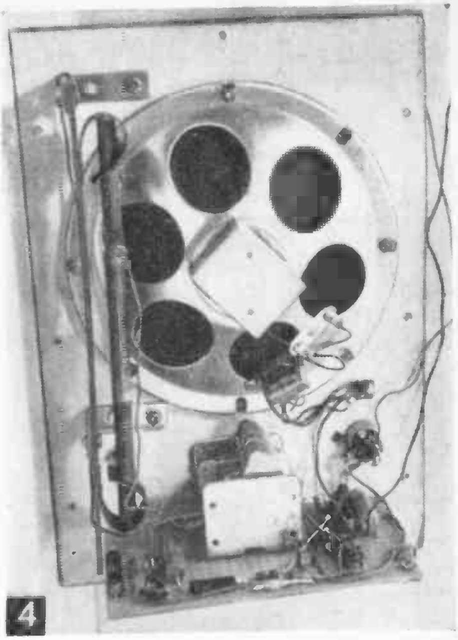
Cut the shaft of R5-S to a length of ⅜ in., and mount R5-S, SK, L1, and J. Cut a square hole, ⅜ in. on a side into the cardboard around the panel hole for J; the jack collar isn't long enough to accommodate the extra thickness of the cardboard. Mount L1 on two 1½-in. right-angle brackets fastened to the front panel, and fasten the output transformer (L3) on the loudspeaker (SK) by soldering at the mounting flanges. Connect the transformer leads and provide a ground lead from the speaker frame to the ground terminal on the jack.

Next, cut the shaft of C1 to ¾-in. length and mount C1 on the board with 6–32 x ¼ in. machine screws.

Modify L2 by disconnecting one of the connections to the center-tap (unmarked) lug. Heat the lug and shake off the solder. Then, with heat applied to the lug, use needle nose pliers to loosen the lead with several gentle tugs. Be careful not to damage the litz wire. This modification changes the coil from a single-winding tapped coil to a two-winding coil. Fasten the coil on the small right angle bracket and mount on the circuit board. Proceed with circuit board wiring. Determine correct pairing of the windings on L2 with

MATERIALS LIST—THREE-TRANSISTOR PORTABLE

Desig.	Description
½ Watt Carbon Resistors, 20% Tolerance	
R10	270 ohms
R3, R7	1K
R8	2.7K
R1	6.8K
R4	22K
R9	47K
R2, R6	68K
R5-S	1K miniature volume control with switch (Lafayette VC-26)
C1AB	2-gang 365 mmf. tuning capacitor (Lafayette MS-142
C2, C5, C11	.01 mfd., 600-v tubular capacitor (Cornell-Dubilier "Tiny Chief")
C9	6 mfd., 15-v miniature electrotytic capacitor (Lafayette CF-104)
C3, C6	30 mfd., 6-v miniature electrolytic capacitor (Lafayette CF-104)
C4, C8, C10	100 mfd., 6-v miniature electrolytic capacitor (Lafayette CF-106)
C7	100 mfd., 15-v miniature electrolytic capacitor (Lafayette CF-126)
L1	transistor loop antenna (Miller 2000)
L2	transistor antenna coil; see text for modification (Lafayette MS-299)
L3	500:3.2 ohm transistor output transformer (Lafayette TR-95)
T1	2N168A NPN RF transistor (General Electric)
T2	2N214 NPN AF transistor (Sylvania)
T3	2N408 PNP AF transistor (RCA or Sylvania)
D	diode (RCA 1N54A)
J	miniature phone jack (Lafayette MS-282)
SK	6" PM loudspeaker, 3.2 ohm (Lafayette SK-27)
B	six 1.5-v flashlight batteries, series connected (RCA VS036)
	3¹¹⁄₁₆ x 6¾" miniature perforated wiring board (Lafayette MS-305)
	two 7¾ x 11⅛" perforated Masonite boards (cut from two Lafayette ML-81 boards)
	two 11⅛" lengths from 1 x 4
	two 6⅛" lengths from 1 x 4
	miniature knob (Lafayette MS-185)
	tuning capacitor knob (made from standard size surplus knob and thin plastic)
	earphones of 500-1000 ohms impedance
	handle, bracket screws



Back view of completely assembled front panel.

an ohmmeter or a continuity checker.

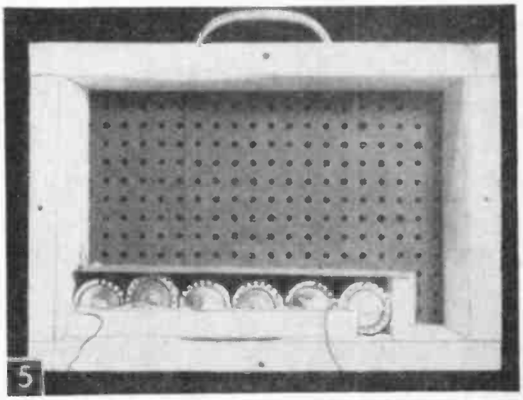
Fasten the wired circuit board to the front panel and complete the wiring. The antenna pickup lead is a 10-in. length of hook-up wire fastened mechanically (but not electrically) to the ferrite antenna loop (L1) mounting board. Fastening the knobs to the front panel completes receiver construction.

Set the L2 slug screw to extend about ⅜ in. beyond the end of the coil. Turn the trimmer on C1A all the way in, and then release it about ¼ turn. The trimmer on C1B should be turned all the way in and then released 2 turns. When you feel sure everything is right, solder in the batteries (using as little heat as possible), and try the set.

If the set squeals, move the lead to the stator lug of C1B away from the stator lug and associated surface of C1A. This lead provides the collector to base capacitance shown in Fig. 2. Tune to a station around 1400 kc, and adjust the C1B trimmer for maximum signal. Then tune to a station around 600 kc and adjust the slug of L2 for maximum signal. Now adjust the position of the C1B stator lead relative to the C1A stator for maximum sensitivity without oscillation.

You may find it advantageous to open the C1A trimmer considerably or to add turns to L1 by winding some of the "high-end" lead on the ferrite core. The plates of C1A may be bent to improve tracking. The important things are to be sure that you can tune the entire broadcast band, and that you have the greatest possible sensitivity over most of the band. Don't overlook the fact that this receiver is very directional!

If you wish to miniaturize this set, use a Miller 2001 or 2004 for L1, a Lafayette SK-65 (2½ in.) for SK, and six penlite cells for B. Coil L1 should make a right angle with L2 (but keep L1 horizontal), and these two coils should be separated as much as possible. Coil L1 should be kept away from the speaker or other metal surfaces.



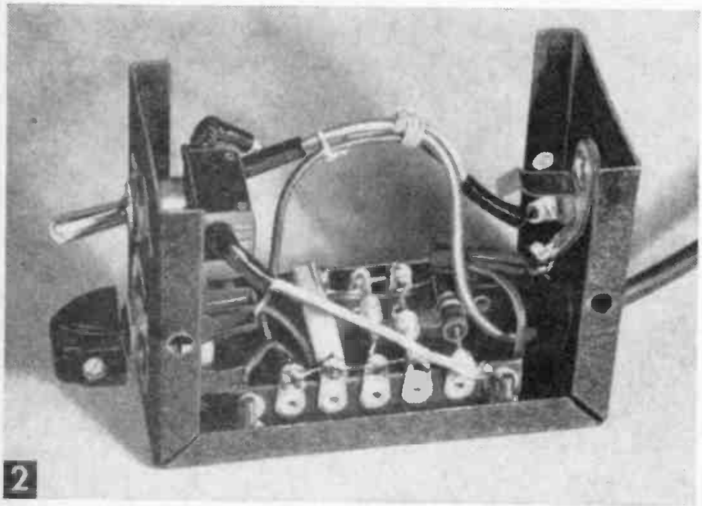
Looking into opened case from front.

The Little Muter A Noise Limiter For The Ham Station

The Little Muter, simple, inexpensive and effective.

By HOWARD S. PYLE,
W7OE

Photos by John F. Hoyt



2

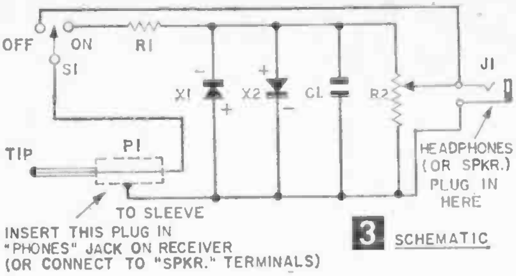
Internal view of noise limiter showing component mounting on tie points.

DISSATISFIED with the rather dubious noise-limiting circuits usually built into the average communications receiver, I conducted a number of experiments with the hope that they would lead to a better signal-to-noise ratio than conventional designs seemed to offer. I wanted a noise-*reducing* device, rather than something that took hold when the noise reached a certain level. In addition, my aim was to attempt to make such a circuit function as an audio noise reducer, with no attempt to reduce the noise pick-up in the antenna circuits, and to make such a device an accessory to the receiver, requiring no modifications or changes in receiver circuitry.

I came up with an extremely simple limiter, or reducer, as you please, which required no battery or other source of power, was small and compact and could simply be inserted in the headphone or speaker leads from the receiver. I have used this device in CW traffic net message exchange for several years . . . I would be completely snowed under without it! While I do not habitually work in the phone bands, the listening I have done there indicates that this little limiter is every bit as effective on phone signals as with CW. Were all parts for this unit to be purchased new, the total cost would be less than $5. With the possible exception of the crystal diodes, everything is readily available in your own station's scrap-box.

The unit is completely contained in a Bud Minibox which measures just 2¼ x 2¼ x 4 in. Figure 3 gives the schematic. In my own unit (see Fig. 2), I mounted capacitor C1, the two crystal diodes X1-X2, and the fixed resistor R1 between two Birnbach #1388 lug terminal strips (tie-points) which were in turn secured to the inside of the Minibox at a spacing of 1 in. Volume control R2 mounts on one end of the cabinet with the toggle switch S1 directly below it. The opposite end of the Minibox mounts the "Phones" jack near the bottom and, near the top center, a rubber grommet in a suitable hole to take the cord from the phone plug. Small decals, available at any radio supply store, mark the controls and add the professional's touch.

Use caution in wiring the two diodes. Make sure that their polarities are in opposition—positive to negative at each end, as shown



3 SCHEMATIC

MATERIALS LIST—NOISE LIMITER

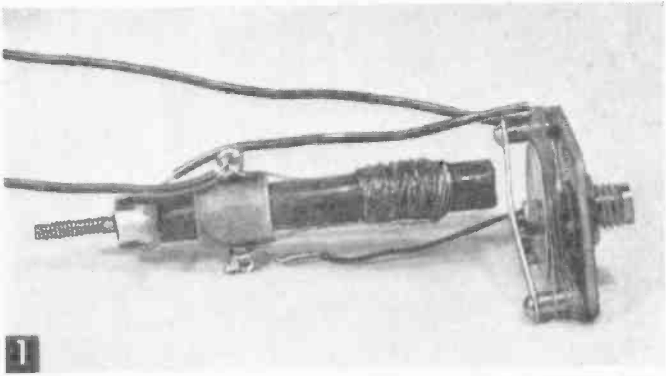
Desig.	Description
S1	SPDT toggle switch
R1	15 megohm 2-watt resistor
X1, X2	Sylvania 1N34 crystal diodes
C1	.0025 mfd. fixed capacitor
R2	10 megohm volume control (Mallory #U-20)
J1	open circuit phone jack
P1	phone plug
	Bud Minibox (CU-3003)

in the schematic. Use care, too, in soldering to the pig-tails of the diodes since they are easily damaged by too much heat. Solder quickly, but be sure it's soldered.

To install, plug the phone plug into the "Phones" jack on your receiver and plug your headphones into the jack under R2 on the *Little Muter*. That's it! If you prefer speaker operation, insert the Muter in the same way in the speaker leads.

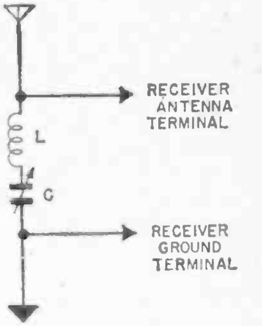
You'll find that Little Muter will cut your audio output, but no matter—with the excessive gain available in modern receivers, this merely means compensating for any loss of audio by running the audio gain control at a slightly higher setting. BUT, you'll find that while the signal comes up, the noise does not come with it in the same ratio! That what you want? I did, and Little Muter gave it to me! When you find conditions such that you don't need it, flip switch S1 to *Off* and you are conventionally connected to the receiver through your headphone or speaker.

Wave Traps Eliminate Station Interference



1

Broadcast band wave traps can be connected across receiver loop antenna if coil's axis is vertical. If trap is enclosed in a metal shield (tin can), orientation is not necessary.

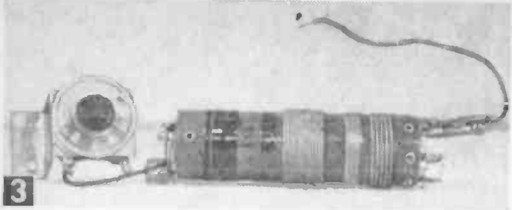


2 SERIES RESONANT WAVE TRAP "SHORTS" SIGNAL AT ITS RESONANT FREQUENCY

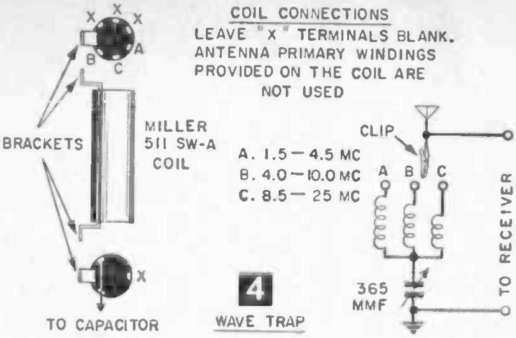
By FORREST H. FRANTZ, Sr.

A STRONG local radio station can interfere with reception of other radio stations in several ways. One type of interference that can affect any type of receiver circuit is adjacent-channel interference. If the strong local station is on 790 kc, it may affect stations from 700 to 900 kc in TRF receivers. The interference may cover a wider spread on the receiver tuning dial in the case of a crystal detector-amplifier type receiver. Adjacent channel interference in the more selective superhet circuit is not severe, but it can be troublesome on closely adjacent stations (for instance, 780 kc and 800 kc when the interference local is on 790 kc).

Another type of local radio station interference that can affect any type of receiver circuit is harmonic interference. Although FCC regulations require radio stations to keep signal harmonics low, harmonics of strong locals can cause interference. (The second harmonic of a station on 600 kc, for



Short-wave trap can be mounted on chassis at rear of set if capacitor is mounted on a bracket. Ground connection for capacitor is made through the bracket. The end of the clip lead connects to the antenna terminal of the receiver.



WAVE TRAP

example, would be received at 1200 kc.)

Local radio stations can produce interference in superhet receivers that is peculiar to the superhet circuit. This type of interference occurs because the superhet employs a fixed intermediate frequency. The incoming signal is mixed with the local oscillator to produce the IF (usually about 455 kc in AM receivers), and the mixing process produces a number of signal frequencies at the output of the mixer tube. The desired IF signal is the oscillator frequency minus the received signal frequency. Thus, if the receiver is tuned to receive a station on 1500 kc, the local oscillator frequency is 1500 plus 455 or 1955 kc. If the receiver is tuned to 1500-2(455) or 590 kc, the local oscillator frequency is 1045 kc. If the 1500 kc station is a strong local, the amount of its signal that appears at the input to the mixer tube even when the receiver is tuned to 590 kc may be very large. One of the signals at the mixed tube output is the received frequency *minus* local oscillator frequency, in this case, 1500—1045, or 455 kc., the IF frequency of the receiver. There is interaction between the 590 kc signal to which the receiver is tuned and the 1500 kc local signal; 590 kc. is the "image" frequency of 1400 kc.

Eliminating Interference. The basic wave trap configuration shown in Fig. 2 is a series resonant wave trap. It is connected across the antenna-ground terminals of the receiver. This wave trap effectively short-circuits the signal frequency to which it is tuned, but has very little effect at other frequencies. The higher the Q of the coil, the more effective the wave trap is. This type of wave trap can be connected across a loop antenna within a broadcast receiver or across the transmission line in the case of a TV receiver. This type of wave trap is recommended for any type of receiver because it will function effectively even if the ground to the receiver is poor.

A wave trap which will suppress frequencies in the broadcast band may be most easily constructed by using a commercially available coil, the Miller #6300 high-Q ferrite antenna coil. This coil has a Q of over 250 and will provide good rejection. The coil is adjustable and will tune the broadcast band with any capacitor having a maximum capacitance between 250 and 500 mmf.

The wave trap shown in Fig. 1 uses the Lafayette MS-445 365 mmf. tuning capacitor. This capacitor was chosen for its small size and low cost. It was housed in a tin can. The leads to the receiver antenna and ground terminals should be as short as possible. The antenna pickup lead on the coil must be unwound and may be shortened to form one of the connecting leads. The screw adjustment on the coil may be set so that the capacitor will tune the broadcast band. Or, by setting the screw for maximum inductance, the trap can tune down to about 450 kc. when the tuning capacitor is fully closed. If the screw is set for minimum inductance, the trap will tune up to about 2.5 megacycles with the capacitor fully open.

The short wave trap shown in Fig. 3 can tune the frequency range from 1.5 to approximately 25 megacycles. The coil is a Miller 511-SW-A, three-band short-wave antenna coil. The capacitor is the Lafayette MS-445, the same as for the broadcast trap. The windings on the coil cover 1.5 to 4.5, 4.5 to 10, and 10 to 25 megacycles respectively. The coil which covers the frequency to be suppressed must be connected in the wave trap circuit. A Mueller Minigator clip permits quick selection of the required coil, but this clip can be omitted and the coil may be soldered in the circuit for a more permanent installation. The schematic (Fig. 4) shows the connections. This wave trap may be fastened directly to the back of the receiver chassis. If you wish to make this wave trap easy to get at, so that it can be used to improve receiver tuning at all frequencies, house components in a metal cabinet and provide a switch for changing connections to the coil.

Save Those Dirty Radio Parts

• When dirty tube sockets, insulators, knobs, tuning capacitors and other metal, bakelite or ceramic radio parts won't come clean in ordinary cleaning solutions, try this idea. Allow the parts to soak a minute or two in a pan of boiling hot water to which a capful of liquid dishwashing detergent has been added, then brush them with a vegetable brush.—J.A.C.

Precision Stroboscope for Only $21

This accurate "motion stopper" will enable you to analyze motor operation and trouble shoot flaws in mechanisms

By W. F. GEPHART

1

Adjust the frequency control to synchronize the flashing strobe lamp with the speed of the fan. The blades will appear as though stationary.

WINKING at up to 6,000 flashes per minute, this easily built portable unit will show you fast moving mechanism "stopped," or in slow motion in order to spot wear, vibration or faulty design in power tools, fans, belts, motors, and reciprocating parts.

A simplified version of equipment widely used in industry, this strobe circuit, uses only about $21 in parts and performs as well as commercial instruments costing over $100. The rate of flashing is adjustable between 600, and 6,000 *rpm*, and by doubling up, you can measure any speed above or below this range. Unlike mechanical tachometers, the stroboscope absorbs no power from a direct connection to the moving mechanism itself.

How It Works. The basic principle of the stroboscope is simple. You might, for example, want to examine a fan blade rotating at about 300 *rpm*, (5 times a second). The blades will be in the same place every successive fifth of a second; therefore, if you could blink your eyes that fast, you would see the fan as though it were standing still. By means of the frequency control, Fig. 1, the rate of flashing is adjusted until it synchronizes exactly with the moving part. Adjust the control to flash slightly faster, or slower, and you can see the movement in slow motion. Reciprocating motions, such as the action of a pump, or the teeth of a high speed jig saw are clearly stopped in action.

If you calibrate your unit against a standard, you will be able to use it as a tachometer to make measurements of the *rpm* of high speed motors, phono turntables, and even of dental drills. Hobbyists have used strobe lights to check the speed of model gas engines vs. various fuel mixtures. And if your model railroad engine is balky, your strobe may quickly indicate the trouble, in a part that is vibrating at certain speeds.

MATERIALS LIST—STROBOSCOPE

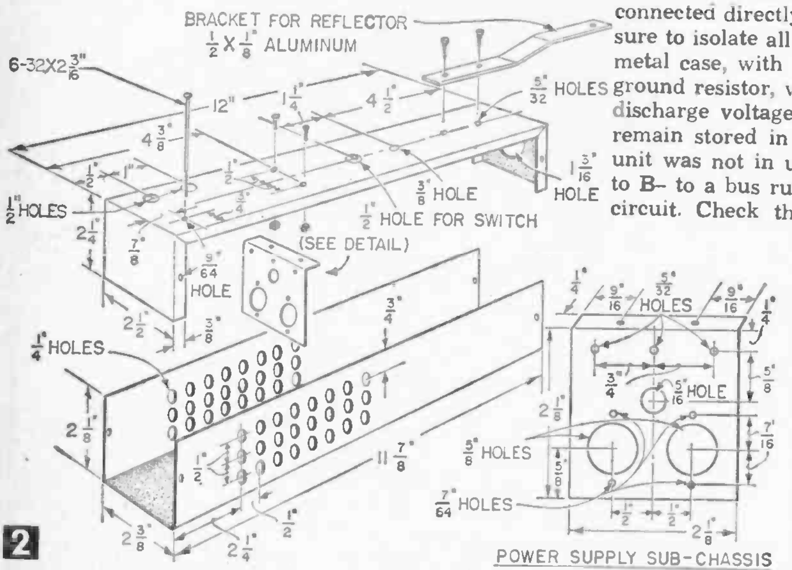
Desg.	Description
R1	27 ohm 1 watt 10% carbon resistor
R2	1 megohm 1 watt 10% carbon resistor
R3	7,000 ohm 5 watt wirewound resistor
R4	560K ½ watt 10% carbon resistor
R5	1 M ½ watt 10% carbon resistor
R6	2M potentiometer (linear taper)
R7	10M ½ watt 10% carbon resistor
R8	100K ½ watt 10% carbon resistor
R9	5K 5 watt wirewound 5% resistor
R10	10K 5 watt wirewound 5% resistor
R11	2K 5 watt wirewound 5% resistor
C1	8 mfd 450 V electrolytic capacitor
C2	8 mfd 150 V electrolytic capacitor
C3	8 mfd 450 V electrolytic capacitor
C4	.05 mfd 200 V electrolytic capacitor
C5	.033 mfd 200 V paper capacitor
C6	1 mfd. 400 V paper (Sprague 4TM-M1)
C7	20 mfd 450 V (Ill. Cond. IHTE 2045)
SW1	DPST toggle switch
SW2	SPST toggle switch (for range switch)
SR1, SR2, SR3	75 ma 130 RMS selenium rectifiers (IT&T Federal #1003A)
V1, V2	RCA OA2 150 volt voltage regulator tubes
V3	Sylvania 1D21/SN4 Strobotron tube
Misc.	Bud Minibox CU-2114 (12 x 2½ x 2¼" aluminum box and cover) 2 ea. 7 pin miniature sockets, 1 4-prong socket, 1 knob, terminal strips, line cord, reflector, decals, misc. hardware. Walsco Stroboscopic Disc #949

Note: See text and drawing for auxiliary trigger switch parts.

Building the Case. The stroboscope is completely enclosed in a compact aluminum minibox. Mount the strobotron tube socket at one end, and drill the holes for the switches and frequency control in the back, as in Fig. 2. Make the sub chassis of scrap aluminum, and mount all parts including tube sockets, and tie points before starting the wiring. The reflector shown in Fig. 1 is from a used Heiland photo flashgun, and can be obtained in most camera stores. Since the design of the bracket will depend on the kind of reflector that you obtain, exact dimensions are not given. Simply bend a piece of hardened aluminum strap, ½ x ⅛-in. to focus the center of the reflector directly behind the flashing area of the strobotron tube, which centers about ¾ in. down from the top of the tube. Since the power supply, and the regulator tubes generate heat, drill ventilating holes near these parts in each side of the cover as in Fig. 2.

Wiring the Circuit. Begin by wiring and testing the power supply, as in Fig. 3. It consists of a selenium rectifier tripler, with an output of about 430 volts, which is subsequently reduced to 300 volts for both the timing and strobe pulse circuits. Since one side of the power supply is connected directly to the a-c power line, be sure to isolate all interior circuits from the metal case, with the exception of the case ground resistor, which acts as a bleeder to discharge voltages which might otherwise remain stored in the capacitors when the unit was not in use. Make all connections to B– to a bus running through the strobe circuit. Check the output voltage of the power supply *before* connecting R3 to the regulator tubes. It should be 450 volts or less. If it is higher, increase the value of R3.

CAUTION: *High voltages in the power supply, and charges stored in the capacitors can be hazardous. Use extreme care to avoid shock in handling the chassis*



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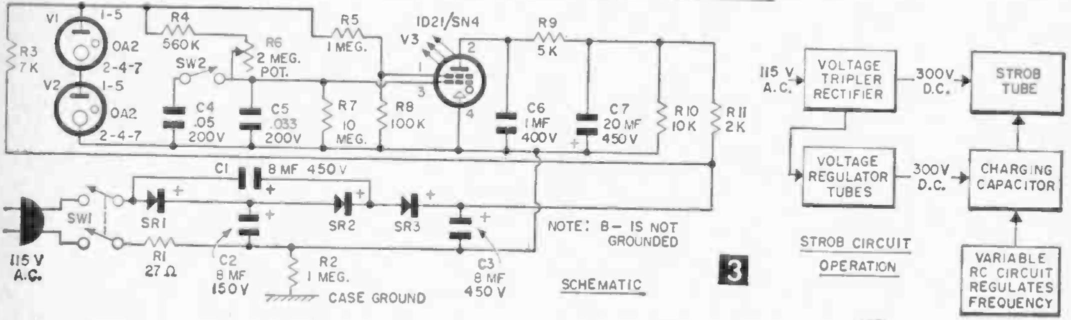
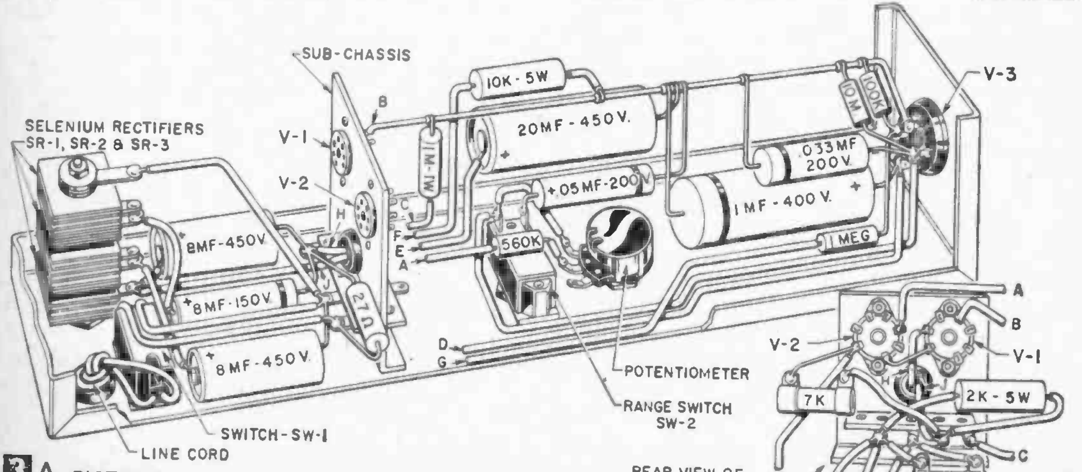


SCHEMATIC

STROB CIRCUIT OPERATION

3



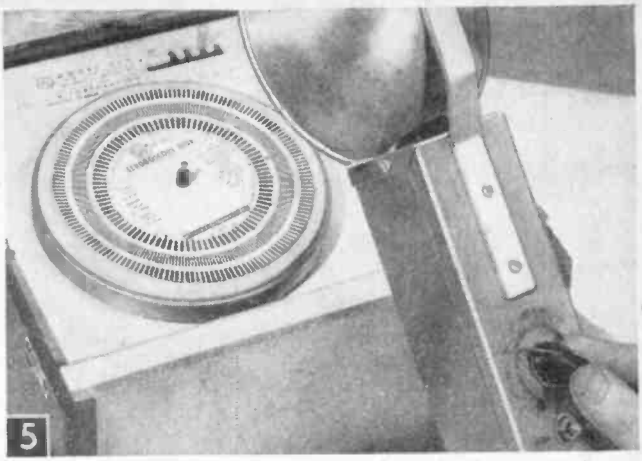
3A PICTORIAL

when power is on. Never touch any live parts, or non-insulated tools, clips, etc., with bare hands.

Next wire the regulator tubes, and the stroboscope section as in the schematic and the pictorial view, taking care to connect the adjustable frequency control R6, so that it has minimum resistance when fully clockwise. Cover all bare wires with spaghetti tubing, and keep the leads to the larger capacitors, C6 and C7, short, so their leads will support them firmly in position.

After wiring, check your work carefully against the schematic. Then, turn the unit on. The strobotron tube should start firing immediately, with the flashing rate increasing as R6 is turned clockwise. The low and high ranges should overlap slightly; with R6 turned all the way clockwise on low, the flashing rate should be slightly faster than with R6 fully counter clockwise on high. The strobe tube makes a slight cracking sound as it fires on low rates, and normally makes a steady buzz at higher flashing rates.

The strobotron tube operates on the principle of placing a high positive potential on the plate with the cathode grounded. When the difference in voltage between the two grids reaches approximately 100 volts, the gas between the grids ionizes, which in turn "ignites" the gas between the cathode and plate. Once the grid voltages "fire" the tube, the plate takes over control, and the gas remains ionized, with a high current flowing between plate and cathode, until the plate voltage is lowered, even though the voltage difference on the grids is removed.


5

An ordinary record turntable and stroboscopic disc are used to calibrate your strobe light.

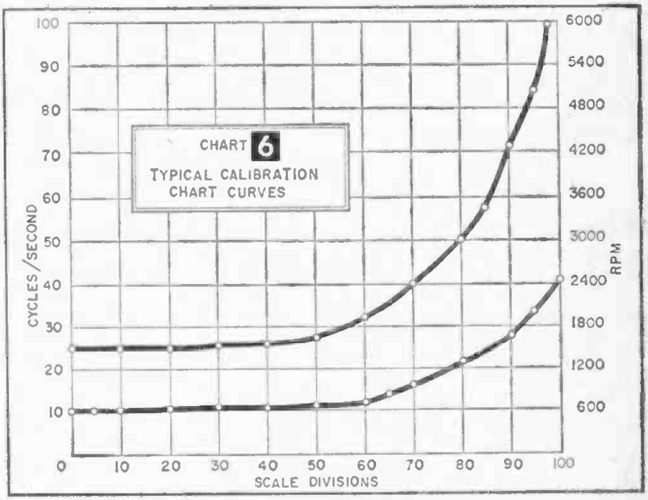
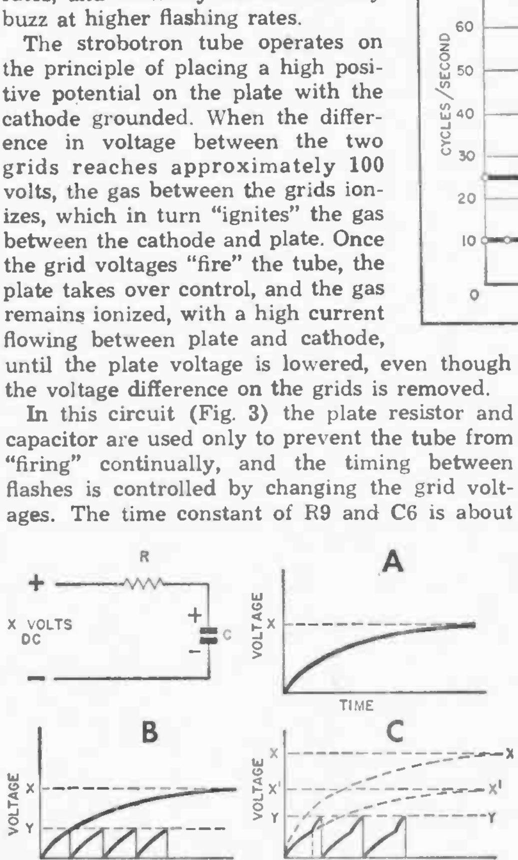


CHART 6

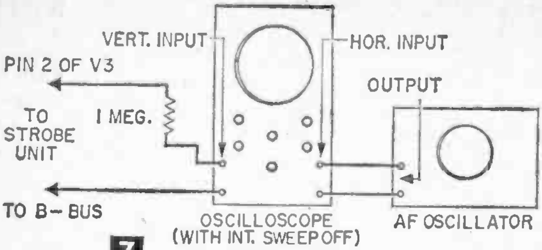
TYPICAL CALIBRATION CHART CURVES

In this circuit (Fig. 3) the plate resistor and capacitor are used only to prevent the tube from "firing" continually, and the timing between flashes is controlled by changing the grid voltages. The time constant of R9 and C6 is about .005 second, which is the duration of each flash. The grid voltage difference is controlled by a variable R-C charging circuit consisting of R4, R6, C5, SW2, and C4. When a capacitor charges through a resistor, the voltage across the capacitor increases, as shown in Fig. 4A, until it reaches the charging voltage. Notice that the voltage increases rapidly at first, and then tapers off as it approaches the charging voltage.

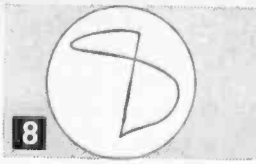
If arrangements are made to discharge the capacitor rapidly before it reaches the full charging voltage, a sawtooth wave, as shown in Fig. 4B is formed, and if this voltage "Y" is substantially below the full charging voltage, the curve will be more linear. Repeated charging and rapid discharging gives a series of evenly-spaced peaks, Fig. 4B. Charging of the plate and grid capacitors immediately after firing places a heavy load on the power supply, which would tend to drop the supply voltage from X to X1 as in Fig. 4C if this tendency was not minimized by the voltage regulator tubes, V1 and V2.



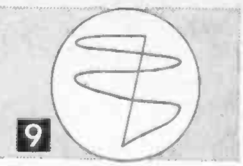
4 CHARGING CYCLES



7 CALIBRATION SET-UP

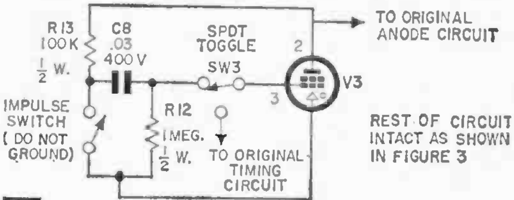


8 SINGLE CYCLE PATTERN, WHERE FLASHING RATE EQUALS OSCILLATOR FREQUENCY. USE FOR 20-100 C.P.S.



9 DOUBLE CYCLE PATTERN, WHERE FLASHING RATE IS TWICE OSCILLATOR FREQUENCY. USE FOR 10-20 C.P.S.

OSCILLOSCOPE PATTERNS



10 AUXILIARY TRIGGER CIRCUIT

The time between the peaks of the grid capacitor charging cycle is dependent on the time constant of the capacitor and the related resistor. The range switch SW2 provides additional capacity for the low frequency range, and R6 makes it possible to vary the time constant for each range. Wired as in the schematic, your strobe unit will have a low range of 10 to 40 cycles per second (600 to 2,400 *rpm*) while high will cover 25 to 100 *cps*, (1,500 to 6,000 *rpm*). You can change the coverage of the unit by altering the value of the grid circuit resistance and capacitance. Reducing the values increases the charging rate, which can be increased up to the maximum flashing rate of the tube, which is 240 pulses per second, (14,400 *rpm*).

It is however impractical to use flashing rates below 15 cycles per second for eye observation, since persistence of vision, the principle which makes it possible for us to see a series of still pictures as a movie, would tend to blur the image. Complete construction by applying the decals to identify the controls, and protect them with a coat of lacquer, or plastic spray.

Calibrating Your Strobe. While the stroboscope will be very useful at this point, calibration will enhance its uses in measuring exact speeds. Rather than calibrate the frequency dial on the back of the case directly, it is suggested that you make a chart (Fig. 6). Two methods of calibrating can be used; the latter requires an oscilloscope, and is somewhat more accurate.

The simpler method is to use a 33⅓ and 78 *rpm* phono turntable, and a stroboscopic disc available at record stores (Fig. 5). Since the accuracy depends on the turntable, check it first, by watching the disc, with a fluorescent lamp, or neon bulb, which will flash at exactly the 60 cycle frequency of your power line. If your turntable is not equipped with a speed adjustment, you can slow it down by loading it with records.

Now, plug in the stroboscope, and allow it to warm up a few minutes. Set the range switch on high, with the control turned clockwise to the maximum flashing rate. Watching the disc, as in Fig. 5, turn the control counter clockwise until the 78 *rpm* ring appears to stop. Mark this dial reading on your chart, as 60 cycles per second (equal to 3600 *rpm*). Continuing to turn the dial counter clockwise, the ring will "stop" again at five lower points on your dial corresponding to 2400, 1800, 1440, and 1200 *rpm*. Repeating these steps on low range, you will be able to obtain four calibration points representing 1200, 900, 720, and 600 *rpm*. With all of these points plotted on your graph, you will obtain curves indicating in-between speeds, as in the graph shown in Fig. 6.

CAUTION: *Avoid looking directly at the flashing strobotron for more than a few moments. The light can be harmful.*

The second method of calibrating requires an oscilloscope and an audio oscillator, connected according to Fig. 7, with a 1 megohm resistor input attenuator. Provided that you have constant line voltage, and warm up your equipment beforehand, it will provide more accurate results. Set the oscillator to 100 *cps* (equal to 6000 *rpm*) and adjust the strobe control to get a pattern similar to the one shown in Fig. 8. Since *rpm* is equal to cycles per second times 60, reduce the oscillator frequency in steps and take note of the dial settings, on your graph, required to obtain the scope pattern shown.

At frequencies below 20 *cps*, adjust the strobe for a two-cycle pattern (Fig. 9) since most oscillators will not go below 20 *cps*. To calibrate the low range, start with the high end of the scale, with the oscillator set at 40 *cps*, and adjust the strobe dial for the two cycle pattern. The strobe is then flashing at 20 *cps*, or 1200 *rpm*. Establish your curve points downward, using the two cycle pattern.

Accessory External Switch. If you wish to observe a motor or mechanism in stopped motion, which is changing speed, you can do it by continuously adjusting the dial, or more conveniently by means of an external switch, and the simple circuit addition shown in Fig. 10. The external switch can operate on a cam, or flattened portion of a shaft. A miniature switch with a nylon contact button which will operate at up to 9,600 *rpm*, without bounce is offered by Licon Division of Illinois Tool Works (Switch #16-4041).

Tips On Strobe Use. Using the stroboscope, you will notice that often you can "freeze" motion at several different flashing rates which are multiples of the true speed. High speeds above your top flashing rate can be measured as harmonics. Generally the true speed will produce the sharpest image. When measuring motor speeds, engrave or paint a fine line out from the center of the shaft. Harmonic speeds will cause the line to appear at several points.

When adjusting the flashing rate for the true speed of an object, the object will appear to move slowly in its true direction when the lamp is flashing too slowly, and seems to move slowly in the opposite direction when the lamp is flashing too rapidly. If a motor for example, is running at a true speed of 1800 *rpm*, and your strobe is set at 1801, the image will appear to be rotating slowly at 1 *rpm* in the direction of the motor rotation.

AMATEUR RADIO PUZZLE

By JOHN A. COMSTOCK

Do you like ham radio? Then here is an anagram puzzle on your favorite hobby. This puzzle contains many of the words, terms and abbreviations that you use in QSO's every day. See if you can fill in all the empty spaces correctly.

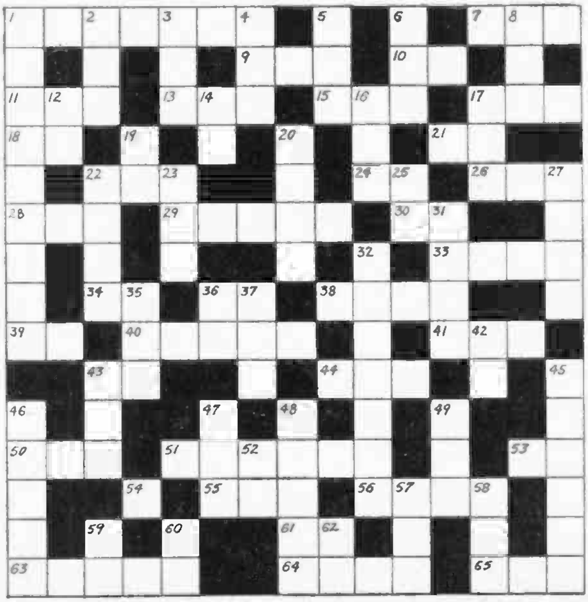
(For Solution, See Page 89.)

ACROSS:

1) A ham meeting.
7) A call acknowledging card.
9) Traffic (CW).
10) Code.
11) A ham radio outfit.
13) What a (.) sounds like.
15) Generator of frequencies.
17) A ham radio conversation.
18) One-million cycles.
21) A vacuum tube.
22) A short-wave listener.
24) Mutual conductance.
26) A circuit that is charged electrically.
28) A bunch of interconnected parts.
29) Type of tube base having eight pins and an aligning key.
30) No connection made.
33) Resistance is expressed in ——— (supply missing letters).
34) Break.
36) Call for all stations.
38) A bunch of frequencies.
39) A positive-potential grid.
40) A class of amateur operator license.
41) An effect connected with antennas.
43) Unit of inductance.
44) What is the correct time?
50) A radio amateur.
51) Class of ham license.
53) Reversing current.
54) Current flow.
55) A meter band used by amateurs.
56) A type of antenna named after its inventor.
61) After-all.
63) Medium of radio wave transmission.
64) Opposite of signal gain.
65) A type of battery cell.

DOWN:

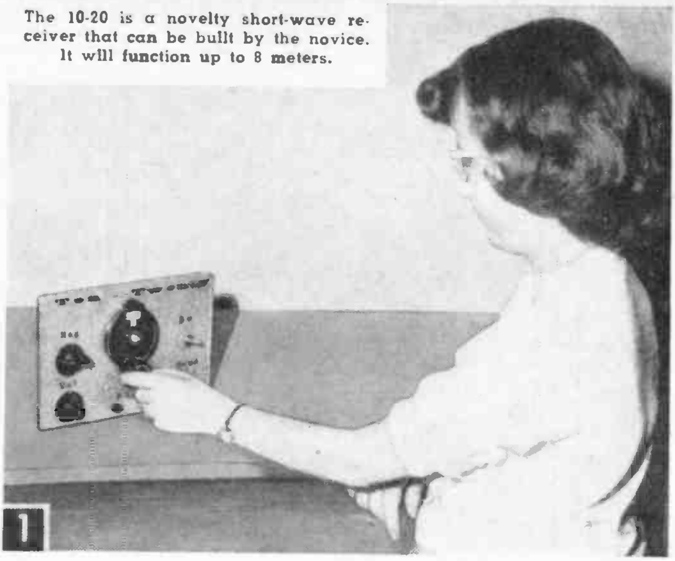
1) These are troublesome to some amateurs.
2) One-million cycles, ohms, etc.
3) Di-di-di-dah, di-dah.
4) Safety signal (CW).
5) An oscillator couppled by its electron stream.
6) Double cotton covered (wire).
8) Distress call (CW).
12) Vacuum tube cathode current.
14) Plate current flow.
16) A carrier of intelligence in communications.
17) A rig's location.
19) A wave that is continuous.
20) A type of transmission line used by hams.
22) Matching transformer.
23) An amateur radio station record book.
25) Minute.
27) To check equipment for proper operation.
31) Something you must learn to send and receive before you can obtain your ham license.
32) Type of oscillator circuit having a tapped inductance.
35) Ham radio operators often pound one.
36) Mid-tap (abbr.).
37) Shall I send more slowly?
42) Neon.
43) It's not good for a modulator to do this.
45) A ham license.
46) An inductance used to limit the flow of ac.
47) Potentiometer.
48) Last amplifying stage of a ham transmitter.
49) Something current does in an inductive circuit.
52) Di-di-di-dah, dit.
57) Address.
58) Continuous waves that are interrupted.
59) Watt-hour.
60) Regulates voltage.
62) Unmodulated carrier wave.



Ten-Twenty Short-Wave Receiver

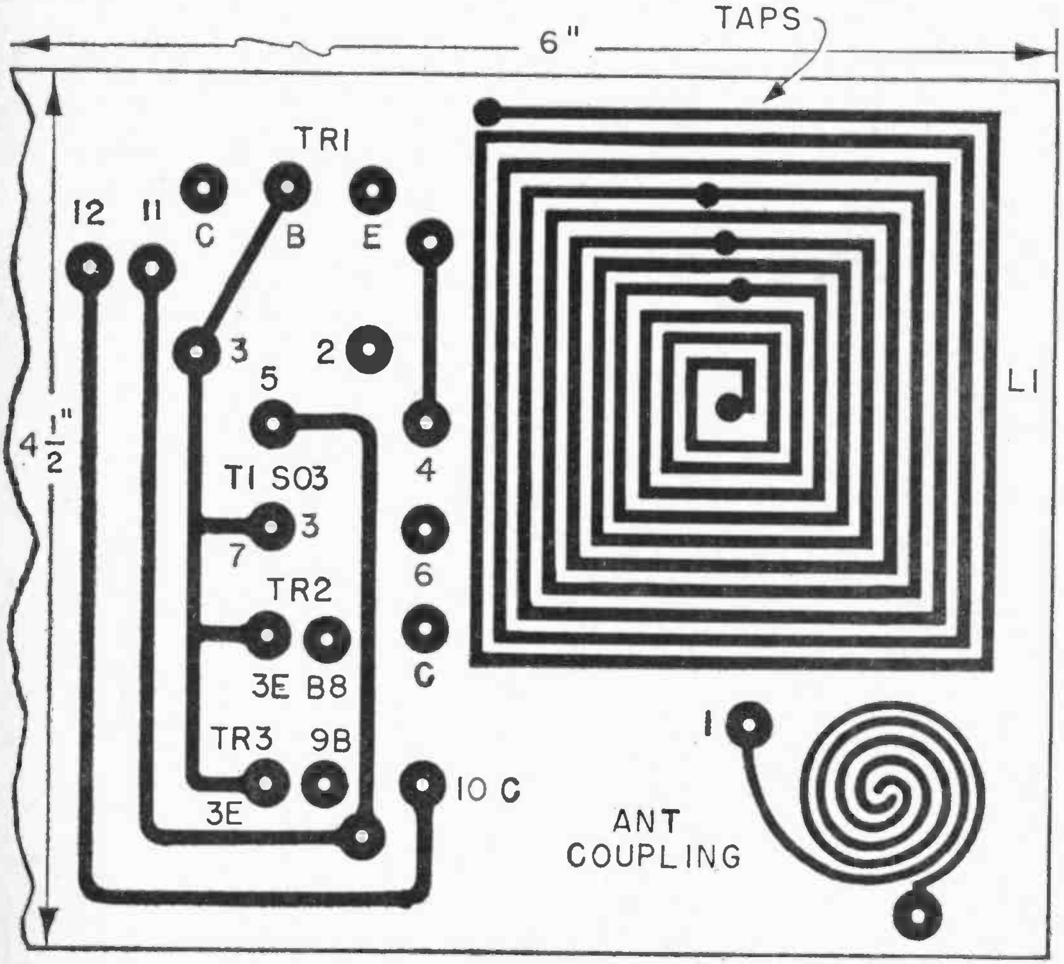
By HOMER L. DAVIDSON

HERE is a small, transistorized short-wave receiver—that the beginning experimenter can put together—that provides good short-wave listening on the 10- and 20-meter bands. And if you get a good specimen of a surface-barrier transistor, it will actually operate up to 8 meters.

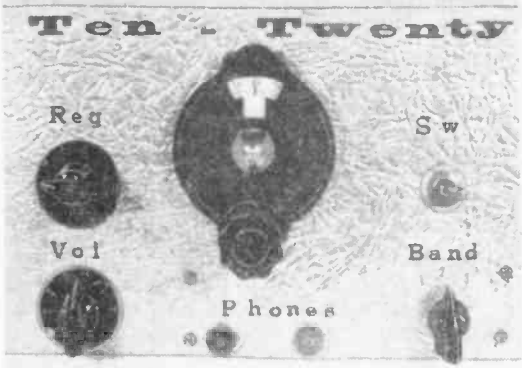


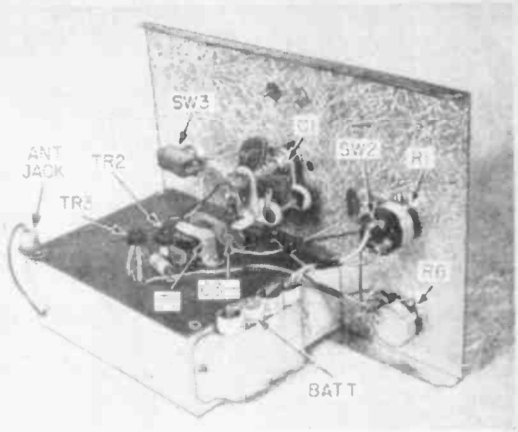
1

The 10-20 is a novelty short-wave receiver that can be built by the novice. It will function up to 8 meters.



2 PRINTED CIRCUIT BOARD ACTUAL SIZE



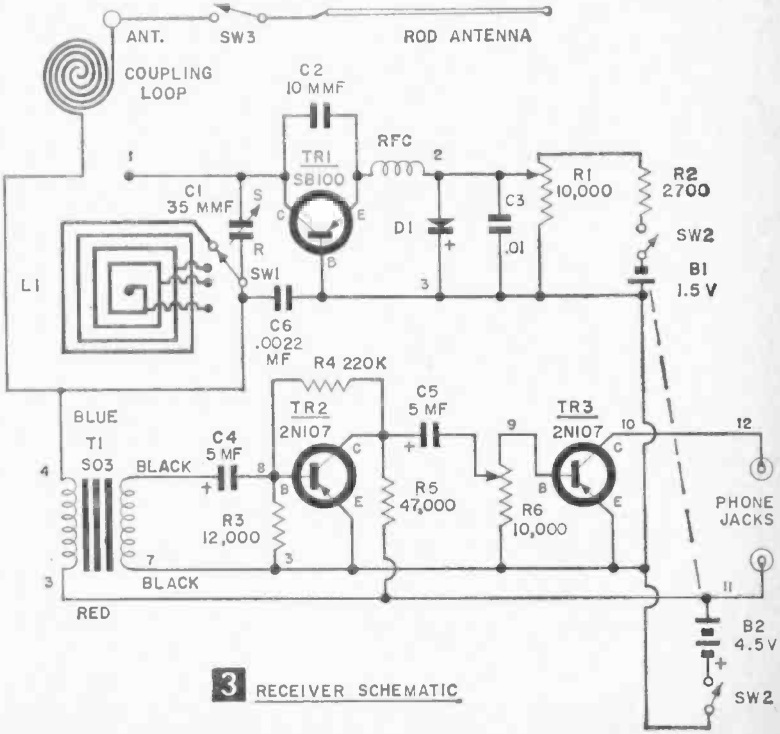


Transistor TR1, a Philco surface-barrier type, is the critical transistor. It is used as a super-regenerative detector.

The chassis for the transistor and parts is a printed circuit board (Fig. 2). Also on this board is coil L1. There is nothing complicated about laying out this coil. Follow Fig. 2, laying out 1/16-in. resist tape on the lines. Be sure the resist-tape has a spacing of its own width between each turn of the coil (a total of 10 turns). The coupling capacitor to the antenna jack and switch is also printed on the board. It is drawn with a ball point resist paint.

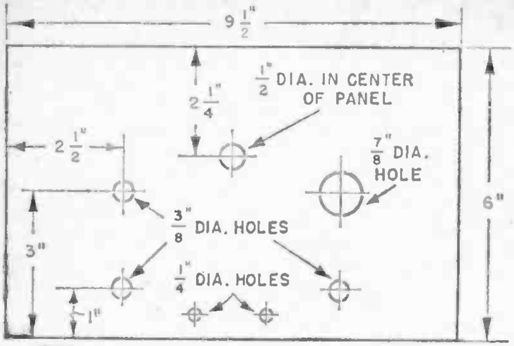
A homemade RF choke is wound with 35 turns of No. 28 cotton-covered wire over a ¼-in. dowel. The regeneration control R1 and C3 form a time constant creating another oscillation that increases the sensitivity of the small receiver. Use of diode D-1 is optional. On the 10-meter band the fixed crystal diode seems to strengthen the signal and sharpens the regeneration point of oscillations. But on the lower, 20-meter band there isn't too much improvement. If you have a fixed diode on hand, solder it into the circuit. Otherwise, omit it.

There are two stages of audio incorporated here with a small volume control in the input circuit of TR3. The output of TR3 is fed directly into a earphone. Battery supply B1 furnishes voltage to the regenerative circuit. Regeneration is very smooth with this type of operation. Battery supply B2 furnishes voltage to the collector side of TR1 and to both audio transistors.



3 RECEIVER SCHEMATIC

Printed Circuit Layout. Trace the printed circuit directly on the printed copper board from Fig. 2. Place a carbon paper beneath this drawing and transfer it with pencil to the board. (Wash the printed copper side with soap and water to remove any finger marks or grease that might be on it.) A sharp pocket knife will be needed to cut off the tape at the joints. A ball point pen will make coupling loop and all round connection joints. If the paint runs into another circuit, let it dry and then take the pocket knife and cut or scratch out a separation. (This can



4 FRONT PANEL LAYOUT

also be done after the circuit has been etched by cutting or scratching out the jointed copper circuits.)

After the circuit has been traced on the copper board, lay down the tape resist and pen point in the rest of the circuits. Let the paint dry several hours, then pour enough etching solution into a small tray or flat dish to just cover the printed board. Rock the tray back and forth for quicker etching. It will take about an hour to complete the process.

Wash the board in clear water and pour the etching solution back into its container. (The solution can be used over and over again.) Now remove the resist material. Use a small knife point to pull off the tape and scratch off the paint resist. Drill all small holes before mounting any parts.

Set Operation. All of the small parts are mounted on the printed circuit board as they are wired into the circuit. Cut the front panel (Fig. 4) from Reynolds aluminum stock, available in sheets at the local hardware store. Figure 5 gives dimensions of the PC board support. Check correct battery polarity before throwing the on-off switch, plug in a pair of earphones and the unit is ready to go. Turn on the regeneration control in the earphone. Hook up the antenna and rotate the tuning dial. Stations and whistles will be heard throughout the bands. When a station is located, turn the regeneration control down until the station is audible.

MATERIALS LIST—10-20—SHORT-WAVE RECEIVER

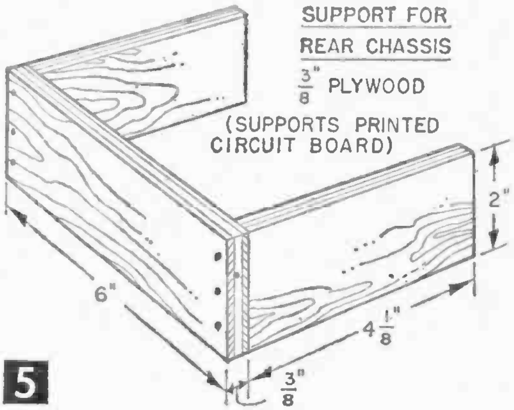
Desig.	Description
C1	35 mmfd Hammarlund variable capacitor MC 35-5
C2	10 mmf fixed disc capacitor
C3	.01 mfd 200-V paper capacitor
C4-C5	5 mfd 25V elec. capacitor
C6	.0022 mfd disc capacitor
R1, R6	10,000-ohm variable resistors
R2	2700 ohm, 1/4-watt fixed resistor
R4	220,000-ohm, 1/4-watt fixed resistor
R5	47,000-ohm, 1/4-watt fixed resistor
SW1	4 position, single throw rotary switch
SW2	DPDT switch on rear R1
SW3	SPST toggle switch
D1	1N64 or 1N34 fixed crystal
T1	S-03 transformer or equivalent (standard transformer)
TR1	SB100 Philco transistor
TR2-TR3	2N107 GE transistors
B1	1 1/2-v penlite cells
B2	three 1 1/2-v penlite cells
RFC	35 turn scramble wound over 1/4" form
L1	see text description

PRINTED CIRCUIT MATERIALS

Techniques Kit—Technicians #5003P obtainable from Lafayette Radio, 165-08 Liberty Avenue, Jamaica 33, N. Y.

Alternate Kit

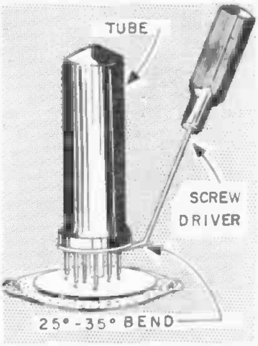
1-pt	PE-5 liquid etchant
1	PRLT liquid resist ball point pen
1	PCB XXXP copper Lam., 1 side 4 1/2 x 6"
1	PRT-2 tape resist 1/16 x 320"
	Also obtainable from Lafayette Radio



5

This little receiver has plenty of volume for earphone operation and some strong short-wave stations can be heard with the earphones laid beside the set. Not only will this small short-wave receiver bring in the 10- and 20-meter amateur bands but also aircraft signals and police bands.

Modified Screwdriver Lifts Tube



- A long-stemmed screwdriver with the bit bent at a 25 or 35° angle makes a handy tube lifter for extracting tight-fitting tubes. To make the bend, heat the tip to a cherry red and let it cool slowly to remove the temper. Bend, then reheat the tip and plunge it into oil. The modified tool also makes a handy offset screwdriver for reaching into inaccessible places on a chassis.—JOHN A. COMSTOCK.

Phono Turntable Repair

- Poor reproduction from a phonograph having the rim-drive type turntable mechanism is usually caused by slippage of the rubber-tired drive wheel. To renew the grip of the rubber tire, sand it lightly with sandpaper. A non-slip dial compound (such as General Cement's *Non-Slip*) applied to the wheel will also cure slippage.

Telephone Actuated Switch For Remote Control

By W. F. GEPHART

Front-panel view of telephone switch remote control unit. Note circular vents in cabinet. Throat microphone is in foreground.

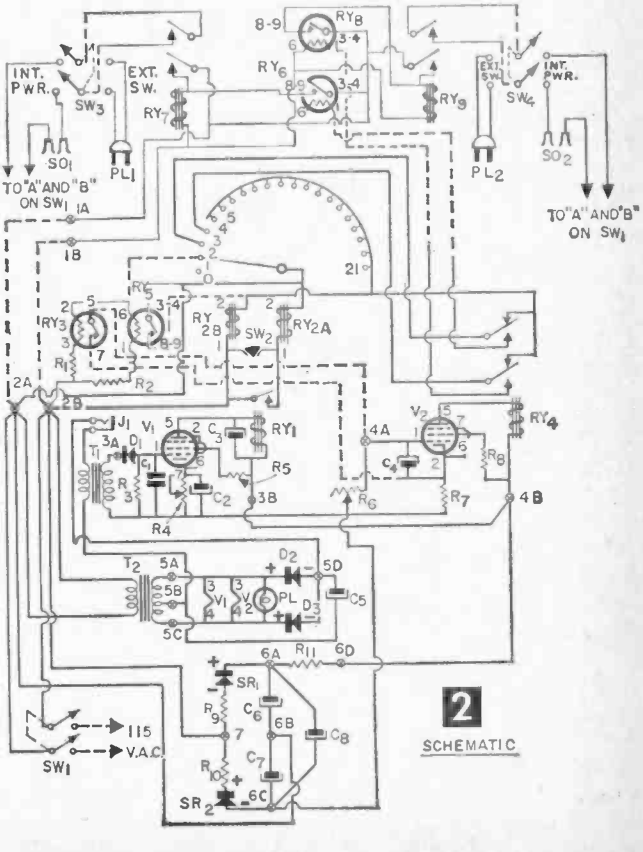
A TIMER will turn on a device at some future time, but it doesn't permit a change in plans. For example, it's nice to have the air conditioner on when you get home after a summer outing, but only if it's needed. With this telephone switch, you can be sure it turns on *only* when needed, because you turn it on by telephoning your home. The only requirement is that you have a dial telephone and the type of service where your telephone rings only when your number is called. Most metropolitan telephone service is of this type.

Switch operation is based on the timing relationship between ringing signals, and minor circuit modifications may have to be made to fit the ringing sequence of your telephone system. The circuit shown here is based on a system of one-second rings, spaced at five-second intervals. If your system operates on a different sequence, an understanding of the circuit is required to make the necessary, and minor, changes.

Tube V1 in Fig. 2 is an amplifier which closes relay Ry1 when the telephone ring is picked up by the microphone plugged into jack J1. Since this "connection" to the telephone is acoustic, it does not violate telephone company rules against devices attached to telephone lines "directly or by induction." Every time Ry1 closes, the "pulse" coil (Ry2A) energizes, moving the stepper relay arm one position. Tube V2 is a timing circuit that closes Ry4 for a given period of time when capacitor C4 is momentarily shorted out.

To operate the switch you dial your telephone number, let it ring *just once,* and hang up. You wait a few seconds, then dial your number again. Let it ring once to turn on the first device, twice to turn on a second device, etc. Ten seconds after you hang up on the second call, the device plugged into the proper outlet will come on.

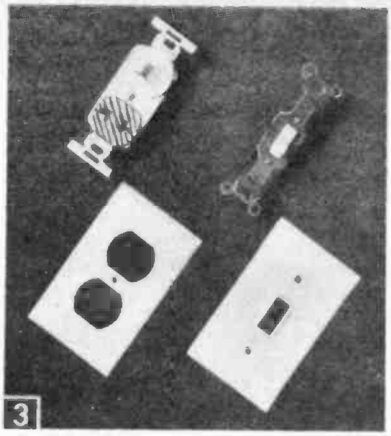
The ring on the first call closes Ry1 momentarily and moves Ry2 to Position 1. This completes the circuit to the heaters of thermal relays Ry3 and Ry5, which require 12 and 25 seconds, respectively, to close. During the dialing time for the second call, Ry3 closes, shorting C4, which closes Ry4. The first ring of the second call moves Ry2 to Position 2, which removes the voltage to the heaters of Ry3 and Ry5. Ry3 opens and



2 SCHEMATIC

Ry5 starts cooling, having had insufficient time to close. If you hang up after the first ring on the second call, Ry2 remains on Position 2, which completes the circuit to the heater of thermal relay Ry6.

After ten seconds, this relay closes, closing control relay Ry7, which turns on the device plugged into SO1. The control relay is then held closed by holding contacts.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Switch-outlet at left replaces regular switch at right (see text) when appliance controlled by wall switch is to be remote-controlled by telephone.

Now the device is turned on, but the stepper relay (Ry2) is on Position 2 and Ry6 is still heated. After a time interval in the V2 circuit, Ry4 opens, removing the voltage to the heater of Ry6 and completing the circuit to the re-set coil (Ry2B) of the stepper relay. The stepper re-sets to zero position, Ry6 cools and opens, but Ry7 remains closed through its holding contacts. The unit is then back to the original condition, except that the first remote-controlled device is now turned on.

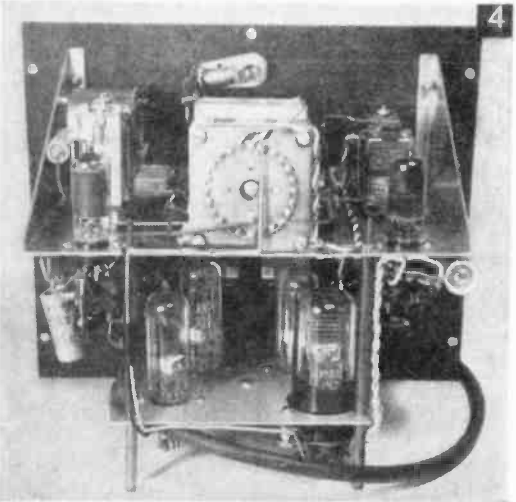
As shown here, the unit has two controlled circuits. Additional circuits for Positions 4, 5, 6, etc., could be incorporated for use by adding additional thermal and control relays. In such case, the time interval of V2 would have to be increased.

Proper timing is the key to successful operation. The timing of the thermal relays can be extended somewhat by resistance in the heater circuit, such as R1 and R2. Relay Ry3 is rated to close in 5 seconds, but closes at 12 seconds, due to R1, while R2 delays Ry5 from its rated 15 seconds to about 25 seconds. This use of resistors provides non-standard intervals and speeds up cooling (and therefore opening) time. A 25-second relay could be used for Ry5, but its normal opening time is about 90 seconds, as compared to the 15-20 seconds of Ry5 (as used here). Also, the octal version is used for Ry3, as it cools and opens faster than the miniature version. The timing of the V2 circuit is set by R6, whose adjustment will be discussed later.

Other Calls. Let's assume another caller than yourself lets your telephone ring a number of times before he hangs up. On each ring, Ry1 closes, the first ring moving the stepper relay arm to Position 1. The second ring occurs five seconds later, so neither Ry3 or Ry5 can heat up or close. This second ring moves the stepper to Position 2, which closes the circuit to the re-set coil (Ry2B) through the contacts of Ry4 (since this relay is still open), and the stepper re-sets. The third ring moves the stepper to Position 1, the fourth to Position 2, which resets it, and the sequence continues.

When the caller finally hangs up, the stepper will either be at zero position or Position 1. At zero position, the unit is at normal position, so no further action is required. If ringing stops with the stepper on Position 1, Ry3 closes after 12 seconds, closing Ry4. Some 12 seconds later, Ry5 will close, completing the circuit to re-set coil Ry2B, and returning the stepper to zero position. In another 10-12 seconds, Ry4 will open, and the unit will be back to normal.

If, during the above, another call comes in after Ry4 closes, but before Ry5 can close and re-set the stepper, the first ring will move the stepper arm to Position 2. Since Ry4 is closed, the circuit to Ry6 will be completed, but the next ring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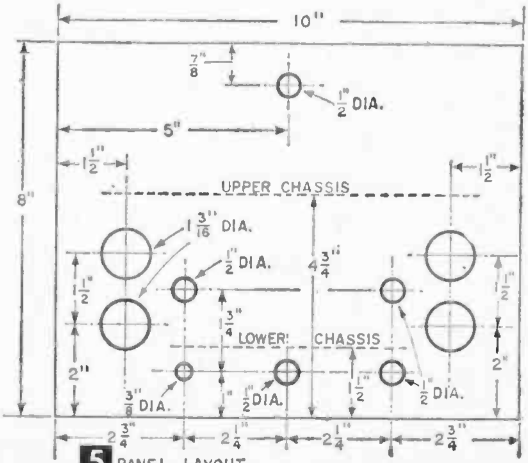
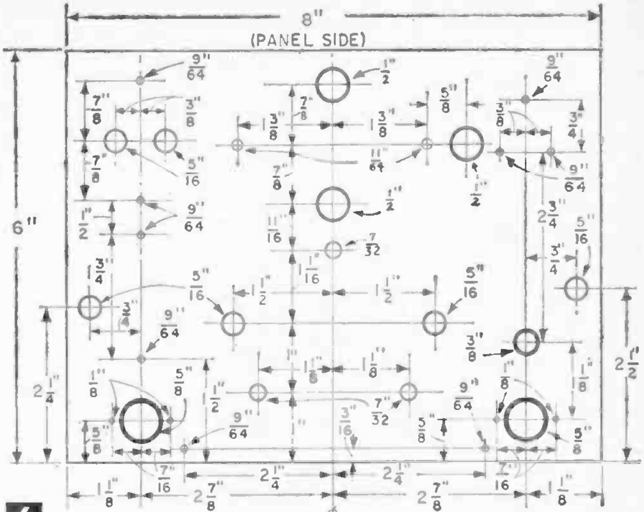
Back view of unit showing dual chassis construction.



5 PANEL LAYOUT

on this second call will move the stepper to Position 3 before Ry6 can close. The third ring will move the arm to Position 4 before Ry8 can close, and the stepper will then be re-set even if Ry4 is still closed.

If your telephone rings just once (as often happens), Ry3 and Ry4 will close, but the unit will be re-set as mentioned above. If a second call comes in within the 30-odd seconds while Ry3 and Ry4 are closed, nothing will be turned on unless this second call consists of only one or two rings. Essentially, then, the unit is foolproof.



6 UPPER CHASSIS LAYOUT

Use. In Fig. 1, the first ring controlled device is plugged into the socket on the left; the second-ring controlled device is plugged in on the right-hand socket. Switches SW3 and SW4 determine whether the unit is to control the external device by furnishing it with power or simply by closing a circuit.

A light or fan normally controlled by a wall switch can be handled by this unit without radically altering the house wiring. Remove the wall switch and substitute a combination switch-outlet, wiring switch and outlet in parallel and connecting the regular wiring to the terminals. The light or fan can then be operated by the new wall switch (as before with the old) or by "jumpering" the outlet. The telephone switch does this "jumpering" when SW3 or SW4 are set on "External Switch" and an ordinary extension cord is connected between the "External Switch" plug on the unit and the new outlet. The old and new items involved are shown in Fig. 3, with stripes painted on the outlet to distinguish it from a power outlet.

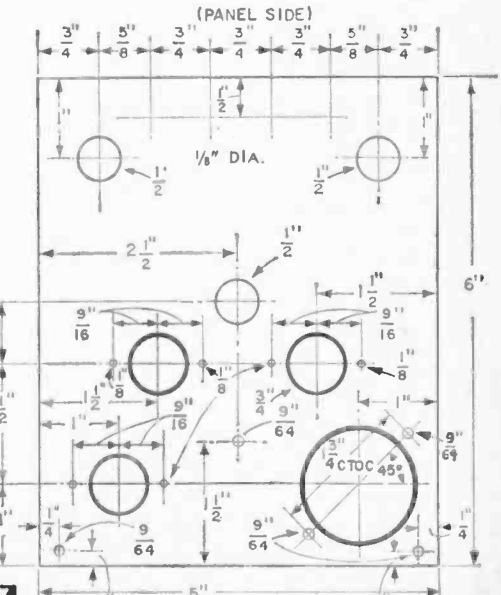
By using impulse relays instead of regular relays for Ry7 and Ry9, the unit can be used to turn things "off" or "on" or both. The impulse relays are wired the same as Ry7 and Ry9, except that holding contacts are not used. The first call throws the relay arm to one position and the second call, using the same code, throws it to the other position.

The "Test" button (SW2) on the front panel parallels the contacts on Ry1 and advances the stepper relay each time it is pressed. It can be used for checking the timer circuits and—when impulse relays are used—can be used to turn things "off" or "on" manually. When regular control relays are used, a device that has been turned on by a telephone call can be turned off only by unplugging it or turning the entire unit off for a moment.

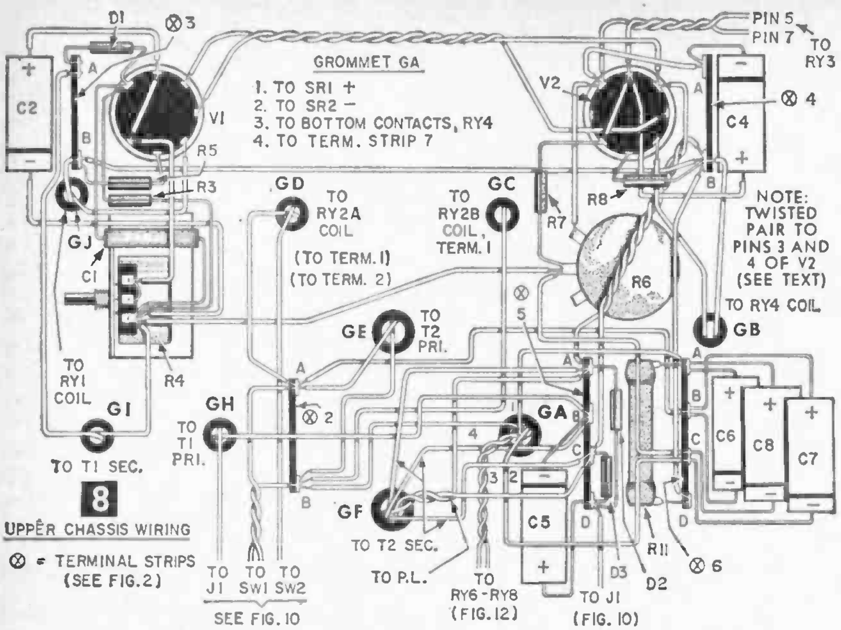
Filament transformer T2 provides filament voltage and with D2 and D3, approximately 3.5 volts dc for the carbon microphone. Plate voltage is provided by a voltage doubler (SR1, SR2, C6, C7 and C8) which connects directly to the power line, requiring that no connection be made to the metal chassis or cabinet.

Construction. Figure 4 shows a back view of the unit. Dual chassis construction is used both to secure adequate room and to minimize the heating effect on the thermal relays. All heat generating items (tubes, pilot lights, etc.) are mounted on the well-ventilated upper chassis, and the thermal relays and control relays are mounted on the lower chassis.

Layouts for the panel, upper and lower chassis are shown in Fig. 5, 6, and 7. The upper and lower chassis are made of scrap aluminum, attached to the panel with aluminum angle. The side sections on the upper chassis are not absolutely necessary, as the connecting bolts between



7 LOWER CHASSIS LAYOUT



8 UPPER CHASSIS WIRING

the two chassis (which rest on the bottom) will properly support the upper chassis. If scrap aluminum is not on hand, a 3½ x 6 x 8-in. "Minibox" (Bud CU-3009 or CU-2109) will provide all that is required. The flanged side of this box will make the upper chassis merely by cutting the ends of the box to make the side supports, and the other half of the box will make the lower chassis and the 2 x 2-in. mounting for R4.

After the panel and chassis sections have been drilled and punched, mount components on all three and attach the upper chassis to the panel. The upper chassis and panel must be wired before the lower chassis is attached to the panel, and the heavy lines in the schematic (Fig. 2) show this initial wiring. As it proceeds, hold the lower chassis (with components mounted) in place from time to time, to check for clearance.

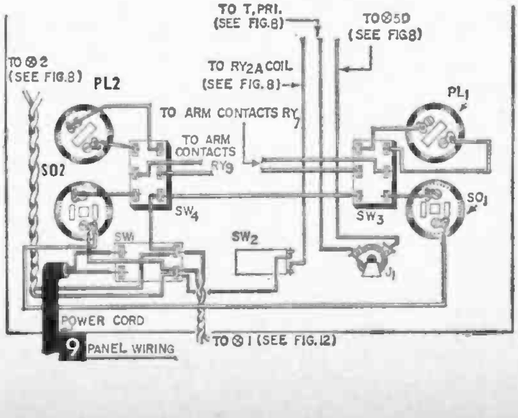
Figures 8, 9, 10 and 11 show wiring. In Fig. 8 a twisted pair is shown to pin 3 of V2 and terminal 4B of the terminal strip, upper right. The twisted pair leads *should* be shown to pins 3 and 4 of V2; the lead now going to terminal 4B should be shown to V2's pin 4. Filament and pilot light wiring is done first, followed by the carbon microphone voltage supply. The *dc* power supply is wired next, and then the relay wiring. In wiring between SO1, SO2, PL1, PL2, SW3, SW4 and the contacts on Ry7 and Ry8, be sure to use at least #14 wire. The tube circuits are wired last.

Testing. Before attaching the lower chassis, temporarily attach *ac* leads to SW1 and make sure that filament, microphone and plate voltages are available. The filament voltage should be 6.3 *v ac*, the microphone voltage about 3.5 *v dc*, and the plate voltage around 260-280 *v dc*. Next, put V1 in its socket and adjust sensitivity control R4. This adjustment is very critical and must be set to your telephone. If your telephone has an adjustable bell, turn the bell to its loudest point to minimize the sensitivity required. Also, allow the unit to warm up 5 minutes before making adjustment.

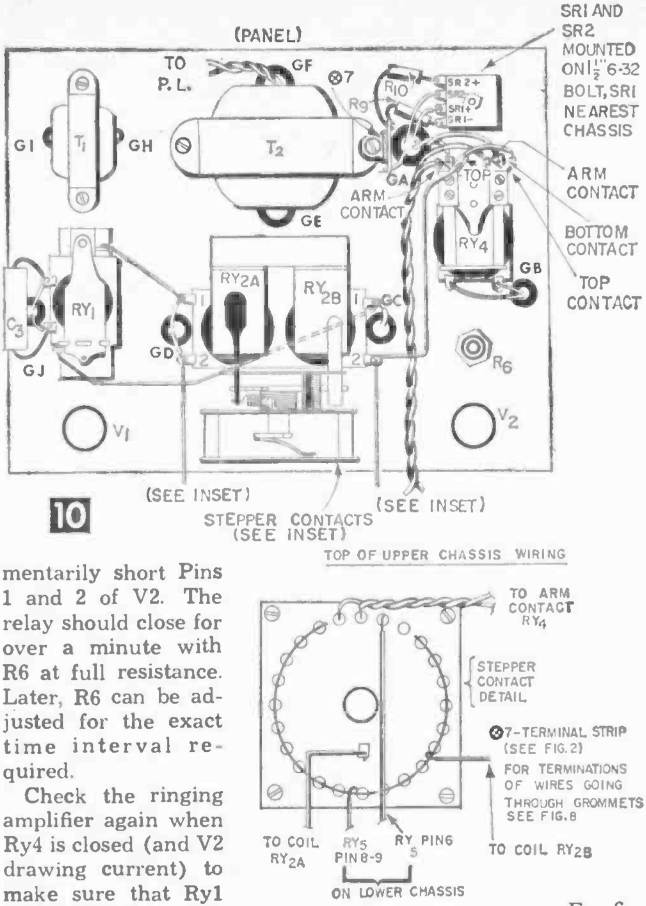
Insert a milliammeter in the B+ lead of V1 at Tie Point 3B. Using R4 to vary the plate current, adjust the relay spring so that the relay closes at about 5.8 *ma*. With this adjustment, the relay should open at about 4.4 *ma*. Then set R4 so that the tube draws about 4 *ma*.

To test this adjustment, place the microphone under the telephone with the two buttons resting against the bottom of the instrument as close to the ringer openings as possible, to utilize both sound and vibration. Have a friend call you and see if Ry1 closes on each ring, and what current is drawn by V1 during the ring. The *dc* voltage across R3 during ringing ought to be about 6 *v*, increasing the plate current to over 6 *ma*. There is a fraction of a second delay in the relay closing, due to the charging of the capacitors in the V1 circuit, but this minimizes accidental triggering of the relay when the telephone is touched or the receiver raised. If the plate current of V1 drops during the ringing, check the polarity of D1.

After this adjustment has been made, put V2 in its socket and set R6 at mid-resistance point. As V2 warms up, Ry4 will close and reopen after a short interval. This is caused by plate current flowing as C4 charges up. After Ry4 opens, set R6 to maximum resistance and mo-



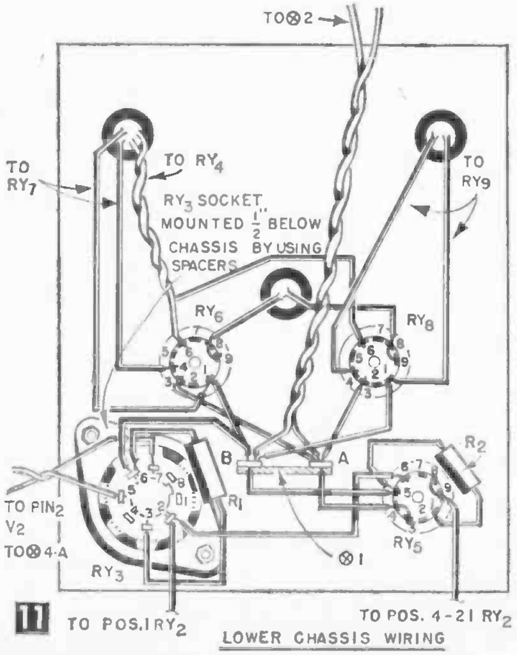
9 PANEL WIRING



10 TOP OF UPPER CHASSIS WIRING

mentarily short Pins 1 and 2 of V2. The relay should close for over a minute with R6 at full resistance. Later, R6 can be adjusted for the exact time interval required.

Check the ringing amplifier again when Ry4 is closed (and V2 drawing current) to make sure that Ry1 will close properly on a ring when the supply voltage is reduced by the load of V2.



11 LOWER CHASSIS WIRING

Before attaching the lower panel, pre-wire it to the extent possible, as shown in Fig. 11 and in the light lines in the schematic, Fig. 2. Then fasten it to the panel and bolt the two chassis together with two 5-in. 6-32 bolts and spacers. The spacers are made of ¼-in. copper tubing, the ones between the chassis being 3¼-in. long, the lower ones 1½-in. long. The wiring is then completed as shown by the dashed lines in Fig. 2, running some wires from one chassis to the other along the spacers.

To check final wiring and thermal relay timing, plug in both tubes and Ry3, and press the "Test" button once. The stepper relay should move to Position 1, and after about 12 seconds Ry4 should close, indicating that Ry3 has closed. This interval was selected as the average time required to hang up after the first call, re-dial a seven letter-digit number, and get the first ring. If this time is too long, or Ry3 doesn't close, reduce the size of R1, by trial and error. If the interval is too short, increase R1.

Next, remove V2, re-set the stepper manually, and plug Ry5 in. Press the "Test" button once, advancing the stepper to Position 1. After about 25 seconds the stepper should re-set, indicating that Ry5 has closed. If this timing interval is off, adjust with Ry3.

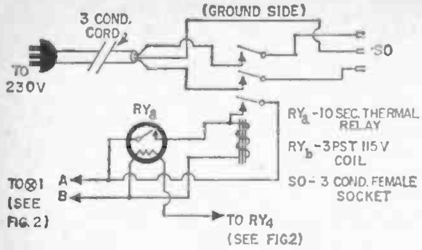
For final checks, replace V2, set SW3 and SW4 to "Internal Power," and plug a table lamp (or night light) with the lamp switch "on" into SO1 and SO2. Press the "Test" button once and as soon as Ry4 closes, press it again. After 10 seconds, Ry7 should close, turning on the lamp plugged into SO1. Repeat this test, but press the button twice after Ry4 closes to see if Ry9 and the lamp plugged into SO2 goes on. To release control relays (Ry7 and Ry9), turn the unit off momentarily.

Before adjusting timing control R6, have a friend call you so you can time the length of the rings and the interval between them. The time Ry4 stays closed must be equal to the total ring-interval time that it takes to move the stepper relay to the last control position (in this case, Position 3), plus 10 seconds. For example, in the unit shown (with two control positions) with a ringing pattern of one second rings spaced five seconds apart, the total time for Ry4 to be closed would be:

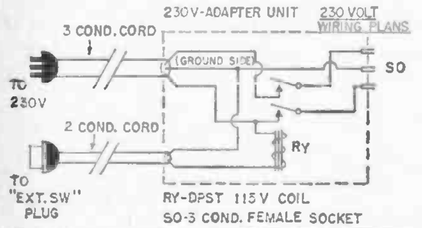
1 second for ring that moved Ry2 to Position 2
5 seconds interval between rings
1 second for ring that moved Ry2 to Position 3
10 seconds for Ry8 to close

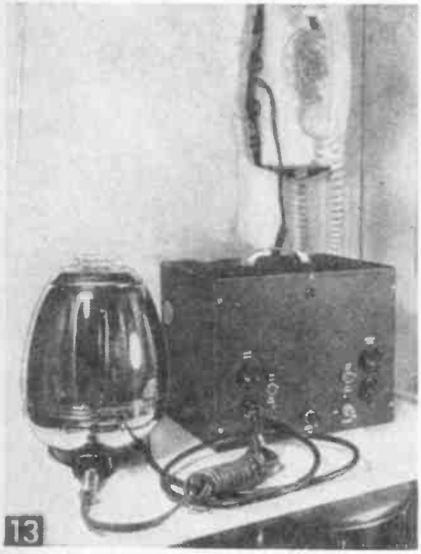
or a total of 17 seconds, plus 5 seconds leeway for a total of 22 seconds

Set the time on Ry6 by shorting Pins 1 and 2



12 230 V CONTROL RELAY WIRING





Unit in operation. Throat mike on wall telephone will turn on coffee maker—black box, black magic, black coffee.

MATERIALS LIST—TELEPHONE SWITCH

Desig.	Description
R1	1200 ohm, 1 watt
R2	2000 ohm, 1 watt
R3	.27 meg. ½ watt
R4	2000 ohm potentiometer
R5	27K, 1 watt
R6	5 meg potentiometer
R7	3000 ohm, 1 watt
R8	12K, 1 watt
R9, R10	27 ohm, ½ watt
R11	3000 ohm, 10 watt
C1	.02 mfd, 200 v
C2	10 mfd, 25 v
C3	25 mfd, 25 v
C4	50 mfd, 15 v
C5	50 mfd, 6 v
C6, C7	20 mfd, 150 v
C8	20 mfd, 450 v
Ry1	SPDT, 2500-ohm coil (Potter & Brumfield LM-5)
Ry2	midget 21 pos. stepping relay (Guardian MER-115)
Ry3	5-sec. thermal relay, normally open (Amperite 115N05)
Ry4	4PDT, 5000 ohm coil (Guardian Series 200 coil, and Type 200-M5 contacts)
Ry5	15-sec. thermal relay, normally open (Amperite 115N015T)
Ry6, Ry8	10-sec. thermal relays, normally open (Amperite 115N010T)
Ry7, Ry9	4PDT, 115-v ac coil (Guardian Series 200 coil & Type 200-M5 contacts)
T1	microphone transformer (Merit A-2929)
T2	filament transformer, 6.3 v @ 2 amp. (Merit P-2945)
SW1	DPST 15-amp. toggle switch (Carling 2FB54-73)
SW2	SPST push button
SW3, SW4	DPDT 15-amp. toggle switches (Carling 2GL-53-73)
J1	open circuit jack
D1, D2, D3	1N66 or 1N34 diodes
SR1, SR2	65 ma., 130-v selenium rectifiers
PL1, PL2	male chassis plug (Amphenol 61-M)
SO1, SO2	female chassis socket (Amphenol 61-F)
PL	6.3-v pilot lamp and jeweled socket
V1	6AU6
V2	6CB6
	7 x 8 x 10" cabinet (Bud CU-879), scrap aluminum (see text), two 7-pin miniature sockets, three 9-pin miniature sockets, one octal socket, four 1" vent plugs, handle, two 5" 6-32 bolts, tie points, miscellaneous hardware. T-30 surplus throat microphone (available from G&G Radio Supply Co., 51 Vesey St., New York 7, N. Y.)

of V2 together repeatedly until the desired time is reached.

Final tests consist of having a friend call to check operation under actual conditions. With table lamps plugged into SO1 and SO2, and SW3 and SW4 on "Internal Power," have your friend call, let the phone ring once, re-dial and let ring once again. If the first ring on the second call comes in before Ry4 has closed *and* your friend's dialing speed is average, decrease the time for Ry3 to close. If Ry4 had closed before the first ring of the second call came in, the lamp plugged into SO1 should go on about 10 seconds after the second call. Repeat this test, but let the telephone ring twice on the second call. Lamp 1 will remain on, and 10 seconds after the second ring, Lamp 2 should go on, the stepper relay re-setting shortly after. If Ry4 opens (re-setting the stepper) before Lamp 2 comes on, lengthen the time interval of the V2 circuit, by adjusting R6.

Adaptations. This unit can be used for switching 230-*v* circuits by altering either or both control relays (Ry7 and Ry9) or by building separate 230-*v* adapters.

Both means are shown in Fig. 12. Either alteration requires a power lead to a 230-*v* source. With relay modification, this lead can be brought out of the cabinet at the point normally used for SW3 or SW4.

The control relays specified have 8-amp. contacts. If additional capacity is required, either heavier relays (requiring additional chassis space and heavier internal wiring) or external power relays will be required. In the latter case, the external relay used to turn the device on should have a 115-*v ac* coil. It would be plugged into SO1 or SO2. When using unit with air conditioners or other heavy-duty appliances, use a portable cord and other connected wiring from an outside relay that has adequate size to carry the current of the appliance safely. Relay contacts should also be capable of carrying the required current.

Figure 13 shows the unit in operation—using the throat microphone strapped to a wall telephone—set up to turn on an automatic coffee maker. Whenever using the unit with a telephone with a separate bell, the microphone should be strapped to the bell box, near the bells.

In operation, there are several points to keep in mind:

1) Let the unit warm up five minutes before using.

2) Place the microphone as near the bells as

possible, and tight against the bottom (or side) of the telephone or bell box, to get both sound and vibration. Where adjustable bells are available, set to loudest setting.

3) Keep in mind that, when calling, the sound you hear is not the actual bell ringing; it is a ringing "signal" indicating that ringing current is being placed on the line. If the sound is a short, fractional part of a full ring, the bell may have merely "tinkled," and Ry1 may not have closed. In such case, complete the calling procedure, and if there is any doubt in your mind, repeat it a minute later. Unless impulse relays are used (to turn "on" and "off"), repeated calls on the same code won't hurt.

4) You can turn on the circuits in any sequence; that is, Number 2 first, followed by Number 1, or vice-versa.

5) If there is repeated difficulty in Ry1 closing on rings, check your line voltage regulation. In areas of high line-voltage variation, the plate voltage to V1 may vary enough to require different settings for R4. In such case it may be necessary to put two voltage regulator tubes (an OA2 and OB2, series-connected) in the doubler power supply circuit.

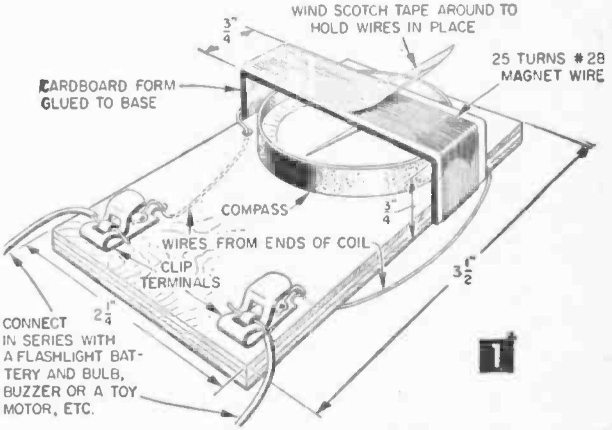
Compass Galvanometer

MANY electrical measuring instruments are based on the design of the d'Arsonval String Galvanometer, but substitute a needle-suspended coil riding on jeweled bearings for the hanging coil employed in the original precise lab instrument.

The galvanometer is usually used to indicate the polarity and presence of small currents by comparison methods.

The d'Arsonval instrument suspends a small coil between the poles of a permanent horseshoe magnet. When a current flows through the coil it becomes an electromagnet and its *like* poles repel the *like* poles of the horeshoe magnet, thus causing the coil to turn or twist on the metallic string or ribbon by which it is suspended (Fig. 2). The strength of the current determines the extent of the coil's rotation.

A small pointer attached to the moving coil registers on a curved dial, or a tiny mirror is attached to the galvanometer string. A beam of concentrated light is aimed at the mirror, bouncing the beam off to a wall screen or chart to give great magnification of tiny current changes.



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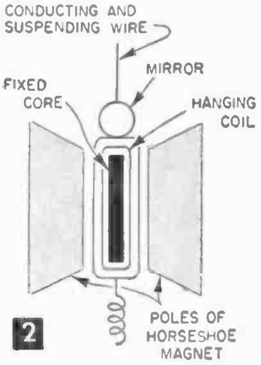


2

Making a Simple Galvanometer. A small amount of insulated magnet wire, any pocket compass and a 2¼ x 3½-in. scrap of plywood is what you need to make the simple galvanometer shown in Fig. 1. Cut a strip of cardboard ¾ in. wide and 3¾ in. long. Score the cardboard ¾ in. from each end, with a dull knife blade and crease so the cardboard resembles a C or bridge shape. Now glue the cardboard to the edges of the wood base.

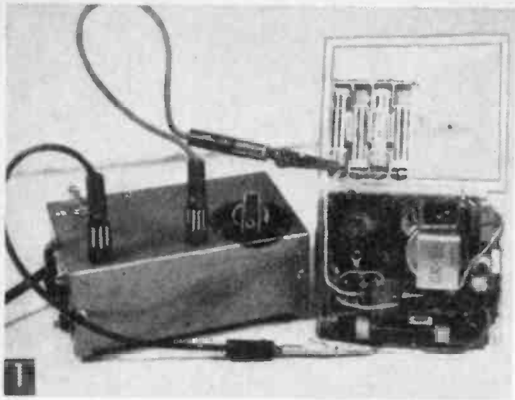
Bind the cardboard with a rubber band until glue or cement dries. We wound 25 turns of #28 magnet wire around the cardboard, but heavier wire and fewer turns will work, too, with a slight drop-off in sensitivity.

Scotch tape is wound around the finished coil to keep the wire turns in place. Connect the ends of the coil to screw terminals or clips. Slip the compass under the coil in a position where its needle comes under the coil and parallel to the coil turns.

Connect the galvanometer in series with a flashlight battery and bulb, a buzzer or a toy motor, etc. When the circuit is closed the compass needle will be drawn so that it is at right angles to the coil (Fig. 1). A slow swing of the needle indicates the circuit is drawing little current. A rapid swing denotes an increase in current flow.

To show how sensitive this simple galvanometer is, connect what appears to be a dead flashlight cell across the terminals, immediately breaking the circuit. The compass needle will spin at a merry clip.

The compass galvanometer's needle would be the horseshoe magnet in the d'Arsonval instrument. But, here we cause the magnet to turn with the coil remaining in a stationary position. However, the end result is the same no matter how the galvanometer is constructed.



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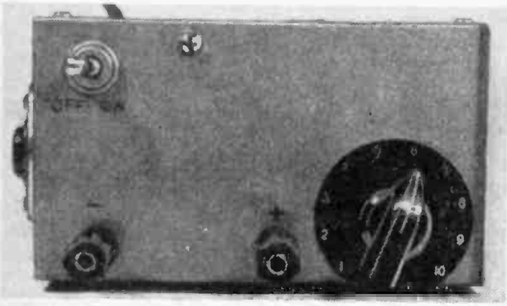


One of the handiest instruments the serious transistor experimenter can own, this regulated power supply has variable voltage control from zero to 10 volts dc.

For Transistor Circuits—

A Regulated Variable Power Supply

By FORREST H. FRANTZ, Sr.

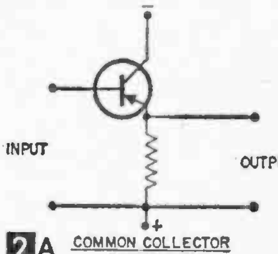
POWERING experimental transistor circuits with batteries is expensive and exasperating. It's difficult to keep a supply of fresh batteries on hand, and the variation of voltage requirements from one circuit to the next means frequent changes in a battery supply lash-up. Voltages that aren't multiples of single cell voltage can't be obtained from batteries without wasting some battery power, and the voltages of the cells themselves tend to drop quickly.

The obvious answer is a power supply that operates from the *ac* line. The power supply described in this article has extremely low ripple—good enough for the most crucial transistor circuit, a variable output voltage control, and regulation that will keep the output voltage from varying due to changes in line voltages or changes in equipment current demand. Cost of components for this unit is approximately $15.

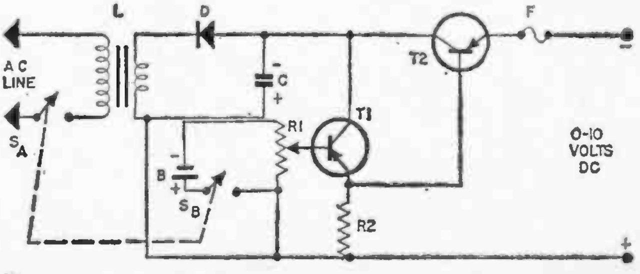
Operating Principles. The common collector transistor circuit configuration (Fig. 2A) performs the regulation task in this power supply. This circuit, sometimes referred to as an "emitter follower circuit," is the transistor counterpart of the vacuum tube cathode follower. The circuit has 100% current feedback and is extremely stable under temperature variations. The voltage from emitter to ground is nearly equal to the applied voltage from base to ground. The emitter voltage remains constant in spite of relatively large fluctuations in the collector voltage or variations in the emitter to ground load resistance. The emitter current is equal to the base current times the Beta of the transistor. Thus, a battery may be used to set the base potential.

The circuit of the regulated variable power supply is shown in Fig. 2B. The transformer is a 12.6 *v*, 1 amp filament unit. A General Electric 1N1115 silicon rectifier is employed in a half-wave circuit with a 1,000 mfd filter capacitor. This basic *dc* power supply provides collector voltage for transistors T1 and T2, and in turn, voltage at relatively high currents for the load.

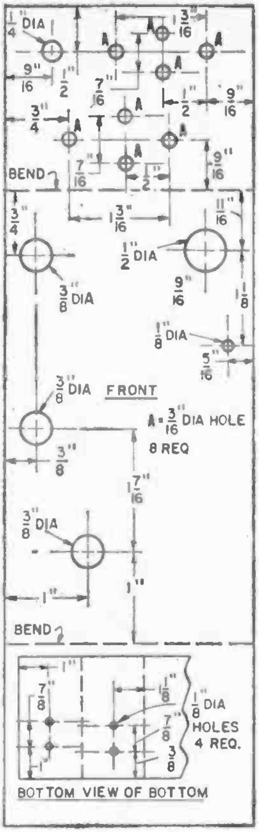
Base voltage for transistor T1 is supplied by a reference supply consisting of the 12-*v* battery B and the 5K potentiometer R1. R1 may be adjusted to present any voltage from 0 to 12 to the base of emitter follower T1. Transistor T2 is another emitter follower directly coupled to T1. The current gain of the cascaded emitter followers is so great that for reasonable power loads, the current demand on the battery (beyond the current required by R1) is negligible (R1 draws 2.4 milliamperes from the battery). The battery switch SB and the line switch SA are ganged to prevent battery current flow when the power supply is turned off. Resistor R2 permits adjustment of the



2A COMMON COLLECTOR CONFIGURATION



B CIRCUIT OF REGULATED POWER SUPPLY



3 DRILLING LAYOUT

terminal voltage to zero under low- or no-load conditions.

The ripple voltage with 9 *v dc* at 200 ma to a terminal load has a peak to peak value of only .004 volts! At higher currents the variation from straight line *dc* increases. The ripple increases to .04 *v* peak to peak when the current to the load is ½ amp.

Construction. The power supply is housed in a Bud CU-2106 aluminum Minibox. The layout for drilling the required holes is shown in Fig. 3. Drill small pilot holes before using ⅜- and ½-in. drills for the larger ones. All components except the battery holders and batteries mount on the front of the box.

MATERIALS LIST—POWER SUPPLY

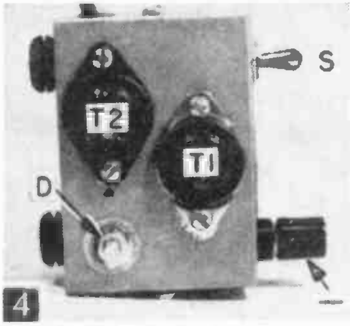
Desig.	Description
R2	1K, 1/2W resistor, 10%
R1	5K, 2W wirewound potentiometer (Clarostat 43-5000)
C	1,000 mfd, 12-v electrolytic capacitor (Sprague TVA-1133)
T1, T2	2N307 transistors, (Sylvania)
D	1N1115 silicon rectifier (GE)
SAB	DPST toggle switch (Cutler-Hammer 8360K7)
L	12.6-v filament transformer (Stancor P-8130)
B	12-v battery (8 RCA VS074 cells series connected)
F	fuse (see text)
two	4-cell battery holders (Lafayette MS-170)
	binding posts (Grayhill 29-1 Red and 29-1 Black)
	2⅛ x 3 x 5¼" aluminum Minibox (Bud CU-2106)

Cut the shaft of R1 to a length of ½ in. Mount R1, T1, T2, SAB, the binding posts and the rectifier D (see Figs. 4 and 5). Insulate the binding posts from the box with fiber washers if the specified binding posts (which are provided with insulation "humps") are not used. Insulate the rectifier from the box with the small mica insulators provided with it. Exercise extreme care in mounting the rectifier. Don't use additional insulating washers because the aluminum box serves as a heat sink for it. The collectors of T1 and T2 terminate on the transistor shells. Note that these connect directly to the aluminum box when they're mounted.

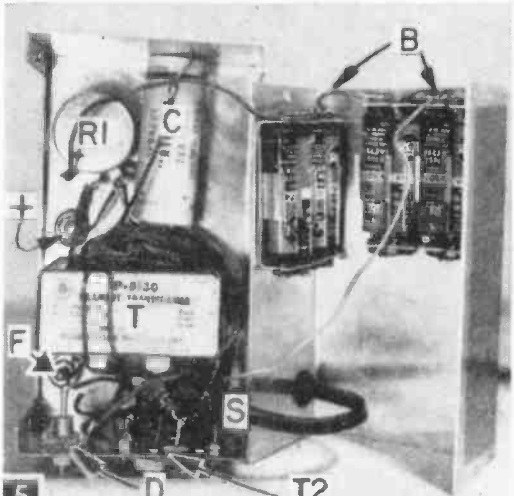
Next, the wiring associated with transistors T1 and T2 should be completed. Then mount the transformer (cut off one of the mounting flanges) and complete the circuit wiring, including the installation of C and R2. Two leads approximately 7 in. long should be provided for connection to the battery holders. The fuse F is a ½-in. length of #36 copper wire with its ends soldered to the negative binding post (or to a short piece of hook-up wire on the binding post) and the hook-up wire lead from the emitter of T2. It prevents damage to the power supply components if the output terminals are accidentally short circuited.

Mount the battery holders on the back half of the aluminum box and connect the terminals in series. Fill the eyelets which will contact the batteries with solder. Insert the batteries in the holder and connect the holder to the two leads provided for this purpose. Be sure the switch is in the off position when you do this.

Assemble the front and back halves of the box. Dress the leads so they won't short or pinch when the box is completely assembled. Fasten the four screws, and your power supply is ready.



4 Side view of power supply showing transistor mounting.



5 Interior view of Minibox chassis with components in place.

Salvaging Parts for Experiments

- A fluorescent light starter contains several parts that can be used by radio-electronics experimenters, such as a thermal switch, small paper capacitor, and neon glow lamp.—J.A.C.

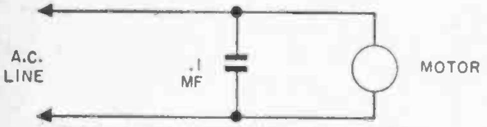
Eliminating TV Interference

How simple filters can cut out annoying TVI from home appliances, neon lights, aircraft, ham broadcasts or other sources

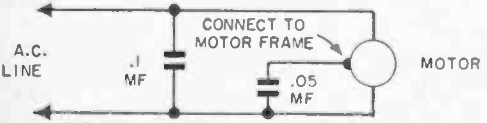
By W. F. GEPHART

TELEVISION interference (TVI) comes from a number of sources, and to eliminate it we must first determine the type and, if possible, the source (Figs 1, 2 and 3).

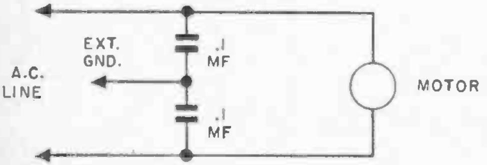
For best results, the interference should be filtered out at the offending device; if that is not possible, it probably can be eliminated at your TV set. Interference is classified into two types as in Table A, (1) broad-band, where the source consists of mány frequencies and harmonics; and (2) narrow-band, where the source has one fundamental frequency and normal harmonics. Most narrow-band inter-



FOR ELECTRIC RAZORS AND SMALL MOTORS

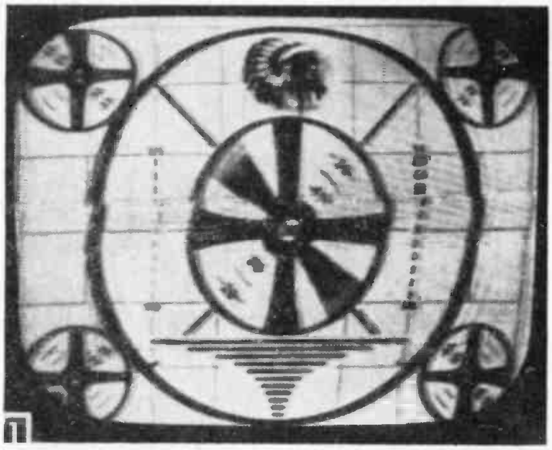


FOR SMALL METAL-CASED MOTORS

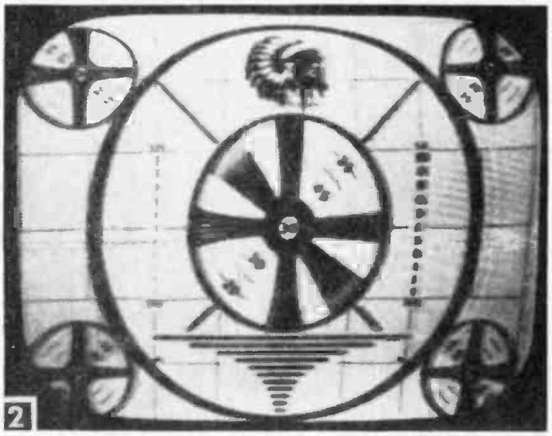


FOR LARGE MOTORS OR 230 V. DEVICES

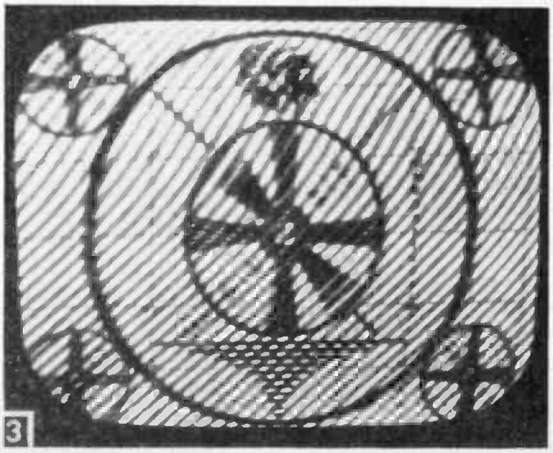
4 SIMPLE POWER LINE FILTERS



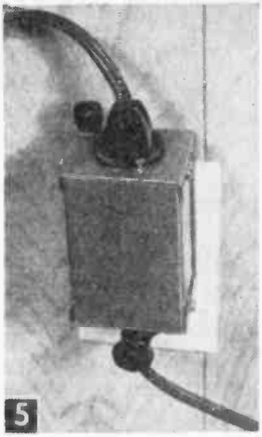
1 Ignition or "spark" interference is characterized by multiple bands of "hash" moving up and down the screen, displacement of picture and often a popping noise in the speaker.



2 A-C interference caused by small motor results in a single unmoving band of "hash."



3 Diagonal lines (sometimes a herringbone or chickenwire pattern) indicate R.F. or oscillator interference.



5 A-C line filter plugged into outlet, with TV set plugged into top. Other half of outlet can be utilized.

ference is due to other radiating electronic equipment.

Many cases of broad-band, *a-c* motor interference can be traced by noting what appliances in your home are operating when the interference is present. Cure by connecting one of the line filters detailed in Fig. 4 to the troublesome motor or device itself to eliminate the interference before it gets into your TV set through the power lines or through the antenna's picking up the radiated interference from power lines.

If you can't install the filter at the trouble source, plug a line filter made as in Figs. 5 and 6 into the wall outlet, and plug the TV set into the filter. Connect the binding post on the top to a good ground such as a water pipe. Mount the male chassis-type plug in one side of the filter chassis as near the bottom as possible as in Fig. 6, and the female socket in the top, slightly off-center to allow for binding post. The coils should not touch the metal case; the wire is stiff enough to make

TABLE A—COMMON TYPES OF TVI SOURCES

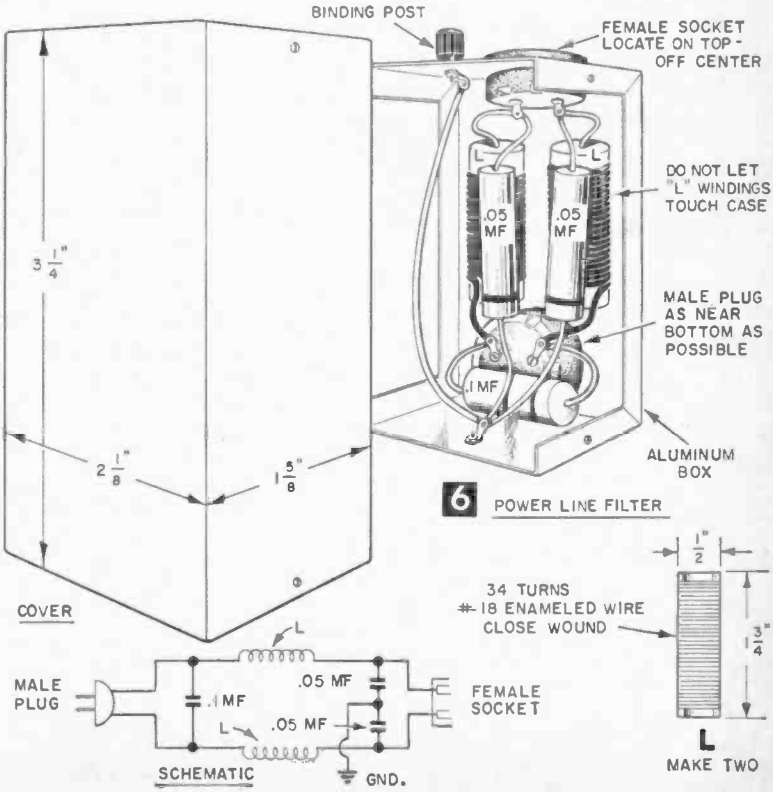
Broad-band Interference

Type	Enters Set Thru	Remedy
Ignition & spark noise Fig. 1 (most common type)	Usually through A-C lines; sometimes thru antenna if interference is near and intense	Wide-band A-C line filter on set or filter on trouble causing device
Electric Motor noise Fig. 2	A-C line	Filter at motor or on set; Wide-band A-C line filter on set
Non-communication electronic equipment such as neon lights, diathermy units, infra-red heat drying equipment, etc. (characterized by wide bands of curved lines across picture)	A-C line	Same as electric motor

Narrow-band Interference

(Entering through antenna)

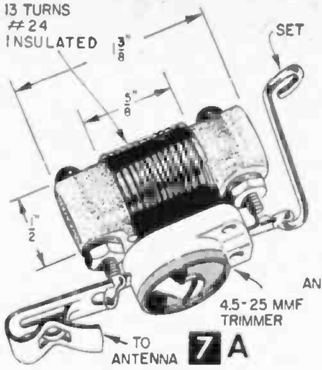
Type	Appearance	Remedy
Oscillator radiation from another TV set Fig. 3	Diagonal black lines or herringbone or chickenwire pattern across screen	Shield offending set (line cabinet with foil or screening) ground receiver (if designed for it), wave trap
Low frequency radio (B.C., police, Hams, etc.)	Diagonal black lines, lines across the screen, usually shifting and moving	Line filter or wide-band R.F. antenna filter
Medium frequency radio (S.W., Hams, aircraft, etc.)	Same as low frequency radio	Specific frequency high-pass filter, wide-band R.F. antenna filter, re-orient antenna
High frequency radio (F.M., aircraft, T.V., etc.)	Same as low frequency radio	Wave trap (stub), re-orient antenna



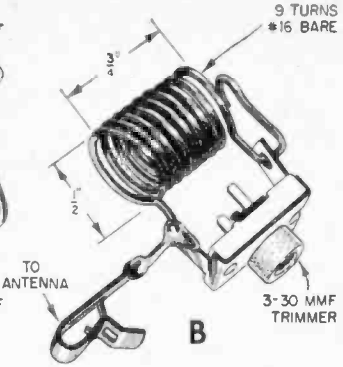
6 POWER LINE FILTER

them self-supporting.

Sometimes turning (re-orienting) the antenna slightly, or moving it to another location eliminates narrow-band radio frequency (R.F.) interference without affecting the signal. If moving within 20 ft. doesn't improve the signal, further moving probably won't help.



7 A

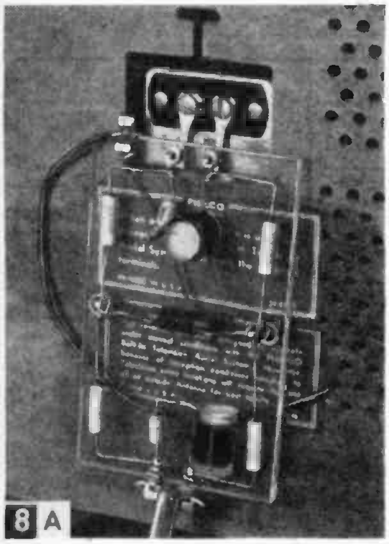


B

Other types of R.F. interference such as FM transmissions, hams or aircraft are eliminated by simple high-pass filters in the antenna leads which allow high frequency TV signals to pass readily but tend to block out low frequency signals. If the interfering frequency is known, make a "tuned" filter (Figs. 7A or B) that will cover the signal frequency, connecting one to each antenna terminal at the set in such a way that the coils are at right angles to each other, and adjust the capacitors with an insulated screwdriver for best results. If tightening the capacitor on the filter does not eliminate interference, install the other filter shown in Figs. 7A and B.

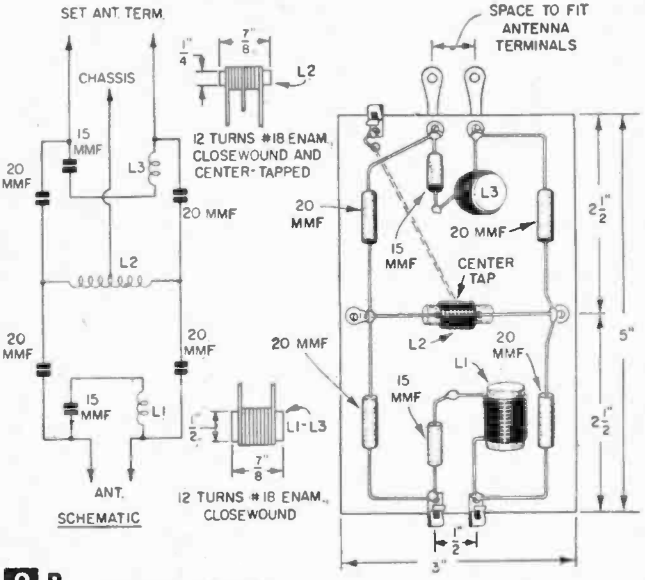
If the interfering frequency is unknown, or if several frequencies may be involved, install the wide-band R.F. filter in Fig. 8A and B. While not as efficient for any single frequency as a "tuned" filter, it does weaken all frequencies below the TV frequencies. The filter must be made the size shown so the coils are separated to prevent interaction and are at right angles to each other. While it's best to enclose the unit in a metal case, with the side of the case at least 3/4 in. from any coil, and the case grounded, you can assemble the unit on a piece of plastic as in Fig. 8A.

If the frequency of the interfering signal is so



8 A

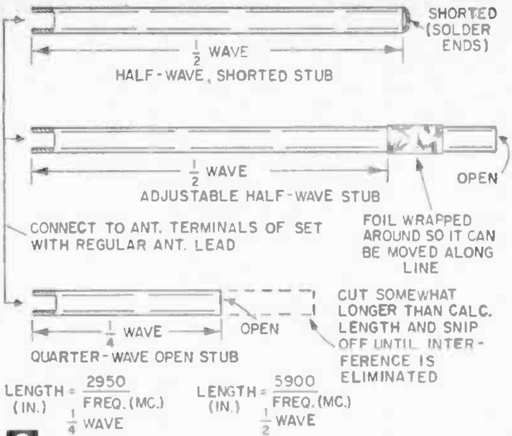
Wide band R.F. filter attached to set. Wire from top clip goes to chassis.



8 B WIDE-BAND R.F. FILTER

MATERIALS LIST—TVI FILTERS

Amt.	Description
	A-C Line Filter (Figs. 5 and 6):
2	1/2" dia. x 1 3/4" long coil rods
1	.1 mf. 400 volt condenser
2	.05 mf. 400 volt condenser
1	male chassis plug (Amphenol 61-M)
1	female chassis socket (Amphenol 61-F)
1	binding post (not insulated)
1	1 5/8 x 3 1/4 x 2 1/3" aluminum box (Bud CU-2101)
9' (approx.)	#18 enameled wire
	10-32 mc. Antenna Filter (Fig. 7A):
1	1/2" dia. x 1 3/8" long coil rod
1	4.5-25 mmf ceramic trimmer (Centralab 822-AZ)
1	Fahnestock clip
20" (approx.)	#24 insulated wire
	30-120 mc Antenna Filter (Fig. 7B):
1	3-30 mmf mica trimmer
1	Fahnestock clip
15" (approx.)	#16 bare wire
	Wide-band R.F. Antenna Filter (Figs. 8A and B):
2	1/2" dia. 7/8" long coil rods
1	1/4" dia. 7/8" long coil rod
4	20 mmf ceramic condensers
2	15 mmf ceramic condensers
3	Fahnestock clips
1 pc	3 x 5" plastic
5' (approx.)	#18 enameled wire



9 TRANSMISSION LINE WAVE TRAPS (300-OHM ANT. LEAD-IN)

close to a TV channel frequency that an antenna filter might also filter out the desired signal, connect a simple filter or trap to the antenna terminals of the TV set (with the regular antenna lead). If you know the TVI frequency, make the filter of a section of 300-ohm antenna lead-in cut to exactly ½ the wavelength of that signal as in Fig. 9; solder the free ends of the stub together. If you don't know the TVI frequency, cut the lead-in somewhat longer than the calculated length (around 30 in.) and tightly wrap a 2-in. section of aluminum foil around the end (Fig. 9) as a short. Move the foil until best results are obtained, then fasten with cellophone tape. Somewhat less efficient is the simply made ¼-wavelength trap. Cut the lead-in longer than needed, fasten in place and snip off sections until the interference disappears.

If the TVI source is so close that even with the antenna lead filtered, wiring within the TV set picks up the signal, shield the set by lining the cabinet with aluminum foil or copper screening and connecting this shield to the chassis. Also connect the chassis to a good ground, *provided* the set is designed to have a grounded chassis. Where chassis is not grounded, set should be so labeled according to U.L. standards. Speaking of shielding, check all shields, such as those on tubes, within your TV set, as omission of or loosely-connected shielding can cause interference on your set or your neighbor's.

Eliminating TVI is often a relatively simple matter, but there is no single remedy. Sometimes in apartments or industrial areas, complete elimination is virtually impossible though some improvement can usually be made by the right combination of antenna orientation, shielding, filtering and wave traps.

Try a Lemon or Tomato Battery

THE principles of dry cell battery operation involve the use of two dissimilar materials such as zinc and carbon, placed in an electrolyte, usually a moist mixture of charcoal or gypsum, zinc chloride and ammonium chloride (or sal ammoniac). The electrolyte acts more strongly on the zinc, slowly consuming it in the process. The zinc is the negative side of the cell and the carbon is usually used for the positive or other material.

Another action that takes place is that hydrogen is released with a load, from the action of the current on the electrolyte. The hydrogen bubbles released tend to collect around the carbon and act as an insulator, thus increasing the cell's internal resistance. This would normally cause a voltage drop were it not for another chemical element that is added, called a depolarizer, which may be powdered carbon and manganese dioxide.

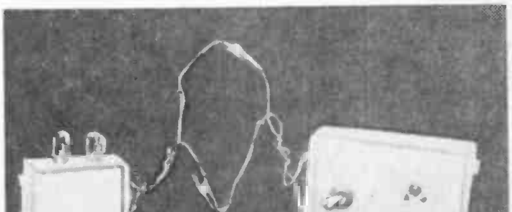
To demonstrate a simple cell and its action, cut a lemon or tomato in half; the half will be the cell container and its juice the electrolyte. Then break up an old flashlight cell to recover the carbon rod and a piece of the outer zinc container (Fig. 2). (Use a cell that is not decomposed to the extent that the zinc is destroyed).

Wash the carbon rod and the zinc container from the battery in hot water. Then cut a 1½ in. wide strip from the zinc container, press the carbon rod in one side of a cut lemon, and the zinc strip in the opposite side.

By connecting the carbon and zinc terminals to a high resistance voltmeter, we can then obtain about a 1.2 volt reading (Fig. 2) which is pretty good for a lemon! However, switching the meter switch to the 10 mil scale shows us that the current capacity is small, for a maximum of about .5 mils will be recorded. Now, put salt on the lemon; the current will rise.

If you put a light load on the cell, however, it will quickly polarize, since it has no depolarizer, and a second check on the voltmeter scale will show a decided drop in voltage. This will slowly rise again and come back practically to its original value.

How Does It Work?



★ Two cases, a pair of wires, one switch, two lamps—Throw switch left and the left lamp turns on; throw switch right and the right lamp turns on, left lamp turns off.

How does it work? The secret is revealed on page 88 together with full details on how to build the unit.

Car Battery Adaptor Operates Portable Transistor Radio

By THOMAS A. BLANCHARD

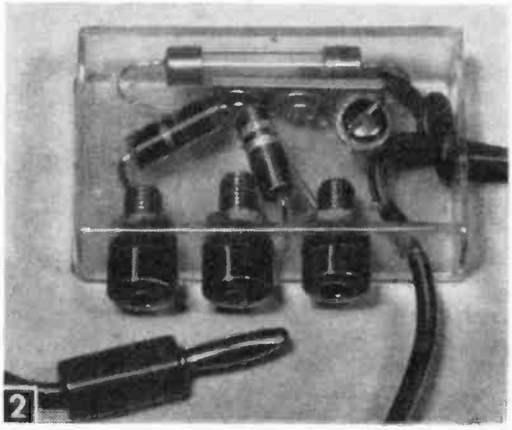
YOU'LL never have to worry about your portable transistor radio batteries going dead when on a car outing or camping trip if you have this tiny car-battery adaptor tucked away in the glove compartment of your car.

Simply plug the adaptor cord into your car's cigaret lighter or map light socket, attach the cord clips to the radio battery terminals and tune in your favorite program. In this way you save the radio batteries for times when you really need them.

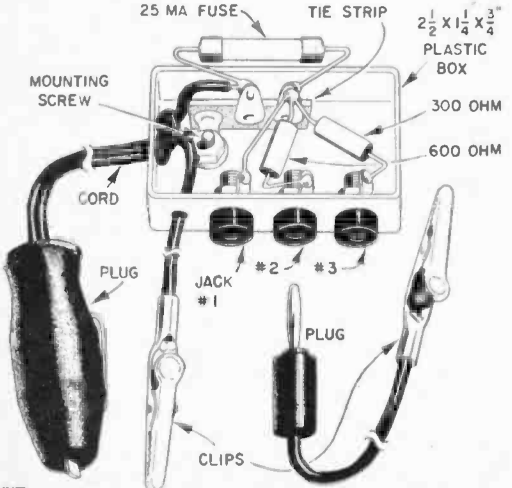
The adaptor will supply power to sets designed for either 6 or 9-volt operation having NPN or PNP transistors. It can be used with 6 or 12-volt car batteries grounded positive or negative to the car chassis.

The plastic box into which the adaptor was assembled will be familiar to many of you radio experimenters since a leading line of radio hardware items are packed in these ¾ x 1⅜ x 2½-in. slide-cover containers. Drill or ream three holes in the side of the box and install three phone tip or banana jacks as in Figs. 1 and 2. Mount a 2-lug tie-strip to the bottom of the box with a 6-32 x ¼-in. screw for securing the various components. These consist of a 25 ma. instrument fuse with pigtail leads, a 600 and 300 ohm 1-watt resistor and wire components.

To connect the adaptor to the car in the side of the a cord and plug from an inexpensive trouble light designed to plug into the dash cigaret lighter socket or a suitable length of light fixture cord and fit it with a plug made from the base of a burned-out dash or dome lamp. If you use the latter, break the glass around the lamp base and scrape the base shell clean. Solder the cord leads into the base and fill the base with sealing wax. The wax can be melted by applying a heated soldering iron until wax flows into shell.



Complete adaptor, not including extension wire, fits into ¾ x 1⅜ x 2½-in. box and may be stored in car glove compartment.



1 PICTORIAL DIAGRAM

In the event that an instrument fuse is not readily available, get one of the midget fuses your local service station stocks for auto clock circuits. With a little care, pigtail leads can be soldered to the ends of any regular glass cartridge fuse with a low current rating.

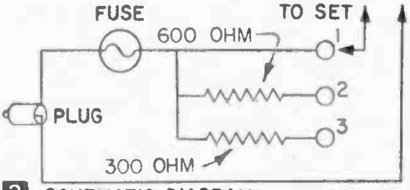
The output leads of the adaptor are fitted with small clips. One clip lead is fitted with either a phone tip or banana type plug for connecting to the desired output jack. Jack #1 should be used for operating either a 6 or 9-volt transistor set from a 6-volt car battery. Jack #2 is used when operating a 6-volt set from a 12-volt car battery. Jack #3 is used for operating a 9-volt set on a 12-volt car battery.

Because of the several variable factors previously mentioned, polarity indications cannot be shown in the wiring plan. To determine which lead is positive, which is negative, attach the adaptor to the dash socket and connect the clip leads into the set. If set fails to work, simply reverse the clips and the radio will play.

However, do not expect to sit in the car and play the radio unless the vehicle has a fabric convertible top. As most experimenters well know, loop radios do not work in hardtop automobiles unless an external antenna is used.

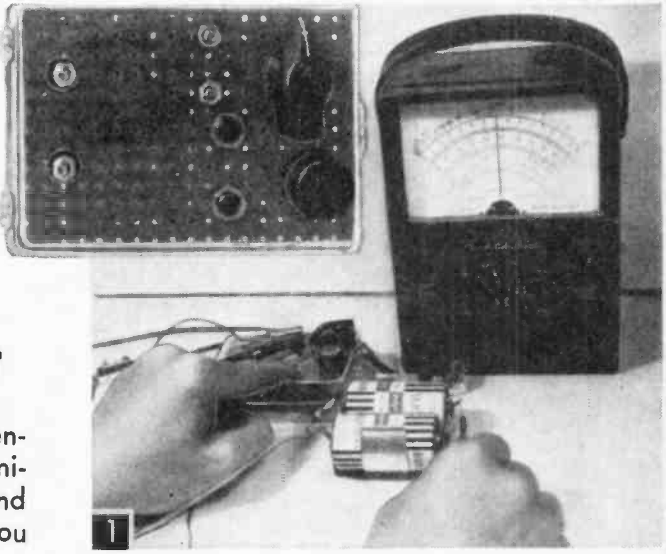
MATERIALS LIST—CAR BATTERY ADAPTOR

No. Req.	Size and Description
1	plastic box ¾ x 1⅜ x 2½-in. or larger
12 ft	light plastic extension cord
3	phone tip or banana jack
1	phone or banana jack
1	3-lug tie strip
2	small test clips
1	300 ohm, 1-watt composition resistor
1	600 ohm, 1-watt composition resistor
1	25 ma. pigtail instrument fuse
1	plug—see text



3 SCHEMATIC DIAGRAM

Meter amplifier (front panel view shown inset) in use with Heathkit volt-ohm-meter.



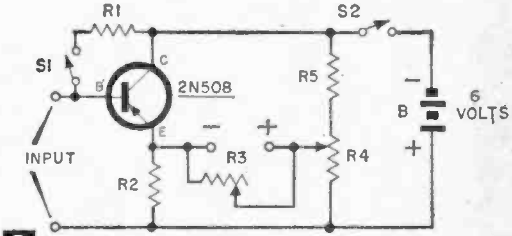
1

Sensitive Direct Current Meter Amplifier

This amplifier increases the sensitivity of a milliammeter or microammeter many times! And it can be built from parts you probably have on hand—

By FORREST H. FRANTZ, SR.

TRANSISTORS are basically current amplifiers (in contrast to vacuum tubes which are voltage amplifiers). This characteristic of a transistor makes it a natural as a current amplifier for a meter. With a current amplifier, a low cost milliammeter can be made as sensitive as an expensive microammeter, and microammeters can be made more sensitive. Extremely small currents can be measured; and, if series resistors are employed with the transistor amplifier-meter combination, the result is a sensitive voltmeter which draws very little current from the circuit under measurement. Here is an amplifier unit which can be built from about $5 worth of parts.



2 SCHEMATIC

Construction. The circuit is shown in Fig. 2. Miniature perforated board layout is shown in Fig. 3. The entire assembly is housed in a plastic case (See Fig. 4).

First, prepare the circuit board. The board on the Materials List is the exact size required, the hole centers coincide with perforations. Drill a ⅛-in. hole for each hole position (back the board with a wood block to prevent breakage). The larger holes may be made with a taper reamer or with drills of appropriate size.

Place the finished circuit board against the face of the plastic case for use as a guide in making the case pilot holes. Use a heated ice pick to make pilot center holes, enlarging these to size with a taper reamer. The battery holder holes on the case must be of about 5⁄16 in. dia. since the mounting nuts are placed on the front of the circuit board.

Cut the shaft of R3 to a length of ⅜ in., the shaft of R4 to a length of ½ in. By placing the unwanted end of the shaft in a vise and cutting to desired length with a hacksaw, you do not place any stress on the shaft bushing which could damage the control.

Fasten the battery holder, potentiometers (R3 and R4), switches (S1 and S2), terminals and soldering lugs (plus and minus) on the circuit board. Retaining nuts for all parts (except the battery holder) fasten from the front of the plastic case in the final assembly.

Turn battery holder connection lugs to the side as required to contact adjacent lugs for connecting the cells in series and solder the appropriate lugs together. Then fill the battery contact eyelets on the holder with solder.

Next make connections between the mounted components and wire R1, R2, and R5 into the circuit. (The value of R1 depends on the meter to be used with the amplifier.) Connect the input leads and slip 1¼ in. lengths of spaghetti on the transistor leads and solder it into the circuit.

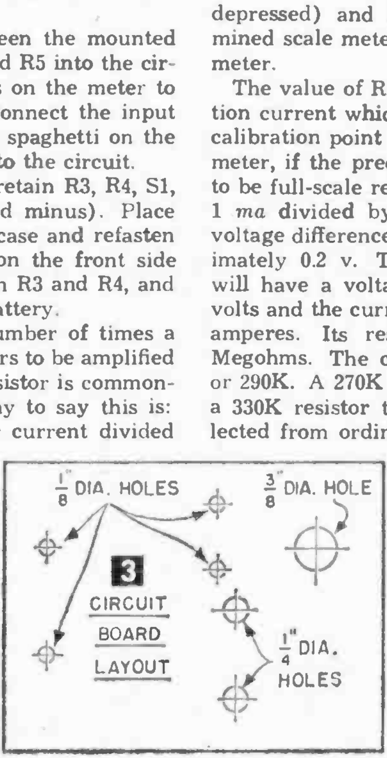
Now remove the nuts which retain R3, R4, S1, S2, and the terminals (plus and minus). Place the circuit board in the plastic case and refasten the component retaining nuts on the front side of the case. Fasten the knobs on R3 and R4, and place the penlite cells in the battery.

Operating Principles. The number of times a given base current change appears to be amplified in the collector circuit of a transistor is commonly called the Beta. Another way to say this is: Beta equals change in collector current divided by the change in base current that started the process. The Beta of the 2N508 transistor is better than 100. It would therefore seem that a current of 10 microamperes on the base of this transistor could cause full scale deflection of a 0-1 milliammeter. Actually, however, the Beta of a transistor isn't constant. Generally, meter current amplifiers are operated without a base biasing resistor and the Beta is lower under these conditions than under the test conditions for which a numerical Beta is given. Another factor which tends to reduce the amount of useful current amplification the transistor has in a meter amplifier application is the leakage current (I_{co}) which flows although the base is open.

DC METER AMPLIFIER

Table A—Sensitivities and Calibration Points for Various Meter-Transistor Combinations

Value of R1 (Megohms)	Meter Range	Meter-Amp Sensitivity (Micro Amperes)	Beta of Transistor	Calibration Point
.58	1 ma.	20 full scale	50 or more	mid-scale
5.8	100 μa	2 full scale	50 or more	mid-scale
.116	1 ma.	50 full scale	20 or more	full-scale
1.16	100 μa	5 full scale	20 or more	full-scale
1.16	200 μa	10 full scale	20 or more	mid-scale



3 CIRCUIT BOARD LAYOUT

The current in the emitter circuit of a transistor is nearly equal to the collector current. The meter connects into a bridge circuit consisting of the transistor and resistors R2, R4, and R5. R4 functions as a "zero" control. With S2 depressed, R4 is adjusted for zero deflection of the meter. If a current flows through the input leads, the meter deflection is proportional to this current.

The potentiometer R3 which shunts the meter is a scale adjustment; its setting determines the amount the meter will be deflected for a given base input current. It is set in the following manner: First, depress S2 and adjust R4 to zero the meter. Then S1 is depressed (with S2 still depressed) and R3 is adjusted for a predetermined scale meter deflection. This calibrates the meter.

The value of R1 is chosen to provide a calibration current which is equal to the meter current calibration point divided by 50. Thus, for a 1-ma meter, if the predetermined calibration points is to be full-scale reading, the calibration current is 1 *ma* divided by 50, or 20 microamperes. The voltage difference from base to emitter is approximately 0.2 v. The battery voltage is 6 v. R1 will have a voltage drop of 6 minus 0.2, or 5.8 volts and the current through it is to be 20 microamperes. Its resistance (R = V/I) is (5.8/20) Megohms. The computed value is .29 Megohms or 290K. A 270K resistor that is high in value or a 330K resistor that is low in value can be selected from ordinary 10% or 20% tolerance carbon resistors.

An alternate approach is to let the predetermined meter calibration point be mid-scale. The current through R1 should then be 20/2 or 10 microamperes, and R1 = (5.8/10) Megohms = .58 Megohms; 560K is near enough to this value to use. The battery voltage can be expected to be a few tenths of a volt below 6 anyway, so that 560K should be more correct than the computed value of 580K. Table A shows the value of R1 for various basic meter ranges, the predetermined meter calibration point and the base current that will cause full-scale meter deflection.

After the meter amplifier has been zeroed (R4) and the scale adjustment (R3) has been made, the amplifier input leads are connected into the circuit in which a measurement is to be made and S2 is depressed. The meter reading divided by 50 is the amplifier input current. The conversion may be performed mentally by multiplying the meter reading by two, taking the proper unit conversion into account.

MATERIALS LIST—DC METER AMPLIFIER

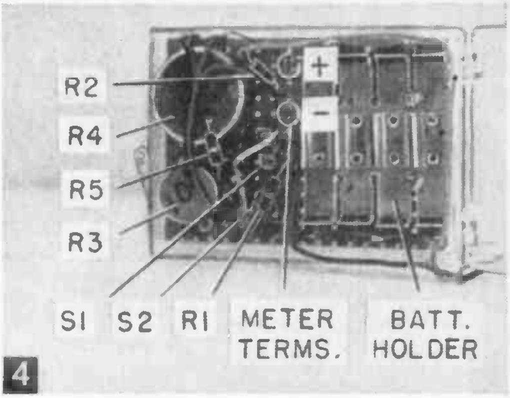
Desig.	Description
R5	470 ohm, ½ watt, 10% carbon resistor
R2	2.2K, ½ watt, 10% carbon resistor
R1	see text and Table A
R4	100 ohm wirewound potentiometer (Clarostat Series 43-100)
R5	10K dime-size potentiometer (Lafayette VC-34)
T	2N508 transistor (GE)—text gives information for using other transistors
S1, S2	miniature push button switches (Lafayette MS-449)
B	4—1.5 v penlite cells series connected (RCA VS074)
	4-cell Battery Holder (Lafayette MS-170)
	2 7/16 x 3 3/8" miniature perforated bakelite board (Lafayette MS-304)
	1 x 2 5/8 x 3 5/8" plastic case (Lafayette MS-159)
	miniature knob (Lafayette MS-185)
	pointer knob (Lafayette KN-41)

Alternatives. Suppose you want to use a transistor other than the 2N508 which you may have on hand, say a CK722 or a 2N107. They'll work, but their current gains are low and they have appreciable leakage. To use other transistors, use a single 1K pot in place of R4 and R5. The zero adjustment will be more critical since no padding resistor is provided, but you'll be able to zero the meter.

Resistor R1 is computed as described earlier, but the assumptions are different. Assume the input base current to be the meter reading divided by 20. Thus for a 0-1 *ma* meter, figure 1/20 *ma* or 50 microamperes of input current for full-scale deflection. Then R1 is (5.8/50) Megohms or 116K for full-scale deflection (110K is the nearest common value).

If transistors of better quality than the experimenter types are used, current amplification scale factors greater than 20 may be assumed. Even experimenter grade transistors which you might have may have Betas of 50 or more. The reduced values were assumed because Betas vary widely between transistors of a given type. Thus, although some readers may get transistors with low Betas, very few will get transistors with Betas below those assumed for the types covered in this discussion.

The physical construction of the meter amplifier may be varied if you prefer different construction. The amplifier and a basic meter movement may be incorporated in a single case, for example. Shunt multipliers may be provided at the amplifier input if several various low current ranges are desired.



4

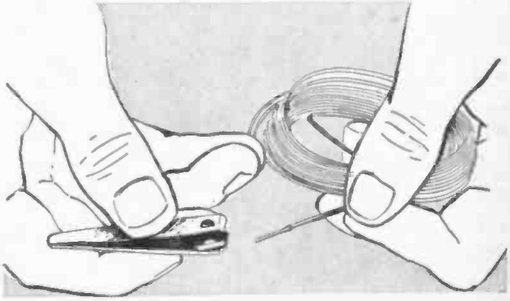
Back view of meter amplifier unit.

Voltmeter. A resistor connected in series with the input lead and the base of the transistor converts the amplifier-meter combination into a high-sensitivity voltmeter. Assume the current sensitivity of the combination is 20 microamperes for full-scale meter deflection (the case for the model described in this article when employed with a .0-1 *ma* meter), and the meter is to read full-scale when the measured voltage is 50 v. Then the required series resistor is (50/20) Megohms or 2.5 Megohms. The nearest standard values are 2.2 and 2.7 Megohms. However, standard values of 1 and 1.5 Megohms are available. Connect these in series.

Since this voltmeter arrangement only draws 20 microamperes from the circuit under test, it may be used to make measurements in most vacuum tube equipment without upsetting circuits and introducing loading error in measured values.

Nail Clipper Strips Wire

• A nail clipper makes an excellent tool for radio and TV hobbyists, to use for removing insulation from small-gage wiring. First, however, remove the pressure-handle to avoid exerting too much force and cutting right through the wire.—R. J. DeCristoforo.



Transistorized Photo-Cell Control

A beam of light can be a handy workman around the home

By THOMAS A. BLANCHARD

Tiny self-contained photoelectronic control being test-actuated at close range with flashlight. Unit is sensitive enough to respond to feeble daylight at surprisingly long distances.

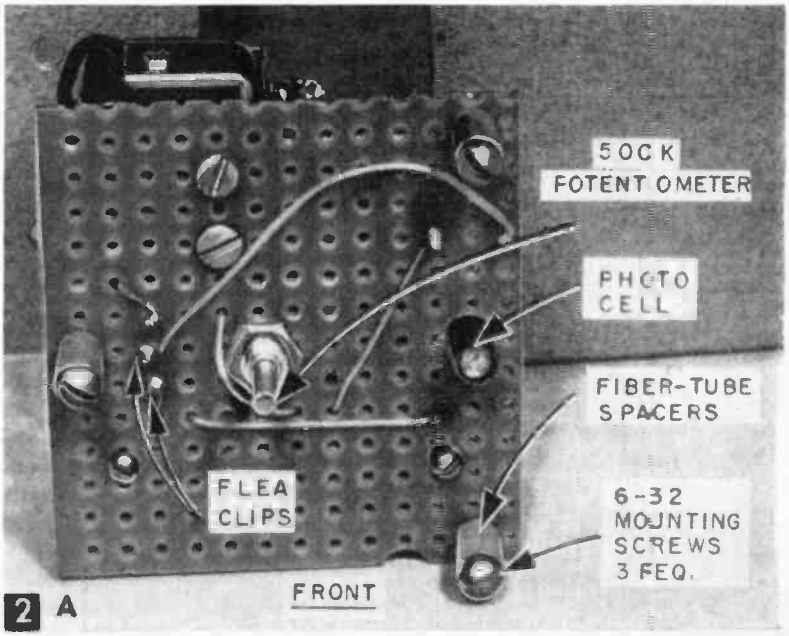
WHEN this photoelectric-cell switch is placed so its activating light beam shines across a doorway, hall or porch, a person passing through will break the light beam and cause a door chime to sound, a light to turn on or a burglar alarm to ring.

The switch may be wired across any existing 115-volt switch to control lights, a bell, etc., not exceeding 2 amps., or about 130 watts. It is battery operated and therefore portable and completely independent of the house current which it controls. The entire unit is housed in a 2⅛ x 2¼ x 2¾-in. radio utility box. All components are mounted on 2½ x 2½-in. perforated plastic panel.

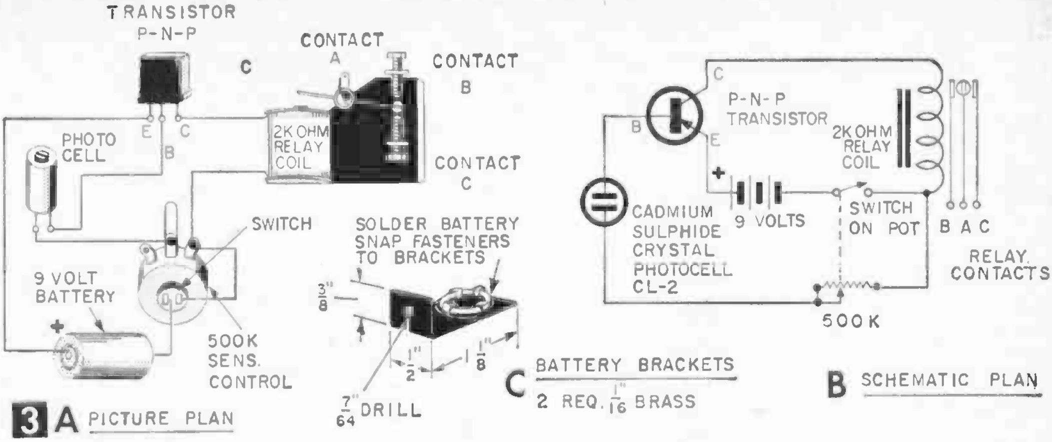
Place the components on the panel and mark and drill holes for mounting the parts as in Fig. 2. Make the battery brackets as in Fig. 3C and bolt them to the panel with 3-48 x ¼-in. screws. Also drill three 5/32-in. holes for the 6-32 x 1 in. mounting screws. Make the fiber tube spacers for the mounting screws the same length that the photocell projects through the perforated panel. Transfer the location of these holes and holes for potentiometer and photocell to the front of the box and drill.

The cadmium sulphide photocell is a Clairex CL-2 which is about the size of a small composition resistor. This tiny unit has the general characteristics of a vacuum tube photocell. It is a photo-conductive device like the phototube. It has the unique property of having a very high resistance in darkness, but as it is exposed to light the resistance drops from the megohm range to 10,000 ohms in bright light.

To actuate the control, only a small light change is required so that sufficient current passes



Front and rear views of panel showing placement of parts.



3 A PICTURE PLAN

C BATTERY BRACKETS 2 REQ. 1/16" BRASS

B SCHEMATIC PLAN

MATERIALS LIST—PHOTOCELL SWITCH

No. Req.	Size and Description
1	2 1/8 x 2 1/2 x 2 3/4" aluminum radio utility box
1	Sigma sensitive relay type 4F with 200 ohm coil
1	Clairex photocell type CL-2
1	2 1/2 x 2 1/2" perforated phenolic (Bakelite) (Lafayette)
1	500K miniature potentiometer with switch
1	P-N-P transistor (type 2N107, 2N34, CK722, etc.)
5	Lafayette "flea clips"
1	1/16 x 1/2 x 3" brass for battery clips
1	9v transistor battery
3	3/16 I.D. x 3" long fiber tube for mounting screw spacers
3	6–32 x 1" *rh* machine screws for mounting panel
2	3–48 x 1/4" *rh* machine screws for battery clips
	Hookup wire and misc. hardware

through it to provide a base return negative voltage to the transistor, thus causing a large flow of current through transistor to the relay coil. The cadmium cell should not be confused with the short-lived selenium cell which is a photovoltaic device.

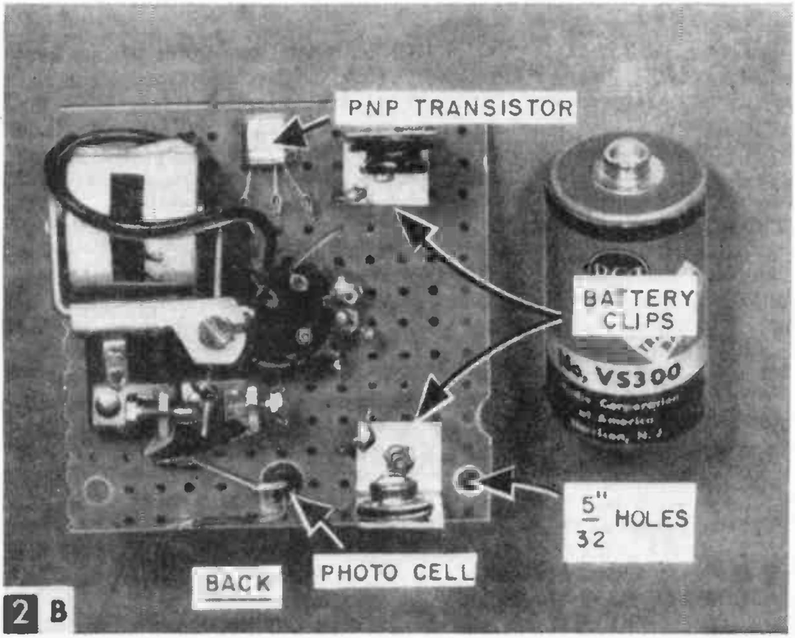
Connect the leads from the photocell and transistor to flea clips and insert them through the holes in the perforated panel. Solder hookup wire to the flea clips on the other side of the panel as in Figs. 2 and 3.

The use of a sensitive plate relay is most important. Fixed relays are set up at the factory with predetermined pick-up and drop-out relay contact specifications. Altering these adjustments is difficult and sometimes impossible. The relay employed is the fully adjustable Sigma 4F with a variable hairspring armature adjustment and screw gapped contacts. The coil resistance of the unit is 2000 ohms.

In this application we adjusted armature tension and contacts so that relay picked up at 700 microamps and dropped out at 500 uA. The relay coil with photo cell in darkness draws just 200 uA and only 1.6 milliamps in brightest light.

While the life of conventional transistor batteries is limited, those desiring a battery good for 10,000 hours of service may employ the rechargeable nickel-cadmium cells now on the market. Many of these batteries are designed expressly for transistor service and will fit nicely into limited space.

Sensitivity of the photo control can be regulated by adjusting the miniature 500,000 ohm linear potentiometer which is wired in series with the photo control so that the desired pick-up and drop-out of relay switch contacts may be adjusted to meet existing light conditions.



2 B

What To Listen For On Short Wave,

Spring and Summer, 1960

By **C. M. STANBURY II**

RAE
RADIODIFUSION ARGENTINA AL EXTERIOR

LRA
RADIO NACIONAL

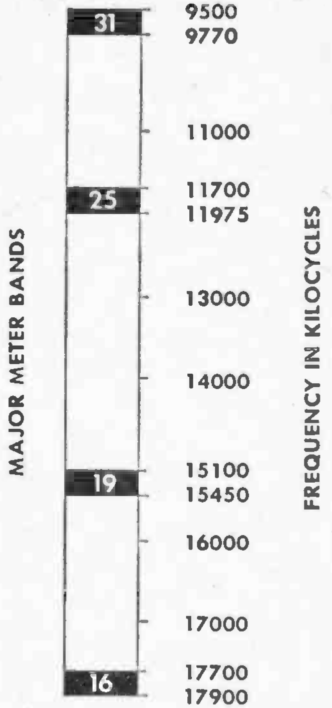
Agradece Su atenta carta del 24 II-58- que contenía un informe correcto de nuestra transmisión de esa fecha.-

FRECUENCIA 9690 KC/S
POTENCIA 100 KW

PALACIO DE CORREOS
BUENOS AIRES
REPUBLICA ARGENTINA

QSL (verification card) from Radiodifusion Argentina al Exterior. Note that on globe map Argentina includes the Falkland Islands (held by the British) and a large portion of Antarctica. RAE covers South American news from a different point of view. For details on this and other easily received SW broadcasts see Table B.

TABLE A—
BEST SHORTWAVE BANDS,
SPRING AND SUMMER, 1960



*To convert to megacycles, divide by 1000

AN international broadcast is worth the expense only if you—the listener—can receive it and—for one reason or another—also enjoy the program. (Admittedly, your interests as a short-wave listener and the interests of a SW broadcaster may not always coincide.) Let's look into the factors that affect reception and then analyze the programs themselves to discover which make for enjoyable listening.

Shortwave signals are weak compared to local broadcasting but this is unimportant, as there is little static on the shortwaves. The serious problems for the broadcaster are finding a clear wavelength, since scores of countries are broadcasting, and choosing a wave length that will be reflected by the ionosphere, a region of ionized air 60 and more miles above the earth upon which all shortwave broadcasting depends. The broadcaster must choose a wave-length which is short enough to escape absorption characteristic of lower frequencies and yet not too short for reflection via the ionosphere. If he's going to stick within the internationally authorized shortwave bands (see Table A), this summer he will be limited to a total of 1100 kc, a total two-thirds of that covered by the standard broadcast band. The National Bureau of Standards estimates that the average shortwave listener will tolerate four times as much interference as he will on the broadcast band. This compromise is a matter of necessity.

During the summer, every summer, absorption of radio waves by the ionosphere increases, while in the top layer of the ionosphere ionization decreases. This means that the longer 49 and 40 meter waves will not escape absorption (only the Communists use the latter for North America anyway) and therefore will be unsuitable for consistent transoceanic broadcasting, and due to decreased ionization in the top layer of the ionosphere, 13 meters at the top end of the dial will be reflected only sporadically. Which leaves 16, 19, 25 and 31 meters—and of these the 16-meter band is on the doubtful side. During the past few summers 16 meters has been "Open" (reflected) but with a dropping sunspot count (sunspots increase reflection); international broadcasters will be able to count on this one less and less.

Taking it by regions, daytime European signals will be received best on 19 meters with some on 16 meters, especially in the afternoon. Then evenings these signals will be heard on 25 and 31 meters with 19 also open several hours past sunset. Similar conditions hold for Africa except you probably won't hear any on 19 while dark. Asiatics will first appear around sunset or shortly before on 16 and 19 meters and because it is a peak listening period, such stations having North American broadcasts will transmit them during this period. However during the early *am* hours of darkness many Asiatic signals should be audible from 19 thru 31 meters. Pacific islands will also be heard during the *am* hours on 19, 25 and 31 meters.

Latin American stations, with the exception of Argentina and Chile, can be received much more easily; they will be received in the summertime all the way down to 6 megacycles (49 meters) and—when static permits—even lower.

The Human Element. As international broadcasting is directed by human beings, for human motives, it is of course far from perfect. And as in any other of man's endeavors, these services range from good, such as the quality program put out by the Swiss Broadcasting Corporation, to the absolute lowest as epitomized by Radio Peking. However there is always one constructive way to judge any shortwave station. Does it provide something worthwhile not readily obtainable elsewhere?

In this connection there are two common practices which, in varying degrees, lessen short-

TABLE B—STATIONS TO START WITH

COUNTRY	FREQUENCY OR WAVE-LENGTH	TIME* (EASTERN STANDARD)	BROADCASTER AND DETAILS
SWITZERLAND	11865 and 9535 Kc/s	2030-2215 and 2315-2400	Swiss Broadcasting Corporation. Swiss news (neutrality and more neutrality), commentary from Swiss newspapers (not so neutral). Good source of factual information about this, one of the world's first republics. You might say it was pro-Swiss but then the Voice of America is pro-U. S. and you really wouldn't want anything else. An interesting little touch with S.B.C.: on each broadcast they give the weather for Switzerland. Finally of note are special international features such as rates of exchange for world's currencies.
NETHERLANDS	15220 Kc/s (16 meters) 11730 and 9590 (9715†)	1615-1705 2130-2210	Radio Nederland. International news from a democratic West European viewpoint. Usually concludes program with a topical talk. These probably reflect quite accurately the general Dutch viewpoint.
SPAIN	9363 Kc/s	2215-2250, 2315-2350 and 0015-0050	The Voice of Spain. This one operates off regular broadcast frequencies to avoid interference. Features a reasonable quantity of Spanish folk and popular music. Too bad the entire program doesn't consist of same.
ISRAEL	9009 (11845) Kc/s	1530-1600	The Voice of Zion. Another off-band operation and that time is a little early for 31M but with a clear channel it should get through. Interesting source of Israeli news from a Zionist point of view. Also Israeli folk and popular music, but not enough.
CONGO REPUBLIC	11725 Kc/s	2015-2100	Radio Brazzaville (French government radio). African news from, primarily, a French point of view. Certainly better than none at all.
JAPAN	17855 and 15325 Kc/s	1930-2030	Radio Japan. News from Asia's leading democracy. Some Japanese folk and popular music; as usual, not enough.
ARGENTINA	9690 (15345) Kc/s	2200-2300 and 2400-0100	Radiodifusion Argentina al Exterior. South American news from a different if not unbiased point of view. Rest of program consists of Argentine popular music, more polished than most Latin American music and probably less interesting. Compare with the Voice of Spain.
GREAT BRITAIN	16 thru 31 meters	1600-2200	General Overseas Service, British Broadcasting Corporation. This is general programming intended for the entire English speaking world and not any one specific area. Time given is best for North America, but G.O.S. can usually be heard throughout the day on many frequencies. The G.O.S. is an excellent example of British programming and conservative English thought. Covers international affairs, theatre, literature and music. Also international sports but the latter would be of little interest to the average American.
AUSTRALIA	11810 Kc/s	0714-0845 and 1014-1145	Radio Australia. Australian news—the continent has an area of almost 3,000,000 square miles, remember. Remainder of program is mostly entertainment. These broadcasts have twice been voted most popular by the world's short-wave listeners.
CANADA	15195 (11900 or another 25 meter frequency)	2000-2045	Radio Canada. Good source of international and Canadian news. Because of the nation's proximity, the latter is of special interest to U. S. citizens.

* Time is given on the 24-hour clock. 1200 is 12 noon, 1300 is 1 pm, 2400 is midnight, and so on. In other words, for times past noon subtract 1200 to get Eastern Standard Time.

† Frequencies listed in brackets are alternate possibilities. If you fail to hear a program on the channels listed first, try these.

wave's usefulness. First, many stations play classical music. Of course if the transmission is intended for an area where shortwave is the only kind of broadcasting, such a feature is certainly justified. But when beamed to North America, it is a waste of time and frequency. As explained, shortwave is anything *but* a hi-fi media and the classical music fan would do far better on FM, or in some areas, even on the standard broadcast band.

Second, most SW broadcasters when attempting to give a view of their country, tend to overemphasize institutions and material things, passing by the real human values. While this is a fault common to most governmental undertakings, it is quite understandable here as these values are quite intangible and obviously difficult to put into words.

I have listed in Table B ten broadcasts which I think you'll find interesting. The chart tells which have been picked for all-round excellence and which for only one or two special features.

Easy Transistor Class Identification

- It's almost impossible to determine whether a transistor is of the NPN or PNP variety just by looking at it in a circuit. However, an easy clue to identification lies in the fact that the middle letter of the transistor class designation indicates which terminal of the battery is connected to the collector element. Thus, in the case of the PNP type, the *negative* terminal of the battery is connected to the collector; similarly, the *positive* terminal of a battery is connected to the collector element of a transistor of the NPN variety. Either by checking the polarity of the potential on the collector element, or by tracing out wires to the battery, it is a relatively simple matter to determine correctly the class of a given transistor.—JOHN A. COMSTOCK.

Wire Scraper from Old Blade

- An old piece of hacksaw blade can be used for cleaning wires when soldering. It will not cut the strands as will a knife.—FRANK A. JAVOR.

Transistors Wired in Tandem

- When building direct-coupled amplifiers using transistors, wiring can be simplified and space saved by connecting matched pairs of transistors together. Cement or tape the two transistors together back-to-back, and solder the emitter lead of one unit to the base lead of the other.

"This circuit has a response of 20-20,000 cps—practically no harmonic distortion up to 25 watts . . ."

memorize morse in 20 minutes!

By Dr. BRUNO FURST

THE International Morse Code is a language of sound used for radio-telegraphy communication. In it, short and long pulses of sound (*dits* and *dahs*) are combined to indicate the 26 letters of the alphabet, the 10 numerals, punctuation marks, and other information. Table A gives the phonic sounds of International Morse as well as the written designations of the pulses, a dot for a short pulse (*dit*), a dash for a long pulse (*dah*). Except when it is the final syllable of a character, a dit is contracted to *di*, the *t* becoming lost in the *d* of the following syllable.

A brief depression of the telegraph key sends a dot signal; a depression three times as long, a dash. Between signals forming the same letter, there is a pause equal to one dot; the pause between two letters within a word is equal to three dots (a dash); the pause between two words is equal to seven dots.

If the letter *a* were represented by one dot, *b* by two dots and so, no help in memorizing the code would be necessary. However, the distribution of dots and dashes is completely irregular (except that the most commonly used characters have the simplest signal combinations) and help is necessary. There is no uniformity in sequence. There is no pattern. Taken all in all, the code presents a confusing picture, difficult to memorize. Here then is a method which has been tested over and over again that enables everybody (even those without previous experience) to learn the International Morse Code in 15 to 20 minutes.

Since the code consists of dots and dashes, the dots are replaced by vowels (a-e-i-o-u-y), the dashes by consonants. For each letter of the alphabet, a specific word which begins with the letter that it stands for is substituted. For example, the cue word *Air* is substituted for the letter *a*. The *cue* words (or cue word combinations) at right above represent the entire alphabet:

A ir
B ruise
C hina
D ray
E sso
F iery
G lobe
H is essay
I ssue
J ust now
K odak
L ydia
M onk
N ote
O n top
P arty
Q-Club
R eno
S usie
T ot
U sual
V isual
W ith
X-rays
Y okels
Z ombie

In order to make easier the task of remembering which word belongs to which letter, memorize this five-sentence story (in it, the cues are used in consecutive order):

"A shell burst in the *Air*, causing a *Bruise* to a soldier in *China*, who was riding in a *Dray*.

"The soldier, Private *Esso*, wrote about the *Fiery Globe. His Essay* is an *Issue Just Now*.

"With his *Kodak* he took pictures of *Lydia* and a *Monk* writing a *Note On Top* of a hill.

"Then he went to a *Party* at the *Q-Club* in *Reno*, taking *Suzie* and her *Tot* along as *Usual*.

"At the club, *Visual With X-rays* were *Yokels* drinking a *Zombie*."

Because of its very oddity, this story—read once or twice—is easy to remember. So also, because of it, are the cue words, since they appear in it in alphabetical order; each cue word acts as an association for the succeeding cue word. Thus each brings the next to mind. (But if you learn the signals mechanically, by rote, and forget one, there is no way in which to recall it.)

Having learned the cue words, apply the following rules: The first letter of each word is used only to indicate the letter of the alphabet being coded. (If the first letter of each word were included in the decoding, many exceptions would be necessary because the Morse Code signs for several consonants start with a dot—F, H, R, etc. —whereas the vowel O starts with a dash.) For the succeeding letters, substitute a dot for each vowel, a dash for each consonant (for example A ir · — or C hina — · — ·).

Because there are no words in the English language consisting *only* of four vowels (as

for an amateur license you must demonstrate ability to send and receive the morse code. here's how you can learn the code - quickly

TABLE A—INTERNATIONAL MORSE CODE

LETTER	SIGNALS	PHONIC SOUND
A	· —	di DAH
B	— · · ·	DAH di di dit
C	— · — ·	DAH di DAH dit
D	— · ·	DAH di dit
E	·	dit
F	· · — ·	di di DAH dit
G	— — ·	DAH DAH dit
H	· · · ·	di di di dit
I	· ·	di dit
J	· — — —	di DAH DAH DAH
K	— · —	DAH di DAH
L	· — · ·	di DAH di dit
M	— —	DAH DAH
N	— ·	DAH dit
O	— — —	DAH DAH DAH
P	· — — ·	di DAH DAH dit
Q	— — · —	DAH DAH di DAH
R	· — ·	di DAH dit
S	· · ·	di di dit
T	—	DAH
U	· · —	di di DAH
V	· · · —	di di di DAH
W	· — —	di DAH DAH
X	— · · —	DAH di di DAH
Y	— · — —	DAH di DAH DAH
Z	— — · ·	DAH DAH di dit

NUMBER	SIGNALS	PHONIC SOUND
1	· — — — —	di DAH DAH DAH DAH
2	· · — — —	di di DAH DAH DAH
3	· · · — —	di di di DAH DAH
4	· · · · —	di di di di DAH
5	· · · · ·	di di di di dit
6	— · · · ·	DAH di di di dit
7	— — · · ·	DAH DAH di di dit
8	— — — · ·	DAH DAH DAH di dit
9	— — — — ·	DAH DAH DAH DAH dit
0	— — — — —	DAH DAH DAH DAH DAH

PUNCTUATION MARKS & SIGNS	SIGNALS	PHONIC SOUND
PERIOD	· — · — · —	di DAH di DAH di DAH
COMMA	— — · · — —	DAH DAH di di DAH DAH
QUESTION MARK	· · — — · ·	di di DAH DAH di dit
ERROR	· · · · · · · ·	di di di di di di di dit
DOUBLE DASH	— · · · —	DAH di di di DAH
WAIT	· — · · ·	di DAH di di dit
END OF MESSAGE	· — · — ·	di DAH di DAH dit
INVITATION TO TRANSMIT	— · —	DAH di DAH
END OF WORK	· · · — · —	di di di DAH di DAH
FRACTION BAR	— · · — ·	DAH di di DAH dit
EXCLAMATION	— — · · — —	DAH DAH di di DAH DAH
COLON	— — — · · ·	DAH DAH DAH di di dit

needed for H) or of three consonants (as needed for O), one exception is necessary: For the letters *s* and *o* a dot or dash is substituted only when they appear at the *end* of a cue word or cue word combination. In all other positions they are disregarded.

the author

Dr. Bruno Furst teaches the art of improving the efficiency of memory. He is director of the School of Memory and Concentration in New York City (the school was 20 years old last fall), professor of law at McGeorge College and instructor at Brooklyn College, Adult Education. His system of memory training has been introduced by many business firms, at the U.S. Army Intelligence School in Washington, and at many Army and Air Force installations.

Aside from his resident classes in New York and other cities in the United States, South America, Africa and Australia, he conducts a correspondence course as well as a self-study course. Readers interested in further developing their memory and powers of concentration can write to Dr. Furst in care of the School of Memory and Concentration at 365 West End Avenue, NYC 24.

Remember this exception by thinking of S.O.S. For example, H is essay · · · · and R eno · — ·

The *s* in His is ignored because it is not at the end of the cue word combination. The *o* in Reno has a dot substituted for it because it is at the end of the cue word.

The entire alphabet is thus transposed as follows:

A	ir	· —	N	ote	— ·
B	ruise	— · · ·	O	n top	— — —
C	hina	— · — ·	P	arty	· — — ·
D	ray	— · ·	Q	Club	— — · —
E	sso	·	R	eno	· — ·
F	iery	· · — ·	S	usic	· · ·
G	lobe	— — ·	T	ot	—
H	is essay	· · · ·	U	sual	· · —
I	ssue	· ·	V	isual	· · · —
J	ust now	· — — —	W	ith	· — —
K	odak	— · —	X	rays	— · · —
L	ydia	· — · ·	Y	okels	— · — —
M	onk	— —	Z	ombie	— — · ·

For learning numbers in the International Morse Code, no memory help is needed. The signs follow a uniform, progressive pattern (see Table A). The numbers from 1 to 5 start with from 1 to 5 dots; the numbers from 6 to 0 start with from 1 to 5 dashes. All are supplemented by the opposite symbol to a total of five.

Besides the International (Continental) Morse Code, there is an American Code which deviates in several instances from the International Code (see Table B). Considerable auditory skill is needed to read this code because of the irregular spacing used within certain letters (irregular in comparison to International Morse spacing). It is therefore rarely used in radio applications. To apply my method to the American Code, simply change some of the cue words and construct a story of your own. With understanding of the method that I suggest, these changes are easily done, and a story that *you* construct is even easier for you to remember than a story that I or someone else constructs for you.

Of course, knowing the signals will not make you immediately proficient in sending and receiving the Code. Proficiency requires practice. Your ear must grow accustomed to the *sound* of the Code. But the highest hurdle—the memorization of the Morse Code signals—need not take you more than 20 minutes.

TABLE B—AMERICAN MORSE CODE

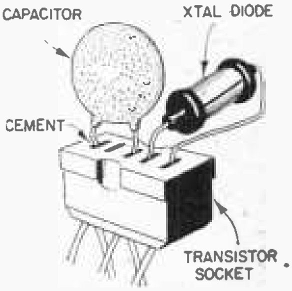
LETTER	SIGNALS	LETTER	SIGNALS	NUMBER	SIGNALS
A	· —	N	— ·	1	· — — ·
B	— · · ·	O	· ·	2	· · — · ·
C	· · ·	P	· · · · ·	3	· · · — ·
D	— · ·	Q	· · — ·	4	· · · · —
E	·	R	· · ·	5	— — —
F	· — ·	S	· · ·	6	· · · · · ·
G	— — ·	T	—	7	— — · ·
H	· · · ·	U	· · —	8	— · · · ·
I	· ·	V	· · · —	9	— · · —
J	— · — ·	W	· — —	0	——
K	— · —	X	· — · ·		
L	——	Y	· · · ·		
M	— —	Z	· · · ·		

Almost everything that we have to learn and to remember in school, in college and in later life can be made easier and retained longer by using more efficient methods. Whenever you face something new that must be learned, do not plunge immediately into parrot-like memorization. Give some thought to the question: Can I find a short-cut which simplifies the task and makes learning and remembering more interesting and more exciting? Invariably the answer is yes.

"I don't remember whether I made that change or not, but I do remember making a mental note to do it."

Lifesaver for Components

• Building a compact transistor circuit? You can save heat-sensitive component parts from being ruined by using transistor sockets not only for transistors, but also for ceramic capacitors, crystal diodes and other parts easily damaged by too much heat from a soldering iron. Just insert the leads into the socket, then add a touch of service cement to the lead where it enters the socket.

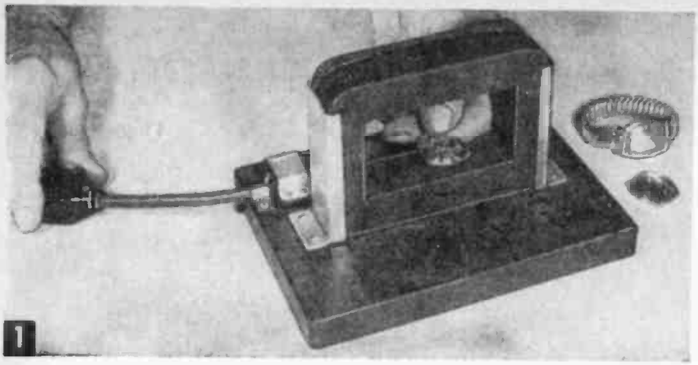


Hi-Fi Speaker Improvement

• Where two separate speakers are used in a hi-fi system to reproduce the high and the low frequencies, apply one or two coats of lacquer to the cone of the larger speaker. This will stiffen the cone and improve its response to the lower frequencies.—JOHN A. COMSTOCK.

File Used as Reamer

• When a rat-tail file breaks, don't throw it away—break it up into a number of 2-in. lengths and use them in your power drill to enlarge radio chassis holes. They cut very rapidly and are ideal for enlarging tube socket holes and for similar radio work.—J. A. C.



1

Demagnetizer for Watches and Small Tools

By HAROLD P. STRAND

THE next time your watch starts to lose time or stops because it is magnetized, you can save yourself a trip to the jeweler's by using this demagnetizer (Fig. 1). With the 115 volt 60 cycle power turned *On*, the alternating current field, created by passage of current through the wound coil, quickly knocks out all magnetism by simply passing the watch movement through the coil opening. Small screw drivers or punches may also be demagnetized with this device.

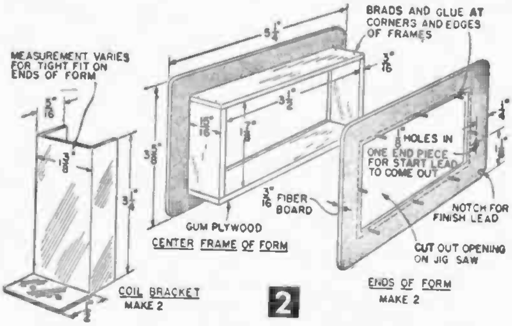
The hairspring of the balance wheel of a watch has a tendency to accumulate a permanent magnetism, since it is tempered spring steel. This may happen for no apparent reason, or it may occur while you are wearing the watch around electrical equipment, especially where direct current is used. Magnetized turns of the hair spring will stick together or result in an erratic action of the watch movement.

Remember, when using this device, to turn on the power *before* placing the piece in the opening and turn off the power *after* its removal. Otherwise, the sudden switching off of the power while the watch or tool is in place, may result in increasing rather than removing magnetism.

The demagnetizer consists of a rectangular coil, a base board, line cord and switch. To wind the coil, first make up a wooden form which is a permanent part of the unit (Fig. 2). The coil may be wound on a lathe at slow speed, or on a winding machine equipped with a turn counter, but you can handwind the coil by carefully counting the turns. Press a block into the opening of the form, and use a ¼-20 machine screw, nut and washer in a bored hole in the block to provide a stud that can be held in the chuck for turning (see Fig. 4). Solder a flexible #20 lead wire to both start and finish ends of the coil, and bring out for connection with the line and the switch.

The resulting coil, when energized with 115-volt alternating current, will have sufficient resistance and inductance so that only a small current will flow. If a small tool is placed in the coil opening, a light pull and vibration will be felt from the effects of the magnetic field produced. Since the current in the coil is reversing constantly through 60 cycles or 120 alternations a second, the magnetic field also is in a constant state of reverse, and this causes a complete elimination of the original magnetic polarity in the piece or neutralizes it to zero.

Fig. 3 shows the start of



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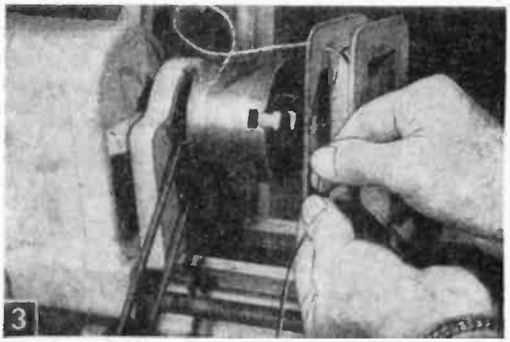

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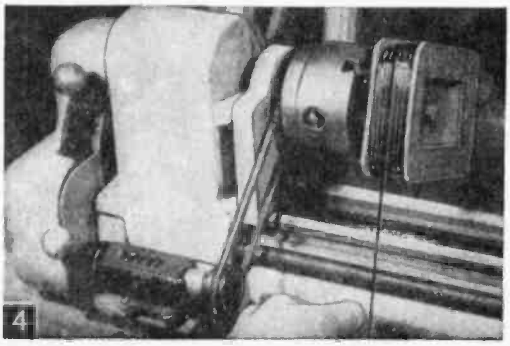

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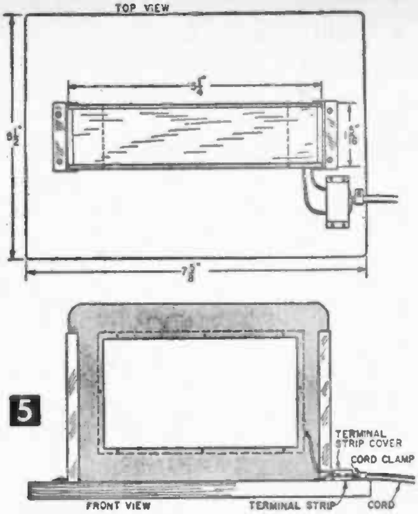

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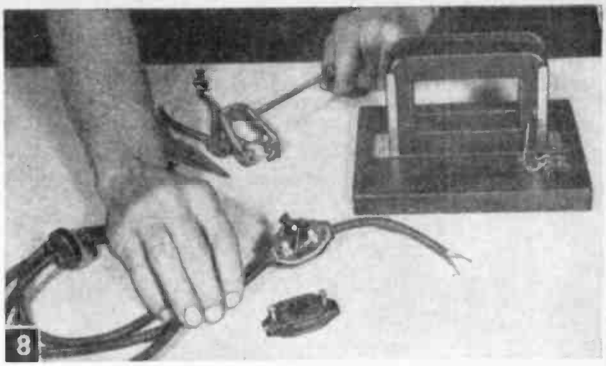


8

winding the coil in a small lathe, with the flexible lead wire passed through a small hole in the form and soldered to the starting end of the magnet wire. A short piece of plastic tubing will be slipped over the splice to insulate it. A turn counter has been fixed up on this lathe bed, with a rubber vacuum cleaner belt to drive it. Wind 2500 to 2800 turns (Fig. 4) and then solder on the other flexible lead to the finish end. Wrap a turn of electrical or adhesive tape around the winding to bind it in place and then remove the form from the chuck and tap out the block.

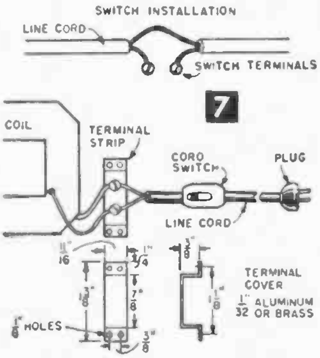
Make the base of the demagnetizer from a piece of maple or birch and sand smooth (Fig. 5). The coil is held in position by two side brackets (Fig. 2) which can be made from any soft aluminum or brass sheet stock about 1/32 in. thick. Their width should be such as to tightly grip the sides of the coil form. Use two small round head screws to secure them to the base (Fig. 6).

The next step is to install a cord switch about 4 in. from one end of a 6 ft. length of rubber line cord (Fig. 8). Connect a regular attachment plug cap to the other end. Connect cord to the terminal screws of the terminal strip and make a small clamp to hold cord securely. Place a small cover piece over the live terminals of the terminal strip as protection against accidental shock, screwing through holes in the cover and also down through holes in the terminal strip, to hold the assembly to the base, taking care to avoid contact between cover and live terminals.

Finish the wood base and the coil unit as desired. A coat of mahogany stain was used in the original, and two thin coats of shellac were then applied as final finish. Sand lightly with 6/0 garnet paper and apply one coat of satin varnish which will complete this project.

MATERIALS LIST—DEMAGNETIZER

Amt. Req'd.	Description	Use
1 pc.	maple or birch 7⅝ x 5½ x ¾"	base
1 pc.	3/16" birch or gum plywood, 12 x 15/16"	inner frame for coil
1 pc.	3/16" Masonite fiber board, 8 x 6"	sides of coil form
1 pc.	1/32" soft aluminum or brass, 8 x 2"	bracket supports
1 pc.	1/32" soft aluminum or brass, 2½ x 11/16"	cover over terminal strip
1	Jones terminal strip, #140, 2 terminal	
1	cord-type toggle switch	
6 ft.	rubber vacuum cleaner cord	
1	attachment plug cap	
1 pc.	sheet brass, 1 x ⅜ x 1/32 thick (bend up to make cord clamp)	
1 lb.	#30 or #29 Formex magnet wire	
	brads, glue, stain, shellac	
4	⅜" #4 rh brass wood screws	
4	½" #3 rh brass wood screws	
1	¼" #5 rh brass wood screw	
2 pcs.	#20 flexible insulated lead wire, 6" long	



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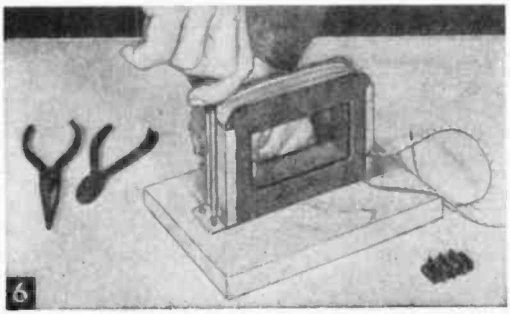
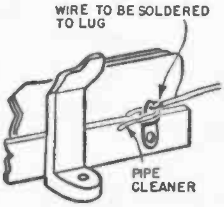


6

Dam for Soldering Lug

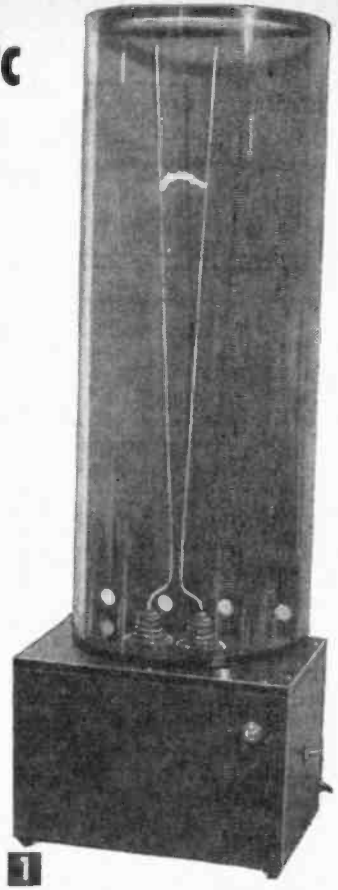


• For a neater job of soldering a wire or cable to a lug, build a dam around it with a pipe cleaner as shown. This idea is particularly good for automotive or radio jobs, where precision is necessary.—V. H. Lamoy.

High-Voltage Traveling Arc

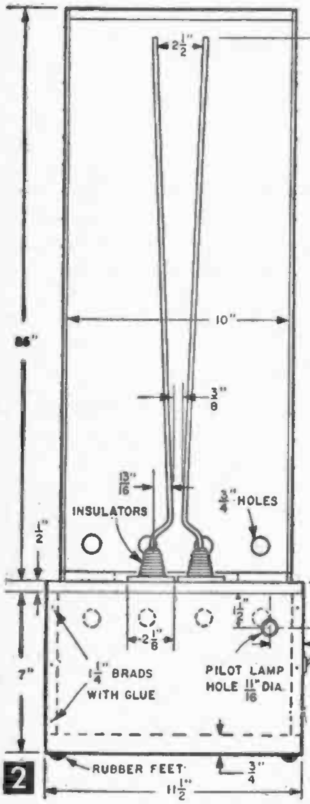
Favorite laboratory background for the movies' "mad scientist" is the Jacob's Ladder or traveling arc. Make your own for about $25

By HAROLD P. STRAND



1

A continuous series of flaming arcs will move up the electrodes of this device, which is similar to one shown at the Boston Museum of Science.



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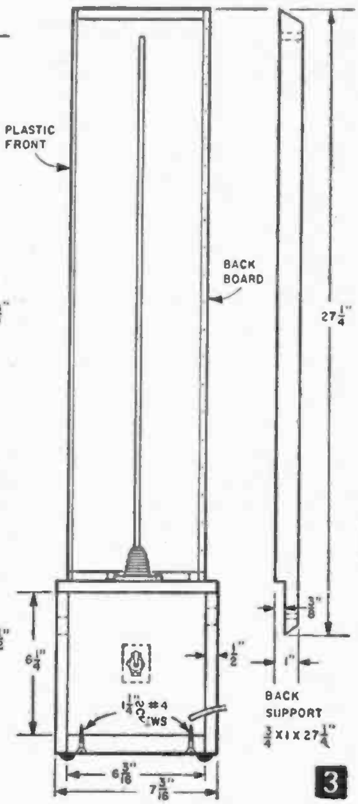
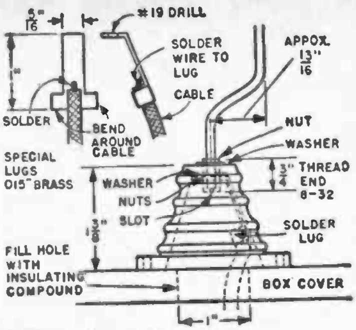


3

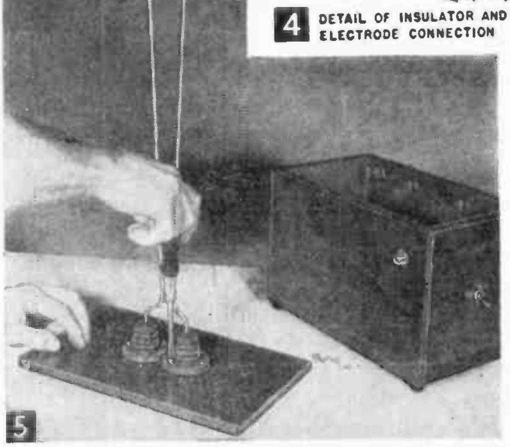
REMEMBER when you saw a movie scientist working in his laboratory with the powerful crackle of an electrical arc slowly moving upward between two V-shaped rods in the background? These "Jacob's Ladders" pack a lot of drama into usually dull laboratory equipment and are sure-fire attention getters. You can build your own for experimenting and display—like the one in Fig. 1. As you switch it *On*, a heavy flaming arc jumps between the wires at the short gap above the insulators. Immediately it starts rising to the top getting longer as the distance between rods increases until it dies out near the top. As soon as one arc is extinguished, another one starts. The process is continuous as long as you keep the switch closed.

What causes the flaming arc to rise? You might expect the spark to remain at the bottom, where the spacing of the wires is shortest. The explanation is that the air is heated in the vicinity of the arc and, as heated air naturally rises, it pulls the arc up with it. As a 15,000 volt transformer is used in the base, an arc of considerable intensity results and you need the protection against accidental contact that is provided by the enclosure.

You can amuse yourself and your friends with this high-voltage traveling arc, and it makes a good electrical display at shows and exhibits to attract attention to a particular booth. The transformer, from an obsolete Timken oil burner, was purchased secondhand from an oil burner service shop for $15. Be sure to have the transformer tested before purchasing, which can be done by arranging two well-insulated wires from the secondary terminals to form a gap for the arc

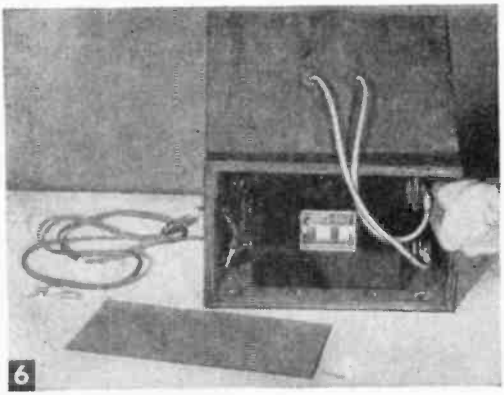


4 DETAIL OF INSULATOR AND ELECTRODE CONNECTION



5

Attach the porcelain insulators to the stained and shellacked cover over 1-in. diameter holes provided.



6

With the transformer mounted in the cabinet and the primary connections made with #18 insulated wire, the high-voltage leads of the automotive ignition cable are attached to the secondary terminals. Note that the holes under the insulators on the cover have been sealed with sealing compound.

to jump across. If the unit is in good condition, a heavy arc about 1-in. long should be obtained. Defective windings will produce a weak and short arc, or no arc at all. (CAUTION: Take extreme care in working around such a transformer, as it packs a charge of electricity that can be dangerous or even fatal.) Other makes of oil burner transformers may be used if the rating is about the same, but the dimensions of the box or cabinet given here may have to be modified to suit the size.

Start by making the box from ½ and ¾ in. birch plywood, cutting the parts about 1/16 inch oversize to allow for dressing down to final size on the sanding disc.

Bore the required holes in the cabinet, including four ¾-in. ventilating holes at the back (Fig. 8A). Assemble sides and ends with a good grade of cabinet glue and 1¼-in. brads, then screw bottom onto the end pieces. Carefully sand all surfaces by hand, slightly rounding the corners. Set the brads and fill the holes with Plastic Wood.

The box can now receive its finish. Apply a coat of walnut oil stain and allow this to dry about ten minutes. Wipe off the surplus stain with a cloth, bringing out the grain. Allow the stain to dry for several hours and then apply a coat of shellac which has been thinned somewhat with denatured alcohol. After drying, lightly rub the surface with #4/0 sandpaper and apply a second coat of shellac, a bit heavier than the first, or with less alcohol. Lightly rub this coat with fine steel wool, taking care to avoid rubbing through the finish at the corners. Apply another coat or two if sufficient shellac has not been built up on the surface. Finish the cover in the same way. Equip the cabinet with rubber knobs or feet at the bottom corners and install a pilot lamp to warn that the power is on and a toggle switch to control the flow of power to the primary. However, a push-button switch can be used instead if desired for momentary operation.

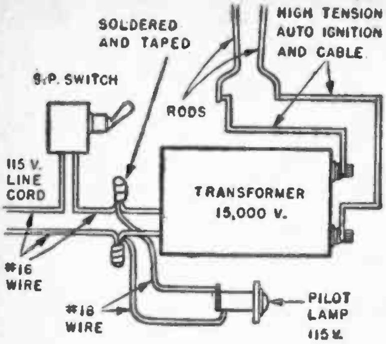
Shape the electrode wires from 5/32 or 3/16 in.

MATERIALS LIST—TRAVELING ARC

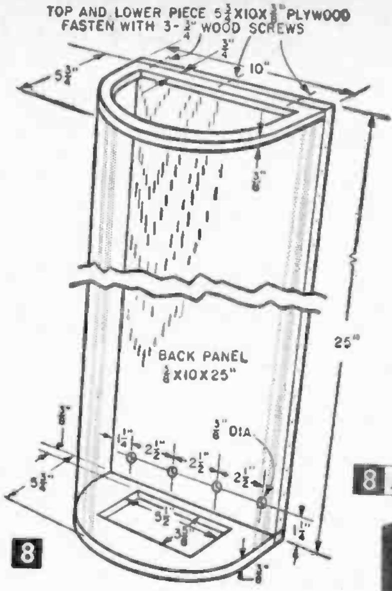
	Birch Plywood
2	½ x 7 x 11½", sides, cabinet
2	½ x 6 3/16 x 6¼", ends, cabinet
1	½ x 7 3/16 x 11½", top, cabinet
1	¾ x 6 3/16 x 11½", bottom, cabinet
1	⅜ x 10 x 25", back board, enclosure
2	⅜ x 6 x 10", end pieces, enclosure
1	¾ x 1 x 27¼" (birch or maple), back support, enclosure
	Miscellaneous
1	15,000 volt, 30 milliampere oil burner ignition transformer for 115 volts 60 cycles (Timken Model A-R Spec. #638-291 or equiv.)
2	porcelain stand-off insulators, 1⅜" high, about 2" diameter bases
1	S.P.S.T. toggle switch, 6 amperes at 115 volts, with ON-OFF plate
1	pilot lamp assembly for 115 volts, clear lens (Dialco #95408-937, Allied Radio #52E507)
1	NE-51 neon lamp
8 ft	#18 or #16 rubber lamp cord for primary connections
1	attachment plug cap
1 sheet	rubber ⅛ x 5½ x 10" (rubber floor tile will do)
2	5/32 or 3/16" dia. x 25" long hard aluminum rod for electrodes, from metal products supply company (see local phone directory). Cut to length after bending
4	rubber knobs or cabinet feet with wood screw threaded center studs
*1 sheet	clear rigid vinyl plastic .030 x 17¾ x 25"
2	solder lugs, .015 x ¾ x 1½" brass or copper
2	solder lugs to fit transformer secondary terminals
	high tension automotive ignition cable

Misc. stain, shellac, screws, nuts, washers

*The Forest Products Co., 131 Portland, Cambridge, Mass., will supply the plastic in a .030 x 20 x 25" piece for $2.75 ppd in U.S.



7 PICTORIAL WIRING DIAGRAM



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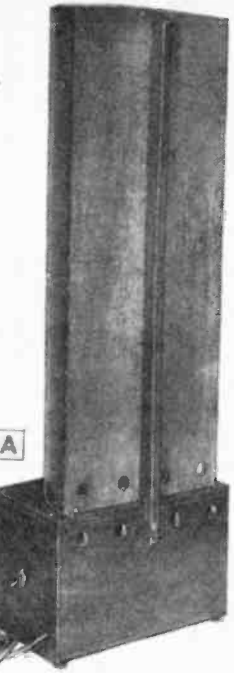


8 A

A view of the finished job from the back side. The author built the device in slightly more than two evenings at a cost of about $25.

dia. hard aluminum rod stock so they will be about 3/8 in. apart at the bottom end and about 2½ in. apart at the top (Figs. 2 and 4). The exact spacing will depend on the diameter of the bases of the insulators obtained, since if they are larger than those we used, greater offset will have to be put in wires to get required spacing. Cut #8-32 to 10-32 threads on wires, depending on rod size, so nuts and washers can be used as in Fig. 4.

Attach the porcelain insulators with the attached electrodes to the box cover (Fig. 5).

Secure the transformer to the cabinet bottom, using four wood screws at its base. Complete the primary connections with two soldered and taped joints (Figs. 6 and 7). Connect the high-voltage cables to the secondary terminals, using solder lugs on the cables (Fig. 4). Seal the holes in the cover through which the cables pass with a sealing compound, which can be any insulating type of hard-setting cement capable of being melted and poured in the holes (Figs. 4 and 6). Place a piece of rubber (shown on the bench, Fig. 6) on top of the transformer to prevent possible leakage of current to that metal surface.

Attach the cover, using roundhead brass screws. Give the unit a preliminary test in this condition, standing 3 or 4 feet away for safety. The arc should form at the bottom and rise, but not in a proper manner as it will when the enclosure is provided.

Construct the enclosure from 3/8-in. birch plywood (Fig. 8). Make the openings in the two curved end pieces on the jigsaw and attach to the back board with glue and flathead screws. Fit the back brace to the board. Bore four ¾-in. diameter holes through the back board at the lower end to admit air. Apply walnut oil stain and finish exactly the same as the cabinet.

Cut the .030-in. clear vinyl plastic front to size with sharp scissors, taking care to avoid cracking, and install to the edges of the unit in a simple manner, using small brads with heads or very small tacks along the two sides (Figs. 8 and 8A). Apply shellac to the edges first, and allow to dry until tacky. Then place the plastic in position on one edge and secure. Bend the material around the curved end pieces, pull it tight and secure it at the other edge. Be sure to drill a small hole for each brad, since this plastic is quite brittle and may crack if you try to drive a brad through it. Avoid the use of plastic that will support combustion, such as some of the cellulose variety. Vinyl plastic will soften if given too much heat, but will not burn easily.

Long testing has proved that the plastic front was sufficiently far enough away from the arc to keep out of trouble. However, if you want added fire safety, cement or tack a strip of sheet asbestos around the inside edge of the top opening, where the intensity and flame of the arc are the greatest.

Drop the completed enclosure down over the wires and secure to cabinet with a single screw through the supporting brace (Figs. 3 and 8A).

While the unit can probably be operated continuously for quite some time without damage, it is well to use it intermittently or for special demonstrations, since the wire electrodes become quite hot due to the moving arc stream. Print a sign or name plate on the front of the cabinet, reading "CAUTION—15,000 volts," as a general warning to persons who may tend to get careless.

If used properly, however, there should be no danger to anyone.

A Volt-Ohmmeter and Transistor Tester For The Experimenter

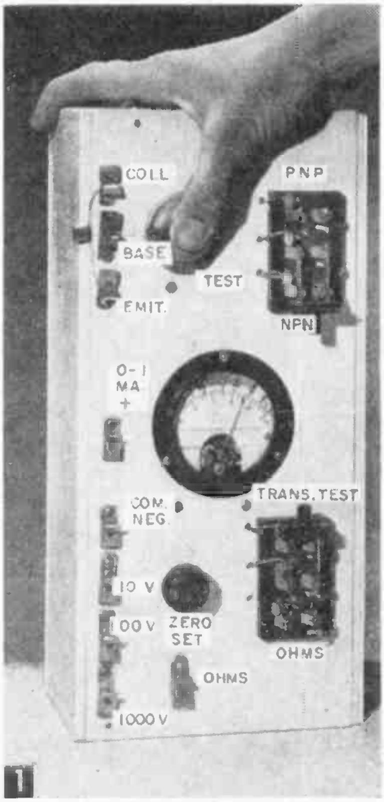
By C. F. ROCKEY

IF you do much serious radio or electronic experimental work, you will frequently need to make voltage and resistance measurements within your circuitry. And the present intense interest in transistors makes a simple transistor tester increasingly valuable. Why deny yourself these essential measurements when you can build a unit to perform both of these functions in a single Saturday afternoon? One for which the cost will be well below that of currently available, American-made instruments of equivalent utility.

Experience indicates that 99% of all routine electronic circuit tests are those of *dc* voltage and resistance. While *ac* voltage and *dc* current scales would be occasionally useful, the added cost and complexity involved does not justify including them within this device.

The only expensive item is the meter itself. Good meters cost money, poor ones are not worth the little they do cost. But the 0-1 milliampere meter used here is one of the most useful of instruments, and it is well worth its approximate $10 cost. (You will find plenty of future use for it, long after you have electronically outgrown this project.) Surplus 0-1 milliammeters are available, we understand, at something like one-half new-meter price. But be careful. It is easy for the beginner to get stung. Make sure that the meter you use is of the correct current rating, has not been damaged by shock or mishandling, and is of the moving-coil (D'Arsonval) type. The cost of the remaining parts in this project is small.

This project is *big;* the writer does not believe in miniaturization in home projects. First, I'm not a jeweler and secondly, miniaturization is costly and subject to difficulties in maintenance. You can redesign this job to fit in a much smaller space. But you will sacrifice ease of construction and maintenance thereby.



1

Not a "black box," but a white one that is inexpensive and useful.

Begin by building the case and panel, a simple plywood box 4 x 6½ x 13½ in. Nail the sides and bottom together to form the cabinet, but leave the top loose. This will be the panel (see Figs. 3 and 5) upon which all parts will be mounted. Quarter-inch plywood scraps were used by the author for the panel, sides, and bottom. The ends are three-quarter inch pine stock. Sand the base and panel for a neat job, but do not finish until all holes have been drilled. Then give the panel a final sanding and finish as you prefer. I used some semi-gloss wall paint I had on hand, but orange shellac is acceptable, and dries much faster.

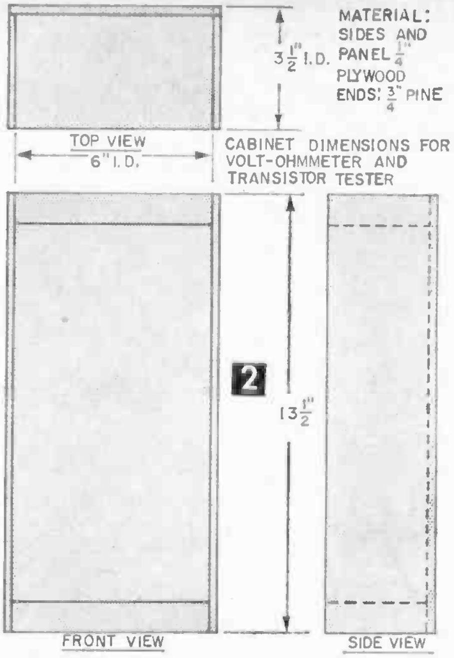
Cut the meter hole squarely in the center of the panel. A hole of 2¾ in. dia. will fit most modern meters. (The old Weston, vintage of the thirties, used in the writer's job, took a 2½-in. hole.) If you have a suitable expansion bit, use this to cut the hole. If not, draw a circle in the right place and drill all around its circumference with a ½-in. drill. This is the hard way, but it works. The rim of the meter will neatly cover any misses.

Next, drill ⅛-in. holes to mount the two DPDT switches. Use a switch as a template. These switches are available at many chain hardware stores, "dime" stores, etc., throughout the country. Drill a ⅜-in. hole for the zero-set potentiometer. Finish the drilling with the ⅛-in. holes for the Fahnestock clips, the mounting holes for panel, and pushbutton lead holes.

If you consider Fahnestock clips old-fashioned, substitute pin jacks. But you'll find, as the writer did, that they'll lose their grip much sooner, despite their prettier looks.

With all the holes drilled, sand and finish. When finish is dry, mount all parts except the meter. Then wire the circuitry according to Fig. 6. Mount the voltmeter multiplier resistors between two tie-lugs, as shown in Fig. 5. Finally, insert and connect the meter. When the wiring is completed, check it again.

Why is the flashlight cell soldered into the circuit and allowed to lounge upon the bottom of the case, instead of being fitted into clips? Because of the long anticipated-life of the cell; under normal conditions it will last over a year. Since a really effective battery clip is tricky to build, the writer did not consider it worth the trouble. (A poor clip, found, alas, in many "store-bought" instruments will cause no end of vexation. So, unless you can build a *good* one, solder the cell in and forget about it for a year.)



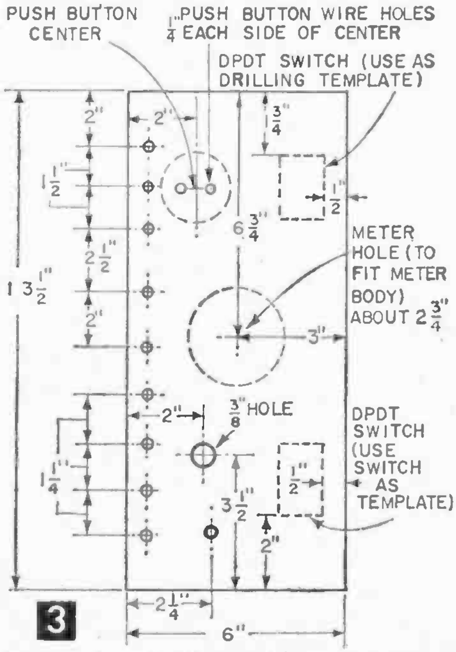
CABINET DIMENSIONS FOR VOLT-OHMMETER AND TRANSISTOR TESTER

2

Put a knob on the zero-set potentiometer, and turn it to its counterclockwise extremity. Short-circuit the "ohms" and the "com. neg." terminals (with the switch in "ohms" position) and adjust the pot to make the meter read exactly *full-scale*. This is the zero on the ohms scale. If this seems strange, remember that, by Ohm's law, maximum current flows when the resistance is minimum. Use this same setting for transistor tests.

In normal use, one of your tests leads is connected to the "com. neg." terminal, while the other is placed in the clip representing the measuring range you wish to use. The number of volts measured is the meter reading *times* ten, one hundred, or one thousand, depending upon the range in use. This makes the mental arithmetic easy, and covers voltages found in most radio and electronic projects. For obvious safety reasons, do not attempt to measure voltages above one thousand volts with this instrument.

Be sure to observe polarity when using the voltmeter, otherwise the meter will swing backwards, which may seriously damage it. Also be sure to unplug all power or remove all batteries from apparatus being tested before using the "ohms" scale. Otherwise the meter may be irreparably damaged; more test equipment is probably damaged through this kind of neglect than any other.



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VOLT-OHMMETER AND TRANSISTOR TESTER FRONT VIEW OF PANEL SHOWING LAYOUT

You may accurately determine any resistance from the ohm-meter reading by using the following formula:

$$R=\left(\frac{1500}{I}\right)-1500$$

Where: R=Resistance of the unknown or measured resistance, in ohms.

I=Meter reading, milliamperes.

Or, if you wish to carefully place resistance calibrations upon the scale of your meter, as the writer has done, you may use the following table (K=one thousand):

10K ohms	0.130 milliamperes
5K ohms	0.23 milliamperes
3K ohms	0.33 milliamperes
1.5K ohms	0.50 milliamperes
1K ohms	0.60 milliamperes
500 ohms	0.75 milliamperes
100 ohms	0.95 milliamperes

Use a sharp steel pen and black ink. Be sure to disassemble the meter carefully, and in a clean, dry place. Airborne grit is very bad for its insides.

While it is quite impossible to thoroughly test a transistor, in the scientific sense, without several thousand dollars worth of laboratory equipment and much experience, one *can* obtain a significant check by using this simple unit. Since the maximum applied voltage is 1½ v, all but the most delicate and specialized transistors may be checked without fear of damaging them. This is more than one can say of some of the commercial testers on the market. Like all simple transistor testers, and many tube testers also, this device gives only a *comparison* test, but this is usually sufficient. It will always reveal a *bad*

MATERIALS LIST—VOLT-OHMMETER AND TRANSISTOR TESTER

No. Req'd	Description
1	0 to 1 ma. milliammeter, 3" size (Weston, Triplett, Simpson, or other good make)
2	DPDT, plastic base knife switches
1	push-button, flush mounting
9	Fahnestock clips
1 set	test leads, ICA
1	1000 ohm potentiometer, (Mallory, IRC, or any other good make)
1	knob for potentiometer
1	flashlight cell, large size
1	single-point tie-lug
1	double-point tie-lug
1	triple-point tie lug
1	1 Megohm, 1-watt carbon 5% resistor
1	100K, 1-watt carbon 5% resistor
1	10K, 1-watt carbon 5% resistor
1	1K, 1-watt carbon resistor
1	47 ohm, 1-watt carbon resistor
1	200K, 1-watt carbon resistor
1	9.1K, 1-watt carbon resistor
	6-32 rh machine screws, ¾" with nuts, #6 x ¾" rh wood screws, hookup wire, rosin-core solder, finish
2 pcs	¼ x 6 x 13½" plywood
2 pcs	¼ x 3¾ x 13½" plywood
2 pcs	¾ x 3½ x 6" pine stock

transistor, but no simple test can definitely assure of a good one, since too many factors are involved. All currently-available types may be significantly checked with it, and the result will be found valid and reliable.

Practically, a transistor has two properties which will determine whether it is usable or not. These are:

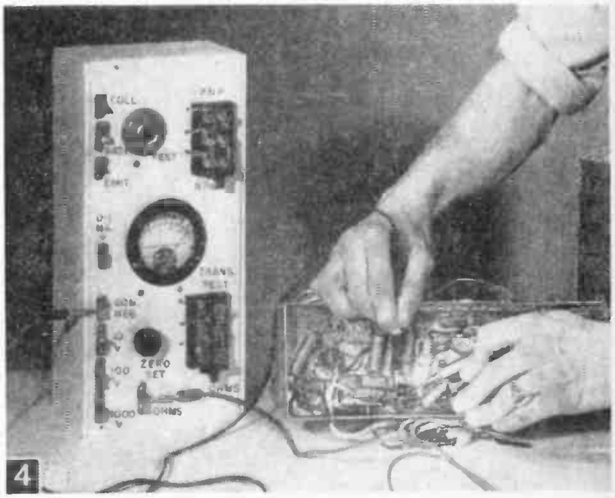
1. The open-base, emitter-collector leakage.
2. The grounded-emitter *dc* voltage gain, or "*dc* beta."

This device gives a comparative indication of both of these properties.

Place the "PNP—NPN" switch in the appropriate position for the transistor you wish to test. Connect transistor leads to correct terminals. Then throw the "ohms—trans. test" switch into the "trans. test" position. The reading you now observe upon the meter is a function of the open-base, emitter-collector leakage. (This is *before* the test button is pressed.) The *lower* the meter reading under these conditions, the better the condition of the transistor. In every case, the meter reading should be less than 0.1 milliamperes, preferably closer to 0.05 milliamperes. If the reading exceeds 0.2 milliamperes it is a sure sign that the transistor has been electrically mistreated, and should be considered questionable, if not downright bad.

If the transistor passes the above test, press the button. The current indication should increase sharply, at least to 0.6 milliamperes. It is the *change* in current observed which gives the measure of the transistor's amplifying ability, its "*dc* beta." The greater the change, the more the potential amplification. One would normally consider a change in current of 0.4 milliamperes to be about the minimum to be expected of a good transistor, as sold today. For a quick check, then, the current should swing up to at least 0.6 ma. when the button is pressed if the transistor is to develop satisfactory gain in the usual circuit.

Experience with this tester will reveal the great variability of characteristics found in transistors *of the same type* sold on the market today. Even with the tremendous strides being made in semiconductor technology, it is economically impossible to hold the tolerances within the 10% or so, one finds in vacuum tubes. This is especially so in the case of the cheaper units which most of us are economically forced to use. But with a tester like the one described here, you can pick and choose from your stock, selecting the highest-gain units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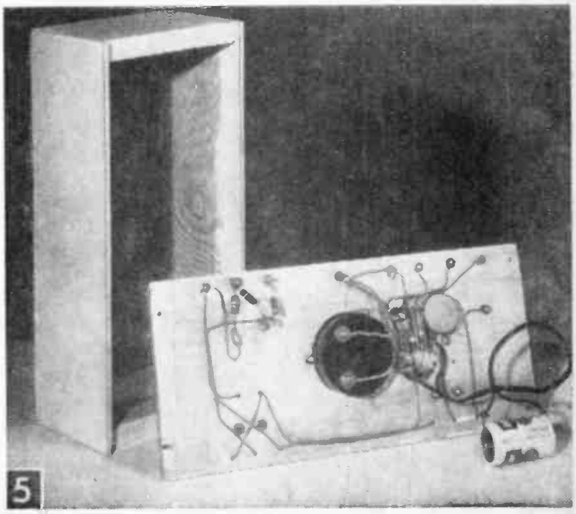
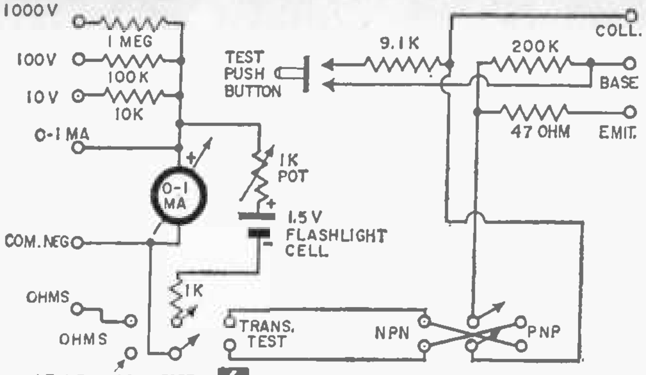
In-circuit testing of resistors is possible, but watch out for those parallel circuits and make sure circuit is dead.


5

Back view of front panel of case, showing simple wiring.

for the most critical parts of the circuit. If you do this, you will soon see the improvement in performance of the gear you build. (Incidentally, do not leave switch in "trans. test.")

You can also use this device for comparative checks of semiconductor, "crystal" diodes. Connect the diode from the "emit" to the "coll" terminals, with the meter switch in "trans. test" position. Switching the "PNP-NPN" switch back and forth *slowly* should reveal a current difference of *at least* 0.6 of a milliampere, if the diode is usable. The greater this difference, the better.



6 SCHEMATIC

Electronic Black Magic

How does it work? Only two wires connect the switch to the lamps, yet throwing the switch in one direction lights one lamp, throwing it in the opposite direction turns the first lamp off, the second on

By FORREST H. FRANTZ, Sr.

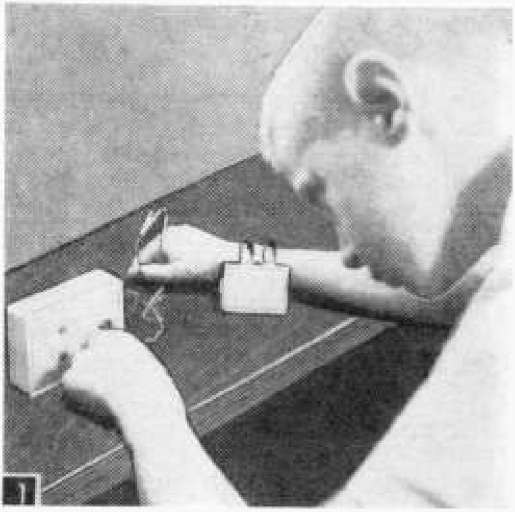
FOR every lamp that is to be controlled separately by a single switch throw, two wires are required from lamp to switch—usually. Here, however, one switch and only two wires control *two* lamps. Extra conductors in the two wires? Hidden wires? Hair-thin connecting wires? Those you demonstrate this device to will look for all of these possibilities. That's one reason connecting clips are used between the switch and lamp cases: to allow observers to convince themselves that the insulation over each lead covers only one wire.

After the observer is convinced that no hidden wires exist, he may take a guess that wireless radio is involved. This goes out the window when you tell him that the entire outfit costs only about $2, and at that price radio isn't involved. Magnetic coupling, then? To kill this theory, separate the cases by several feet. Point out that the light bulb intensity remains constant no matter what the physical separation between units.

How does it work then? Electronic black magic.

Construction. Layouts for switch and lamp cases are shown in Fig. 2. The smaller holes, and pilots for the larger holes, are made with a heated ice pick. Plastic that accumulates around the sides of the holes may be trimmed off with a pocketknife after the material has cooled. Larger holes are finished with a hand taper reamer. When you make the holes for the lamps, work slowly and ream the holes just large enough so that the lamps fit into them tightly.

When all of the holes have been made in the cases, wash them with soap and water, rinse and dry with a lintless cloth. Then paint the insides any color you wish. I used white because this encourages the observer to hold the cases up to the light to try to determine their contents. Although he'll be able to see the switch and battery, he won't be able to see enough to determine the



Black magic from white boxes. A single switch and a single pair of wires control two lamps.

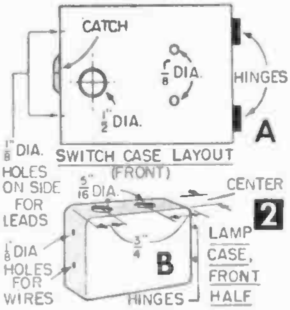
MATERIALS LIST—ELECTRONIC BLACK MAGIC

Desig.	Description
	SWITCH UNIT
B	four 1.5-v penlite cells, series connected (RCA VS074)
S	DPDT toggle switch (Carling 316-25)
	battery holder (Lafayette MS-170)
	1 x 2⅝ x 3⅝" plastic case (Lafayette MS-159)
	LAMP UNIT
D1, D2	1N54A diode (RCA)
L1, L2	#48 miniature lamp (RCA)
	1 x 1⅝ x 2⅛" plastic case (Lafayette MS-156)
	2 Minigator clips (Mueller 30)

Components for this project may be obtained from Lafayette Radio, 165-08 Liberty Avenue, Jamaica 33, New York.

secret. Use two coats of paint if necessary.

Now mount the battery holder and the switch in the switch case (see Fig. 3).. Connect the battery holder terminals so that the four penlite cells will be in series. Fill the battery contact holes on the holder with solder. This assures reliable contact. Don't allow the clips to cut the paper covering on the batteries when you insert them. Complete the wiring as shown in Fig. 5.



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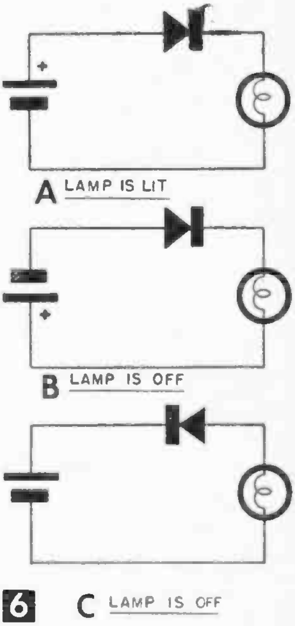
The inside view of the lamp case is shown in Fig. 4. Wire the lamp case, making sure you observe diode polarities. Don't apply heat to the diodes for a long period of time when you solder them into the circuit. Too much heat will damage them.

With construction completed, connect the units together and try your handiwork. By now you probably know the electronic black magic that's involved, but for the gadgeteer without electronic experience, an explanation is in order.

A diode will conduct in one direction only. A diode connected in series with a lamp and battery as shown in Fig. 6A will conduct and allow the lamp to light. But if the battery polarity is reversed (Fig. 6B), the diode will not pass current, the lamp will not light. By the same token, if the battery is left as shown in Fig. 6A, but the diode is reversed as in Fig. 6C, the lamp will not light.

Now, referring to Fig. 5, it is apparent that throwing the switch causes the battery polarity to be reversed. Since the diodes are oppositely connected to the respective lamp bulbs, one—and only one—of the lamps will light, the position of the switch determining which one will. No black magic after all.

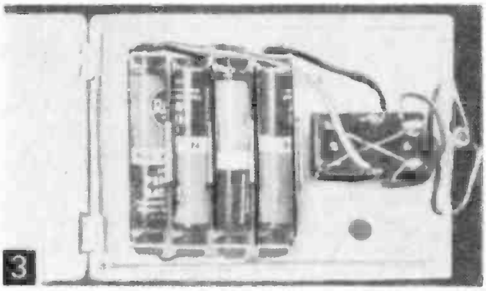


A LAMP IS LIT

B LAMP IS OFF

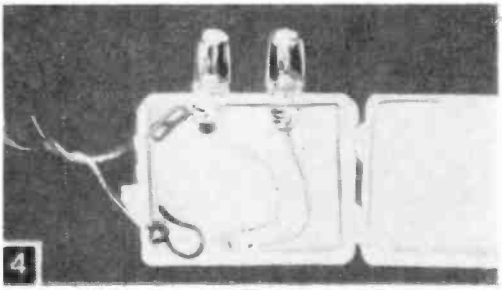
C LAMP IS OFF

6



3

Inside view of switch case.



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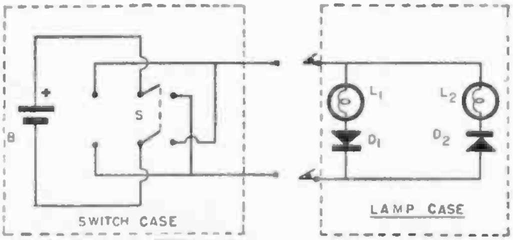
Inside view of lamp case. Disconnect two cases when not in use to prevent unnecessary drain on batteries.



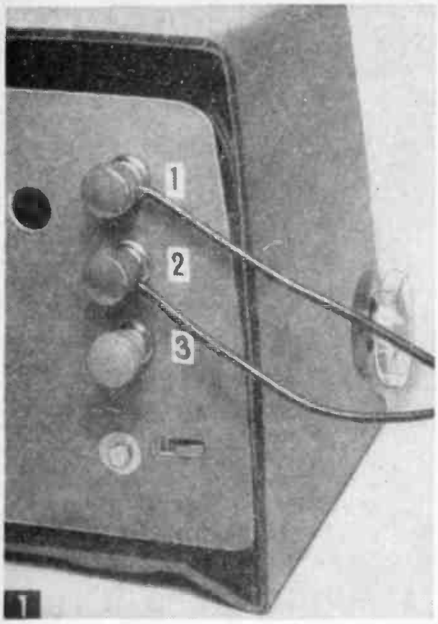
5 CIRCUIT DIAGRAM

Crystals Like It Cool

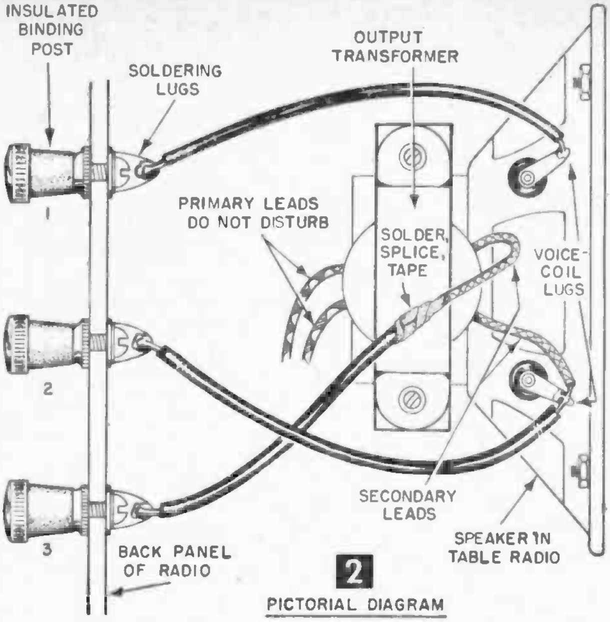
• The crystal elements of microphones and phonograph pickups and crystal diodes and transistors are sensitive to high temperatures. All these crystal and semiconductor elements are enclosed in a case or shell. If exposed to strong sunlight, the temperature inside may rise far higher than that outside the case or shell, damaging the elements so they no longer work and may actually melt. To prevent damage, be sure to shade the pickup arm of a portable phono pickup or shelter a transistor radio being carried or used on a picnic during the summer. And never leave a pickup unit in its case in the window.—James A. McRoberts.

H	A	M	F	E	S	T	■	E	■	D	■	Q	S	L
A	■	E	■	N	■	T	F	C	■	C	W	■	O	■
R	I	G	■	D	I	T	■	O	S	C	■	Q	S	O
M	C	■	C	■	P	■	C	■	I	■	V	T	■	■
O	■	S	W	L	■	■	O	■	G	M	■	H	O	T
N	E	T	■	O	C	T	A	L	■	N	C	■	■	E
I	■	U	■	G	■	■	X	■	H	■	O	H	M	S
C	■	B	K	■	C	Q	■	B	A	N	D	■	■	T
S	G	■	E	X	T	R	A	■	R	■	E	N	D	■
■	■	H	Y	■	■	S	■	Q	T	R	■	E	■	T
C	■	U	■	■	P	■	F	■	L	■	L	■	■	I
H	A	M	■	N	O	V	I	C	E	■	A	■	A	C
O	■	■	I	■	T	E	N	■	Y	A	G	I	■	K
K	■	W	■	V	■	■	A	A	■	D	■	C	■	E
E	T	H	E	R	■	■	L	O	S	S	■	W	E	T

SOLUTION TO
AMATEUR
RADIO
PUZZLE
Page 51



1



2 PICTORIAL DIAGRAM

Four Extra Uses for Table Radios

By making a few wiring changes and adding three insulated binding posts to the back of your table radio as shown in Figs. 1 and 2 you can:

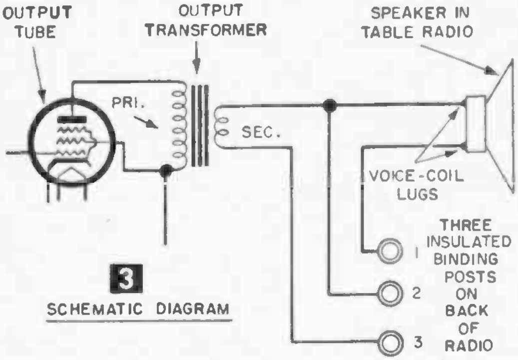
1. Use the speaker only for an experimental dynamic microphone, or speaker can be connected to a code practice set for group instruction or testing a radio you are building by connecting the latter to posts 1 and 2. If the speaker has a permanent magnet, pull out the line cord plug; if it uses a field coil, turn the set on to energize the speaker magnet.

2. Add a small extension PM speaker to the radio for use in other rooms, connecting it to posts 1 and 3 if both speakers are to operate or posts 2 and 3 if only the extension speaker is to be used.

3. Boost the radio fidelity by connecting a large PM speaker housed in a good baffle to posts 2 and 3.

4. Use the radio speaker as a "tweeter" and a large PM speaker connected, in series, to posts 1 and 3, as a "woofer." Place the radio on top of the woofer cabinet. If you want the speakers in parallel, connect the woofer to posts 1 and 2 and a wire jumper from post 1 to 3. In either case the speakers should be in phase (their cones moving in the same direction at the same time) to give the best tone quality. If they are out of phase, reverse the woofer connections for better sound.

The radio still can be used as its designer intended by connecting a wire jumper to posts 1-3.



3 SCHEMATIC DIAGRAM

How to Wire. Fig. 1 shows the installation on an FM table radio; Figs. 2 and 3 furnish the wiring info. Do not disturb the two wire leads, usually red and blue, on the primary side of the output transformer. If you cannot find a place for the posts on the rear panel where they won't interfere with the loop antenna, if any, mount the posts on a strip of insulating material and fasten with an angle bracket to the back of the cabinet.

Caution: If one side of the speaker voice-coil and one of the output transformer's secondary leads are grounded to the chassis of an *ac-dc* radio, remove these leads from the chassis and connect the latter directly to the voice-coil. This will by-pass a possible hot chassis, and there will be no danger when handling the binding posts. If the radio has a power transformer, there is no danger and no change need be made.—ART TRAUFFER.

"Hop-Up" That Small Radio with a Tuned Antenna Coupler

You'll be surprised at how well your small receiver performs when coupled to an outdoor antenna with a tuned antenna coupler.

Do you want to listen to that distant 250-watt station despite a 5000-watter blasting away nearby? Do you live so far from the nearest transmitter that even your local reception is weak and full of noise? If so, this simple gadget is for you.

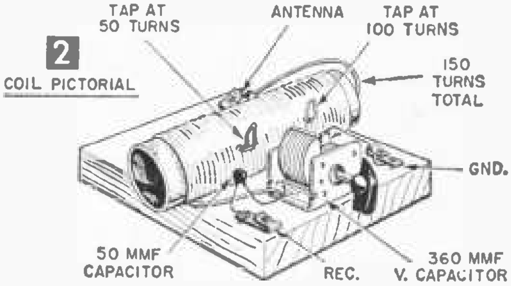
A long, outside antenna seldom proves satisfactory with the usual small broadcast receiver, since it often spoils the selectivity of the front-end. A simple antenna tuner, such as this unit, used with an outside antenna, will restore this selectivity and couple the circuits more effectively. Result: No more "birdies," or local station smear, and the little ones from far away stick their heads above the mud.

Obtain a cardboard mailing tube, or a core from a bathroom tissue roll about 1½ in. in diameter and at least 3½ in. long. (The dimensions are not critical, and may vary ½ in. either way.) Carefully close-wind on this tube 150 turns of No. 24 copper magnet wire. Cotton-covered wire is best but enamelled wire will do. Arrange for taps on this coil at 50 and 100 turns (see Fig. 2).

Connect this coil in series with a variable capacitor of 360-*mmf* maximum capacitance. Any variable capacitor having this capacitance will work satisfactorily. (If you use a two-gang unit, salvaged from the junkpile, use only one section.) Mount the capacitor and coil upon a ¾ x 4 x 4 in. softwood board (see Fig. 2), and your antenna tuner is complete.

There are two ways to connect this tuner to your radio, depending upon the impedance of its input circuit. Try both connections, the one giving the sharpest tuning and the greatest signal boost will be immediately evident. The connection shown in Fig. 3A is for high-impedance, 3B for low impedance inputs.

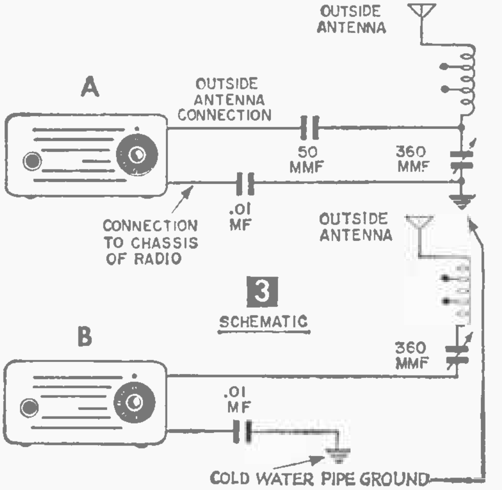
Use a well-insulated outdoor antenna with a total length of 60 to 150 ft. A good cold-water pipe ground should also be used. Set the radio dial to the frequency of the weak station you wish to hear and rotate the variable capacitor knob until it peaks to maximum volume. Then readjust radio tuning for best signal quality. Clip the antenna clip on the coil tap that gives best results.—C. F. Rockey.



2 COIL PICTORIAL

MATERIALS LIST—ANTENNA COUPLER

No. Req'd	Description
1	variable capacitor, 360 mmf. max.
1	Mueller spring battery clip, miniature size
1	knob, for variable capacitor
¼#	No. 24 magnet wire, cotton-covered or enamelled
1	0.01 mfd., 200 w.v. paper capacitor
1	50 mmf., disc-type ceramic capacitor



3 SCHEMATIC

Learn By Doodling

By ROBERT W. LUEBKE

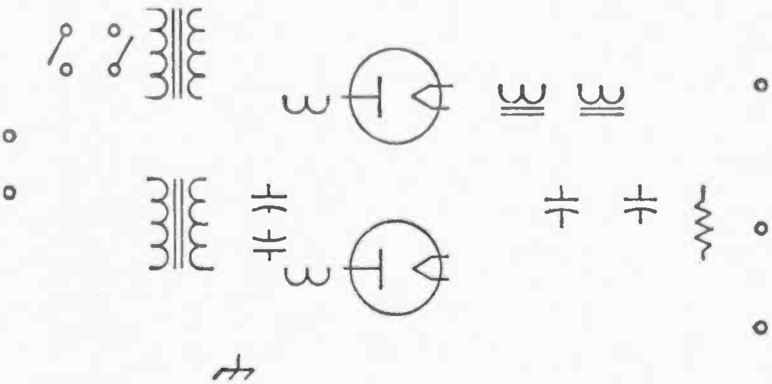
HERE'S an easy way to test your knowledge of amateur radio circuits. The six circuits given on these two pages are some of those you'll find it essential to know about when working toward an Amateur Radio Operator's General Class license. We publish them by special permission of The American Radio Relay League, publishers of the *Radio Amateur's License Manual.*

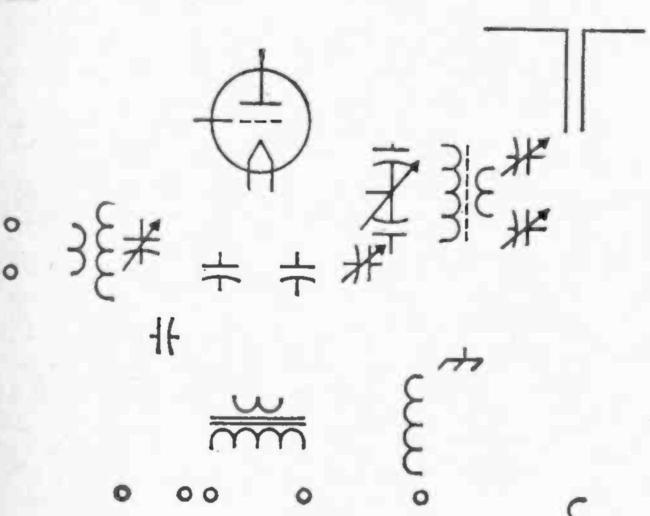
The connecting wires have been removed, but all the components are shown. Cover the outlines on these pages with onion-skin or any other translucent paper and "doodle" in the missing connecting lines. Check your doodling for errors by comparing with the complete circuit diagrams on page 94.

If you find your first doodle in error, study the circuit carefully and try again. Use a new sheet of paper each time rather than doodling directly on these pages. Soon you will be able to draw the entire circuit without using the outline at all.

1. Draw a schematic diagram of a full-wave single-phase power supply using a center-tapped high-voltage secondary with a filter circuit for best regulation, showing a bleeder resistor providing two different output voltages and a method of suppressing "hash" interference from the mercury-vapor rectifier tubes. Give the names of the component parts and approximate values of filter components suitable for either amateur radiotelephone or radiotelegraph operation.

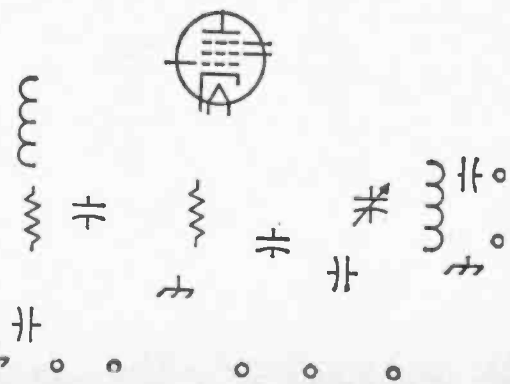
1





2. Draw a simple schematic diagram of a plate-neutralized final RF stage using a triode tube coupled to a Hertzian antenna, showing the antenna system and a Faraday screen to reduce harmonic radiation.

2

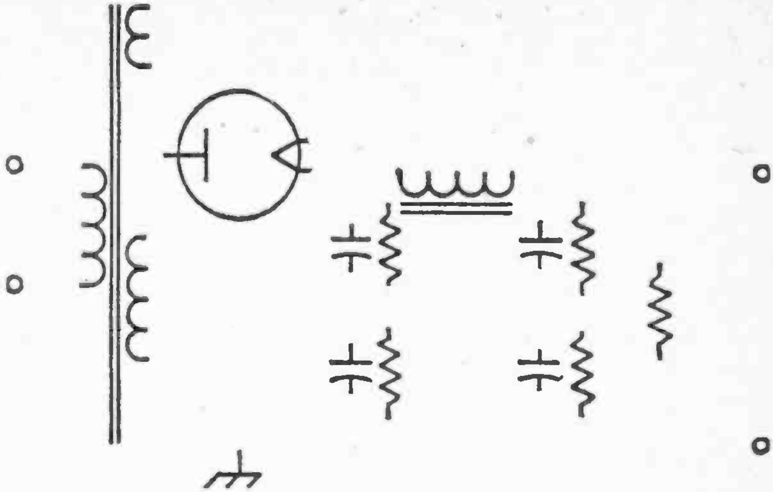


3. Draw a simple schematic diagram of a piezoelectric crystal-controlled oscillator using a pentode vacuum tube, indicating polarity of electrode supply voltages where externally connected.

3

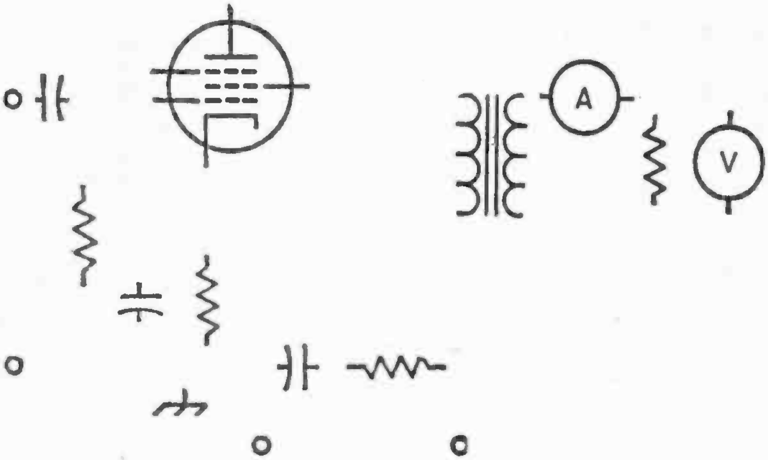
4. Draw a simple schematic diagram of a half-wave rectifier with a filter which will furnish pure dc at highest voltage output, showing filter capacitors of unequal capacitance connected in series, with provision for equalizing the dc drop across the different capacitors.

4



5. Draw a schematic diagram of a pentode audio power-amplifier stage with an output coupling transformer and load resistor, showing suitable instruments connected in the secondary for measurement of the audio-frequency voltage and current, and naming each component part.

5



6. Draw a simple schematic diagram of two RF amplifier stages using triode tubes, showing the neutralizing circuits, link coupling between stages and between output and antenna system, and a keying connection in the negative high-voltage lead including a key-click filter.

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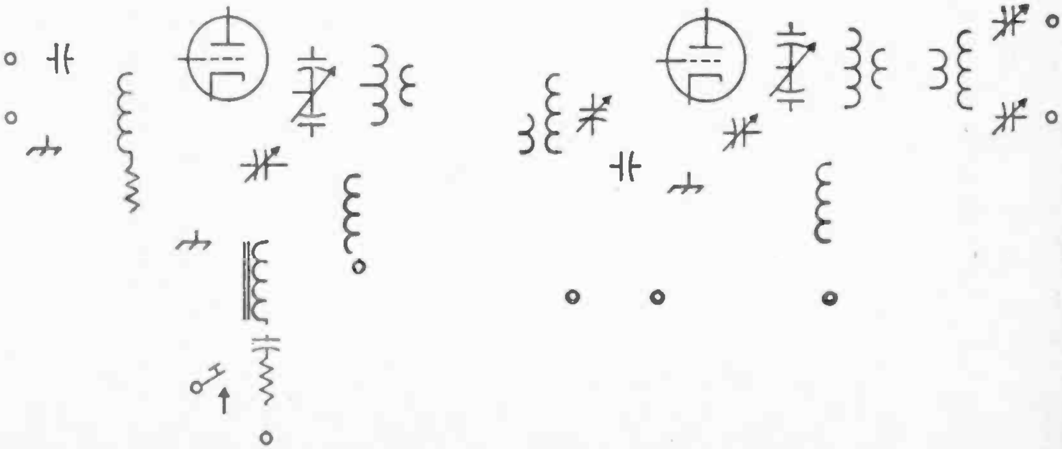
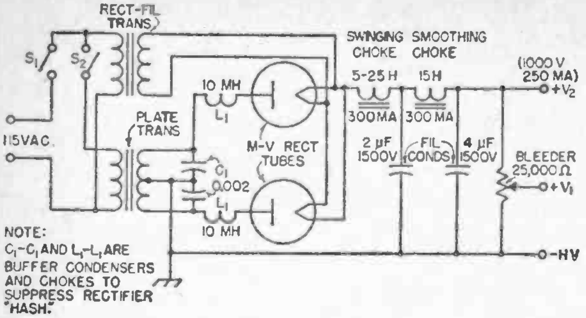


Completed Circuit Diagrams

1



NOTE: C_1–C_1 AND L_1–L_1 ARE BUFFER CONDENSERS AND CHOKES TO SUPPRESS RECTIFIER "HASH."

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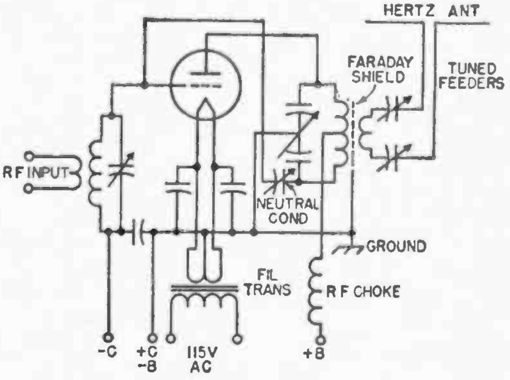

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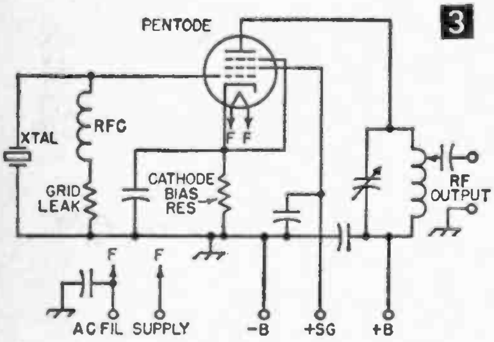

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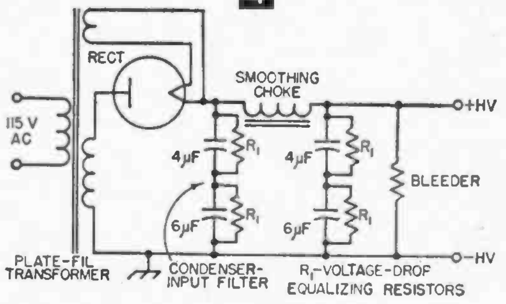

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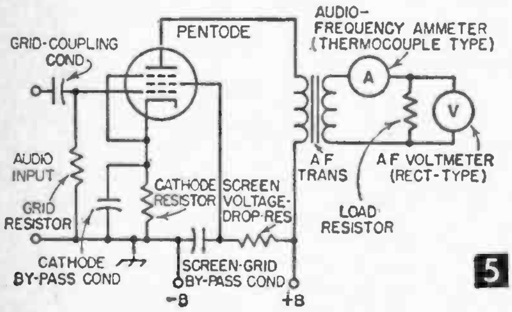

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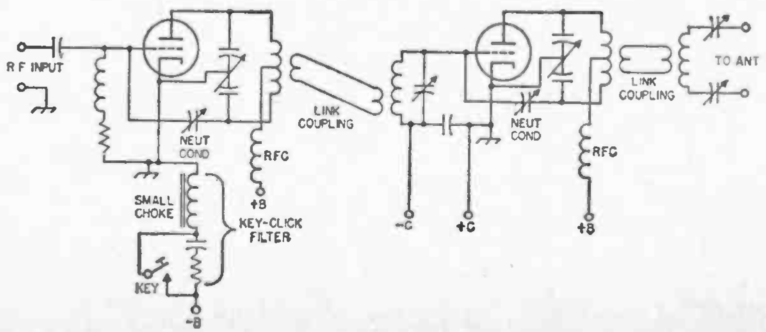

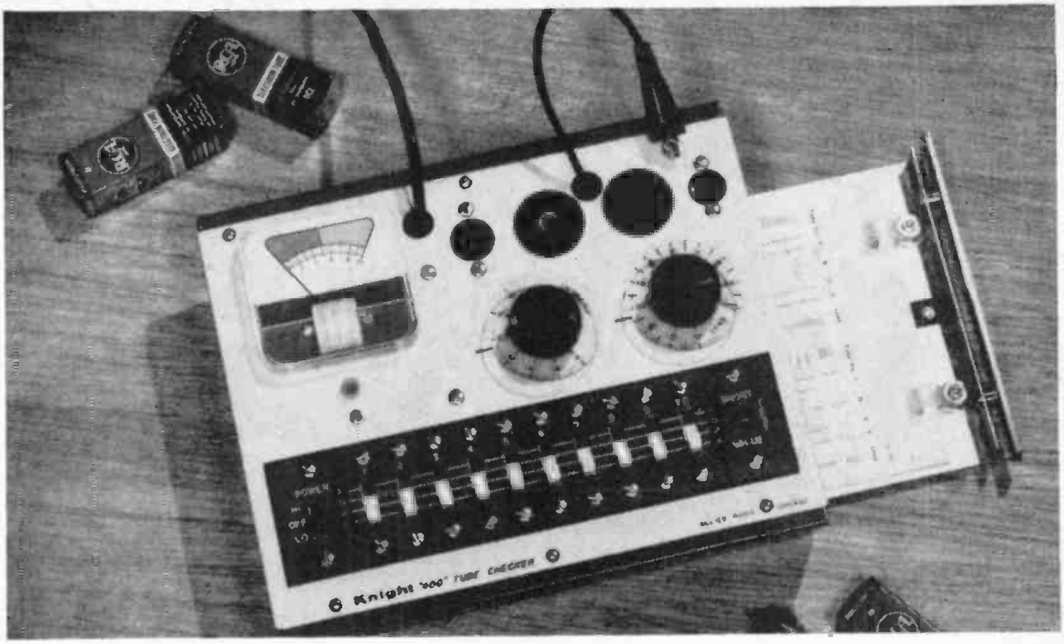

Knight Tube Checker KIT REPORT

THE KNIGHT-KIT 400 tube checker is an excellent construction project—and it is the lowest priced cathode emission checker on the market.

The 400 tests for filament continuity, for short-circuits and for cathode emission. The most important of these tests is the cathode emission test. In this test full line voltage is applied between the control grid of the tube and ground through the meter. The resulting electron emission from heater to grid is measured, and this is assumed to be the same as if current from heater to plate (as occurs in actual tube use) were being measured.

Seven filament voltages are available on the unit, although in actual use a tube would require a specific filament voltage, of which there are at least a dozen in common use. Presumably there is no possibility of damage to the grid as the result of carrying line voltage during this test.

We ordered our test kit by mail. It arrived by parcel post, in a sturdy carton. The parts were well padded with corrugated, and all of the small parts were in polyethylene bags—screws in one bag, washers in another, and so on. Transformer, meter and wafer switch were individually boxed and padded. Resistors were mounted on a card, each of them designated by a number, keyed to the instruction booklet. All hook-up wire was cut to the lengths required for the project. Instructions call for a certain color wire—that color is pre-cut to the right length, nine different colors, nine corresponding lengths.

Panel and case of the checker were of heavy-gage steel, well constructed, neatly and accurately punched to receive the four tube sockets, meter, load resistor and 13 slide

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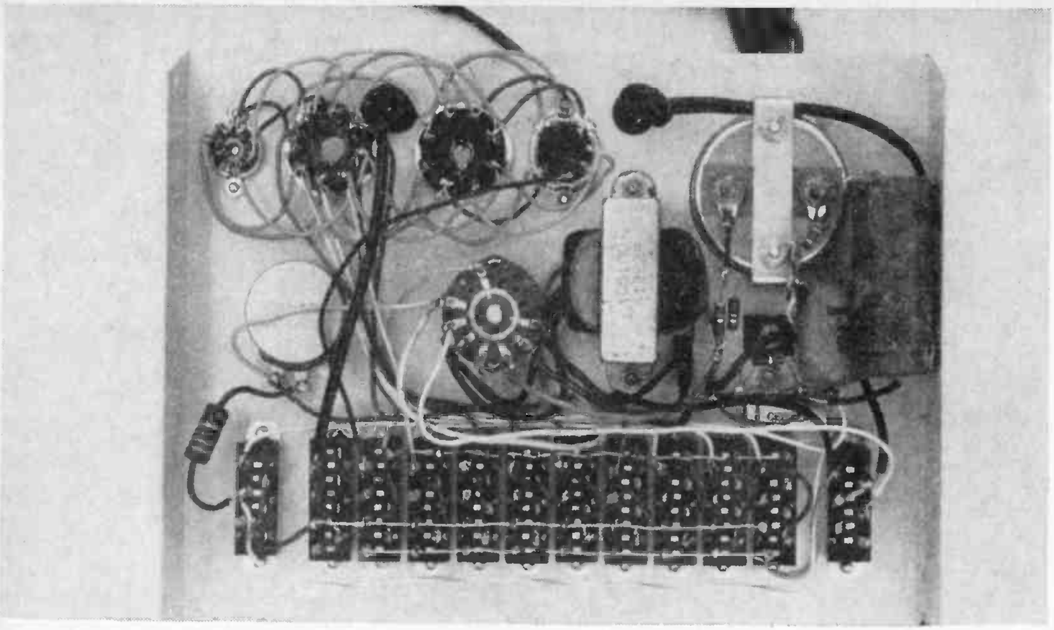
KNIGHT 400 TUBE CHECKER

- Checks cathode emission, shorted elements, filament continuity of 400 tube types.
- Has sockets for 7-pin miniature, 9-pin miniature, octal and loctal-base tubes.
- Meter has red-green "Replace-Good" Scale, special scale for diodes.
- Slide-out metal drawer has flip-type tube charts in loose-leaf binding.
- For operation from 110-125 v, 50-60 cycle ac; has "Hi-Lo" line-voltage compensator switch.
- Carrying weight: 5¼ lbs.; size: 2⅜ x 8 x 9½ in.
- Allied Radio (100 N. Western Ave., Chicago 80) catalog #83Y707. Price: $19.95.

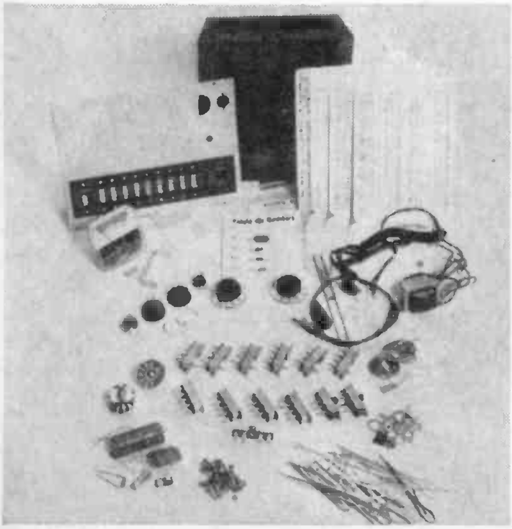


This underside view of the completed panel shows trim parts placement and design.

switches. The panel was handsomely enameled in white, grey and black; all dial markings were clear and distinct. The line cord appeared to be of good quality and plentiful solder was supplied.

Of the 25 tubes that we tested for cathode emission, all but three registered perfect on the meter—so perfect that the needle banged the meter housing in most instances. The tubes tested varied in age from two to 15 years. Of the three that did not register perfect, two registered zero, and were, indeed, burned-out. For one of the tubes that was tested, an error in the flip-type tube chart data accompanying the checker caused the tube to test *shorted*. In testing for shorts in miniature tubes on this tester—as on all other testers—it is necessary to make each test as brief as possible to avoid the possibility of causing a short in the tube due to the relatively high voltage used in the test.

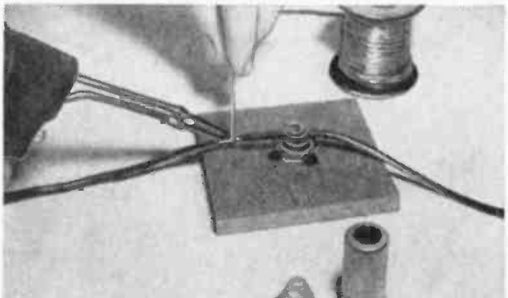
This kit makes an enjoyable construction project, and when used in conjunction with a tube manual, provides a good introduction to some of the ailments that beset tubes and the diagnosis of those ills.—H. SIEGEL.



The components of the tube checker.

Shield Spring for Soldering

- A spring removed from a miniature tube shield makes a handy gadget to hold parts or wires still while you solder them. By tacking the spring down to a scrap piece of wood as shown and clamping the work between the spring's turns, it makes a welcome partner for any electronic hobbyist's bench.—J.A.C.



Loop Crystal Set

Just aim the loop at the station you want, and then enjoy yourself

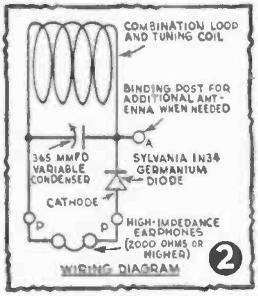
By ARTHUR TRAUFFER


1

IN THESE days of powerful transmitters, sensitive germanium diodes, and sensitive earphones, a loop crystal set for local stations is practical and sometimes a distinct advantage. For example, for those living within about 4 miles of 5,000 watt stations, and 5 or 6 miles from 50,000 watt stations, no conventional antenna or ground is needed. The loop crystal set can be carried around playing, and used anywhere in the house; just aim the loop at the desired station.

Interfering stations, which are at right-angles to the desired station, can be greatly reduced in volume simply by pointing the loop at the desired station with the loop broadside to the interfering station. In some cases, a loop crystal set will prove to be more selective than most crystal sets using a conventional antenna and ground, but don't expect the same sensitivity with a loop that you will get with a long outside antenna and a cold water pipe ground. A binding post on the side of the cabinet provides for an additional antenna for those living outside the range of the loop, and for those desiring to pick up more distant stations after the locals have signed off for the night.

The extreme simplicity of this set is demon-



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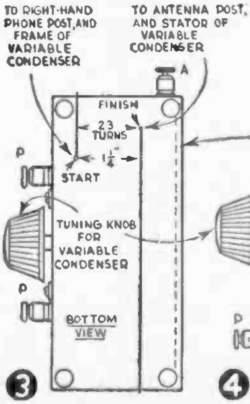

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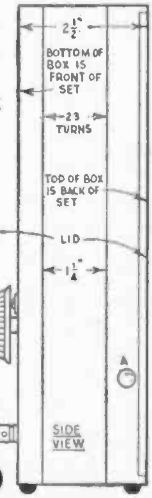

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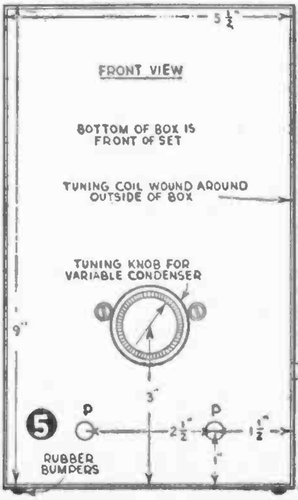

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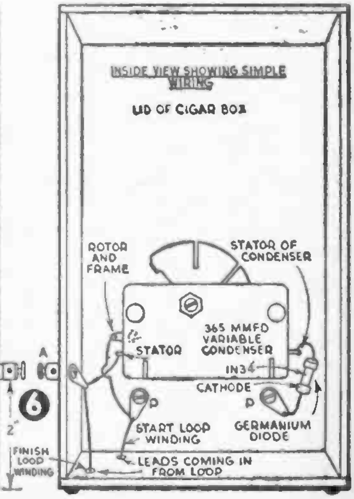

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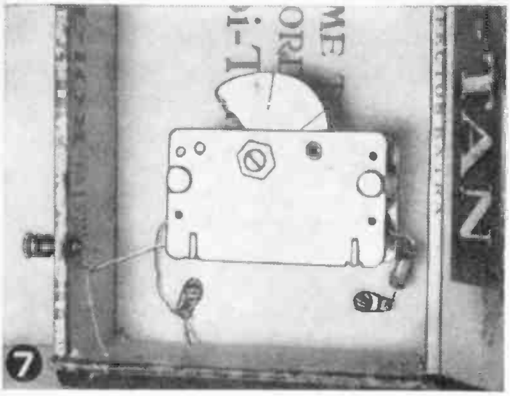
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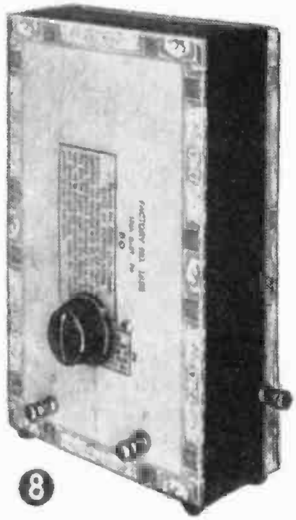
strated by the fact that the set shown (Fig. 1) was assembled and wired by a child under the supervision of the author.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This set differs from other crystal sets in that the tuning coil is wound around the outside of a cigar box to form a loop antenna (Fig. 2), instead of on a small Bakelite or cardboard tube inside the set. Figs. 5 and 6 show the simple layout for the 365 mmfd. variable condenser, the 3 post-type binding posts, or Fahnstock clips for the earphones, and the extra antenna connections. Fasten a soldering lug under the head of each binding post screw. Wind the loop, consisting of 23 turns of #24 gage enameled or double-cotton covered magnet wire, around the outside of the cigar box (Figs. 3 and 4). To start loop winding, connect to right-hand phone post (as seen from front view of set) and to variable condenser rotor and frame (Figs. 3 and 6). Then wind 23 turns clockwise around outside of box and connect the other end of loop to antenna post and stator of variable condenser. The width of loop winding will be about 1¼ in. with the turns spaced the diameter of the wire apart. Connect germanium diode cartridge from another variable condenser stator lug to left-hand phone binding post (Figs. 6 and 7). Mount a pointer knob or a graduated turning dial, on the variable condenser shaft, and tack or glue 4 small rubber bumpers onto the bottom of the cabinet. The set is now completed (Fig. 1).

Wind a few turns of Scotch tape over the loop wires to protect the wires (Fig. 8), or brush a couple of coats of shellac over the loop wires. The writer tried shunting a small by-pass capacitor across the phone terminals, but no improvement was noted. This loop crystal set will give you slightly more volume indoors than outdoors, due to RF energy picked up by induction from the house wiring circuit. There will be some variation in signal strength in different parts of the room and different rooms in the house, due also to the house wiring circuit.

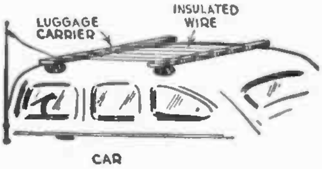
Glue a disc of heavy white paper or thin white cardboard onto the panel under the pointer knob on the tuning condenser so you can log your stations. When an additional antenna is used, however, the log will shift somewhat due to the added capacity introduced into the tuning circuit by the antenna. A water pipe or gas pipe connected directly to the antenna post makes a very efficient antenna for picking up distant stations. To obtain better results on distant stations connect a water pipe to the antenna post and use a bed spring as a counterpoise. Connect the bed spring to the right-hand phone post, which is the other side of the loop.

If you use a variable condenser larger than the one specified, you may have to remove 1 or 2 turns from the loop in order to cover the entire broadcast band. If you use a smaller capacity condenser you may have to add 1 or 2 turns to the loop. It is best to use a condenser not smaller than 365 mmfd., which is a standard size for the broadcast band. A little experimenting will give the desired results.

MATERIALS LIST—LOOP CRYSTAL SET

1	5½" x 9" x 2½" cigar box
1	365 mmfd. variable condenser, single gang, any good make. The one used by the writer was made by Insuline
1	Sylvania 1N34 germanium diode, or any other sensitive crystal
60	ft. No. 24 or 26 enameled or double-cotton-covered magnet wire
3	post-type binding posts or Fahnstock clips
3	soldering lugs
4	small rubber bumpers
1	Bakelite knob or tuning dial for ¼" shaft

Auxiliary Auto Aerial



• An auxiliary aerial for trips, when you are away from broadcasting stations, can be added to your car radio if you have a luggage carrier on top of your car. String an insulated wire back and forth between carrier crossbars and attach one end to regular aerial with a small clip.—W. H. McClay.

Draftsman's Tape Holds Tight

• Draftsman's tape makes an excellent "third hand" to hold electronic components together during assembly or soldering. Due to its high insulation, the tape can be left on permanently.

What Every Young Man Should Know—

About Printed Circuits

As more and more manufacturers turn to high-speed production, where radios almost wire themselves, you may wonder how it's done. Or worse—how it can be redone. Despair is changed to easy repair with these tips

By THOMAS A. BLANCHARD

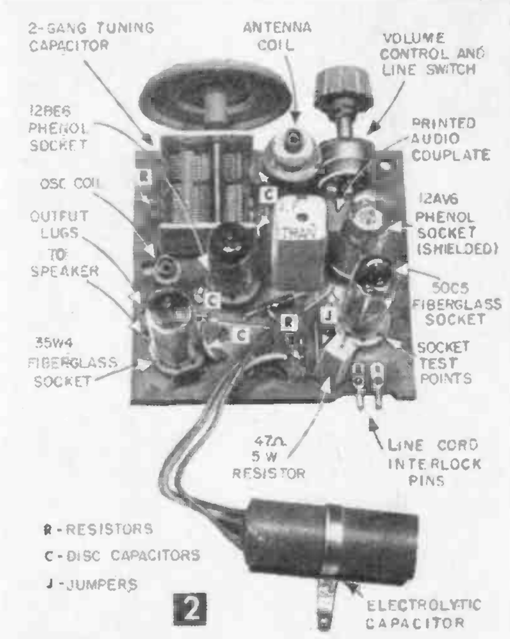
Many printed sets are vertically mounted in cabinet and slide out for quick circuit repair. Note that a fine-tip pencil iron, not over 40 watts, is used to prevent wiring damage.

AS THE radio and TV industry turns more and more to the use of printed circuitry, the experimenter will eventually have to tinker with, or repair, such sets.

Figure 4 shows a popular four-tube superhet table receiver using a circuit that is more or less standard with the industry. Figure 5 shows a hand-wired set which employs the identical circuit. Note the confusion the latter presents compared to the neat underside of the set with the printed circuit board.

A printed circuit starts on the drawing board. First the positions and mounting holes for the individual components are determined, then a drawing resembling a modified peg board is sent to the tool and die maker who creates a punch and die set which will pierce the necessary holes in the panel of phenolic plastic.

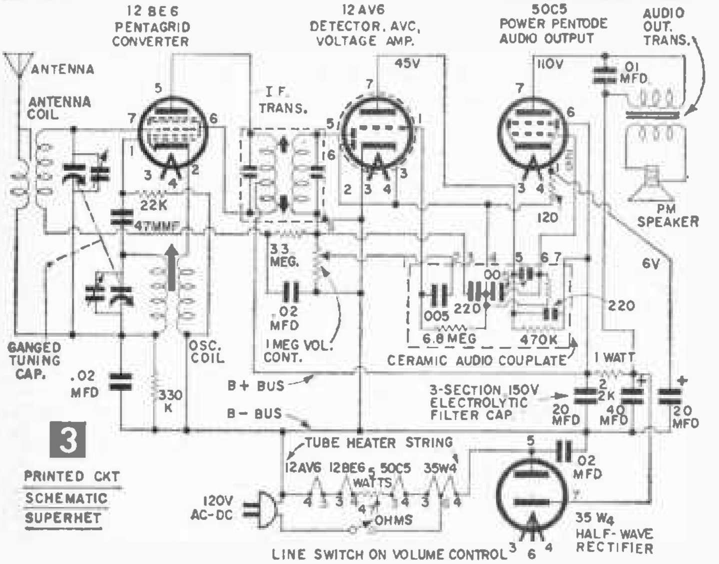
Using a copy of the initial drawing, the draftsman next draws in a series of heavy lines connecting the various component holes. This drawing resembles a puzzle maze. Note in Fig. 4 that no paths cross each other on the underside of the board. Where a B− lead must cross a B+ path, a small wire jumper is inserted on the top of the board to complete the circuit.



A typical "printed" circuit four-tube superheterodyne showing top of chassis. Note set is complete except for attachment of speaker and line cord. Strap of electrolytic capacitor is secured to a speaker mounting screw in cabinet.

The drawing is turned over to a photographer for copying. The photographer first produces a regular negative. This film is then printed on another film or reversed in development, to get a positive transparency. This positive copy goes to the silk screen printer.

The printer mounts a piece of fine Swiss silk in a printing frame, coats the stretched silk with a photographic light sensitive emulsion and al-



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PRINTED CKT
SCHEMATIC
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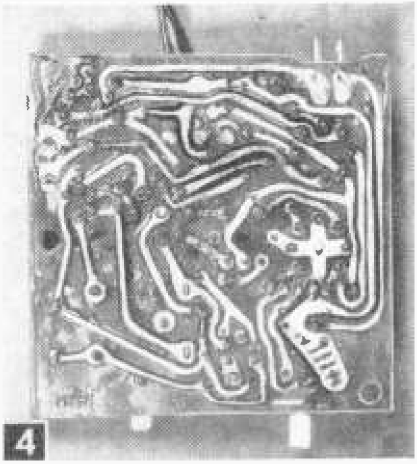

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A single dipping into molten solder secures all components to wiring board and establishes the printed wiring paths which resemble a puzzle maze.

lows the silk to dry in the dark. Next the positive film is placed in contact with the sensitized silk and exposure made in a bright light, then the silk is developed just the same as a photograph.

Development creates the printed wiring image on the silk screen. The emulsion has washed out of the silk where maze lines appeared, the background has filled in solid. The silk screen is now mounted in a suitable press and a phenolic wiring board is placed underneath. A squeegee now passes over the silk screen forcing a special conductive paint through the tiny weave openings in the silk. When the silk screen is lifted the plastic panel bears an exact reproduction of the draftsman's original drawing.

The conductive paint is graphite in a suitable vehicle. Experimenters can purchase this paint in any radio parts house under the trademark "Tube Koat" (General Cement Div., Textron, Inc., Rockford, Ill.)

When the phenolic board has dried, it is transferred to a copper electroplating bath. Here a thin film of metal is deposited on the graphite paint, while the rest of the board remains blank. (In some instances the vapor vacuum plating technique is employed to deposit the copper, but the end result is the same.)

The printed circuit is now finished. The plate may be buffed or blast-tumbled with sawdust to polish the copper image. Next the board is fluxed and protected from damage at the same time by spraying with rosin dissolved in alcohol. The printed boards may now be moved on to the assembly department. The assemblers are sometimes human, but more often automats.

Resistors and capacitors in printed circuitry are identical to those used in usual radio assembly. Items such as coils are fitted with tubular pins instead of the spade type soldering lugs. Tubular pins replace lugs on IF transformers, tube sockets, etc. Since the wiring board has been punched, assemblers simply push each component into its proper position on the "peg board" layout.

With all components in place, the board is dipped into a tray (soldering pot) of molten solder consisting of 60% tin and 40% lead. It is removed immediately and given a momentary blast with a CO_2 (liquid carbon dioxide) gun which instantly sets the solder. In one fell swoop all parts have been rigidly secured to the wiring board and all connections and conductive paths completed.

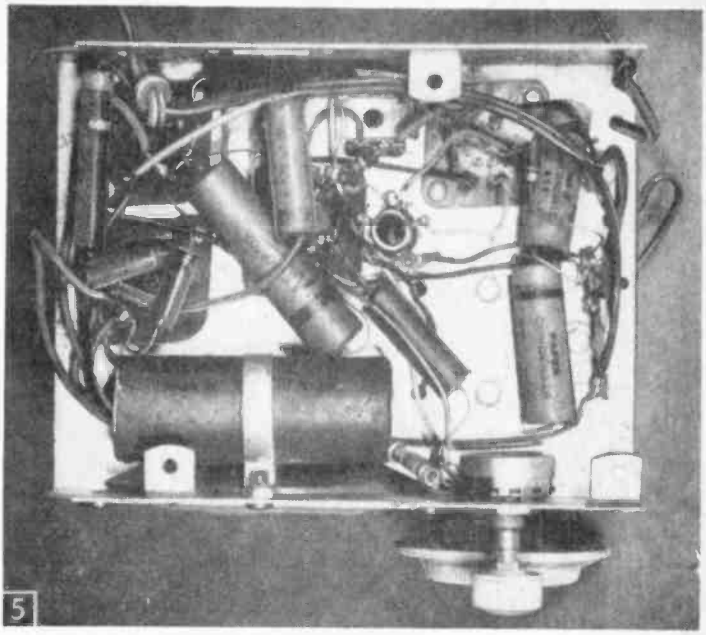
There now remains only the matter of sliding the printed chassis into the cabinet, attaching knobs, and hand soldering the output transformer which is mounted on the speaker frame. Because of uniformity of design, tuning capacitor, oscillator coil and IF transformers are often prealigned so that the receiver is immediately ready for shipment to the dealer.

Servicing a printed circuit is easier than working on the old metal chassis construction. Hidden breaks in hookup wire have been eliminated. All wiring is in clear sight, moreover many circuit boards have voltage measurement points and other identifying data printed along with the circuit. Cold circuit joints are practically unheard of. Failure of the set will be in an easily accessible component located on top of the board.

In regular wiring, wafer sockets carrying rectifier and output tubes often char because of the intense heat such tubes produce. The printed circuits employ wafer sockets fitted with eight supporting pillars. Because the sockets provided for hot tubes such as the 35W4 and 50C5 are a fiberglass laminate, socket charring is eliminated.

These pillars serve a dual function, since measurements can be made from the top of the socket without removing the tube from the set (see Fig. 2).

Most printed circuit receivers contain printed circuits within printed circuits. For example the complete resistance/capacitor network for the audio amplifier is contained in a small ceramic plate fitted with seven pigtail leads or soldering pins. A breakdown of a component in such a couplate or audet does not always require replacement of the entire unit unless the trouble is a short circuit. Locating the open capacitor or resistor, you need only jump it with a disc capacitor or small composition resistor as the case may be. Dotted area of schematic Fig. 3 shows the tiny couplate and its built-in components.



Underside of a four-tube set with hand-wired components and conventional metal chassis. Its circuit is identical to that of the printed set, but note the "jungle" of parts.

To replace a defective part on the circuit board, here is a simple and sure method: If a disc capacitor or composition resistor is involved, clip the pigtail leads as close to the component body as possible. Small diagonal wire cutters are the best tool for this. Because circuit boards may contain unused holes, and since some components contain more than two leads, apply a drop of nail polish or model plane dope to the wiring board prior to cutting out the defective part, to identify the holes from which the bad part is being removed. A toothpick makes a good applicator.

With the defective components removed, apply a pencil type soldering iron to the underside of the circuit board and pull out the clipped pigtail from the top of the board with flat or needle-nose pliers. With all pigtails removed, the next step is to open the clogged solder holes in the printed circuit.

For this you'll need a metal probe to which radio solder will not adhere. One such metal is stainless steel. Now, while you can buy a probe for $1 from any parts supplier, you can get *six* probes for a dime at your local hardware or dime store. These bargain probes are "Fowl Lacers" used to keep the stuffing in the Thanksgiving turkey.

Again applying the pencil soldering iron to the underside of the board, insert one of the stainless steel pins into the clogged hole and twist as the solder softens. Remove the iron and slowly remove the pin. A neat open hole is the result.

With all holes cleared in this manner, you need only insert the new component and resolder the underside of the circuit board. Here a word of caution is in order. Do not use dime store solder, nor use a soldering gun, nor any other heavy-duty iron. You need a 60 tin-40 lead solder alloy such as Kester's "Resin-Five" or Alpha's "Tri-Core." The iron should have a fine tip.

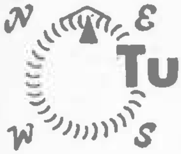
Since solder carries most of the current load in a typical printed radio circuit, you want to melt only the center of the circuit path. When a new part is being installed, hold the iron steady, allowing the solder to form a molten puddle at the joint. At this point, merely lift the iron away from the connection and allow the joint to cool while avoiding any jiggle of the component which could result in a "cold" bond.

Most printed circuits feature interlock cord sets such as are found on TV sets. This is to insure safety since all ground returns may be *live* except for the tuning capacitor and volume control shafts which are kept at a safe potential through a capacitor/resistor ground return. With so much exposed wiring, plus a direct ground on the IF transformer cans and detector tube shield, never work on line-powered sets on a metal table, or in rooms with concrete floors, since dangerous or fatal shock could result through carelessness.

When chassis is connected to line, be sure the bench or table is clear of small tools, wire, or solder. Such items shorting on the printed circuit can result in its utter ruin before the power line fuse has a chance to blow.

Removing Lock-In Tubes

• To remove a "Lock-In" or loctal tube with ease, push against the side of the tube with a thumb while pulling gently upward, so as to unsnap the locking arrangement. Sockets for these tubes have spring catches which prevent tubes from falling out during shipping or rough use in portable receivers.



Tune in on the World

By C. M. STANBURY II

THE development of radio has given us a wonderful medium for vicarious travel. However, the average listener hears only what his local AM, FM and TV stations care to broadcast. Only when you make full use of your equipment and ears does the *magic* dimension of radio come into play. Such application of ears and equipment is known as *DXing*—distant reception.

Via DX you can move throughout the country learning about people and happenings. The only price is patience and a reasonable amount of equipment and know-how. Your table radio will do for a start; once you decide what you want you may purchase or build more.

There is an element of skill in DXing. In 1920 the reception of KDKA Pittsburgh in New York was a feat. A few years later the same listener was shooting for the Pacific Coast and beyond. He didn't stop until the globe was circled, and today this same pioneer is tuning for the moon. There are as many challenges as there are bands. Colombia on the standard broadcast band is DX. On the short-wave band it's routine. If you saw it on your TV, you'd be one tremendous DXer. Table B shows all the bands of the radio spectrum. However, most of the dividing lines are purely arbitrary, one band shading into the next. Major exceptions are the medium-wave broadcast band and the FM and TV broadcast bands. Like conventional means of travel, each band has its own advantages. And for every individual personality, taste and temperament, there is at least one that is "right."

Early Broadcasting. Radio broadcasting became possible when De Forest invented the vacuum tube, although earlier there had been the dots and dashes of *spark-gap* transmitters. It was just one step from the vacuum tube to voice transmissions, broadcasting and KDKA. Both KDKA in Pittsburgh and WWJ Detroit claim the first broadcast, but KDKA was first licensed. With the licensing of these stations in 1920, the dash into broadcasting was on and radio's golden era had begun. The twenties were an era of newness for the sake of newness, and radio was of a piece with the era. It caught the public's fancy, and its continual expansion kept its fans enthusiastic, even rabid. Every radio listener was a DXer—even those with local stations to listen to hunted distant calls. Stations took on the character of their locale. Those like WEAF New York acquired sophistication, while rural broadcasters took on a neighborly air. A famous rural broadcaster was Henry Field's KFNF Shenendoah, Iowa. Field, realizing the great selling power of his battery-operated pioneer, transformed it into a general store of the air. "I don't know if they're any good but you try them out and let me know," he would say, and whether the product was dried prune or automobile tires, the entire shipment would be sold within 48 hours. The DXer was soon able to shoot for the West Coast, for in 1920 California boasted of KNX and KGER; Seattle, of KTW.

Like everything else in the Jazz Age, radio was wild. The Federal Radio Commission licensed, but the stations chose their own frequencies. Many stations tried several channels before settling on one, only to find that some nearby competitor was camping on the same wave-length. Station WHT in Chicago used two channels, switching from one to the other at 9 p.m. Adding to the complexity and confusion of the game were outlaw stations which were hard to trace. In 1928 the chaos was complete as the FRC was declared null and void. During that year every station did as it pleased.

Despite the anarchy, many stations were on the air to stay. In California, KNX, KFI, KGO, KLX, KYA, KMJ, KXO and KFSD; in Washington, KTW, KHQ, KJR and KGY; in Iowa, KFNF. Some of the eastern pioneers were Baltimore's WCBM, WGY Schenectady, WOR New York, WNAC Boston and WSM Nashville. Also founded in 1927 was the Newark News Radio Club, sponsored by the *Newark Evening News*. In 1928, Irving Potts, president then, as now, of the NNRC, inaugurated a series of DX programs over WOR attracting widespread attention to the club.

TABLE A—RADIO CLUBS

American Ionospheric Propagation Association, 360 Zimmerman Blvd., Kenmore 17, N. Y. Covers TV only.

National Radio Club, 325 Shirley Ave., Buffalo 15, N. Y. Covers standard broadcast band only. Publishes *DX News* which is issued weekly during fall, winter and early spring. Annual dues are $4.

Newark News Radio Club, 215 Market St., Newark 1, N. J. Monthly bulletin contains sections on all branches of DXing. Annual dues are $4.

Universal Radio DX Club, 109 Mesa St., Vallejo, California. Devoted primarily to short-wave. Annual dues are $4. Publishes *Universalite*, which includes experimental space section.

The party was over in 1930. The nation had a king-sized hangover. The effect on radio should have been catastrophic, but it wasn't. Despite the fact that numerous stations went broke, radio hung on. For with a twist of the dial, a man could become top dog, champion. For a few hours the depression ceased to exist.

DXers competed in trying to log the most stations. Of the many radio clubs organized during this period only two remain: the National Radio Club and the Universal Radio DX Club. Normally, standard broadcast band (BCB) stations are not heard at a great distance, but on a morning in 1932 scores of night-owls heard a cricket match. Some logged it as Poste Parisien while others claimed it to be Rockhampton, Australia.

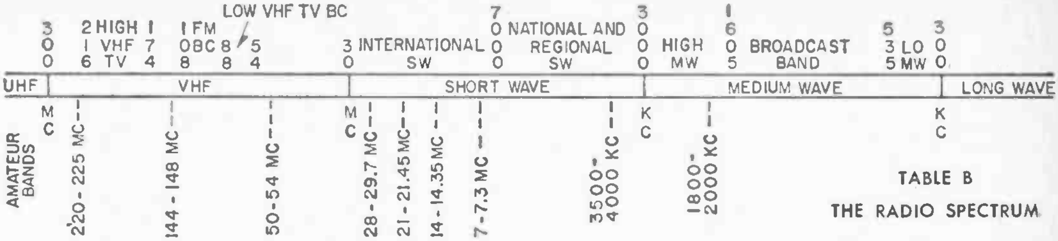


TABLE B
THE RADIO SPECTRUM

This chart shows the frequencies allocated to all the commercial broadcasting media. From right to left, these allocations are: Standard Broadcast, 535-1605 kc.; National and Regional Shortwave, 3000-7000 kc.; International Shortwave, 7000 kc. to 30 megacycles; Very High Frequency Television, 54-88 mc. and 174-216 mc.; Frequency Modulation (FM), 88-108 mc. The Ultra High Frequency Television band begins at 473 mc., off the left side of the chart. Amateur band frequencies are also shown.

Verifications were received from both stations—at first Poste Parisien had been heard carrying a wire broadcast of the match. Later when the European station had faded out, Australia was heard with an on-the-spot description of the same match. When verification of reception established the validity of both sides' claims, the practice of collecting verification cards and letters became almost universal—the cards evidenced the listener's accomplishments and provided the souvenirs that every "tourist" collects. Completing the winter of 1932-33, DX's greatest season, the NNRC scheduled its second historic DX broadcast, a test from LR5 in Buenos Aires. It was a great success—every listener who tried heard LR5.

The Broadcast Band Today. DX permits you to escape the limits of your local stations. If you're a sports fan, the number of baseball, football and basketball broadcasts available to you will be tripled via DX. Those interested in American folk music will be trying for such stations as WAOK in Atlanta, Georgia. Most of the music played by WAOK is the folk or popular music of the southern Negro, sometimes referred to as rhythm and blues. Similarly, many stations such as WVOK Birmingham specialize in hillbilly tunes. When disasters occur, stations in the disaster area reflect the emergency. DXers are able to listen in.

Examples of broadcast band DX, and others, may be heard on an ordinary radio. Some BCB DX may be had around sunset and during the evening. The first period will produce brief reception from a large number of stations. This is accomplished by tuning to a channel used primarily by daytime stations and catching them as they sign off. Such a procedure will boost total of stations heard and verified, but it doesn't provide very interesting listening.

For best results you should listen between 1 and 6 *a.m.* Most stations are off during this period leaving four excellent sources of DX: 1) a number of stations operating all night and, because of the comparatively clear channels, easily heard at a distance; 2) stations further west which sign off later; 3) stations conducting equipment tests and frequency checks; 4) and stations which sign on before others of their channel.

A greater challenge is offered by attempting reception of foreign stations on the broadcast-band. BCBers have battled static, interference from U. S. and Canadian stations and ridiculously weak signals, to come up with such faraway locations as French West Africa, Russia and Australia. Best listening periods here are the early evening and after midnight. Ordinary receivers will usually not do—a communications type set is needed for best results.

International Broadcasting. Like the pioneer international wireless telegraphy, the first international broadcast stations used long-wave. The first was at Daventry, England on 187 *kc*. This station might compete with KDKA and WWJ as first broadcaster (however regular transmissions were not scheduled until 1922). The British Broadcasting Corporation attempted a North American service with the Daventry transmitter but reception was unsatisfactory.

Short-wave was known in the twenties but was not considered of practical use. In India and the islands which now comprise Indonesia, frequencies just above 3000 *kc* were used for local broadcasting. In this part of the world, static renders the broadcast band almost useless. Short-wave was carried on by experimental stations and culminated in a regular service by the BBC. Enhanced by the broadcasts of King George V, interest grew rapidly, enough to make it an unqualified success. Today, stimulated by World War II and world tensions, international short-wave broadcasting has greatly increased in scope. For more on this, see page 74.

International broadcasting plays a part in improving understanding among peoples. However, many short-wave services are carried on for political, religious or economic (sometimes an appeal to the tourist trade) reasons and are thus necessarily limited in depth and frankness. Similar to commercial broadcasting, there are both far-sighted and narrow-minded sponsors. As on the broadcast-band, you may use comparison but there are never two contrasting stations within the same country to compare. Thus, you can

TABLE C—BEST SEASONS FOR THE BANDS

Long Wave: Late fall and winter
Medium Wave: Fall, Winter and early spring
Short Wave: All year round
Very High Frequency (VHF) and Ultra High Frequency (UHF): Late spring, summer and fall

TABLE D—VERIFICATIONS

In order for a station to verify your reception, you must give enough broadcast details so that your report can be checked. In reporting to *broadcast* stations, there must be a complete general description of the program heard. Much better than the general description, however, is the definite item system. Commercials, program name and announcer's name would all be definite items. Song titles will usually not do, however, since many stations keep no record of them. In verifying TV stations, visual descriptions are, of course, important. Always enclose return postage.

In reporting to *utility* stations you may *not* repeat specific details of communications heard. Instead, list date/time, frequency, station contacted or called and, in the case of a mobile facility, position if known. Many utility stations require the DXer to submit a prepared card for them to sign and mail back to him.

obtain a general picture of Europe or Asia but only a comparatively stilted view of individual countries and their people. You can get closer to a country by tuning in on programs intended for home consumption (usually below 7000 *kc*) or for nationals abroad. Unless you have command of a second language, however, you'll be limited to English-speaking countries. Another way of penetrating the gloss is by concentrating on programs featuring folk music. The imperfections of short-wave are countered by its availability—you can hear stations at any hour of the 24.

Police and Other Utilities. Broadcasting stations occupy only a tenth of the short-wave bands and only two-fifths of the medium-waves. With the exception of a few narrow amateur bands, the rest of the bands are assigned to *utility* radio services—ships, aircraft, airports, police and coast guard. This is the most potentially revealing of all radio listening. The authentic bits of life you overhear come straight. These are men going about the business of living, and you are a completely invisible observer. The aeronautical channels are a source of rare countries—8845 *kc* will produce such places as Kuwait and Bahrain, Arabia. Other faraway countries can be heard via aircraft passing over them.

VHF and UHF. Distant reception on medium-wave and short-wave is made comparatively consistent by the ionosphere, a layer of gases extending from 50 to 250 miles above the earth which are affected by ultra-violet radiation from the sun. The ionosphere reflects and refracts medium and short-waves back to earth thus making distant communications possible. As frequencies above 30 *mc* aren't normally reflected by the ionosphere, reception over 30 *mc* does not extend much beyond the horizon. Occasionally, however, DX is made possible via an upward extension of ionospheric effects, or special conditions in the troposphere. The long periods of nothingness punctuated by bursts of exciting reception give this brand of listening a flavor all it's own. For high-frequency DX you need the proper antenna—it should be the right length, directional, and mounted on a rotor. To find the proper length for FM antennas see the article on page 136.

America's pioneer FM station, in Alpine, N. J., went on the air in 1938. The first commercial FM station on the air was WSM-FM in 1941, now off the air. Cultural offerings are standard on FM. FM, a high fidelity sound system, is ideal for the reproduction of classical music and this music is widely broadcast on FM. Because of the audience it attracts, other intellectual features such as literary reviews are made commercially feasible. During a DX opening you will have your choice of many stations.

Television. Almost simultaneous with the discovery of radio itself, men became fascinated by the prospect of transmitting pictures to distant points. The first commercial VHF TV station WNBT (now WRCA-TV) opened in 1941. Because of high production costs, most broadcasters stick closely to established program formula, as gambling or experimenting is too expensive. A few misses and the broadcaster would be out of business. Thus 95% of American TV stations have similar programming. The polish possessed by the BCB outlet does not compare to that of his video cousin. The DX results of this are unmistakable: In comparison with the other broadcasting forms, the number of DX viewers is small, only FM attracts less. The largest TV DX club has 100 members. While most DXers have at one time or another tried for a distant TV station, usually their interest has been only a passing one.

TABLE E—RECEIVERS

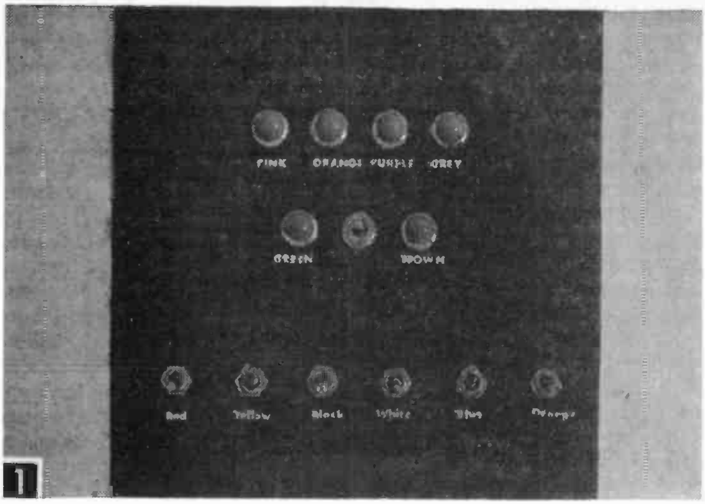
For best results on any band, a communications type receiver should be used. These are priced from $75 up. The major manufacturers selling to the general public are as follows:

- **Hallicrafters Company, 4401 West 5th Ave., Chicago 24, Illinois**
- **Hammarlund Manufacturing Co., 460 W. 34th St., New York 1, N. Y.**
- **National Company Inc., Malden 48, Massachusetts**

These companies will furnish information upon request. When purchasing a receiver, these features should be considered: Frequencies covered and in how many bands (the more the better), sensitivity and selectivity, including crystal selectivity. (The latter is essential in foreign BCB DXing.)

The European TV scene is in startling contrast to the North American. With numerous different nationalities and national customs in close proximity, DX is very popular and the number of such viewers far exceeds those on this side of the Atlantic. This is surprising when you consider not only the language barrier, but that four different TV systems are used in Europe—which means a DX viewer has to make numerous modifications in his set.

Despite it's present inadequacies, TV's potentialities are obvious. The possible uses and human benefits are endless. DX-wise, the future holds unlimited promise. As technological advances multiply, such potentialities will convert an increasing number of DX listeners to DX viewers.



1

Electronic Color Wheel

By D. X. FENTEN and J. SCHACHNER

Most commercially produced toys are either entertaining or educational, rarely both. Here's a toy you can make that is both, and inexpensive to boot.

THE Electronic Color Wheel is entertaining, educational, inexpensive, and easily built. To light a lamp, two correct switches must be thrown. The lighted lamp is the color that would result if the colors indicated on the switches were mixed. If, for example, the *red* and *yellow* switches were thrown, the orange lamp would light. However, if two color switches are thrown that have no definite color combination, (*red* and *green*) nothing happens.

Single- and double-pole, double-throw toggle switches are used to build the color wheel circuit. The second throw on each switch is used to prevent improper readings in the event that more than two switches are closed. However, despite the fact that the DPDT switches are incorporated to prevent incorrect readings, they are not infallible. Errors can occur. By closing a few select special combinations of three switches, for example, a lamp can be lit.

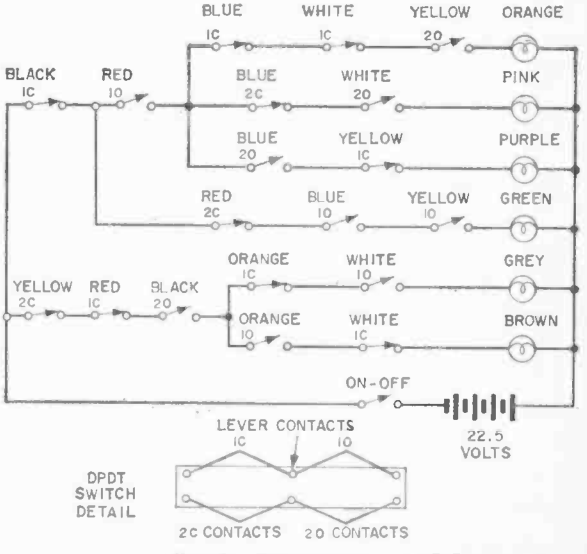
Consider the situation when the *red*, *yellow*, and *blue* switches are closed. Normally, no lamp should light. However, when the *red* switch is closed, its "lo" contacts close, (see Fig. 2), applying ground to both wiper arms on the blue switch. In effect, this jumps out the *red* 2c contacts. If the *blue* and *yellow* switches are now closed, the *green* lamp will light. In this manner, an erroneous indication is given. The possibility of an erroneous indication can be overcome in either of two ways—expensive, complex circuitry, or following a simple set of rules of play. As:

1) Set On-Off switch to the Off position.
2) Set two color switches to the On position.
3) Set the On-Off switch to On. If the proper colors have been selected, the mixed color lamp will light.

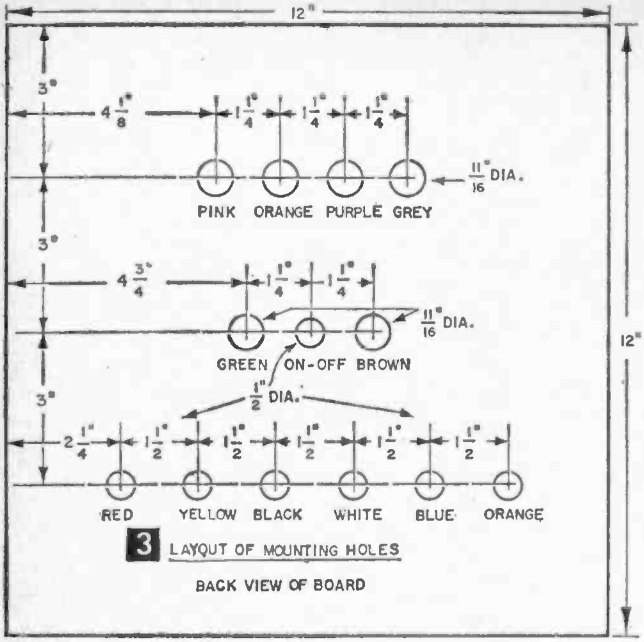
How to Build. In a piece of ¼-in. plywood, or other suitable material, bore all the holes necessary to mount the indicator lamp sockets and the toggle switches. Using the Fig. 3 layout as a guide for hole positioning, bore seven ½-in. holes to accommodate the toggle switches, and six 1¹⁄₁₆-in. holes for the indicator lamp sockets.

Mount the indicator lamp sockets in the 1¹⁄₁₆-in. holes so that all the terminals are aligned horizontally (see Fig. 4) to facilitate wiring. Mount the SPST switch in the middle row between the two lamps, the remaining switches in the six remaining holes on the bottom row. Reading from right to left, as in Fig. 2, the switches mount in this order:

HOLE	COLOR
1	Red
2	Yellow
3	Black
4	White
5	Blue
6	Orange



2 SCHEMATIC



3 LAYOUT OF MOUNTING HOLES

BACK VIEW OF BOARD

The switches, unlike the lamp sockets, mount vertically. This will place the "o" terminals on the top and the "c" terminals on the bottom, the "1" switch on the left, and the "2" switch on the right.

Now mount the battery on the lamp board. The mount will vary according to the size and type of battery used. Each of the many standard size battery holders has its own mounting method, so a holder which is most easily installed should be used, or a home-made, improvised version designed and used.

The battery shown in Fig. 4 is a standard 22.5-v hearing aid battery. Simply mounted with two #6-32 x ¾-in. screws and a strip of friction tape, it is easily replaced if necessary, and the mount is inexpensive and easily fabricated.

Solder the negative side of the battery to the On-Off switch and wire the 2c terminals of the *red, yellow* and *black* switches to the other side of the On-Off switch. Solder the common side of all the lamps to the positive side of the battery. The other terminal of each lamp is wired to the correct terminal of the color switches. When this has been completed, the control circuit—the switch terminals—is wired, completing the assembly.

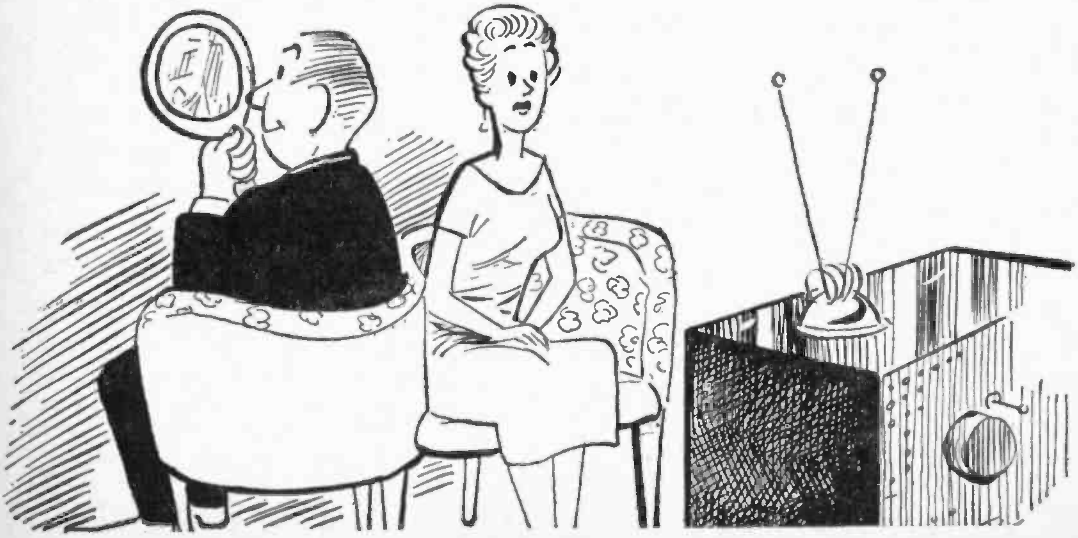
Nothing remains but to turn a youngster loose on the wheel.

MATERIALS LIST—COLOR WHEEL

No. Reqd.	Description
1	¼" x 1 x 1' plywood
6	DPDT toggle switches, without center Off position
1	SPST toggle switch
7	Indicator lamp sockets and lamps
6	indicator lamp jewels of the following colors: orange, pink, green, purple, grey, brown.
1	battery (can be either of several normally available, but battery voltage and the required lamp voltage must be the same; 6-v. lamps and a 6-v. battery, 22.5-v. lamps and a 22.5 battery, etc.)

Wiring in the switches.

4



VHF Amateur Radiotelephone Station

The VHF amateur radiotelephone station in action. The operator is listening for an answer to a two-meter CQ.

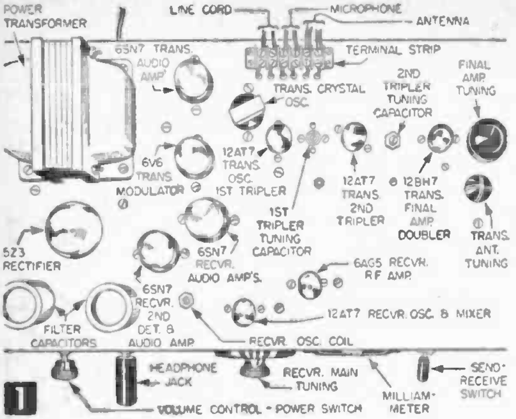
By C. F. ROCKEY,
W9SCH

SELF-CONTAINED in a single chassis—except, of course, for antenna, microphone and headphones—this Very High Frequency transmitter-receiver operates in the 144 megacycle, two-meter amateur band. Probably as straightforward—and simple to construct—as a VHF station can be, its cost runs under $60, less than one-fourth the cost of comparable, commercially made equipment. The receiver, tube for tube, develops maximum gain, has maximum sensitivity. It will easily receive signals from within and beyond the range of the transmitter; also, its efficiently engineered R.F. stage greatly reduces signal-radiation interference during reception. And, since all three stages of the transmitter are tuned to a different frequency, self-oscillation of a transmitter stage (with attendant off-frequency operation) is virtually impossible. No tricky "overtone" oscillator circuit, requiring hand-picked crystals, is used; no neutralization is necessary; there is no spurious signal output from the push-push final amplifier.

Construction of Power Supply and Receiver. On the 4 x 10 x 17-in. chassis, punch socket holes (Figs. 1 and 2) with 1³⁄₁₆-in. dia. and ¾-in. dia. socket punches (obtainable at electronics supply store) and mount the power transformer, rectifier tube socket, filter capacitors, filter choke coil, terminal strip, and volume control-power switch. (Mounting holes for the transformer are drilled from the data supplied by the manufacturer; tube sockets, filter choke and other station circuit components, except where otherwise indicated, are fastened to the chassis with 6-32 x ⅜-in. machine screws and nuts.)

Wiring for the power supply is shown in Fig. 3. (Figure 6 gives a pictorial wiring diagram for both receiver and transmitter sections.) Solder all connections with rosin core solder, checking connections at each step. When the wiring has been double-checked, connect a line cord to the proper terminals on the terminal strip (Fig. 1), insert the 5Z3 rectifier tube in its socket, plug the line cord into a power outlet and turn on the power switch. Now connect a d-c voltmeter from B+ to chassis; it should read between 300 and 400 volts. If it doesn't, check for faulty wiring or a defective tube and remedy or replace.

With the power supply working, mount and wire the send-receive switch (mount according to manufacturer's instructions; see Fig. 4 for wiring), the receiver's 6AG5 and 12AT7 sockets (with *rh* 4-36 x ¼-in. screws) and the sockets for the receiver section's two 6SN7's. Then mount and wire the receiver's main tuning capacitor's



1

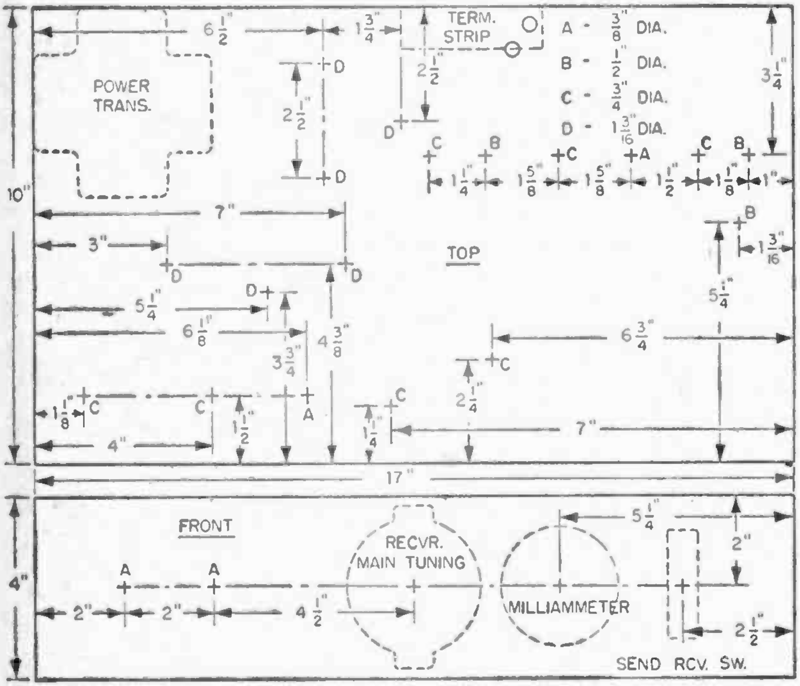
> CAUTION: Although anyone may use the VHF receiver, the transmitter cannot be used without an amateur's license issued by the FCC. Failure to obtain a valid license from the FCC exposes the offender to a maximum penalty of $10,000 and/or two years imprisonment.

vernier tuning dial (according to manufacturer's instructions) and the headphone jack. Wire the audio amplifier sections of the 6SN7's (see Fig. 5) starting with the stage which feeds the headphone jack (all tubes get B+ via the B+ section of the send-receive switch). As the wiring of each audio amplifier stage is completed, test it by plugging a pair of magnetic headphones into the headphone jack and—with power on and send-receive switch in *receive* position—touching a screwdriver to the grid of the section under test. Grasp the metal shaft of the screwdriver; *touch nothing else.* When the end of the screwdriver is brought into contact with a grid, a hum should be heard in the phones. If a stage does not operate, the difficulty is incorrect wiring, a solder-blob short, or a defective component.

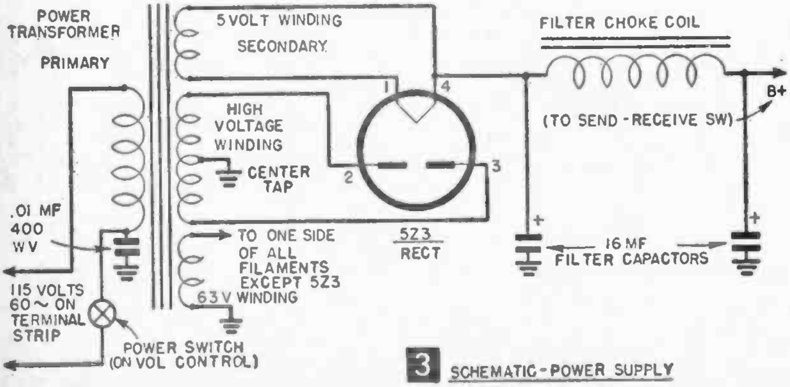
Next, wind the second detector coil (Fig. 7), mount it, and wire the 6SN7 second-detector section into the receiver circuit.

Test the second detector by applying power, plugging in the phones, and turning up the volume control. With the control turned about halfway up, a loud, clean hiss should be heard in the phones; backing the control down should cause the hiss to die away smoothly. If no hiss is present in the phones, recheck wiring and circuit components.

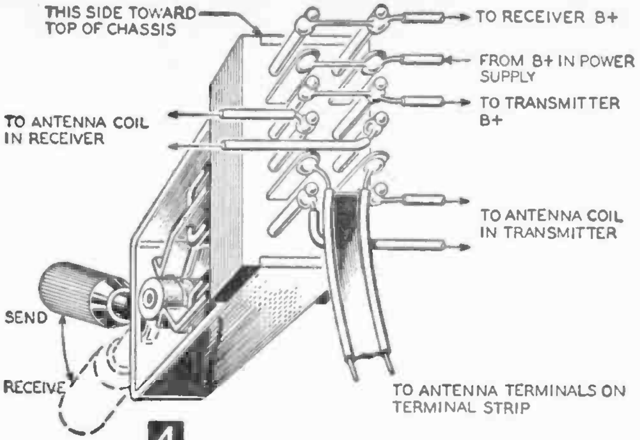
High Frequency Section of the Receiver. When wiring the VHF stages of the receiver (or transmit-



2 CHASSIS LAYOUT



3 SCHEMATIC-POWER SUPPLY



4 SEND-RECEIVE SWITCH (END VIEW)

ter), keep all leads as short and direct as possible. A lead 1 in. long is considered short enough for ordinary broadcast and shortwave equipment, but at 144 megacycles it is far too long. Also, use a minimum amount of solder; use ceramic bypass and coupling capacitors; and establish one ground point for each stage, returning all chassis grounds for the stage to that point.

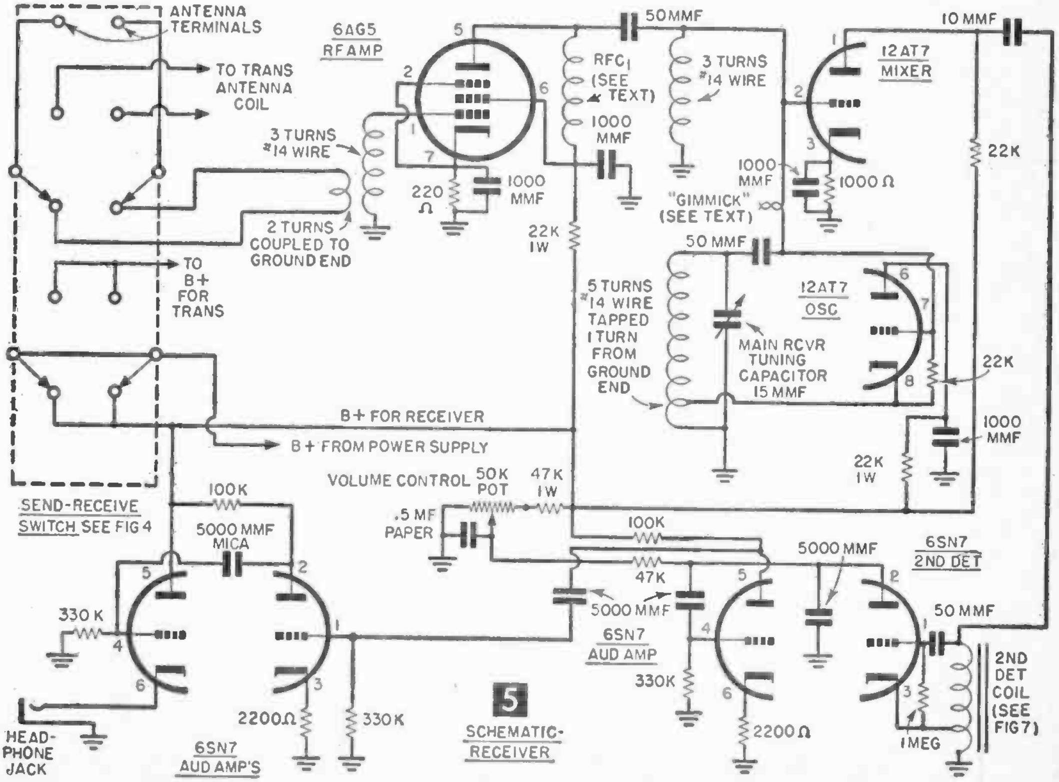
In Fig. 5, RFC1 designates an Ohmite Z-144 VHF R.F. choke, the plate load of the 6AG5 R.F. amplifier. The tuning coil in the 6AG5's grid circuit consists of three turns of #14 tinned copper wire. Wind this coil on a ½-in. dia. form (we used a ½-in. drill shank) and then remove the form, leaving an "air-wound, air-spaced" coil. To properly adjust this coil, a grid-dip meter is needed. (With it, also align second detector to 29 megacycles.)

With the 6AG5 and the meter in the circuit (instructions for the use of the grid-dip meter are supplied by the manufacturer), spread apart or squeeze together the three turns of the coil until the meter indicates that the circuit is resonant to about 146 megacycles. For our receiver, this condition occurred when the coil was about ½ in. long.

Wind and adjust the coil in the grid circuit of the 12AT7 mixer in the same manner, but with both the 6AG5 and the 12AT7 in their sockets and all other connections properly made.

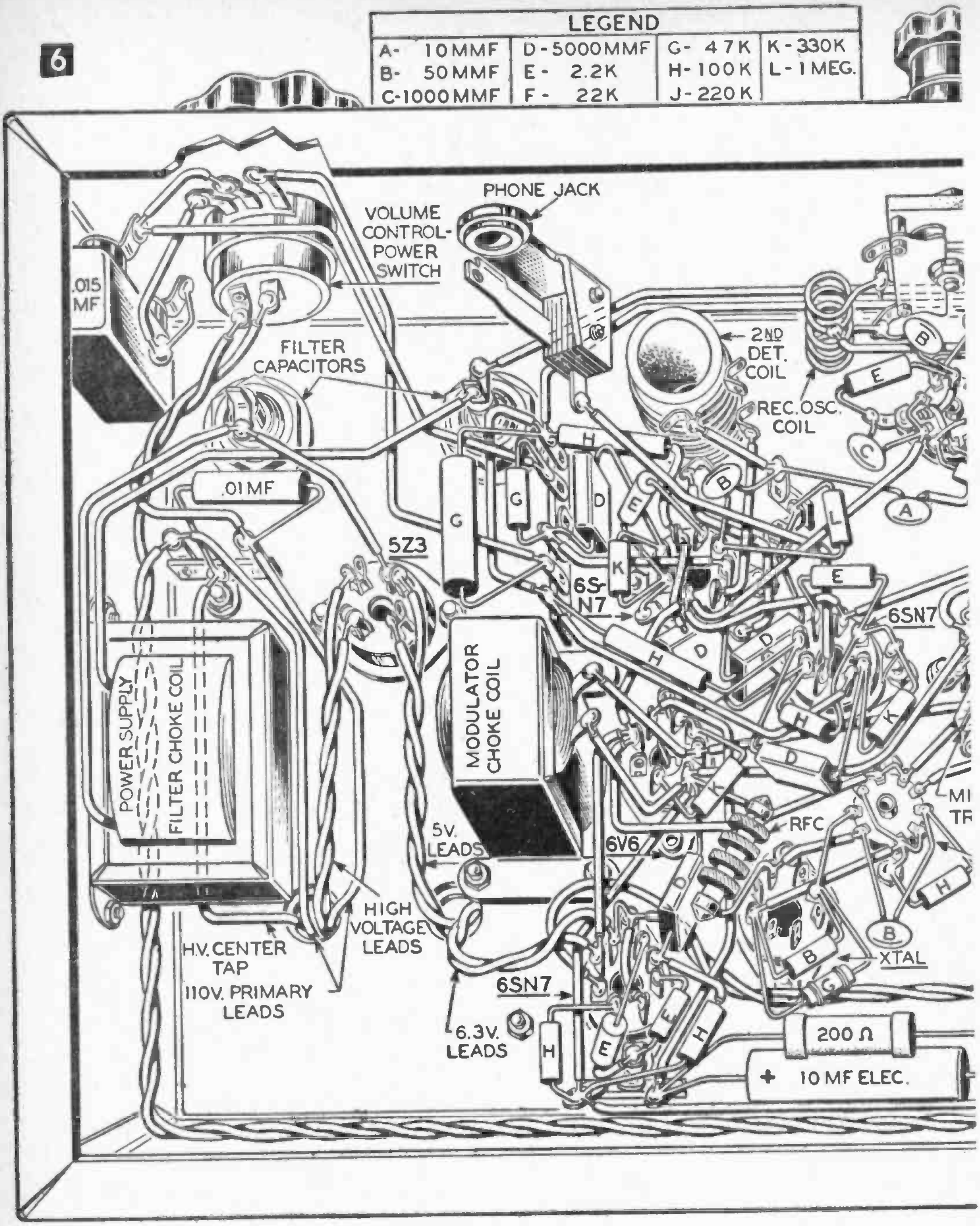
The small, home-made capacitor, labelled "Gimmick" in Fig. 5, consists of two pieces of ordinary hook-up wire (insulation left on) twisted together three times. It couples the signal from the oscillator to the mixer.

The oscillator coil consists of five turns of #14 wire wound as were the three-turn grid coils. The cathode lead from the oscillator sec-



5 SCHEMATIC-RECEIVER

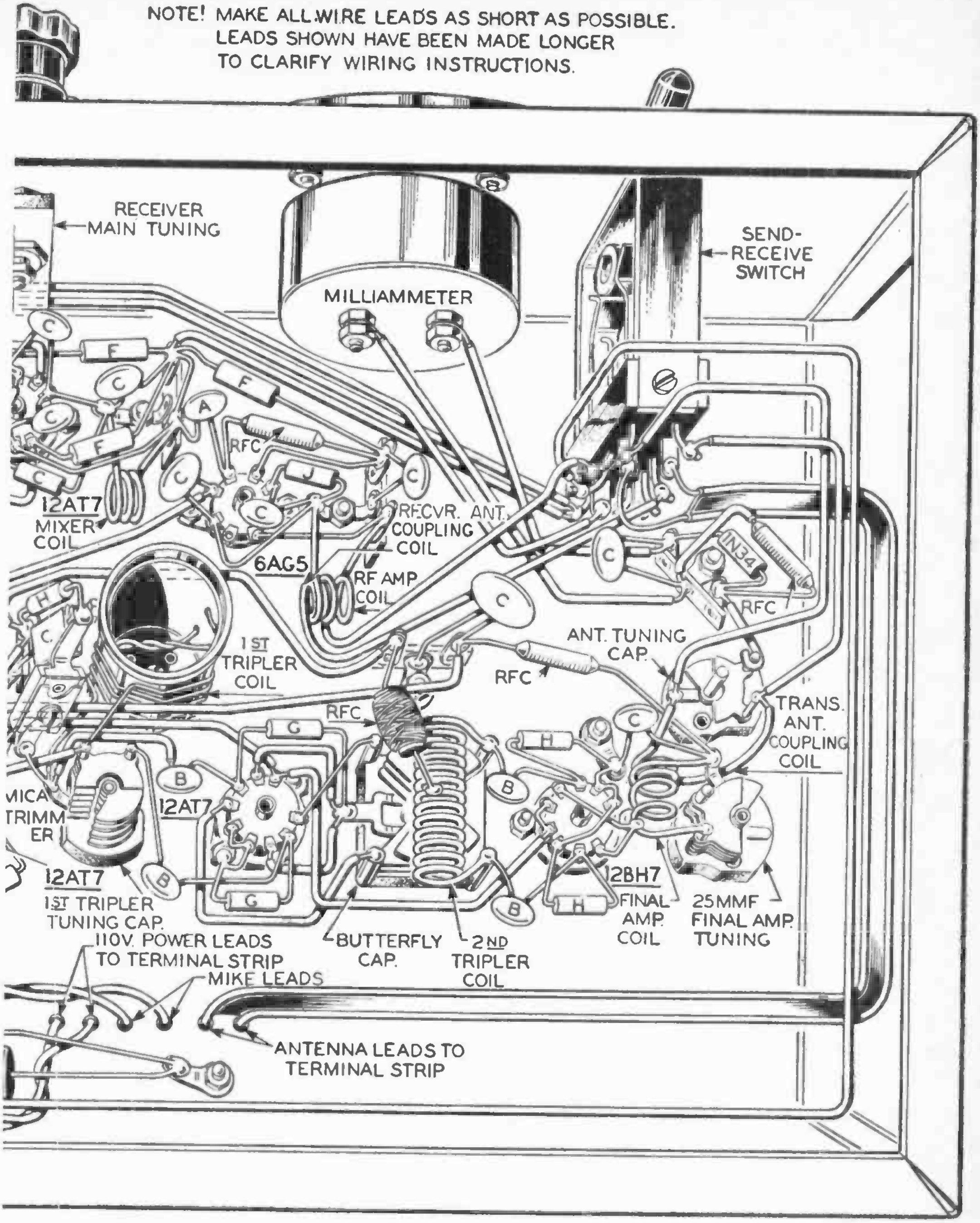
6



LEGEND			
A- 10 MMF	D-5000 MMF	G- 47K	K-330K
B- 50 MMF	E- 2.2K	H-100K	L-1 MEG.
C-1000 MMF	F- 22K	J-220K	

tion of the 12AT7 is soldered to the coil one turn from the ground end. When the R.F. amplifier, mixer and oscillator circuits are completed, apply power and throw the send-receive switch to the *receive* position. The tuning range for the oscillator, as indicated by a grid-dip meter, should be from within about 115 to about 132 megacycles. If the oscillator is not oscillating, look for shorts between tube pins or try a different 12AT7. If the oscillator's tuning range is incorrect, squeeze or spread the oscillator coil turns slightly until the correct range is obtained.

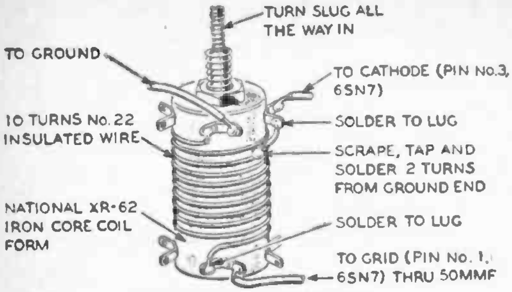
When the oscillator is working correctly, plug the headphones into their jack, adjust the volume control for a good, strong hiss, set the grid-dip meter for 145 megacycles and place it about 10 ft. from the set. Now tune the main tuning dial on



the receiver throughout its range. At some point on the dial the hiss should disappear. Turning the grid-dip meter off should cause it to reappear. If it does, the receiver is operative. If it doesn't, you'll need to recheck the wiring in the mixer and R.F. amplifier circuits only; the oscillator has been checked.

For test purposes, couple a dipole antenna (see Fig. 8) to the 6AG5 R.F. amplifier grid coil by means of one turn of wire inserted between the two turns at the ground end of the grid coil. With the volume turned up, tune the main receiver tuning dial through its range. If there are radio-equipped taxicabs, mobile radio telephones, or other 144-megacycle amateurs operating within range of you, you should hear them.

Note that when a signal is tuned in, the hiss from the receiver tends to disappear and the



7 SECOND DETECTOR COIL (WHEN WOUND, COAT WITH POLYSTYRENE CEMENT)

voice signal takes its place. The stronger the signal, the more completely the hiss will disappear. Slight readjustment of the volume control and slight retuning will often do wonders to clear up a weak signal.

Finish work on the receiver section by connecting the antenna coil leads of the 6AG5 directly to the appropriate connections of the send-receive switch (Fig. 4). Then run a short length of 300 ohm "twin-lead" TV lead-in line from the proper switch connections to the antenna terminals on the Jones terminal strip and connect antenna lead-ins to these terminals.

Construction of the Transmitter. Fasten tube sockets for the 12AT7's, 12BH7 and crystal (use 6-32 screws for the crystal socket, 4-36 for tube sockets) and mount the 50 mmf first-tripler tuning capacitor, the "butterfly" second-tripler tuning capacitor, and the 25 mmf final amplifier tuning and antenna tuning capacitors. Be sure that the 50 mmf and the 25 mmf capacitors are mounted with shafts insulated from the chassis. (Drill the shaft hole large enough to give the shaft ample clearance.)

First wire the crystal oscillator (see Figs. 6 and 9), wiring to any two *alternate* pins desired on the crystal socket. In the oscillator's plate circuit, RFC2 (Fig. 9) designates a National R-100 2½ mh R.F. choke.

Choose your crystal frequency according to the class of amateur license you hold. If you hold a general class license, any crystal frequency between 8.000 and 8.210 megacycles will do. If you are a novice, choose a crystal frequency between 8.032 and 8.132 megacycles.

When the crystal oscillator circuit wiring is completed, plug the crystal into the socket pins that are connected to the oscillator circuit. Apply power and throw the send-receive switch into the *send* position. Now, *holding it by its glass envelope,* touch the base of a 2-watt neon bulb to the plate connection (pin #1) of the 12AT7 oscillator tube. A faint but definite bluish-red glow of the neon bulb indicates satisfactory operation of the oscillator circuit. If no glow is observed, recheck the wiring or substitute a different crystal.

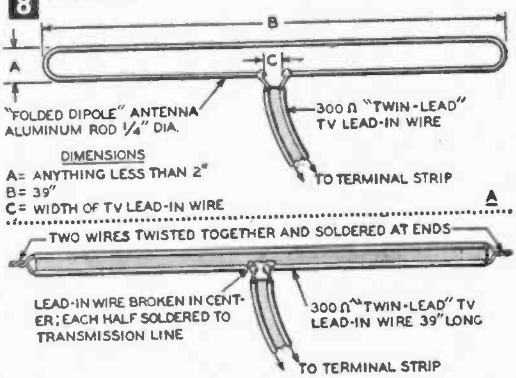
Next, wire the first tripler circuit. The first tripler coil is wound as shown in Fig. 10.

With the first tripler wired, apply power and set grid-dip meter to about 24 megacycles. Hold the grid-dip meter coil near the tripler coil and adjust the 50 mmf capacitor until maximum output from the tripler is observed on the meter. This adjustment must be made with an *insulated* screwdriver to avoid shocks and to insure accurate tuning.

When a good, strong indication is secured on the grid-dip meter, insert the loop of the transmitter tuning lamp (see Fig. 11) into the first-tripler coil with the loop of the lamp parallel to the turns of the coil. When the lamp is inserted all the way into the coil, and the 50 mmf capacitor is readjusted for maximum tripler output, a noticeable glow of the lamp filament should be observed.

Now, wire the second-tripler 12AT7. The second-tripler coil consists of 12 turns of #14 tinned copper wire wound on a ½-in. dia. form. Space the turns carefully to make the entire coil about 1¾-in. long, then remove the form. Connect this coil between the two stationary sets of plates of the "butterfly" capacitor. Keep leads as short as possible.

8 ANTENNAS



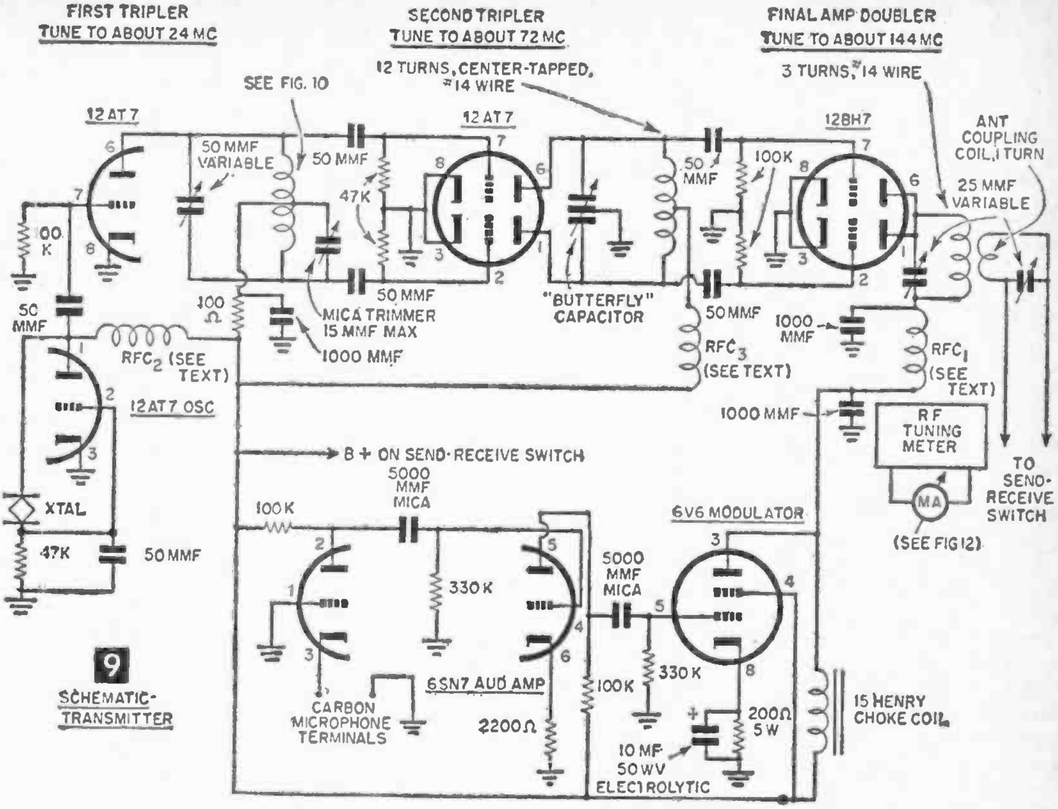
A is superior for outdoor installations.
B is suitable for indoor or temporary use.

RULES FOR ERECTING ANTENNA

(1) Keep it horizontal.
(2) Keep it broadside to the directions you wish most to work.
(3) Erect it as high above ground as possible.

The R.F. choke (RFC3) connected to the center tap of the second-tripler coil is made by scramble-winding 100 turns of magnet wire equal to or smaller than #22 around a 1 megohm, 1 watt carbon resistor. Solder the ends of the coil to the resistor leads, dope liberally with polystyrene cement, and solder RFC3 into the circuit.

Insert the 12AT7 in its socket and apply power. Tune the grid-dip meter to about 72 megacycles and adjust the "butterfly" capacitor for maximum second-tripler output. Then insert the loop of the tuning lamp between the middle turns of the second-tripler coil and readjust the "butterfly" capacitor for maximum second-tripler output. Then, using an insulated screwdriver, read-



9 SCHEMATIC-TRANSMITTER

just the *first*-tripler 50 mmf tuning capacitor until the tuning lamp (still in the second-tripler circuit) glows brightly. Now, adjust the first-tripler 15 mmf mica trimmer capacitor and the first-tripler 50 mmf tuning capacitor alternately, until the tuning lamp glows at nearly full brilliance.

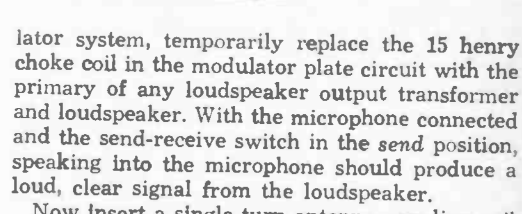
The final stage of the transmitter's R.F. section to be wired is the push-push doubler final amplifier. It operates at the output frequency of 144 megacycles, so make every lead as short as possible. The final-amplifier tank coil consists of three turns of #14 tinned copper wire ½-in. in diameter. Space out the turns until the length of the entire coil is about one in., remove the form, and connect the coil across the final amplifier tuning capacitor. Keep leads to minimum length.

When the final amplifier is completed, tune the grid-dip meter to about 144 megacycles, insert the 12BH7 tube in its socket and, after the tube has heated, apply B+ by throwing the send-receive switch to *send*. Using the insulated screwdriver, adjust the 25 mmf final-tuning capacitor for maximum indication on the grid-dip meter and readjust the "butterfly" capacitor for maximum output at the final amplifier. Then insert the tuning lamp between the turns of the final amplifier coil. It should gleam brilliantly.

Finally, wire the audio amplifier and modulator. (RFC1 designates an Ohmite Z-144 VHF R.F. choke.) To test the audio amplifier-modulator system, temporarily replace the 15 henry choke coil in the modulator plate circuit with the primary of any loudspeaker output transformer and loudspeaker. With the microphone connected and the send-receive switch in the *send* position, speaking into the microphone should produce a loud, clear signal from the loudspeaker.

Now insert a single-turn antenna coupling coil into the final-amplifier tuning coil at the end farthest from the 12BH7 socket. Push it well down into the final-amplifier coil to obtain tight coupling and run its leads directly to the 25 mmf antenna tuning capacitor. From there, run leads directly to the proper terminals of the send-receive switch (see Fig. 4).

Give the entire transmitter a final test by connecting a #48 dial lamp bulb directly across the antenna terminals on the terminal strip. With every component in the circuit and with the



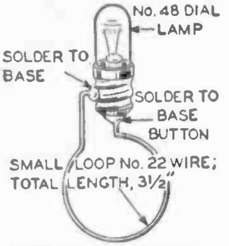
10 FIRST-TRIPLER COIL

send-receive switch in *send* position, the lamp should glow brightly. Touch-up the various tuning adjustments for maximum brilliance of the lamp and then speak clearly and directly into the microphone. The lamp should flicker noticeably, indicating that modulation is taking place.

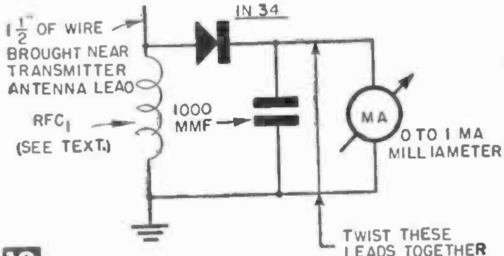
MATERIALS LIST—AMATEUR RADIOTELEPHONE STATION

Req'd.	Receiver and Power Supply
1	10 x 17 x 4" aluminum chassis
1	knob, ¼" shaft
1	terminal strip, 6 terminal (Jones barrier 6-140)
6	8-prong sockets (Amphenol type MIP)
4	9-prong sockets (Amphenol, 59-410)
1	7-prong miniature socket (Amphenol, 147-505)
1	power transformer (Stancor type PC-8410 or equivalent)
1	filter choke coil (Stancor type C-1001 or equivalent)
2	can type electrolytic capacitors, 16 MFD 450 w.v. (Cornell-Dubilier, Type KR-516A or equivalent)
1	single circuit phone jack
1	Vernier dial, 0-100-0 scale (National type BM)
1	4PDT anti-capacity switch (Federal #1424)
1	50K linear taper potentiometer, with switch (50,000 ohms)
1	pair 2000 ohm headphones (Trimm "Dependable" or equiv.)
1	phone plug
5 ft.	power line cord with plug
1	.01 mf, 400 volt paper capacitor
1	Ohmite Z-144 R.F. choke
8	1000 mmf disk type ceramic capacitors
8	50 mmf disk type ceramic capacitors
1	10 mmf disk type ceramic capacitors
1	1000 ohm, ½ watt composition resistor
1	220 ohm, ½ watt composition resistor
7	100K ohm, ½ watt composition resistors (100,000 ohms)
1	47K ohm, 1 watt composition resistor (47,000 ohms)
3	47K, ½ watt composition resistors (47,000 ohms)
2	22K, ½ watt composition resistors (22,000 ohms)
2	22K, 1 watt composition resistors (22,000 ohms)
5	330K, ½ watt composition resistors (330,000 ohms)
3	2200 ohm, ½ watt carbon resistors
1	100 ohm, ½ watt carbon resistor
1	1 meg., 1 watt carbon resistor
1	0.5 mf paper capacitor
6	5000 mmf mica capacitors, "postage stamp" type
1	ceramic, iron core coil form (National type XR-62)
1	15 mmf midget variable capacitor (Hammarlund type HF15 or equivalent)
1	5Z3 tube
2	6SN7GTB tubes
1	12AT7 tube
1	6AG5 tube
25'	#14 tinned copper wire
	hook-up wire, solder
	tube polystyrene cement
	tiepoints
	screws
	miscellaneous hardware
10"	300 ohm twin lead TV antenna lead-in wire
12"	#22 insulated magnet wire
	antenna materials, as desired
	Transmitter
2	knobs, ¼" shaft
1	choke coil (Stancor type C-1002 or equivalent)
1	0-1 milliammeter (Triplett)
1	0.5 mf, 200 v. paper capacitor (Sprague or equivalent)
1	10 mf, 50 v. electrolytic capacitor (Sprague or equivalent)
2	Ohmite type Z-144 VHF RF chokes
1	2½ mh RF choke (National R-100)
1	1¼" ribbed plastic coil form (ICA)
3	25 mmf midget variable capacitor (Hammarlund type APC 25 or equivalent)
1	50 mmf midget variable capacitor (Hammarlund type APC 50 or equivalent)
1	"Butterfly" type midget variable capacitor, 10 mmf per section (Johnson 11MB11)
1	1½-15 mmf mica trimmer capacitor
1	1N34 crystal diode
1	quartz transmitting crystal, about 8 megacycles, see text (Petersen radio "PR" type Z2 or Bliley type AX-2)
1	6SN7GTB tube
2	12AT7 tubes
1	12BH7 tube
1	6V6GT tube
2	#48; 2 v., 60 MA dial lamps
1	2 watt neon bulb
1	single-button, telephone-type microphone
1	2-lug tiepoint

The R.F. output meter (Fig. 12) assures proper tuning of the transmitter under all conditions. Fasten the 1N34 crystal diode, the RFC1 choke (an Ohmite Z-144) and the 1000 mmf capacitor to a two-lug tiepoint strip mounted near the transmitter antenna tuning capacitor. The 1½-in. pickup lead should be brought within about ½ in. of the transmitter 25 mmf antenna tuning capacitor and a twisted pair of wires run to the 0-to-1 milliammeter on the front of the chassis. Apply power, and throw send-receive switch to *send*. If the meter reads backwards, reverse the leads to it. Position the pickup lead so that when the transmitter is operating and the antenna is properly loaded the meter reads about mid-scale. The transmitter may now be easily adjusted by tuning for the greatest meter reading.



11 TRANSMITTER TUNING LAMP

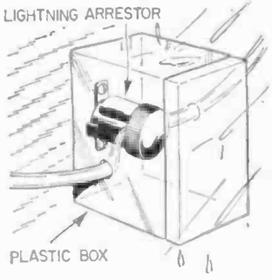


12 RF TUNING METER

Connect the transmitter to one of the antennas shown in Fig. 8, put the antenna as high and in the clear as possible and you're ready to go on the air. With a dipole antenna 25 ft. high, your range of communication will be around 10 miles; with a dipole antenna 50 ft. high, it will be about 15 miles; 100 ft. high will get you out 20 miles. With a high-gain directional antenna system, you can get out in excess of 100 miles under special atmospheric conditions.

Weatherproofing TV's Lightning Arrestor

• Does your TV picture get snowy nearly every time it rains? If your TV's lightning arrestor is located outdoors where it is exposed to the elements, signal loss may result when the arrestor becomes covered with rain. To prevent this, install arrestor in a plastic box with a tight-fitting lid. Cut holes in the side of the box to accept the lead-in wire; drill holes in the bottom to fit the arrestor's mounting screws.—John A. Comstock.



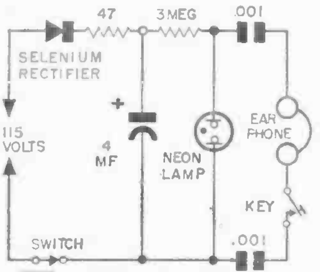
Press the key, and the signal plays through the radio speaker. When plug connecting accessory oscillator is removed (not shown in photo) radio functions normally.

Loudspeaker Code Practice Oscillator

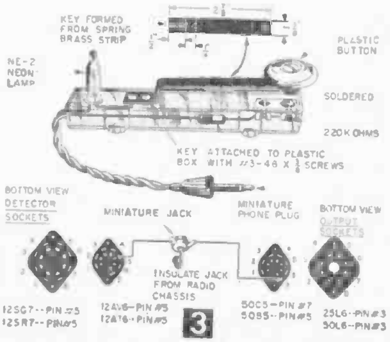
For 50¢

Stealing power from a superhet radio, and playing through the speaker, this unit will also double as a tone generator

ONLY two main parts, a neon lamp and a resistor, plus the key and plug, are all that you need to build this oscillator. Not only is it handy for code practice, it also provides two full octaves of tone, for testing and experimental purposes.



2 SCHEMATIC DIAGRAM (TYPICAL RELAXATION OSCILLATOR CIRCUIT)



MATERIALS LIST—CODE PRACTICE OSCILLATOR

No. Reqd.	Description
1	NE-2 Neon Lamp
1	220,000 ohm 1/4 or 1/2-watt composition resistor
1	3⅝" long, ¾" wide, ⅜" deep plastic box
1 pc.	spring brass, steel, etc.
1	7/8" dia. plastic garment button
4	3-48 x ⅜" long rh machine screws and nuts
1	subminiature phone plug & jack (Lafayette MS-281 & 282)

The oscillator's operation is based on the neon glow relaxation circuit, principle of which is shown in Fig. 2. Such a circuit, while it has been popular for years, requires many more parts, and provides only earphone volume and tone. Our circuit (Fig. 3) actually drives a loudspeaker with lusty volume.

The minimum 90 volt *d-c* current required to excite the neon glow lamp in the oscillator circuit is obtained from the plate lug of the output tube of any small *ac-dc* radio. The other lead of the oscillator is connected to the first diode of the radio's detector tube. Since this diode is also the input of the voltage amplifier, the weak oscillator signal is therefore automatically amplified by the set's two audio stages and reproduced by the speaker. The wiring plan (Fig. 3) shows how to make the connections to the tube sockets of most popular radio sets. If you want to use an earlier model receiver, simply check the respective diode and plate pins of the input and output tubes on a tube chart, and connect according to the tube base outlines.

The miniature phone plug and jack allow the oscillator to be connected to the radio set at will. When the plug is removed from the jack, the set again functions in normal fashion. Leads from the tube sockets to this jack should be as short as possible, and the jack must be fully insulated from the metal chassis of the radio, or a short circuit will result. On some sets, you may find that the hardboard back, to which the loop antenna is attached, is a convenient place for the jack, or drill a hole in plastic cabinet.

As a novelty, the code practice oscillator shown in Fig. 3, was built into a small plastic box, such as is used to package emery boards. The key was homemade of spring brass. The serious radio amateur practicing code for license examinations is advised to use a conventional type of sending key, since the "feel" of a solid key under the hand is important in learning speed.

Drill a hole in the plastic just large enough to pass the NE-2 neon glow lamp, cementing it in place with Duco cement. Shape the key by bending a strip of spring brass according to the plan. The knob is a ⅞-in. dia. garment button.

The tone of the oscillator is determined by the setting of the receiver's volume control. If the key is held down, and the volume control rocked back and forth, an electronic siren effect will result.

If, instead, you alternately close the key, and vary the volume control setting, a musical tune will result, much in the manner of the "Uke-Atron." This is an electronic musical instrument, described in S&M Radio-TV Experimenter, Volume 3 (#538—50 cents). And it demonstrates the basic principle of electronic organs.

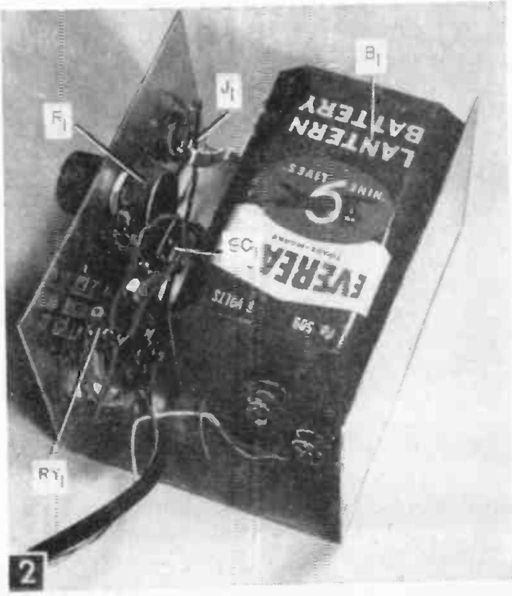
Another interesting feature of the relaxation oscillator is that it not only provides an audible signal, but also a visual signal. Every time the key is pressed, the lamp fires with a bright orange glow.—THOMAS A. BLANCHARD

Sound Down

By BERNARD DICKMAN
and
ALFRED LUCAS

Micro-switch mounted at back of phone cradle controls sound dimmer on either version one (A) or two (B) of sound-down unit.

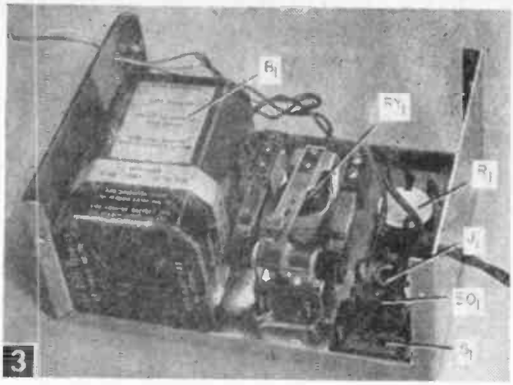
Below, parts placement in Version One.



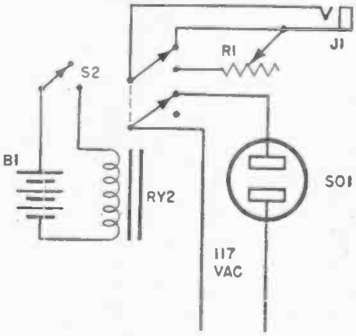
HERE'S a device which will automatically turn down the sound on your television or radio set when you lift the telephone receiver. There are two versions, one of which can be built for less than $10, the other for less than $15. The first version (Fig. 1A), while it is the less expensive of the two, draws current from the battery all the time the telephone is in use. The second version (Fig. 1B), will draw current only the moment the telephone is lifted from or returned to its cradle.

Part layouts for the two versions are shown in Figs. 2 and 3. The value of the potentiometer is not critical; almost any good junk-box unit will do. Schematics are shown in Figs. 4 and 5. Note particularly the wiring of the micro-switch (S2). In both schematics it is shown with the phone in use. Switch S1, on the schematic for the second version (Fig. 5) is shown in position for use in turning the TV or radio completely off.

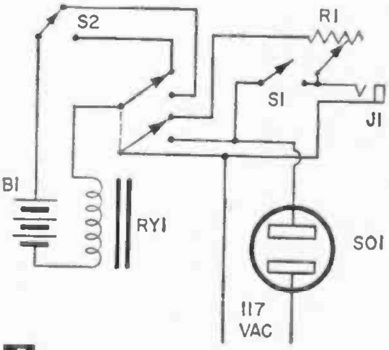
After the unit has been wired, connect the micro-switch (Fig. 6) to the telephone. Press it tightly into position under the lip of the handhold of the telephone as is shown in Fig. 1. Pull



Parts placement in Version Two.



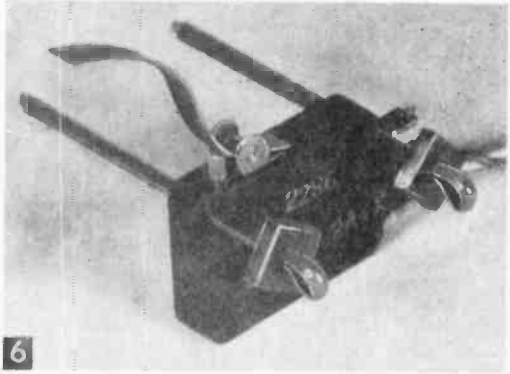
4 VERSION ONE SCHEMATIC



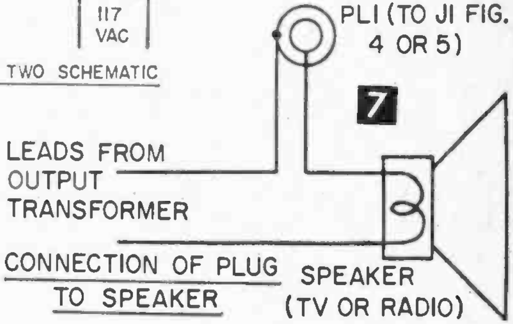
5 VERSION TWO SCHEMATIC

cotter pins tight while holding switch in position. Bend the leaf of the micro-switch around the arm rest. Test to see if switch makes and breaks contact when telephone receiver is lifted from and returned to cradle, then cut cotter pins to suitable length.

To connect either of the versions so that they turn *down* the sound on a radio or TV, connect the phone plug in series with one of the speaker terminals of the set. The second version must never be plugged into the 117-v wall socket when it is being used with the phone plug. After turning switch S1 on, insert the phone plug into the jack on the unit. With the phone off its cradle and the radio turned on, adjust potentiometer R1 to the desired difference in sound from the TV or radio set. Then, when the telephone receiver is returned to its cradle, the sound will automatically return to normal listening volume. If either unit is plugged into the wall socket with the TV or radio line plug inserted into the *ac* chassis socket on the unit, the radio or TV will be turned *off* when the telephone receiver is off the cradle. The first version, in other words, can control a radio and a television set simultaneously; the second version can only be used for one function at a time. The first version controls in these two ways: 1) with several *ac* chassis sockets added, several sets can be turned on and off; 2) with one set connected so that sound will be turned down and one set so that sound will be turned off, both radio and TV can be controlled simultaneously.



Micro-switch with cotter pins and nuts ready for mounting on phone.



CONNECTION OF PLUG TO SPEAKER

MATERIALS LIST—VERSION ONE

Desig.	Description
B1	6-v lantern battery
J1	standard phone jack
PL1	standard phone plug
R1	0-100 ohm linear potentiometer (see text)
RY2	6-v dc, DPDT relay (Advance GHA/2C/6VD; Allied Radio 76 P 461)
S2	leaf actuated micro-switch (Acro 2CMD1-2AXX-A24; Allied Radio 35 B 030)
SO1	ac chassis socket
	aluminum case 3 x 4 x 5" (Bud Minibox CU-3005; Allied Radio 80 P 365)
	screws, grommet, line cord and plug, cotter pins, nuts (for cotter pins)
	VERSION TWO
B1	6-v lantern battery
J1	standard phone jack
PL1	standard phone plug
R1	0-100 ohm linear potentiometer (see text)
RY1	6-v dc, DPDT ratchet relay (Potter and Brumfield AP11D; Allied Radio 76 P 585)
S1	Single pole, single throw slide switch
SO1	ac chassis socket
S2	leaf actuated micro-switch (Acro 2CMD1-2AXX-A24; Allied Radio 35 B 030)
	aluminum case 3 x 5 x 7" (Bud Minibox CU-3008; Allied Radio 80 P 368)
	screws, grommet, line cord and plug, cotter pins, nuts (for cotter pins)

1

Oscillogram pattern of a full-wave, battery charger rectifier showing lower half-cycle, (lost in Fig. 4) inverted and above horizontal centerline, indicating it is being used.

Using an OSCILLOSCOPE

For diagnosing troubles in electronic circuits, the oscilloscope is as useful to the experimenter as the X-ray machine is to a physician

By HAROLD P. STRAND

THE oscilloscope is probably the most useful of all test apparatus commonly employed by electronic technicians and engineers. It can actually give you a moving picture of what is going on in a circuit by means of waveforms and traces on the face of a cathode ray tube. It can be used for many varieties of test, teaching and research work, such as signal tracing, peak-to-peak measurements, frequency measurements, and servicing radio and television receivers. One interesting application is for testing and watching the operation of microphones. The voice produces a varying wave-form on the scope in step with the intensity and type of sounds delivered to the microphone.

It is commonly believed that an oscilloscope is too complex, and too difficult for an experimenter to construct himself. Actually, however, kits are available from electronic supply houses that belie this belief. The scope used for the experiments discussed in this article, for instance, was made from an Allied Radio kit with printed circuit board, that makes the job of building a good, general-purpose oscilloscope quite simple.

This scope is designed for viewing waveforms to 1.5 megacycles. It has built-in regulated calibrator to measure exact amplitude of the waveform appearing on the screen, by the flick of a switch. The sweep covers from 15 cycles to 150 kilocycles. These specifications are usually adequate for most general use. The vertical amplifier has a sensitivity of .025 volts (r.m.s) per inch and the input impedance is 3.3 megohms shunted by 45 mmfd. The horizontal amplifier has a sensitivity of .07 volts per inch and an impedance of 2.2 megohms shunted by 30 mmfd. The kit is supplied by Allied Radio, 100-A N. Western Ave., Chicago 80, Ill., under Cat. No. 83YU146, $44.95 complete. Laced cables, printed circuit board and pre-cut hook-up wires all trimmed, plus easy-to-follow assembly instructions make its construction simple for anyone having some electronic experience.

The wiring of the printed circuit board of this kit especially simplifies its construction. Those of you who have never used this marvel of circuitry, will be pleasantly surprised at the time saved over conventional wiring. The complex part of the circuit will be already wired for you; it is only necessary to insert the sockets and the resistor and capacitor leads in punched holes and solder them on the back to the silvered copper foil pattern. The top side of the board is lettered and marked to help in quickly identifying the parts to be installed.

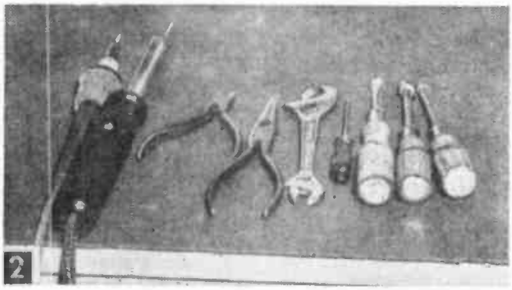
Soldering to the printed circuit is not difficult if care is taken to apply just the right amount of heat and all excess solder is eliminated. For use on the connections where small diameter wire is involved, an Ungar soldering pencil was found to be very satisfactory. For use at the other terminals, where larger wire is found, such as with the 1 and 2 watt resistors and large capacitors, you use a 60-watt iron. When you have completed assembly and tests, you can begin your experiments.

The first should be the production of a 60-cycle sine wave on the screen. A 6.3-volt filament transformer mounted on a small piece of board, with insulated line terminals and a terminal strip for the low-voltage secondary leads, is made up for quick connections to the scope with either 6.3 volts or 3.15 volts. You can obtain either voltage by using the two outside or the center and one outside terminal and many experiments can be conducted at a safe, low voltage. This test unit is shown in Fig. 3, connected to the vertical input terminals of the scope.

Set the V. Input Atten. to .1, the Sync Selector to +INT and the Sweep Selector between 15 and 150. Turn on the power to both the scope and the transformer and after the former warms up a few minutes, you should get a sine waveform on the screen by adjusting the V. Gain, H. Gain and the Sweep Vernier controls. The latter is a vernier on the sweep selector and a point will be found where a single cycle wave will appear and the Sync Lock control will hold the trace stationary. The sine wave is adjusted on the screen so as to be equally divided and below the center horizontal line. This represents a good wave-form which is usually obtainable from the standard 60-cycle line. It shows the rise and fall of the alternating current from 0 to positive maximum, then back to 0 to reach a maximum amplitude in


3

Testing the completed oscilloscope with a small step-down filament transformer. The sine wave shown in the above photograph is one cycle or two alternations of the 60 cycle current.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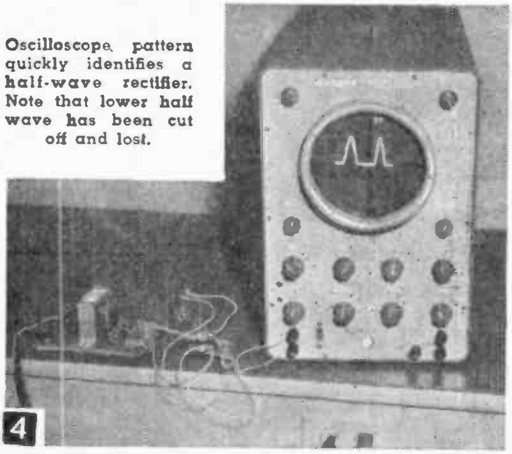
Tools needed to assemble the kit.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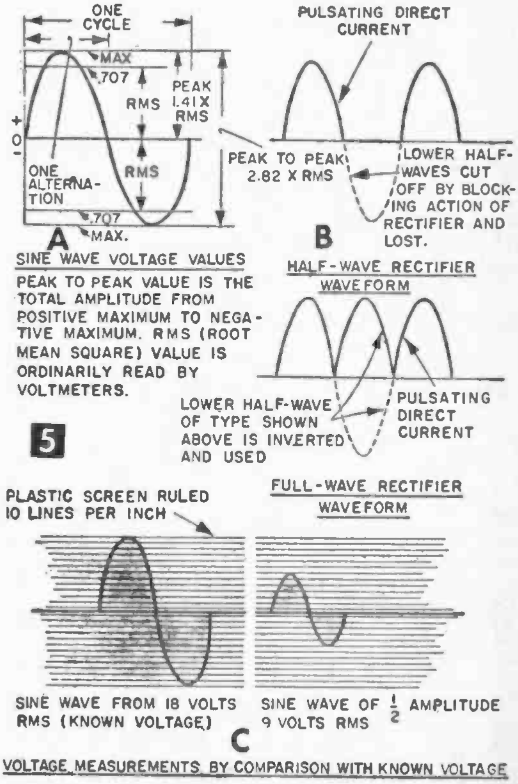
Oscilloscope pattern quickly identifies a half-wave rectifier. Note that lower half wave has been cut off and lost.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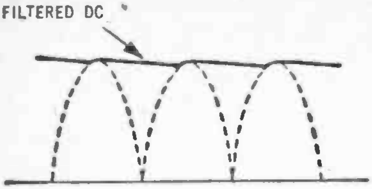
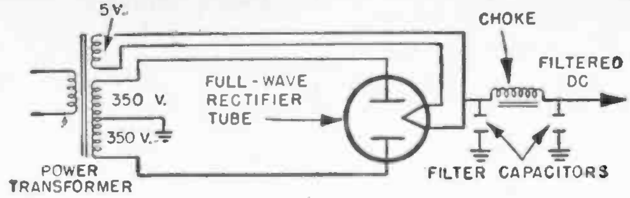


SHOWING THE EFFECT OF FILTERING A FULL-WAVE RECTIFIER OUTPUT



6

FILTERED POWER SUPPLY

a negative direction, from where it returns to 0. This is one cycle or two alternations. This sine wave is shown in Fig. 5A for further study and the relation of peak voltage to r.m.s. (root-mean-square) voltage as ordinarily measured by voltmeters, is indicated.

The oscilloscope can be used to measure voltage by comparison of the amplitude of the waveform from a known voltage with an unknown voltage. A plastic screen ruled with 10 lines to the inch (Fig. 5C) and applied to the face of the tube is a convenient method of calibration. The waveform from the known voltage can be adjusted between a certain number of lines and without touching the vertical gain control, the unknown voltage is applied, using the same vertical input terminals of the scope. If the trace has a peak to peak amplitude from the unknown voltage that is twice as great as that from the known voltage, the voltage is twice as great. Knowing the value of one signal applied, is is quite easy to calculate other voltages.

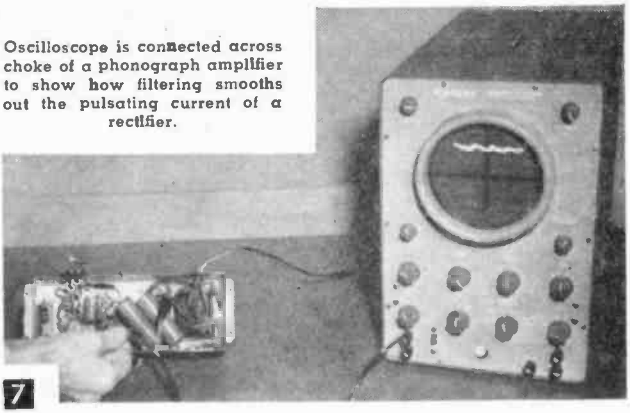
To get familiar with the scope controls, turn the Sync Selector to the —INT position and it will be found that the trace is shifted 180 electrical degrees, indicating that synchronization is being effected through the use of the negative half-cycles. If moved to the EXT position, the trace will start to drift, as in this position it requires the use of an external synchronizing source to be connected to the Ext. Sync. terminal.

Further experiments with the controls should include the V. Input Atten. When on the .01 position, the signal voltage connected to the V. Input terminals is divided by a factor of 100 and the trace will be considerably reduced in vertical gain from that shown when the switch is on the 1 position. The .1 marker divides the input signal by 10. This allows some control over the value of the input voltage to the scope and therefore, when applying an unknown voltage or one known to be quite high, always place the attenuator on the .01 position first, advancing the switch later to the other positions if required.

The oscilloscope is useful for indicating either half-wave or full-wave rectification. Such rectifiers are used in battery chargers, radio and television power supplies and many other types of electrical apparatus.

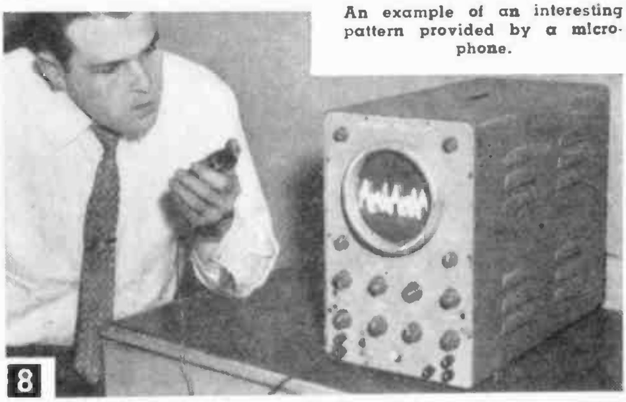
For the demonstration of half-wave rectification (Fig. 4) a selenium stack has been connected in series with one side of the secondary of the 6.3 volt test transformer and a dummy resistance load connected across the resulting line, with leads to the V. Input scope terminals. A half-wave vacuum tube would show approximately the same waveform.

A half-wave rectifier uses but one of the half-waves of the 60 cycle sine wave shown in Fig. 5A, the other half being lost or wasted. The half-wave that has been cut off is indicated by dotted lines (Fig. 5B) and represents the action of the blocking effect of the rectifier, so that D.C. pulsating current is produced from an alternating current source. An oscillogram of a half-wave rectifier, showing two half-waves above the cen-



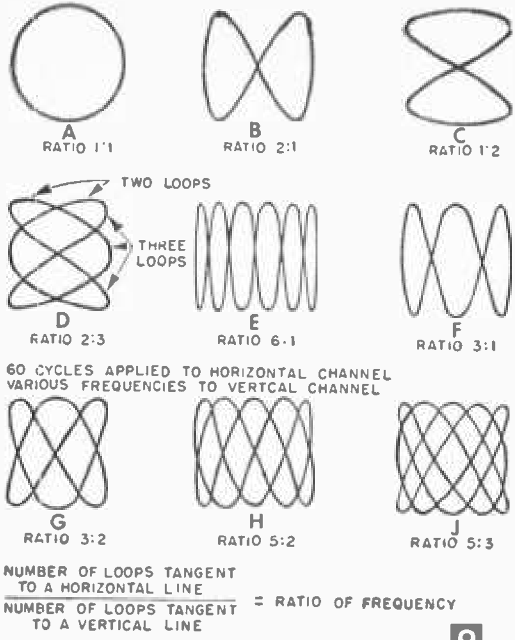
7

Oscilloscope is connected across choke of a phonograph amplifier to show how filtering smooths out the pulsating current of a rectifier.



8

An example of an interesting pattern provided by a microphone.



9

VARIOUS LISSAJOUS FIGURES FOR DETERMINING FREQUENCY

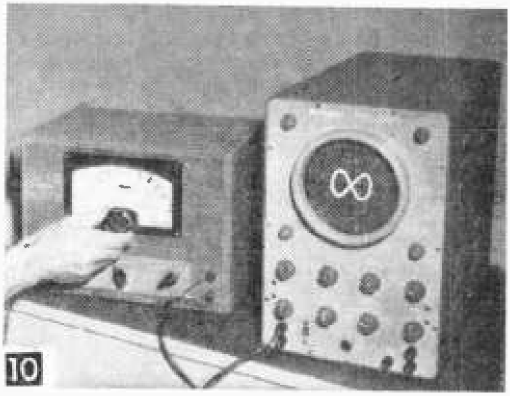
ter line with a space between is shown in Fig. 4. In full-wave rectifiers, both half-waves are used for better efficiency, the lost half-wave of the first case being inverted and used to pass unidirectional current. Rectifiers may be either of the dry disc or vacuum tube types.

An example of full-wave rectification in a battery charger is shown in Fig. 1. A dummy resistance load, of a value to show a small amount of current on the meter, has been connected across the spring clips, with leads connecting to the scope. It will be seen that the half-wave lost in the first subject has now been inverted to the space between the half-waves above the line and we have a full-wave rectifier. The pattern has been adjusted by the Vertical Position control so its lower points are on the horizontal line of the screen to get the correct picture. Full wave is obtained from either a bridge type rectifier stack or two half-wave stacks in a circuit with a center-tapped transformer. A full-wave vacuum tube rectifier also delivers this type of current.

The rectifiers illustrated produce pulsating direct current which is unidirectional but is not steady enough for some applications such as electronic power supplies. To smooth out the ripple to an extent as required for the purpose, a filter is added. This usually consists of a choke and two electrolytic capacitors (Fig. 6).

An example of a filtered power supply (Fig. 7) shows the scope connected across the choke in a phonograph amplifier. While the trace on the screen is not exactly a straight line, it has far less ripple than would be the case with the unfiltered rectifier shown in Fig. 1 or in other words, it now takes the peaks of the waves only with just a slight dip between. Such an oscillogram allows the designer to check the effect of more or less inductance and capacitance so as to result in as little ripple as possible. (*Care should be taken while working around apparatus employing high voltage, such as power supplies, since such voltage can deliver dangerous shocks if the worker gets careless and comes in contact with live terminals.*)

An interesting demonstration of voice modulation on the oscilloscope is possible with a crystal microphone. Connect the microphone leads to the vertical input terminals, attaching the insulated center wire of the shielded cable to the red terminal (V. Input) and the braid to the ground terminal. When connecting any apparatus always connect the lead from the ground to the GND. terminal where one of the leads does represent ground such as with microphones and many radio and TV test connections. Also, use shielded leads to prevent stray pick-up. Various sounded words and letters, as well as whistling will produce a wide variety of interesting patterns one of which is shown in Fig. 8. Musical notes sounded are especially effective. By this means, a good test for the condition or quality of a microphone is provided. A good unit in sensitive condition will respond to very low tones, while a cheap unit or one in bad condition will usually require loud signals in order to get comparable traces or the same gain on the screen. A dead microphone can be quickly identified, since it will have no response.

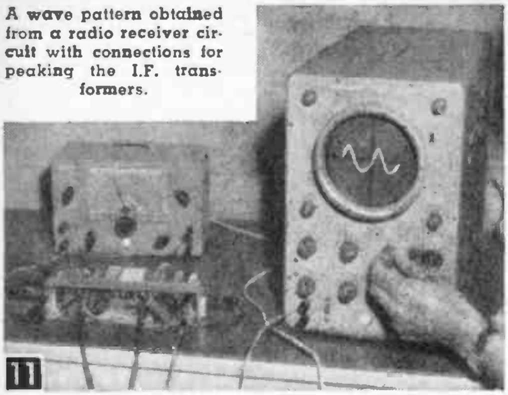


10

Frequency measurements are made with 60 cycles applied to the horizontal channel, by placing the Sweep Selector on this point and applying the unknown frequency to the vertical channel. Here an audio oscillator is being used to obtain a pattern of 120 cycles.

For use with a crystal microphone, the oscilloscope controls should be set somewhat generally as follows. The V. Input Atten is on 1, the Vertical Gain about ¾ advanced clockwise, the Horizontal Gain about ½ advanced clockwise, the Sweep Selector between 15 and 150, Sync. Selector on +INT. The controls are further adjusted as required in a test.

Frequency measurements are another possi-



11

A wave pattern obtained from a radio receiver circuit with connections for peaking the I.F. transformers.

bility open to the owner of an oscilloscope. It is often necessary to determine the frequency of some power source and this can be done quite easily by what are known as Lissajous figures. By this method a known frequency is applied to the horizontal channel and the unknown to the vertical channel to produce a variety of patterns that can be interpreted to indicate the frequency of the unknown signal. Fig. 9 shows some of the Lissajous patterns obtained.

The Sweep Selector is set to the 60 cycle position which allows a portion of the 60 cycle line to be applied for the horizontal sweep. For demonstration of various frequencies, which can be taken as the unknown frequency source, an audio oscillator is connected to the vertical input terminals of the scope as in Fig. 10. By adjusting a knob and a range switch, frequencies from 20 to 20,000 cycles are possible; 120 cycles are being delivered to the scope and the pattern shown has two top loops and one side loop. The Sweep Vernier has been adjusted to get the figure shown in Fig. 10. The calculation for frequency of the unknown signal is made by considering the ratio of the loops at the top of the pattern, which represents the unknown frequency, to the loop or loops at the side. In this case the ratio is 2:1. The actual frequency is determined by dividing the loops tangent to an imaginary horizontal line by those tangent to a vertical line or in this case 2/1=2 and multiplying this ratio by that of the standardizing frequency or 60 cycles to get 120 cycles. If the unknown frequency source happened to be 30 cycles, for another example, there would be one loop at the top to two at the side, as indicated in Fig. 9C. It will be noted that there is but one loop at the top, with two at the side or a ratio of 1:2. Therefore, 1/2=.5 or the frequency would be ½ that of 60 cycles or 30 cycles. This can be carried out for a great variety of unknown frequency measurements up to a point where it will be difficult to count the number of loops or perhaps up to ratios of 8:1 maximum. In many cases the figures will not remain very stationary due to phase differences in the two signals, but in other cases where they are exactly in phase, the patterns will be quite stationary.

Radio and television service men often use an oscilloscope to get wave patterns in various parts of circuits and also for lining up the I.F. transformers in a superheterodyne radio receiver. For locating trouble in the audio stage the oscilloscope is often connected across the speaker output leads. Where oscillograms are desired in some parts of the I.F. or R.F. sections, an extra accessory is required, called a demodulator probe. In Fig. 11 the Allied oscilloscope is being employed for peaking the I.F. transformers. A signal generator, shown at the left, produces the necessary 456 kc signal to the grid of the mixer tube through a .001 capacitor. The scope is connected across the detector load resistor. The controls on the scope are adjusted to get a pattern showing the frequency response curve of single-peaked I.F. transformers. This output waveform can be used in combination with the tone from the signal generator to make the adjustments at the I.F. transformers. It is usually necessary to shunt out the oscillator section of the variable tuning condenser to accomplish this work.

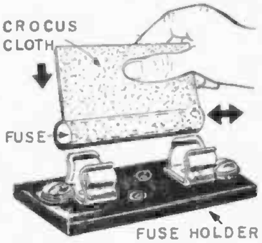
There are so many possible applications of the oscilloscope in electronics and industry that it would be impossible to try and describe them here. In general the operator should have some background knowledge of electricity and electronics in order to handle the instrument properly. There are several good books on the subject which are suggested for study, among them being the following—

Modern Oscilloscopes and Their Use by Jacob H. Ruiter, Jr., Rinehart & Company, 232 Madison Avenue, New York 16, N. Y.

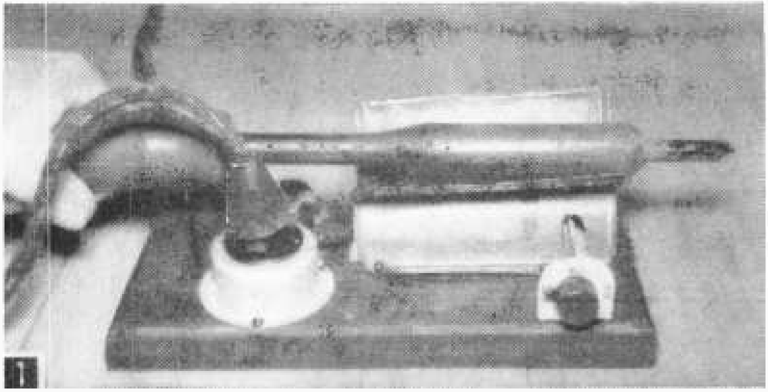
Obtaining and Interpreting Test Scope Traces by John F. Rider, John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y.

The Oscilloscope by George Zwick, Gernsback Publications, Inc., 25 West Broadway, New York 7, N. Y.

Cleaning Fuse Clips



• When tubular fuse-holding clips in electrical equipment become corroded, contact resistance increases and the fuse and its holder effectively become a "resistor," thus impairing the fuse's original purpose. To prevent this, place the fuse in the center of a strip of crocus cloth, with the abrasive side out, and force this into the fuse clip holder. Move the fuse and cloth back and forth several times to burnish the overall insides of the clips and expose fresh metal. This will assure a positive contact when the fuse is replaced. If this process tends to make the fuse fit loosely in the clips, pinch them together slightly, then replace the fuse.—John A. Comstock.



Thermostatically controlled stand regulates heat of iron through three levels—saves on electric bills!

Thermostatically Controlled Soldering Iron Stand

A thermostatically controlled soldering iron stand prolongs element life, prevents "frozen" tips and provides the right iron temperature for a variety of jobs. It is one of the few appliances that saves current while working instead of consuming it

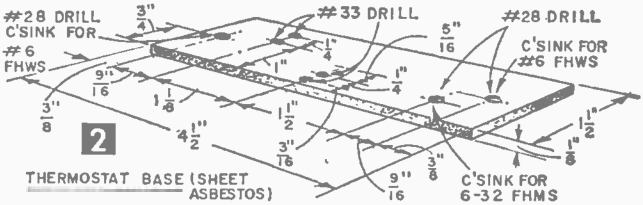
By W. McCORMICK

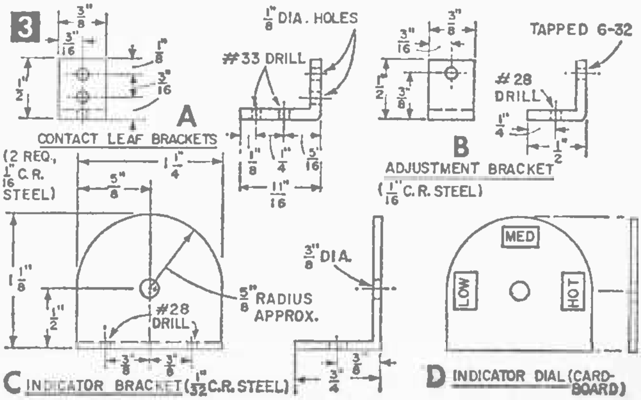
HERE'S a thermostatically controlled soldering iron stand you can make, mostly of junk, that will control any iron from 80 to 600 watts. The temperature sensing element is a bi-metal thermostat. When two strips of metal having different expansion co-efficients, such as steel and brass, are fastened together and heated, the compound strip will bend, with the more expansive metal, the brass, on the convex side. If one end of the strip is held fast, a swinging motion occurs at the free end. This motion can open and close electrical contacts.

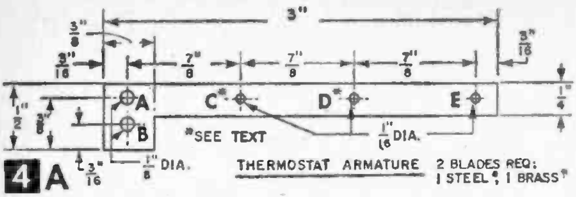
To use this principle to control soldering iron temperature, first make the sheet asbestos thermostat base, Fig. 2. Next, make the brackets shown in Figs. 3A and 3B, and the indicator bracket, Fig. 3C, and indicator dial, Fig. 3D, and cement the dial to the face of the bracket. Do not use material heavier than called for or the thermostat will regulate poorly.

Now, snip out the thermostat armature blades, one of tin-can steel, the other of brass shim stock (Fig. 4A). Scribe the location of all holes on each blade, centerpunch and drill. Deburr blades, flatten them and rivet them together with 1/16-in. diameter eyelet rivets *only* at holes "C" and "D." Ream hole "E" and force-fit a 1/4-in. x 2-56 *rh* machine screw into it with the screw head on the armature's brass side. Run a hex nut on the screw, tighten it and snip off the excess screw shank. File screw shank flush with the nut, make sure nut is still tight, and file the screw head flat.

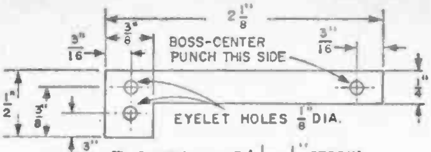
Now set one of the brackets (Fig. 3A) before you with its foot behind it and its 1/2-in. dimension in the vertical plane. Place the brass side of the armature against the back side of the vertical bracket leg, approaching the bracket







4A THERMOSTAT ARMATURE 2 BLADES REQ: 1 STEEL*, 1 BRASS*

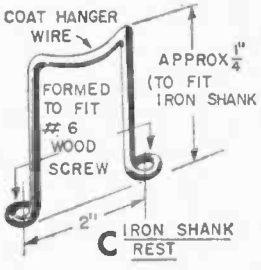


B CONTACT LEAF (1/64 - 1/32" STOCK)

with the brass side of the armature from behind, and rivet the armature and bracket *lightly* together with ⅛-in. diameter eyelets. Mount the armature assembly on the thermostat base with ¼-in. x 4-40 *fh* machine screws. Adjust the armature blades paralled with the armature base, and set the eyelets.

Next, make the contact leaf shown in Fig. 4B. Place the second bracket with its foot toward you and its ½-in. dimension in the vertical plane. Rivet the contact leaf *lightly* to the far side of the vertical leg, with the leaf's boss facing from you. Use ⅛-in. diameter eyelets.

Check the contact leaf for parallelism with the thermostat base, and set the eyelets and mount this assembly on the thermostat base with ¼-in. x 4-40 *fh* machine screws. The boss on the contact leaf should face the flat screw head in the armature. Center up the contact leaf's boss with the screw head in the armature, leaving about 1/32-in. between the boss and screw head. Spring the armature a little if necessary. Tighten all the bracket mounting screws.



C IRON SHANK REST

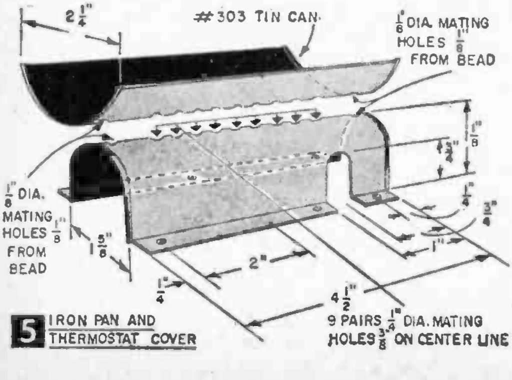
Now mount the adjustment bracket (Fig. 3B) with its tapped hole facing the back side of the contact leaf's boss, and in alignment with the armature's screw-head contact. (Foot of bracket toward you.) Snip the red tip off the fiber aligning tool, and cut the fiber shaft, leaving the tool 3 in. long, overall. Thread ½ in. of the fiber shaft with a 6-32 thread. (The bracket hole thread will do this if the fiber shaft is made slightly pointed.) Slip the compression spring on the threaded end of the alignment tool and screw the threaded shaft into the tapered bracket hole one or two turns—*not* enough to force the contact leaf boss against the screw head in the armature. Put a soldering lug and nut on the screw-end nearest the upright of both the armature bracket and the contact leaf bracket. Tighten nuts.

Next, make the thermostat cover and iron pan (Fig. 5). Cut both ends out of a #303 tin can and snip cylinder lengthwise into two half-round sections. Form and drill. Rivet finished pieces together with ⅛-in. diameter eyelets and blue over a flame. Form the iron-shank rest (Fig. 4C) from a 6-in. length of coat hanger wire.

Now, chamfer the top edges of the hardwood base ¼ in., and give it a coat of thinned black enamel. Drill a 5/16-in. hole in the shell of the 110-v outlet and insert the grommet. Then place all the completed parts on the wood base and make a trial layout. The thermostat assembly mounts with #6 x ½-in. *fh* wood screws. The

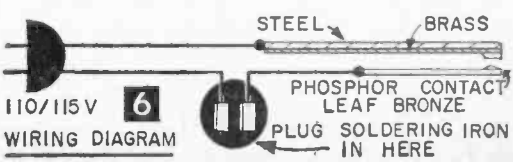
MATERIALS LIST—SOLDERING IRON STAND

No. Req'd.	Description
1 pc	sheet asbestos, 1/8 x 1 1/2 x 4 1/2" (linen-base Bakelite can be used for irons under 200 watts)
1 pc	cold rolled steel, 1/16 x 3/8 x 5"
1 pc	phosphor bronze, spring steel, spring brass or beryllium copper, 1/2 x 2 1/8 x 1/64 to 1/32"
1 pc	brass shim stock, 1/64 x 1/2 x 3"
1 pc	cold rolled steel, 1/32 x 1 1/4 x 1 7/8" or two thicknesses tin can steel sweated together
6	1/8" O.D. x 1/8" eyelet rivet
2	1/16" O.D. x 1/8" eyelet rivet
1	2-56 x 1/4 rh machine screw and hex nut
4	4-40 x 3/8" fh machine screw and hex nut
1	6-32 x 1/4 fh machine screw and hex nut
13	#4 x 1/2" rh wood screws
2	#6 x 1/2" fh wood screws
2	#6 x 1/2" rh wood screws
1	rubber grommet 5/16" mtg. hole (Walsco 7023F)
1	cable clamp 1/4 to 3/8" cable (Walsco 7505F)
1	assort. comp. spring 3/32 x 1 1/2" (Walsco 7440F)
1	instrument knob 1/4" shaft (Burstein Applebee 12A122)
I	alignment tool (General Cement #8247)
1	Amphenol 61F receptacle (outlet)
1	Amphenol 231S receptacle shell
1	electric iron cord, asbestos wrapped heavy duty
2	soldering lugs (Walsco 7150F)
1	compression spring, 3/32" I. D. x 1 1/2" approx. (from old ball point pen or Walsco 7440F)
	2 x 2" piece white-faced cardboard
1	#303 tin can
1	tin can (any size)
	10" length #14 ga. stranded hook-up wire
1	hardwood base 4 x 8 1/2 x 3/4" thick



9 PAIRS 1/4" DIA. MATING HOLES 3/8" ON CENTER LINE

5 IRON PAN AND THERMOSTAT COVER



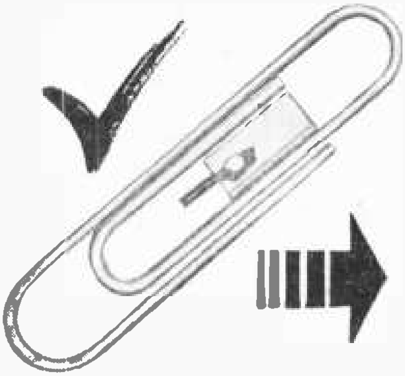
6 WIRING DIAGRAM

indicator bracket, 110-v outlet and the iron-shank bracket mount with #4 x ½-in. *rh* wood screws. The cord clamp takes a #6 x ½-in. *rh* screw.

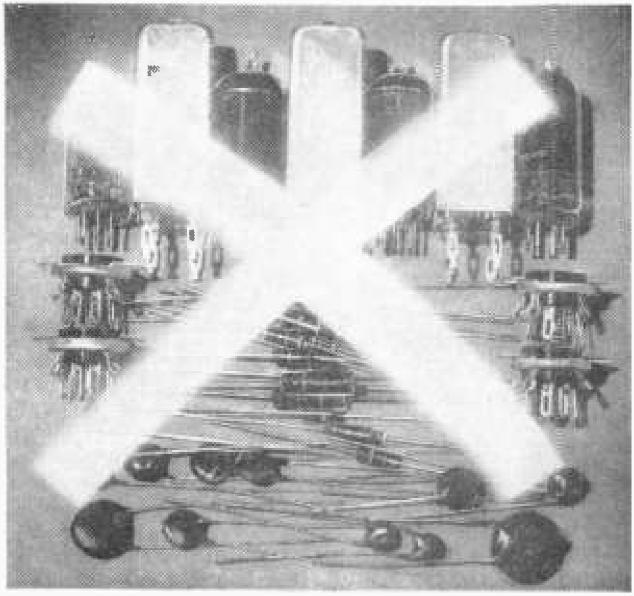
Wire as shown in Fig. 6. Wrap solder lugs around the connections to the thermostat, and crush lug loops on the wires. Trim wire ends, and tape the appliance cord where it passes under the cable clamp. Mount the thermostat cover and iron pan assembly over the thermostat.

To calibrate unit, plug a lamp into the soldering iron outlet and plug the iron stand cord into a 110/115-v outlet. Turn the aligning tool clockwise until the bulb just lights without flickering. Put the adjusting knob on the ¼-in. diameter end of the aligning tool, set it to point to "LOW" on the indicator dial and tighten its set screw. The unit is now fully calibrated and will read "MEDIUM" and "HOT" temperatures correctly. Unplug the lamp, plug in your soldering iron in its place.

Unique Circuit Simplifier the Tunnel Diode



Nestled inside this paper clip—with room to spare—is a tunnel diode, one of last year's most startling electronics developments. If an FM receiver were rebuilt using one of the new diodes, all the conventional components shown at the right could be omitted.

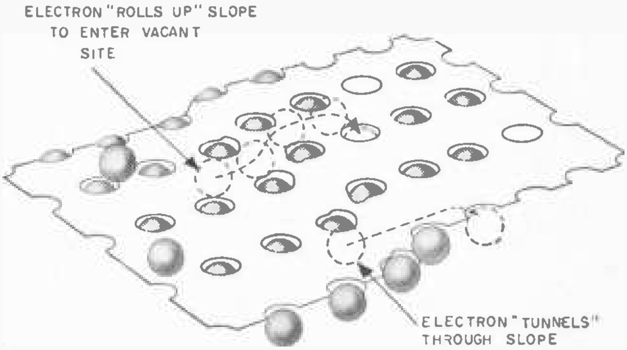


THE tunnel diode—newest baby in the fast-growing family of semiconductors—may soon be giving its first cousin, the transistor, an inferiority complex.

So small that a radio transmitter the size of a 50¢ piece has been built with it, the fantastic tunnel diode can perform almost all the functions of a standard low-power transistor and could lead to enormous savings in cost and complexity of electronic circuits.

A few of its features that have electronics engineers most intrigued are: An amplification noise figure of about one decibel, power requirements as low as one millionth of a watt and operation frequencies as high as 10,000 megacycles.

In some instances, the new diode may replace conventional components. In others, it might be used to improve their performance by working with them.



Here—in an extremely simplified diagram—is how the tunnel diode operates. Drawing represents a structure similar to a Chinese checkerboard, with one side slightly raised. Holes on the left side (which represents an n-type semiconductor) are filled with marbles, with a few left over and sitting on top. Right side (representing a p-type semiconductor) has a few holes vacant. The slope represents the potential barrier. A marble (or electron) from the left, can—after being given a push—enter a hole on the right by rolling up the slope and dropping in. Or, without the push, it can miraculously "tunnel" through the board and appear in a hole. The former process is used in conventional diodes and transistors. The latter represents what happens in tunnel diodes.

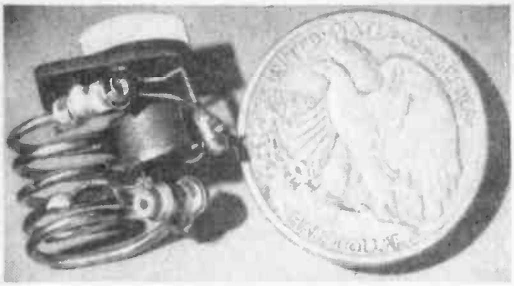


Photo compares transmitter with 50¢ piece. It consists of one variable and two fixed ceramic capacitors, tuning coil and the diode itself—inside can in center of transmitter.

The tunnel diode was first reported by a Japanese scientist—Dr. Leo Esaki—in 1958, and although its construction is very similar to an ordinary rectifying diode's, it works on an entirely different principle.

It takes its name from the phenomenon that makes its operation possible: quantum-mechanical tunneling.

As with transistors, it depends on the transfer of an electrical charge across a p-n junction. This is the region between a p-type semiconductor, which has an excess of positive carriers or "holes" (empty electron states), and an n-type, which has an excess of free electrons.

The opposite sides of this junction take on a charge which resists the movement of the "holes" and electrons across it. In the transistor, a charge carrier must be emitted into a region where its energy can be boosted by an outside voltage. It is then collected on an output electrode. The speed of this process is limited by the time it takes the charge carrier—having left the emitter—to traverse the control region and appear on the collector. This time limits the frequency at which the device can function and is quite long compared to, say, the time needed for a signal to travel an equivalent distance along a copper wire. The reason: in the wire, each electron moves only a microscopic distance, and those coming out the other end aren't the same ones that went in as a signal.

The quantum-mechanical theory says there is another way in which the particles can pass the barrier: an electron has a small, but definite, probability of disappearing from one side of the potential barrier and re-appearing simultaneously on the other—even though it does not have enough energy to surmount the barrier. It is as though the particles "tunnel" under the barrier, setting up almost instantaneous surges of current. Thus, in the tunnel diode, the signal moves with the same speed as it would in a copper wire—the speed of light.

The construction of the amazing device gives it some other interesting characteristics.

Its p-n junction is made of materials more heavily loaded—or doped—with impurities than conventional diodes (semiconductor materials are doped to form either p-types or n-types), and made so that the barrier between p and n sections is extremely thin, less than a millionth of an inch thick.

So long as no outside voltage is applied across the p-n junction, there is no net current—since the electrons tunnel back and forth easily through the barrier in both directions. Apply a small voltage, however, and current appears. Add still more voltage, and current *decreases*. Add more, and current increases again.

In the range where an increase in voltage results in a fall-off of current, the tunnel diode is said to have "negative" resistance—making it suited for use as an amplifier or oscillator.

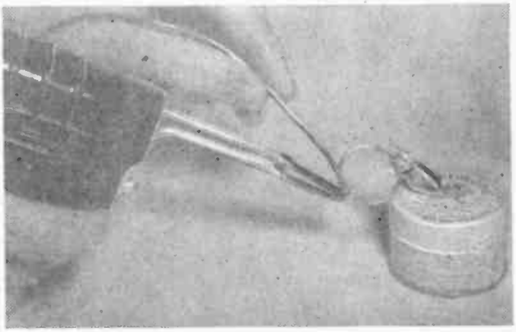
This negative resistance quality, combined with speed-of-light operation, makes possible a very high frequency response. Oscillation frequencies higher than 2000 megacycles have already been obtained—matching advanced transistor performance—and engineers confidently expect frequencies of more than 10,000 megacycles in the near future.

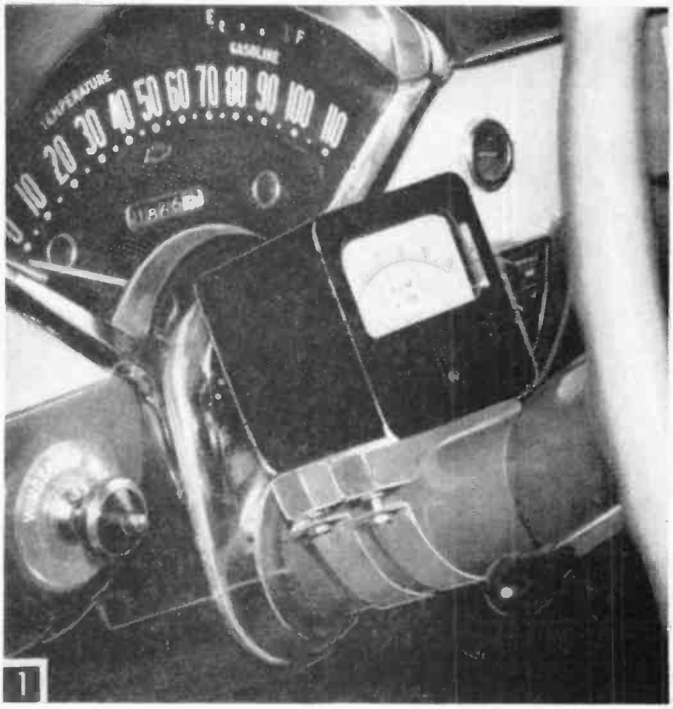
Some other outstanding features:

- It is smaller than a transistor and, because of its simplicity, ultimately will be just a fraction of its present size.
- It is affected very little by environment. The tunnel diode can operate at the near-absolute zero temperature of liquid helium or—at the other end of the thermometer—at temperatures up to 650°F, while conventional silicon diodes won't operate above 400°F.
- It has a low noise level, only parametric amplifiers and masers competing closely with it. And of these, only the tunnel diode can operate directly from a battery.
- Because it is less dependent on the structural perfection of its crystal than is the transistor, the tunnel diode is less affected by the damage that nuclear radiation can do to such crystal structures.

Soldering Flux Can Carries Vise

- Attach a test-clip to the lid of a can of soldering flux to use as a handy vise for holding small parts while applying solder. Enlarge hole in clip slightly with a drill and attach to can with a small self-tapping metal screw.—John A. Comstock.





1

Less bulky than conventional units, complete tachometer clamps to steering column for handy visibility. Instrument can also be installed on dash or used as portable test device.

Electronic Tachometer

Dependable transistor circuit counts ignition pulses. Readings indicate proper speeds for operating and tuneup of cars, outboards, truck, marine and stationary engines

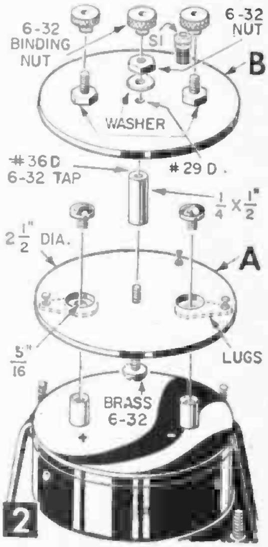
By JAMES E. PUGH JR.

THE Speed of an engine is the key to its performance. A standard item on the dash panels of many sports cars, the "tach" makes it possible to select the best engine speeds for gas economy. Also it advises the driver when the engine is turning over at just the right speed for shifting—thus cutting down unnecessary clutch and transmission gear wear. And it is essential in making proper carburetor and distributor tune-up adjustments in the garage.

This tachometer is designed to operate on either 6 or 12 volt ignition systems, positive or negative ground. Provided that you change one part, which depends on the number of cylinders, you can use this tachometer on any kind of engine from a "one lung" 2 stroke outboard motor up to an 8 cylinder 4 stroke engine. The photo shows the dial calibrated 0-5000, which is sufficient for most purposes, but it can also be arranged to read the range, 0-10,000 rpm. With an accessory switch, it can even be used to measure the speeds of rotating shafts in appliances and power tools. And unlike conventional tachometers which are bulky and difficult to install, it is compact, and hooks up without costly special cables and switch assemblies. Cost for all parts should be under $25.

Construction. The meter, M1, shown in Fig. 1, is inexpensive, but has an accurate 50 microampere movement. With the attached circuitry the entire assembly extends only 2⅜ in. deep behind the panel. Begin construction by cutting Discs A and B (Fig. 2), of 3/32-in. sheet bakelite with either a jig saw or circle cutter. If you use a circle cutter, drill the center hole for a #6 screw, and reverse the cutter blade so that the cutting edge is inside. Rotate the cutter counterclockwise, and work through from both sides of the bakelite sheet to obtain neat discs. Make the spacer, C, from a piece of ¼-in. brass bar stock, and thread it through with a 6-32 tap.

Parts layout is not critical, but it is necessary to be careful to avoid crowding the wiring in some spots. Cut out the two templates (Fig. 3), and fasten them to the bakelite sheets with tape or rubber cement. Turret type terminal lugs can be used for easier and neater construction, however if you prefer, you may choose to use 4-40 machine screws instead. Either way, drill the holes carefully for a tight fit. Fasten solder lugs to the bottom of disc A for mounting and making connections to the meter. Drill two 5/16-in. holes in this disc for the meter terminal screws. A 6-32 screw fastens disc A to the threaded spacer later and also connects the positive solder lug at the center (Fig. 8), and thus brings the positive terminal through to the back of disc B.



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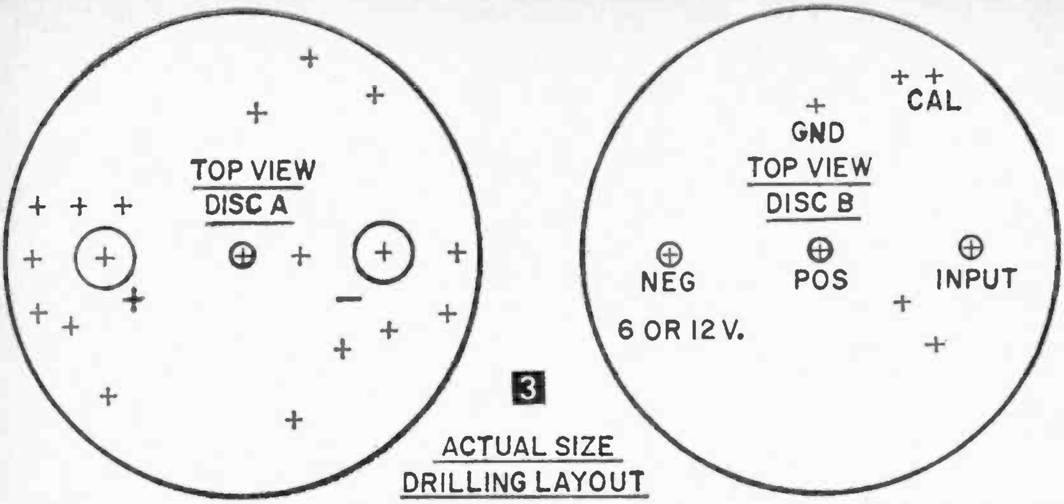


3

ACTUAL SIZE DRILLING LAYOUT

Use a 4-40 screw for the calibration switch S1 (Fig. 3). When all parts are assembled, this switch operates by turning the screw in and out of its threaded hole in Disc B, and it contacts the C4-V1 terminal.

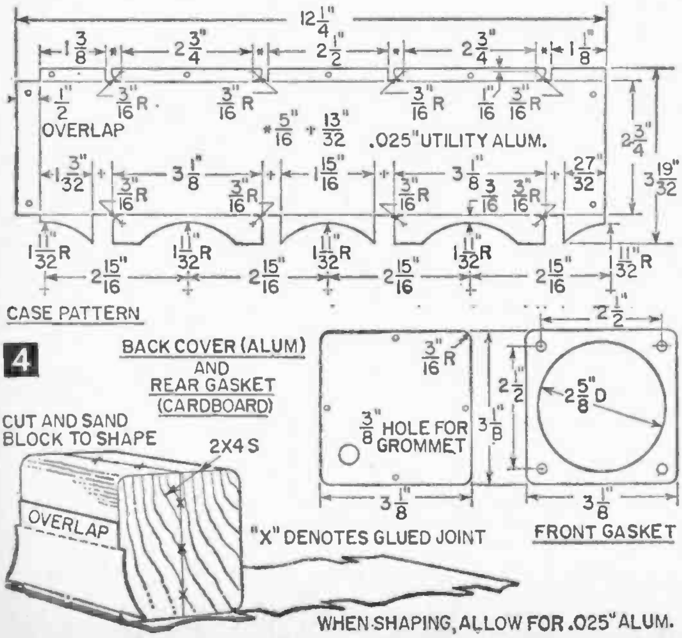
Mount potentiometer R7 with its adjustment screw near the disc edge for ease of adjustment. Note that the wiring will be connected to terminals 1 and 2 on this control, so that clockwise adjustment of the screw will increase reading.

Making the Case. The case and brackets (Fig. 5), are made of utility sheet aluminum, with the corners rounded by means of a wooden forming block. Make the block as in Fig. 4 from two pieces of 2 x 4 glued together. Cut the sheet metal to size, and notch out the slots. Clamp the bottom portion to the block, and use a rubber hammer, or soft wood block to shape the metal around the form. Bend over the end tabs, and drill the four holes to fit the meter mounting screws. Make the two dust gaskets of cardboard or sheet rubber, and use sheet metal screws to fasten the two halves of the bottom together. Drill the holes for fastening the rear cover to fit sheet metal screws, and install the grommet.

Saw and sand the curve on the two wood blocks, Fig. 5, to fit the diameter of the steering post of your car, and shape the two mounting straps to fit. Fasten to car steering post with four 6-32 x 1¼-in. *rh* machine screws as in Fig. 1.

Wiring. Since the tachometer is designed to operate on any kind of engine, and can also be set up for various speeds you may want later to change part C4, the capacitor which determines the range of the instrument. Select the value of C4, which corresponds to your engine (Table A), and connect it to the D2-D3 feedthrough terminal with a fine wire link, as in Fig. 8. This will reduce the danger of damaging the diodes when soldering C4. Similar links are used at the D2D4 to meter plus, and D3D5 to meter minus connections. Another very important precaution is to hold the terminal wires of the diodes, the transistor, and capacitor C3 with long nosed pliers, between the part and the solder point, to avoid damage from overheating.

How It Works. This tachometer circuit consists of three main sections; a low pass filter, a clipper and pulse amplifier, and a counting circuit. A low voltage pulse is picked up at the distributor breaker points (see Figs. 9 and 10 for connections to engine) and is fed to the input of the low pass filter circuit, as shown on the schematic. This resistance-capacitance filter circuit is de-



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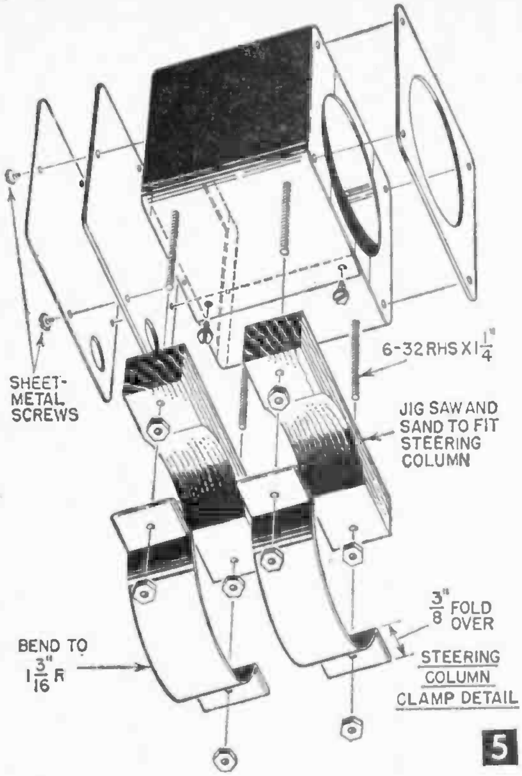
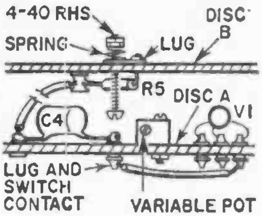


STEERING COLUMN CLAMP DETAIL

5



CALIBRATION SWITCH (SI) 6

signed to pass the maximum number of pulses from an 8-cylinder engine operating at 10,000 rpm. Frequencies above this range and other "hash" elements are eliminated by the filter, to eliminate the possibility of error in the meter readings.

Then the output of the filter circuit is fed to transistor V1, where the wave shape is clipped and shaped into a square pulse, and amplified. The Zener diode, (D1) is next in the circuit lineup, and it keeps the pulses at a constant level, regardless of changes in battery voltage. It makes it possible to use the tachometer on either 6 or 12 volt systems, without changing any parts, and with only a minor calibration adjustment.

TABLE A. Calibration data for tachometer using 0-50 meter scale. 5000 rpm at full scale reading.

Number of cylinders		Pulses		
2-stroke	4-stroke	per second	60 cps calibration	optimum C4
	1	41.7	36+	.20 uf.
1	2	83.3	36	.10 uf.
2	4	166.7	18	.068 uf.
	6	250	12	.04 uf.
4	8	333	9	.03 uf.

+ at 30 cps

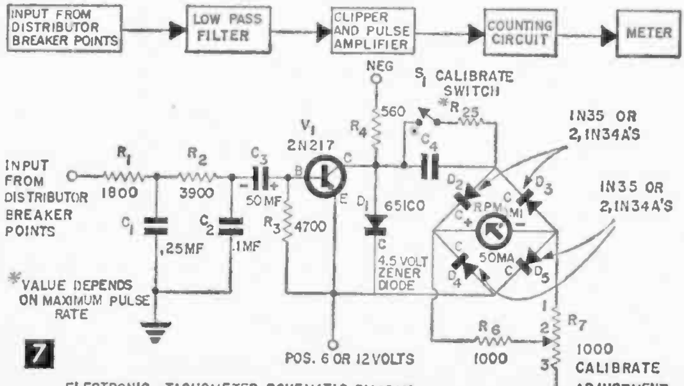
Next in the counting circuit, the capacitor C4 with the resistive part of the rectifier and meter circuit, convert the square pulses into negative and positive spikes. The electronic enthusiast may enjoy observing these wave shapes on an oscilloscope.

Finally, the diodes D2, D3, D4 and D5, wired as a full wave bridge rectifier, change all the spikes to one polarity to produce a meter current that is directly proportional to the number of pulses coming from the engine.

Calibration. When you have finished the wiring of your tachometer, connect the flexible ground link to correspond to whether your car is wired negative (Fig. 9), or positive ground (Fig. 10). Connect the tachometer to the car battery, or to one of corresponding voltage. Next, connect an audio signal generator to the tachometer ground and input terminals, and set it to 60 cycles per second (or to 30 cps for a 1 cylinder 4 stroke engine).

Adjust potentiometer R7 to give the meter reading listed in Table A for your kind of engine. Note that if you set the audio signal generator to multiples of 60 cps, the meter reading will increase proportionately, for example for calibrating a 6-cylinder 4-stroke engine, the reading at 60 cps will be 12; at 120 cps it will be 24; at 180 cps, 36, etc.

If you have no signal generator, you may be able to borrow one from a radio ham, or use one at a radio service shop. Otherwise you can calibrate without it, by using the output from a 6 or 12 volt filament transformer. Connect the transformer to the tachometer ground and input terminals, and adjust the meter reading, by means of trimmer pot R7, to the desired point as listed in Table A.



7 ELECTRONIC TACHOMETER SCHEMATIC DIAGRAM

MATERIALS LIST—ELECTRONIC TACHOMETER

M1	0-50 DC Microammeter (Lafayette Radio Co., 165 Liberty Ave., Jamaica 33, N. Y. Cat. #TM-70)
D1	4.5 volt voltage regulator Zener Diode (Texas Instrument 651 C0)
D2, D3, D4, D5	Two IN35 diodes (paired type) or four IN34A single diodes Sylvania crystal diodes
V1	2N217 Transistor, RCA

CAPACITORS

C1	.25 mfd. 200 volt metallized-paper tubular capacitor, Aerovox P 82Z
C2	.1 mfd. 200 volt metallized-paper tubular capacitor, Aerovox P 82Z
C3	50 mfd. 25-volt ultra miniature electrolytic capacitor, Barco P25-50 (Lafayette Radio)
C4	100 volt capacitor Elmenco tubular, Type DP (See table A for value)

RESISTORS

R1	1800 ohm ½ watt 10% Carbon resistor
R2	3900 ohm ½ watt 10% Carbon resistor
R3	4700 ohm ½ watt 10% Carbon resistor
R4	560 ohm ½ watt 10% Carbon resistor
R5	See Table A ½ watt 10% Carbon resistor
R6	1000 ohm ½ watt 10% Carbon resistor
R7	1000 ohm miniature trimmer potentiometer Bourns Wire-wound Trimit 273

HARDWARE

1	Threaded bushing, ¼ inch x ½ - 6-32
1 dz. ea.	Turret terminals, Keystone Electronics Corp. Type 1532 single end; Type 1522 double end (Allied Radio)

MISCELLANEOUS

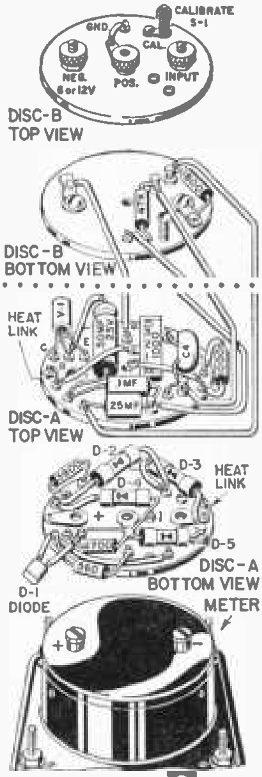
terminals, screws, nuts, decals, plastic spray, or varnish, 3/16 soft aluminum sheet metal

Next, disconnect the signal generator, close S1, and select a resistor for R5 that will give a convenient reading near the top of the scale. The value of this resistor, will of course, vary for different tachometers. In the one illustrated in this article, a 47,000 *ohm* resistor gives a reading of 48. Solder the resistor in place and write the meter reading, with S1 switch closed, on a small piece of white tape. By means of this switch, you can easily check the calibration after the tachometer is installed, simply by closing the switch (with the ignition on, but engine off).

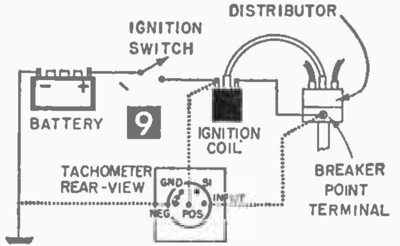
Table A lists the pulses per second that are obtained from various engines at 5,000. To calibrate your tachometer to read 0 to 10,000 maximum, simply double the PPS value, and divide the C4 value and 60 cycle calibration point by two. The formula for calibrating the tachometer for use on any engine is: $PPS = \frac{C \times R}{60 \times N}$, in which PPS is the number of pulses per second; C is the number of cylinders, R is the revolutions per minute, and N is the number of revolutions per each cylinder firing.

The value of N will be 1 for a 2 stroke cycle, and 2 for a 4-stroke cycle engine.

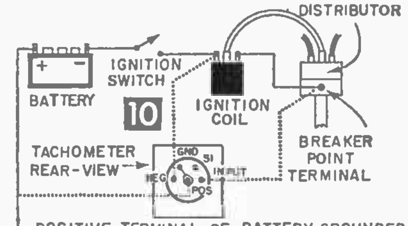
The stability of the tachometer circuit is excellent, and your meter readings should be linear with .5% at 70° F.



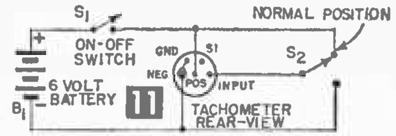
PICTORIAL 8



NEGATIVE TERMINAL OF BATTERY GROUNDED



POSITIVE TERMINAL OF BATTERY GROUNDED



CONNECTION FOR MOTORS, DRILL PRESSES, LATHES, ETC. WHERE PULSE IS SUPPLIED BY SHAFT-ACTUATED SWITCH.

Installation. Use small diameter test prod wires for connecting to the engine, and be sure to follow the following precautions to avoid damaging the meter and transistor:

1. Make sure that the flexible ground link is connected to the *correct ground position* for your car, as shown in Figs. 9 or 10.
2. Be sure that the tachometer terminals are connected to the *correct* battery terminals, with the "hot" tachometer terminal connected to the coil side of the ignition switch.
3. *Never start the engine with the calibrate switch (S1) on.*

Using Your Tachometer. The tachometer, installed on your car, will not only add to driving pleasure, but will save you money as well. For example, gas consumption is higher at both low and high rpm, therefore, shift and drive with the engine operating in the middle range as much as possible for maximum gas mileage.

When piston speed exceeds 2500 feet per minute, ring and cylinder wear go up fast. Calculate the engine speed, at which the piston speed is about 2500 fpm, and use your tachometer as a reminder to operate below this range, to minimize wear.

Best gear shifting is obtained when the teeth of the driving and driven transmission gears are moving at about the same speed. Synchromesh transmissions in standard cars reduce some of the strain when the speeds are unequal, but with your tachometer you can practically eliminate this wear. And on trucks etc., which have no synchromesh, the tach is even more useful. Driving and driven gear speeds can easily be calculated. Synchronize your gears, simply by adjusting your motor speed to the best speed while in neutral and then shift.

If you own a sports car, or one of the smaller foreign cars, never start, pull a heavy load, or travel uphill at low rpm. To do so causes heavy wear on the connecting rod and main bearings. The tachometer will remind the driver to avoid such abuse. Since maximum torque is developed over a narrow band of engine speeds, the tachometer will help you to select the best rpm for fast passing and pulling heavy loads.

Tuneup With Tachometer. To adjust your carburetor, set the low speed adjustment (air to gas ratio) for maximum tachometer reading at idle speed. Then set the idle adjustment to the recommended value, usually between 400 and 600 rpm. Adjust your distributor setting for maximum rpm, and then back it off slightly to compensate for the grade of gas being used. It should be adjusted for highest rpm without ping. Generally, the adjustment that yields the highest rpm gives the highest economy, power and speed.

Checking Tool Speeds. You can use the tool to measure speeds in checking performance and servicing of electric motors, drill presses, etc. Often, the rpm especially of metal working machines, is the guide to selecting or grinding tools that will cut at the proper rate of feed. Figure 11 shows the circuit needed to hook up your tachometer, with a switch to supply the pulses, and a dry cell battery. An old distributor will work fine as a switch, or you can use a snap action leaf switch, equipped with a roller. Make a cam for the shaft, or simply file a flat spot, and use a 6 volt dry cell, or low voltage rectifier for a power supply.

Using the switch as in Fig. 11, will result in the same readings as for a 1 cylinder, 2 stroke engine, since one pulse will be obtained for each revolution.

It should be noted that if you install an ordinary contact switch, as in Fig. 11, for continuous service on a rotating machine, that the life of the switch will be limited. Many makes of roller, leaf and snap switches are available; however, Switch #11-104, offered by Licon Division of Illinois Tool Works, will operate for many hours at up to 3500 rpm, and is available through distributors.

Compass Making

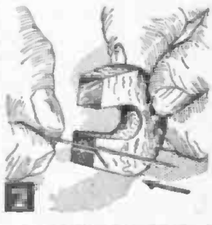
A MAGNETIZED sewing needle, a cork or round wood disc and a small bowl of water form this simple magnetic compass.

Take a fair-sized steel sewing needle and magnetize it by stroking it along its length with the South pole of a small permanent magnet, either horseshoe or bar type as in Fig. 2. You use the South pole of the magnet because a piece receiving induced magnetism from contact with a permanent magnet will assume the opposite polarity when separated. Thus a South pole will leave a North pole at the point of the needle and this end will point towards the North, provided that you end your magnet-rubbing strokes in the direction of the point.

Some permanent magnets are marked N and S for identification. If not, use an ordinary pocket compass to test it; the end which attracts the North pole of the pocket compass will be the South pole of the magnet (unlike poles attract), and you can mark this end with an S.

The float for the needle is a ⅜ in. long piece cut off from a hardwood ¾ in. diameter dowel. For the water container, use a small plastic, glass or china dish or saucer. Do *not* use metal. After magnetizing the sewing needle, place it on the float and melt a drop of wax over it in the approximate center.


1


2

Checking the complete magnetic compass with a standard pocket compass (Fig. 1) shows that the needle is pointing due North. The closer you move the two compasses together, the more you will notice a slight interference between the two magnetized needles. Of course, compasses should be kept away from any iron or steel objects which might cause stray magnetic fields and result in an error.

You can arrange a cardboard ring on the top of the dish with N, S, E and W markings.—H.P.S.

Voltmeter accuracy may be checked within reason by dry cell giving 1.5 volt readings.

Repair That Old Meter!

Simple repairs on meters can easily be made by the home craftsman in his own workshop

By J. B. DEVEREAUX

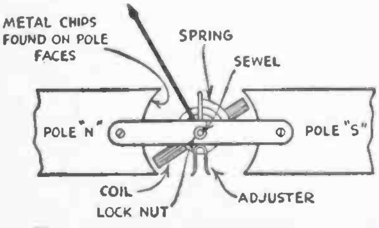
BECAUSE of the delicacy of such instruments, many home shop mechanics, electrical and radio experimenters hesitate to attempt repairs of any sort on electric meters. Such timidity is perhaps justified in many cases where major repairs are required and where extensive dismantling would impose problems that would finally wind up in brushing the parts off the bench and into the waste can.

On the other hand, there are many simple ailments that can be remedied with a little patience and care and many otherwise good meters may often be restored to serviceable condition with a half-hour's tinkering. We are here dealing only with moving coil meters inasmuch as they are by far the most common type in use today for direct current. For A.C. we have the moving iron meter which is also relatively simple and can be easily repaired in many instances. Where major damage has been done, and this is evident by examination, then the owner of the meter had best give up the job or send the meter back to its maker for rehabilitation.

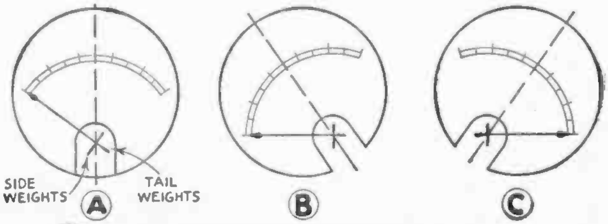
Use only very small screw drivers in taking meter out of case.

The simple ailments that may be cured at home are frictional retardation, bad balance, overthrow and sticky needles. All other troubles are usually hopelessly beyond home tinkering without the knowledge of design and the special assembly tools and skill available to the manufacturer of the meter only.

The meter that requires tapping with the fingers to bring full reading has frictional trouble of some sort. The needles of such meters move to a certain point depending upon the current and there they stop. Thereafter if agitated by tapping, the needle will move forward for another scale unit or two. Such meters are usually troubled with dull



① VITAL PARTS OF MOVING COIL VOLT METERS AND AMMETERS



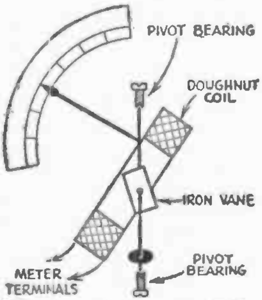
② HOW TO BALANCE METER POINTER

pivots, cracked jewels, dirty points or lint. Cracked jewels may result from dropping or other rough handling and the manufacturer only can remedy such ailments. That also goes for dull pivots. Lint may be removed by the aid of a toothpick or a piece of sharp-pointed wood smeared with a bit of light adhesive material. One must be careful, however, to see that the wood is clean and that he does not deposit more in the meter than is carried away.

Workers on meters of any kind must provide a scrupulously clean bench covered with a piece of glazed cardboard. This should be wiped clean with a moist cloth before the meter case is opened. Linty clothes on the worker should also be avoided, it being best to roll up the sleeves. Such precautions may sound a bit silly to amateurs until it is recalled that the barest piece of foreign matter in a milliammeter or milli-volt meter can produce readings inaccurate by as much as 50%.

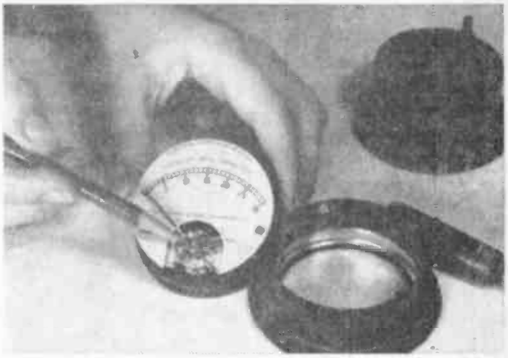
The meter should be uncased using the right sized miniature screw driver so that the screw slots will not be ruined. If a shunt is present, it should be left soldered in place. Removal may interfere with readings. Should the repairman find that the moving coil has been burned out by heavy current, he will know that so far as the home repair is concerned, the meter is beyond recall. The same holds true if the pivots are found to be dull. Special machinery would be required to sharpen them and a manufacturer would prefer to replace them with new ones. If the coil, spring, pivots and jewels appear sound then the meter is simply troubled with friction.

Should an examination under a magnifier reveal lint, then the stick moistened with the light adhesive may be tried. Inasmuch as these meters have powerful magnets, they often accumulate bits of iron or steel and these often introduce frictional factors. Their removal may usually be effected with the sharpened end of a paper clip. One must make sure, however, that all metal filings are removed from the end of the paper clip wire before it is introduced into the meter to pry off any metal chips that may already be there adhered to the magnet. Great care should be exercised in the use of this simple tool to make sure that one does not touch the coil of the sensitive spring.

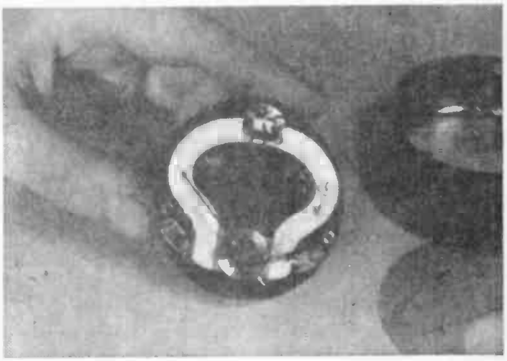


③ MOVING IRON TYPE INCLINED COIL AMMETER

If the pointer is found to be touching the dial, often the case with rough usage or dropping, then the pointer may be straightened with a small pair of tweezers but here a very steady hand will be required.



Pointing to pivot bearings, which, if broken, makes factory repair imperative.



An ammeter removed from case.

Oftentimes, especially in the case of the cheaper meters, frictional losses are introduced by tight pivots. In such a case, the jewel screw may be given a half turn or so.

The meter is given a final examination before being replaced in the case. One watches especially for a hair which may have dropped in. With a really sensitive meter, this is like introducing a telegraph pole into the works.

An unbalanced meter is brought into balance by means of the simple steps, 1, 2, and 3 shown in drawing number 2. First the pointer or needle is set on zero by means of the zero adjustment screw while the meter is held in a normal or horizontal position. Then the position of the meter is shifted to that shown at B. The tail weight is then adjusted until meter pointer rests on zero. The side weight is then adjusted until pointer is on zero while holding meter in vertical position. This operation is a very delicate one and the meter may be very easily damaged, especially the pointer, if a steady hand is not used. Overthrow is often due to a bent pointer, that is, bent to the right. Sometimes in the cheaper meters a flexible tail weight is used and this must be bent one way or another to restore balance. Daubs of shellac are used at times.

Old meters that have been used near heavy transformers will usually have badly weakened magnets and these are always factors in inaccuracy. The only hope here is for re-magnetization or replacement with a new magnet.

A.C. meters with moving iron are treated in much the same manner. In the case of a vane moving in a close fitting chamber, lint or tiny particles of iron may cause great trouble, making the meter practically useless at times.

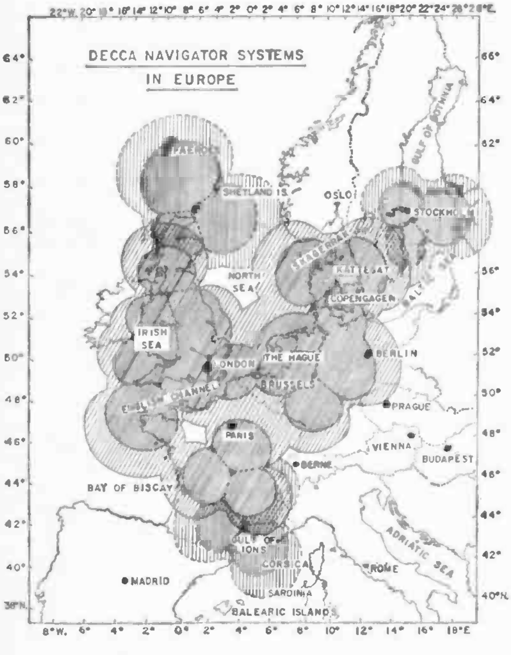
With such meters, the soft iron vane should not be bent since all meters of this type depend upon proper relationship here for accuracy. Any change in the position of the coil around the vanes will also result in inaccuracy.

The accuracy of small meters runs plus or minus 2% of the full scale deflection. In the case of a small voltmeter of a few volts range, simple tests for ordinary accuracy may be run by connecting to two or more (depending upon voltage of meter) new dry cells in series, each cell adding 1½ volts. A potentiometer may also be used so that the pointer of the meter may be run up and down the scale.

A multimeter such as is used by radio repairmen may be used to calibrate such meters inasmuch as extreme accuracy can never be had with inexpensive instruments. The multimeter type of check will be quite sufficient. If the repairman does not have such an instrument then he may be asked for assistance. Calibration may be only a matter of a few minutes. In such cases, the multimeter is used with a potentiometer, the former serving as the standard for determining the calibration.

Why Wait *For Air Safety?*

By
C. M. STANBURY



IS THE U. S. doing anything to improve air safety? Is Washington taking steps to alleviate air traffic congestion? Yes. If you've read any of the magazines in the radio field, you're already familiar with numerous research projects in this field, including radar which, in the future, could increase the effective air space as much as 60 times.

But why wait when the world already has a well established navigational system, a system which in many ways is more effective than even the most advanced radar? This system is DECCA.

DECCA vs. Radar. In the future radar could increase effective air space 60 times. It would do this by dividing the present 10-mile-wide airway in three, cutting the required vertical separation in half, and reducing the distance between high speed aircraft flying the same course from 100 to 10 miles. It *could* do all this in the *future*.

DECCA cuts the width of the airlane by only half; vertical separation remains unchanged. But separation between aircraft flying the same course is, within 60 miles of the terminal, cut to a mere *two* miles. The effective airspace is multiplied 100 times. As the distance increases from the terminal, the Master DECCA station and the congested area around them, the system gradually becomes less effective. But at the same time, the air traffic density and danger of air collisions is also diminished.

So DECCA is usually as accurate as radar will be. More important, DECCA is ready now. It has done all these things in Europe for several years and is now doing them in Eastern Canada which is the western terminus for all major North Atlantic routes.

VOR and DME Systems. The Federal Aviation Agency is not, of course, sitting on its hands waiting for this advanced radar to become operational. The FAA is spending millions of dollars for the construction of these comparatively new VHF and UHF navigation devices. A VOR (VHF Omni Range) automatically indicates the aircraft's bearing in relation to the VOR station. It is accurate to within 4 degrees. DME measures the distance from the plane to the facility. A system such as VORTAC which combines VOR and DME, can indicate for the aircraft its position so long as it is within range. Sounds like a match for DECCA, but let's look beneath the surface.

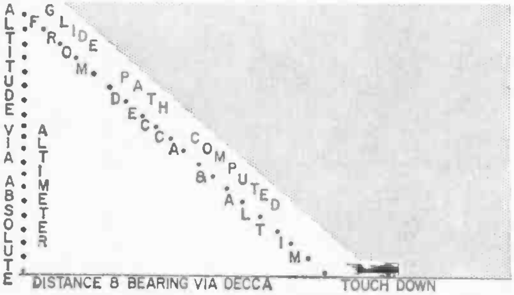
At a distance of 30 miles, VORTAC has a potential accuracy of 1 mile which would permit a minimum separation between aircraft of 2 miles. That's just what DECCA has already obtained at twice that distance. Further we haven't told you about DECCA's potential accuracy, 10 *yards* within 50 miles.

ICAO Turns Its Back on DECCA

At a special meeting in Montreal, the International Civil Aviation Organization voted to adopt DME as a standard short range navigational aid to go along with VOR. The action, spearheaded by the FAA, was bitterly opposed by Great Britain, Canada (previously neutral) and Australia. After the resolution had been pushed through, the head of the British delegation indicated that his country would continue to use and develop DECCA. He elaborated: "Our belief is that the need for a high accuracy, hyperbolic system will arise much more quickly than many here today believe. Before long we will have to get together and adopt such a system." But probably the most telling objection was that of Australia, which has used DME since the war: On the basis of their unequaled length of experience, they concluded that DME, especially DME allied with VOR, could *not* meet the needs of the jet age. Time will tell who is right.

However, let's be generous and assume both systems to be equally accurate. DECCA can serve any number of aircraft simultaneously, DME only 50. When this number is exceeded, the system automatically accepts the 50 strongest and rejects the rest. How would you like to be riding in the 51st?

Worst of all, VOR and DME systems, because they utilize VHF and UHF frequencies, are limited to line-of-sight reception. DECCA is not. Nor for practical aeronautical purposes is DECCA affected by natural barriers such as hills or mountains. The new U. S. system is. In one month in 1958, some 40 VOR/DME navigation facilities were either inoperative, partially out of order, or in some way operating imperfectly. And this figure does not include those being relocated or reconstructed. What hope has this system in such mountainous regions as the Rockies or the Alleghenies?



A control system incorporating DECCA—RAILS (Remote Area Instrument Landing System). Although the accuracy of this system is still being evaluated, chances are good it will enhance DECCA's overall superiority. At present it's only commercial use is in conjunction with the Bell helicopter service in the Dallas-Fort Worth area.

The Handwriting on the Sky. I have no desire to sell radar short. The radar of today, although it does not equal DECCA as a navigational aid, is already an important navigational device. In the future it will be on a par with DECCA. Most probably, they will complement each other. Radar, under those circumstances, would be an airborne system providing data on other nearby aircraft. DECCA would act as the overall, stable ground-based system. They would continually provide a cross-check on each other.

But why wait? Why fool around with VOR and DME which, considering DECCA's obvious superiority, are no better than interim measures when no interim measures are necessary. DECCA is here now.

Every moment wasted on VOR and DME systems, when the U. S. should be building DECCA chains, costs us money and lives. In 1958 the *Electra* disaster brought this out with sickening emphasis. LaGuardia Field is equipped with the newest VOR/DME system—VORTAC—but Flight 320 still wound up in the East River. Nor was tracking via radar enough.

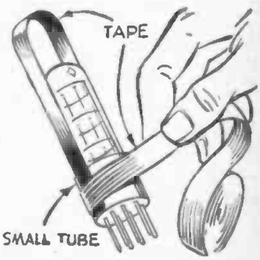
Speaking conservatively, if there'd been DECCA it might not have happened. The American manufacturer of DECCA, Bendix Aviation, has developed RAILS (Remote Area Instrument Landing System) which can be used where conventional ILS is inadequate. By combining DECCA, the aircraft's own absolute altimeter and a computer, the pilot is furnished with glide path guidance, distance to touch down and ground speed.

Maybe Flight 320 was destined to miss the runway and no amount of technology could have saved her. But DECCA could have made her chances for survival better, while VORTAC was powerless. And there'll be more 320's. How many? That depends upon how much time we waste with VOR/DME, how long we ignore DECCA.

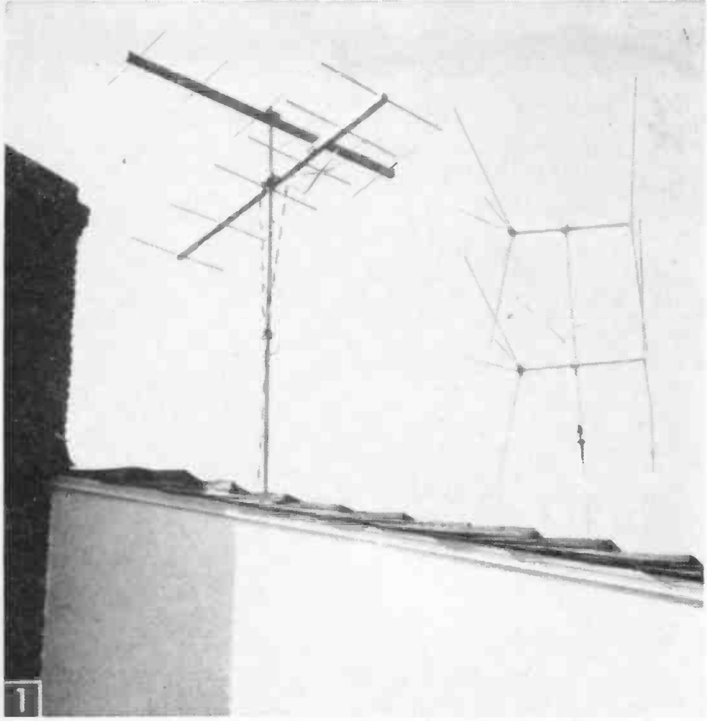
How DECCA Works

A DECCA chain normally consists of 4 stations, a master and 3 slave stations designated red, green and purple. By measuring the phase difference between radio waves from the master station and any two of the slaves, a navigation fix is obtained and automatically plotted on a gridded chart. Because it utilizes lightweight receiving equipment and is extremely simple to operate, DECCA is suited to all types of aircraft, big or small, commercial or private.

Tape Tube Handle



• Pulling miniature and sub-miniature tubes from their sockets in crowded electronics hookups will be much easier if you provide each tube with a handle. Use a strip of masking or *Mystik* tape looped over the top of the tube and secured around the bottom with another strip of tape. Don't use tape on tubes that heat up excessively, because of the possible danger of fire due to tape igniting. *Never* use plastic tape for this purpose as it ignites easily.—J. A. Comstock.



Completed aerials are turned toward their respective transmitters. These aerials could have been mounted on the same pole as the commercial aerial in the background.

Custom-Build Your TV and FM Aerials

By R. W. MONTAGUE

ESPECIALLY tailored to receive tough-to-get channels, one or several of these antennas, cut for the needed channels, can be stacked on your present television mast or mounted in your attic, if you have a non-metallic roof.

When carefully directed toward the desired TV or FM station transmitter, these Yagi, high-gain type aerials will give the best single (or dual) channel reception possible with any conventional antenna and are especially useful in the so-called dead or fringe areas. Though usually used to fill in the weak spots in commercial "all-channel" aerials, these antennas may be used alone or in stacks.

First, calculate the materials needed and the dimensions of the components from the information given in Fig. 2 and Tables A (for TV aerials) and B (for FM aerials).

While there are six cross pieces called for in construction of the aerials in the tables, as many as 10 could be used to improve signal strength. For extreme fringe areas, try adding two to four more directors, cut to the same length and spaced the same distance as the last director (L_6) in the table. If two close TV channels are available locally (other than 6 and 7, since the FM band lies between these channels), an aerial cut for one of these channels usually will work well for the other. One of these aerials, successfully bringing in channels 7 and 9, was dimensioned for TV channel 8, unused in the Seattle area where the antenna is located.

It will be noted from Table A that aerials for channels 2, 3 and 4 would be quite large, and it may be that another type of aerial might be more

TABLE A—TV AERIALS

Band	Channel	Spacing Between Cross Pieces S_1	S_2	S_3	S_4	S_5	Total Spar Length	Length of Cross Pieces L_1	L_2	L_3	L_4	L_5	L_6
		(Inches)					S+4"	(Inches)					
Low VHF Band (54 to 88 mc)	2	41 11/16	46 19/32	38 29/32	56 13/32	55 13/32	243 1/8	96 5/32	87 1/2	83 19/32	83 19/32	81 19/32	80 23/32
	3	37 13/16	42 7/32	35 3/16	51	50	220 7/32	87	79	75 1/2	75 1/2	73 13/16	73
	4	34 1/2	38 1/2	32 3/32	46 1/2	45 13/16	201 13/32	79 1/2	72 1/4	69	69	67 13/32	66 19/32
	5	30 7/32	33 23/32	28 3/32	40 23/32	40	178 3/4	69 1/2	63 7/32	60 13/32	60 13/32	59	58 1/4
	6	28	31 5/16	26 1/16	37 13/16	37 1/32	164 9/32	64 1/2	58 19/32	56	56	54 23/32	54
High VHF Band (174 to 216 mc)	7	13 15/32	15 1/16	12 17/32	18 3/16	17 13/16	81 1/16	31	28 7/32	26 29/32	26 29/32	26 5/16	26
	8	13	14 1/2	12 3/32	17 17/32	17 7/32	78 11/32	29 29/32	27 7/32	26	26	25 13/32	25 3/32
	9	12 19/32	14 3/32	11 23/32	17	16 23/32	76 1/8	29	26 13/32	25 7/32	25 7/32	24 19/32	24 11/32
	10	12 7/32	13 21/32	11 1/8	16 1/2	16 7/32	73 31/32	28 5/32	25 19/32	24 11/32	24 11/32	23 29/32	23 19/32
	11	11 27/32	13 7/32	11	16	15 23/32	71 25/32	27 5/16	24 13/16	23 23/32	23 23/32	23 7/32	22 29/32
	12	11 1/2	12 27/32	10 23/32	15 1/2	15 1/4	69 11/16	26 1/2	24 3/32	23	23	22 1/2	22 7/32
	13	11 3/16	12 15/16	10 13/32	15 3/32	14 13/16	67 31/32	25 23/32	23 13/32	22 13/32	22 23/32	21 13/16	21 19/32
Partial UHF Band	14	5 1/32	6 5/8	4 11/16	6 25/32	6 1/16	32 13/16	11 19/32	10 9/16	10 1/16	10 1/16	9 27/32	9 23/32
	15	4 31/32	5 9/16	4 5/8	6 1/16	6 19/32	32 7/16	11 7/16	10 13/32	9 15/16	9 15/16	9 23/32	9 19/32
	16	4 15/16	5 1/2	4 19/32	6 21/32	6 17/32	32 7/32	11 5/16	10 5/16	9 27/32	9 27/32	9 5/8	9 1/2

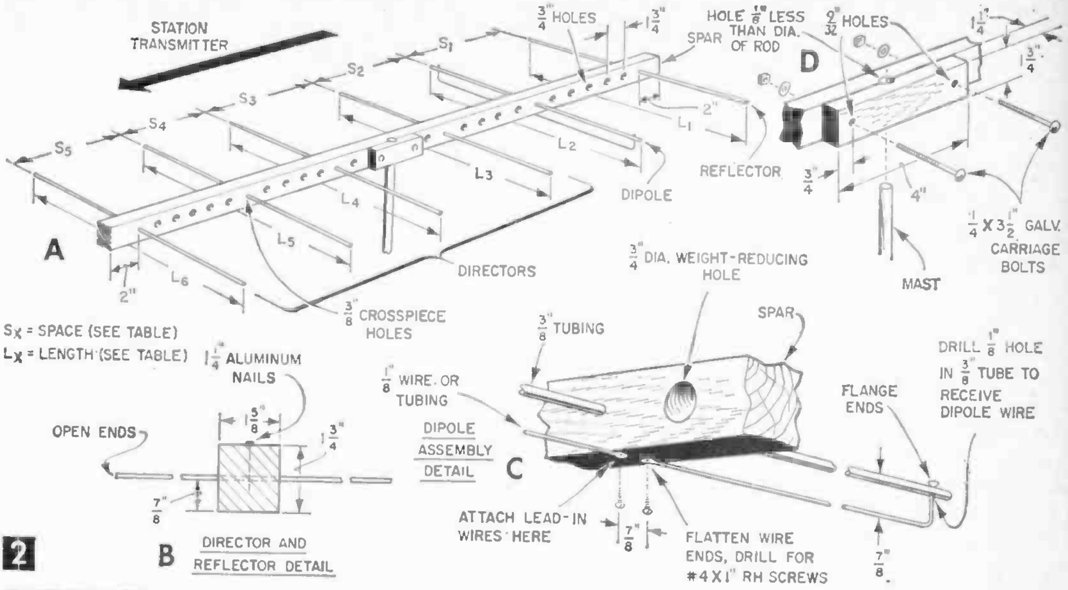


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TABLE B—FM AERIALS

Calculate FM aerial dimensions as follows:

1. Learn the frequency of the particular FM station desired.
2. Calculate wave length in in. (W_L), using the following formula:

$$W_L = \frac{11{,}070}{\text{frequency (mc)}}$$

3. Prepare a table for the aerial desired, similar to those in TV aerial Table A:

S_1	S_2	S_3	S_4	S_5	L_1	L_2	L_3	L_4	L_5	L_6
$.215W_L$	$.240W_L$	$.20W_L$	$.290W_L$	$.285W_L$	$.495W_L$	$.450W_L$	$.430W_L$	$.430W_L$	$.420W_L$	$.415W_L$

EXAMPLE

A station operating on a frequency of 98 mc would have a W_L of: $\frac{11{,}070}{98}$ or 112.9 (112 29/32). Following the formula above would produce these specifications for an antenna:

S_1	S_2	S_3	S_4	S_5	L_1	L_2	L_3	L_4	L_5	L_6
24.2"	27.1	22.6	32.7	32.1	55.8"	50.7	48.5	48.5	47.4	46.8

desirable. However, the information is included in the table (which covers all VHF channels in the U. S. and Canada and some UHF) because in extremely bad signal areas this type of aerial would give the highest gain and may have to be used. Mounted in the attic these aerials would not be so conspicuous. UHF television channels higher than those given in the table are best received by other types of aerials; an extremely small Yagi would be difficult to build.

MATERIALS LIST—AERIALS

Amt.	Description
1 pc	*1⅝ x 1¾" fir, pine or oak
6 pcs	*⅜" O.D. alum. tubing or rod (copper can be substituted)
1 pc	*⅛" (#10) copper or aluminum wire or tubing
1 pc	1¾ x 1⅝ x 4" fir, pine or oak
6	1¼" aluminum nails
2	¼ x 3½" galv. carriage bolts, washers and nuts
2	#4 x 1" *rh* screws and washers
	varnish or paint
	misc. installation hardware and lead-in wire to match individual installation (see text)

* Length determined by specifications of desired aerial.

It also may be possible to select a frequency in the middle of the FM band and get good reception for the whole band with a single aerial. This depends on individual location problems and must be decided by the wearisome method of trial and error.

Start construction by cutting the 1⅝ x 1¾-in. wood spar to the length determined as explained above. Drill the ⅜-in. cross piece holes as in Fig. 2A, spacing as in Table A or B. Also drill a number of ¾ in. holes as in Fig. 2A to reduce the aerial's weight without loss of strength. Cut cross pieces to length from ⅜-in. O.D. aluminum tubing, the size used in commercial TV aerials, and available from aluminum supply houses or salvage yards (occasionally it is obtainable free from TV repair shops). If using salvaged tubing, first clean off with fine sandpaper. If the tubing is not available, substitute ⅜-in. O.D. copper tubing or the heavier ⅜-in. aluminum rod (available from Sears, Roebuck and Co.).

Insert cross pieces, except the dipole, in the proper holes as in Fig. 2. Use paraffin to ease the metal through the tightly-fitting holes. Center the tubes and from the top of the spar, through the tubing, drill a hole for a 1¼-in. aluminum nail as in Fig. 2B and fasten securely.

Complete and assemble the dipole parts as in Fig. 2C, and check for fit. Remove one ⅛-in. wire section and insert the dipole into its spar hole. Complete the assembly, then flange the ends of the wires where they pass through the tube. Insert #4 x 1-in. *rh* screws with washers through holes drilled in the flattened end of the ⅛-in. tubing. These screws must be the same distance apart as the distance between the upper and lower dipole tubes. Lead-in wires will be attached to these screws.

At the center of your aerial, located by measuring and balancing, clamp a 1⅝ x 1¾ x 4-in. piece of wood stock. Center a ¼-in. hole ¾ in. from each end of the block (Fig. 2D), insert ¼ x 3½-in. galvanized carriage bolts, washers and nuts, and draw up tightly. Center a hole in the top of this assembly, sizing it ⅛ in. under the diameter of the roof or attic aerial mast (usually a 1¼-in. dia. pole) and drilling with an expansive bit or hole saw. Apply at least three coats of spar varnish or marine quality paint to the now-finished antenna, allowing plenty of drying time between coats.

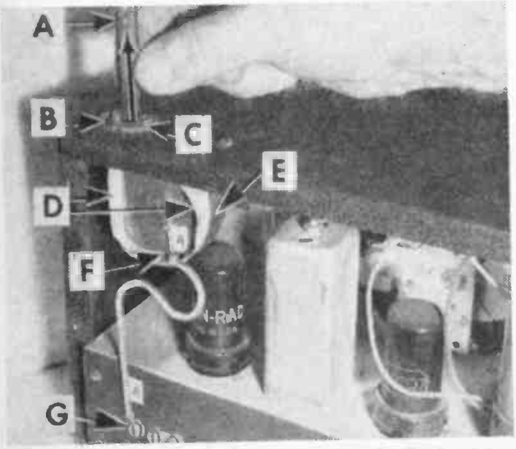
Install the aerial as in Fig. 2A, with the directors closest to the transmitter of the station desired. Where two stations will be brought in by the aerial, the latter will probably be best directed between the two transmitters. Try it before fastening permanently in place.

There are so many variables involved in aerial installations that it is impossible to describe one lead-in hookup that will work well in each case. The trial and error method must usually be resorted to in the end. It sometimes is possible to just tie lead-in wiring for the new aerial almost any place into the existing lead-in wire to the set (using standard 300 ohm double-strand television wire) if the new aerial is being used to supplement another aerial. If this doesn't give a good picture or interferes with other channels received, a hi-lo coupler may be needed. Low-band channels (2 through 6) will probably have to be led in through a coupler if high band channels (7 through 13) are also received. As a last resort, a completely separate lead-in wire may be used by coupling into an antenna switch (available from TV supply stores, Allied Radio, Dept. SM, 100 N. Western Ave., Chicago 80, Illinois or Sears, Roebuck & Co., Chicago) at the back of the television set. However a 40¢ double-throw knife switch available in hardware stores would serve, though less conveniently. When the aerial is installed and hooked up, make fine direction adjustments by turning the aerial slightly in each direction until the best picture is obtained.

These aerials can be stacked on one roof pole about a foot apart, if desired, although aerials pointing in the same general direction should be two feet or more apart, if possible.

Roll-Up Aerial

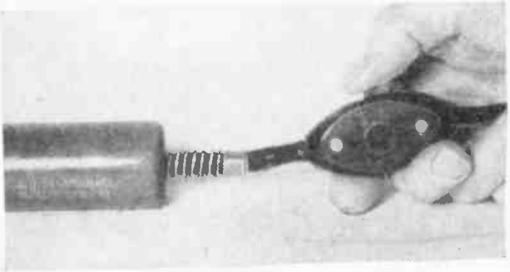
• Stronger and clearer radio signals from greater distances are possible with an aerial made from a roll-up steel rule. To mount the rule cut a hole in the top of the radio cabinet and bolt a fiber washer to the hole so that the rule will not ground against the cabinet. Insulate rule housing from the set with friction tape, and fasten the housing to the cabinet with a strip of metal bolted to the cabinet. Solder one end of a length of insulated wire to the rule housing, and connect the other end to the aerial terminal of the set as shown in photo below. Range and volume increase as the rule is pulled out and are reduced as the rule is pushed in.—M. A. Tidd.

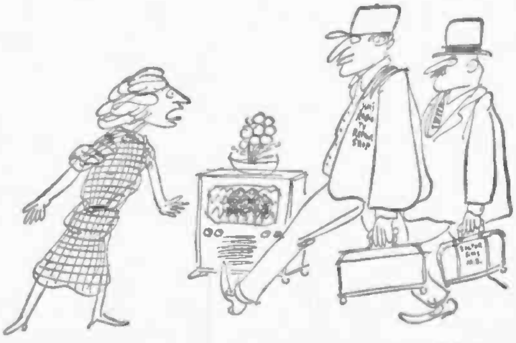


(A) Steel rule, (B) fiber washer, (C) bolts, (D) friction tape, (E) metal strip, (F) solder wire to case, (G) aerial terminal.

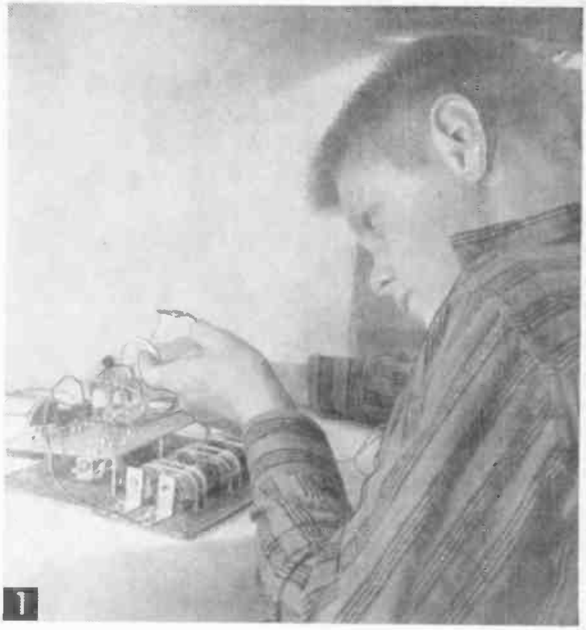
Soldering-Iron Switch

• Install a feed-through tumbler switch with "on" and "off" markings on it on the cord of your electric soldering iron close to the handle, as shown in the photo. The iron can be kept plugged in while in use and simply turned on or off as needed.—Arthur Trauffer.





Thank goodness, you're here! My husband is sick in the bedroom—and Jack Paar's all blurry!



1

Experimenting with a one-stage audio amplifier.

Learning Electronics By Experimenting

"Breadboard" experimentation is a logical way for a beginner to learn electronics, and the approach has considerable merit for the old-timer, too, because it allows him to try his ideas quickly with comparatively conventional parts

By FORREST H. FRANTZ, Sr.

THERE are two possible approaches to follow in obtaining a radio lab kit. One is to acquire the parts yourself and make up your own kit. The second approach, and the approach that I consider best for beginners, is to buy a commercial kit. I tried both approaches.

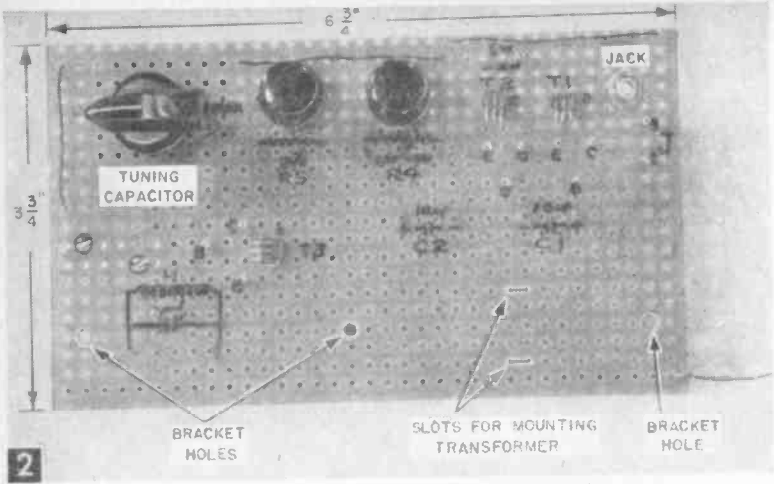
The home-rolled version was built on a miniature perforated bakelite board. The board layout, component placement and preliminary wiring are shown in Fig. 2 (front) and Fig. 3 (back). Lay out and drill the board first. Shorten the volume control shafts to ⅜ in. length with a hacksaw. Solder leads about 1½ in. long on the transistor sockets. Mount the parts and complete the wiring to the interconnection lugs (called "flea clips"). Fill the portions of the flea clips that protrude from the front of the board with solder for increased rigidity. The transistor sockets are held in place with Duco cement. Bend the leads tightly against the board as an added precaution.

A separate battery board cut from a piece of perforated Masonite (see Fig. 4) was provided, the batteries held in place with rubber bands. Brackets provided with machine screws make terminal contact. A third bracket provided with a metal spring cut from a tin can makes the connection between the two rows of batteries. The experimental board may be mounted on the battery board with brackets, or it may be used unattached as shown in Fig. 4.

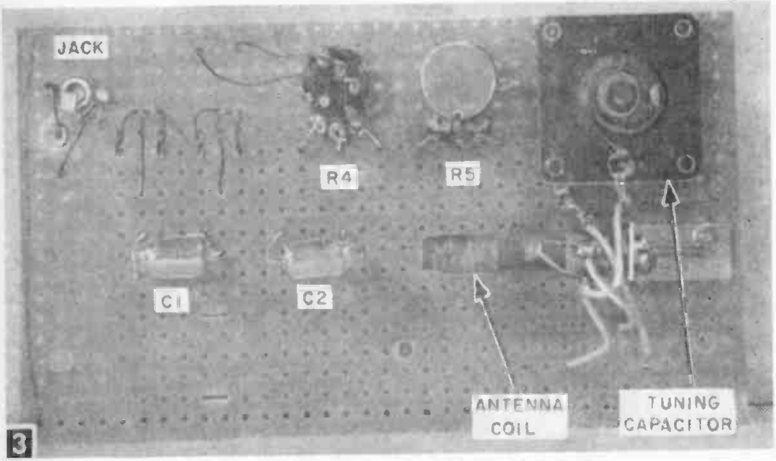
The hook-up of Fig. 4 is the simple one-transistor audio amplifier shown schematically in Fig. 5A. A number of additional, but by no means all of the circuits that can be built with the home-rolled lab kit are also shown in Fig. 5. The resistors and all of the capacitors aren't mounted on the board. They were originally connected by plugging them into the flea clips. However, this wasn't too satisfactory and mini-gator clip leads were adopted for all connections.

The audio one-transistor amplifier of Fig. 5A has very low volume. If another transistor amplifier is connected in front of this amplifier, the two-transistor amplifier of Figure 5B results, with much greater volume. The transistor configuration used is known as the common emitter circuit because the emitters of the transistors are both connected to an input terminal and the common battery terminal. The capacitors between collector of T2 and between the base of T1 and volume control center terminal and base of T2 are provided to allow all audio signals to pass, but to prevent transistor bias voltages from being upset. A capacitor has low impedance for *ac* voltages, but it has (ideally) infinite impedance for *dc* voltages. The resistors in the circuit establish the *dc* bias voltages on the transistor elements that are required to make the transistors function.

It is apparent then that there are two basic groups of voltages that you are concerned with in any piece of electronic equipment. One is the voltage required to make the transistors or tubes function at all—the *dc* bias voltages. The other is the signal voltage which is the voltage of interest. The *dc* bias voltages are somewhat like the gasoline requirement in an automobile and might be thought of as fuel supplied at the right place in the proper amount. The input signal voltage corresponds to the driver's demands of the automobile which he injects at the input in the form of throttle and steering commands. The



Front view of home-made lab kit circuit board.



Back view of home-made lab kit circuit board.

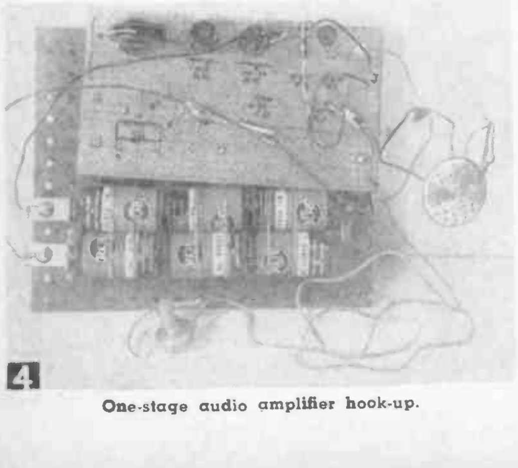
input signal is handled by the electronic equipment as required (in this case it's amplified) for the desired output. The mechanical, electrical, and pneumatic systems of an automobile operate on the driver's input signals in an analogous way to provide the required energy and direction at the wheels. The two-transistor amplifier may be used with the microphone (as shown) or with a phono pick-up, or with a radio tuner.

If the amplifier output is connected to the amplifier input as shown in Fig. 5C, an audio oscillator is created. An oscillator is a device that converts *dc* operating voltage into an *ac* signal. It may be thought of as an *ac* generator driven by a *dc* voltage. The advantage of an electronic generator (oscillator) is that the frequency may be varied and controlled very readily. The frequency of the oscillator of Fig. 5C may be varied by adjusting the control that functioned previously as a volume control for the amplifier.

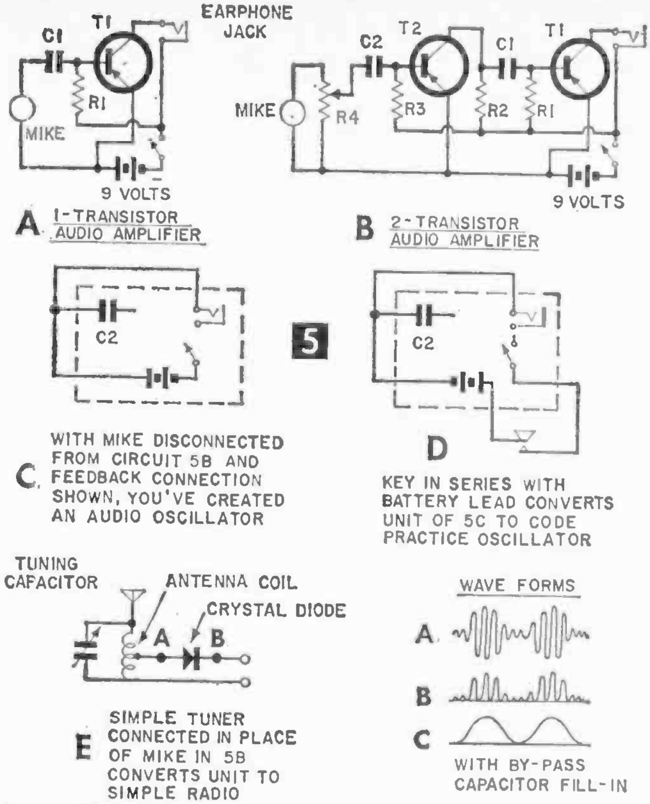
The principle of the oscillator's operation is that a part of the signal at the output is fed back into the input and is continually recirculated. The amplifier action of the basic unit builds the signal at the input back up to the proper level for the output signal continuously.

How do you start it? Well, all electronic equipment has an amount of noise associated with it. Although this noise is very low, the amplifier will build it up to a point where the transistor characteristics, part values, and *dc* operating voltage in the circuit limit the output signal size. But at this point, the output signal is high enough to be useful. A key connected in one of the leads from the battery to the amplifier as shown in Fig. 5D would permit quick turn-on and turn-off of the oscillator, and the unit could be used as a code practice set.

Figure 5E is a crystal detector tuner which may be added to the amplifier of Figure 5B to produce a broadcast receiver. The coil-capacitor combination builds up the radio frequency (RF) voltage received from the antenna at a particular frequency determined by the tuning capacitor setting. The tap on the coil permits the signal to be fed to the crystal diode without disturbing the tuning. The crystal diode is a unidirectional device; that is, it passes a signal readily when the anode side is plus, but impedes the signal when it's minus. The waveforms show: A, an RF signal which is the carrier and has the fre-



One-stage audio amplifier hook-up.



5

A 1-TRANSISTOR AUDIO AMPLIFIER

B 2-TRANSISTOR AUDIO AMPLIFIER

C WITH MIKE DISCONNECTED FROM CIRCUIT 5B AND FEEDBACK CONNECTION SHOWN, YOU'VE CREATED AN AUDIO OSCILLATOR

D KEY IN SERIES WITH BATTERY LEAD CONVERTS UNIT OF 5C TO CODE PRACTICE OSCILLATOR

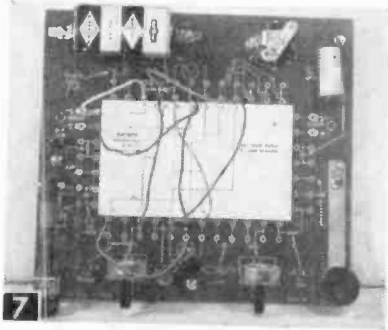
E SIMPLE TUNER CONNECTED IN PLACE OF MIKE IN 5B CONVERTS UNIT TO SIMPLE RADIO

WITH BY-PASS CAPACITOR FILL-IN

quency of the capacitor-coil tuned combination modulated in height (amplitude) by an audio signal which is the desired signal information; B, the signal rectified (negative excursions chopped off) by the diode as it would appear between the crystal diode cathode and common if no capacitance appeared across these terminals; and C, the audio signal that appears at these terminals due to alternate charging and discharging of a capacitor connected across these terminals. In the case of the simple receiver consisting of this detector and the amplifier of Figure 5B, this fill-in is provided by the capacitance of C2 through the base to emitter circuit of T2 and the stray wiring capacitance of the circuit.

The Commercial Kit. This kit (Knight 10-Circuit Transistor Lab Kit, Allied Radio Catalog No. 83Y299, $15.75) costs a little more than the basic, home-rolled version just described, but with it you can perform twice as many experiments.

Figure 6 shows the parts and instructions furnished with the kit. There's a preliminary wiring manual which describes the basic assembly in step-by-step and pictorially illustrated detail, and a folder with general soldering and construction information. A set of cards showing how to make plug-in connections between the various parts for each of the 10 circuits is included with the kit. The card for a given circuit fits on the board as shown in Fig. 7, and connections are made with plug leads. There is also a manual of experiments provided in the kit. This manual shows a pictorial and a schematic diagram for each circuit and provides

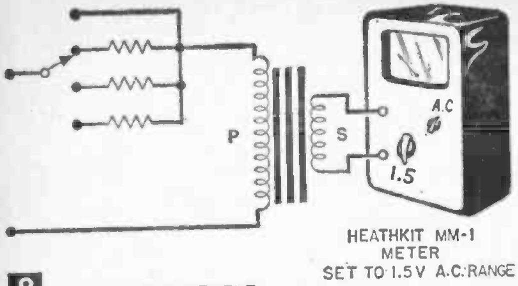


7

The Knight 10-in-1 Transistor Lab Kit with the Electronic Switch Circuit set up.

6

Parts and instructions furnished with Knight 10-in-1 Transistor Lab Kit.



8 BASIC ARRANGEMENT

a text explaining how to adjust and use it, how it works, and how to apply the circuit. In addition to this specific information for each circuit, the manual has sections on how radio works, transistors, capacitors and resistor color codes, and electronic symbols.

The 10 circuits which may be built with the Knight Kit are: a two-stage broadcast radio; a photoelectronic relay; a wireless broadcaster; a code practice oscillator; an electronic switch; a two-stage audio amplifier; a capacity operated relay, an electronic timer; a voice operated relay; and an electronic flasher.

The Knight Kit may also be used for additional experiments and hook-ups, the only limit being the ingenuity of the builder. For example, with an external multimeter, you can measure voltages across various circuit elements. You're cautioned to use a 20,000 ohm-per-volt meter or vacuum tube voltmeter (VTVM), however, since lower sensitivity meters will upset the circuit seriously and may even damage components. Currents may be measured by replacing connecting leads with a meter. And the number of experiments that can be performed can be increased by using components external to the Lab Kit board. Thus, a supplementary board with two transformers, two transistor sockets, a few resistors and capacitors, and a loudspeaker would allow you to add several kinds of amplifiers to the basic audio amplifier, broadcast receiver, or code practice oscillator. The extra parts and board would permit you to add a one-transistor transformer-coupled Class A output stage, a one-transistor-resistance coupled output stage, a two-transistor Class A transistor-coupled output amplifier, a two-transistor Class A resistance-coupled output amplifier, a two-transistor Class B transformer-coupled output stage, and a two-transistor complimentary symmetry output stage. Thus a parts investment of from $10 to $15 adds six circuits—probably more for the ingenious experimenter—and would provide a comparatively thorough lab course in audio amplifier circuits.

Transformer Principles. Since, in amplifiers, the plate load impedance of an output tube is always much greater than the low impedance of the loudspeaker voice coil which it drives, a voltage step-down transformer from output tube to speaker is necessary to make the speaker look like a high impedance to the tube, and the tube a low impedance to the loudspeaker. The same technique may be used to increase the input impedance, and hence the ohms-per-volt sensitivity of an *ac* voltmeter. The advantage of using a transformer to increase meter impedance is that no tubes, transistors or operating power are required.

The chief advantage of a high input impedance *ac* meter is that circuit loading is reduced and circuit measurements for which 1,000 ohms-per-volt or even 5,000 ohms-per-volt *ac* meter sensitivities would be inadequate are brought within reach. Another advantage is that *ac* voltmeters employing the higher quality (better frequency response) miniature transformers to increase input impedance are extremely portable, wide frequency instruments. This is particularly true if germanium diodes are used for rectification in the meter.

TABLE A—SIMPLIFIED IRON CORE TRANSFORMER THEORY

P = Power (watts
V = Volts
I = Current (amperes)
Z = Impedance (ohms)
Subscripts: p = Primary s = Secondary

For an Iron Core Transformer correctly terminated, efficiency approaches 100%. Then,

(1) $P_p = P_s$ (Z_p and Z_s are assumed resistive)

(2) (a) $I_p^2 Z_p = I_s^2 Z_s$ (b) $\frac{E_s^2}{Z_s} = \frac{E_p^2}{Z_p}$

(3) (a) $Z_p = Z_s \frac{I_s^2}{I_p^2}$ (b) $Z_p = Z_s \frac{E_p^2}{E_s^2}$

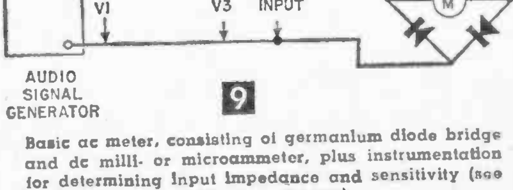
(4) (a) $I_p^2 = I_s^2 \frac{Z_s}{Z_p}$ (b) $E_p^2 = E_s^2 \frac{Z_p}{Z_s}$

(5) (a) $I_p = I_s \sqrt{\frac{Z_s}{Z_p}}$ (b) $E_p = E_s \sqrt{\frac{Z_p}{Z_s}}$

To get a feel for what you can do with transformers in this application, let's take a quick look at some examples. Table A summarizes the applicable formulae and theory used in the examples.

A Heathkit MM-1 Volt-Ohm Milliammeter has an *ac* sensitivity of 5,000 ohms-per-volt. The lowest *ac* range is 1.5 *v*. The meter input impedance for this range is 5,000 x 1.5 or 7,500 ohms. The meter will be set to the 1.5 *ac v* range for all measurements, and series resistances in the transformer primary circuit (Fig. 8) will be used to increase range. To increase the input impedance from 7,500 ohms by a factor of 100 to 750,000 ohms would require a transformer with a 750,000 ohm primary and a 7,500 ohm secondary.

But, in changing the meter impedance with the transformer, the input voltage required for full



9

Basic ac meter, consisting of germanium diode bridge and dc milli- or microammeter, plus instrumentation for determining input impedance and sensitivity (see Table B, next page).

scale meter deflection will be changed. The transformer primary voltage for full scale meter deflection is calculated with equation 5b on Table A:

$$Ep = 1.5\sqrt{\frac{750{,}000}{7{,}500}}$$

$$Ep = 15 \text{ volts}$$

The new sensitivity of the meter is 750,000 ohms-per-15 volts or 50,000 ohms-per-volt!

For ranges other than 15-*v* full scale, the multiplier series resistance will be 50,000 times (Voltage Range minus 15). Thus, for the 50-*v* scale, the multiplier resistance is 50 x (50 −15) kilohms, or 1.75 megohms.

This can be improved, however, and approached more practically. The lowest range (15 *v*) has a low *dc* resistance in spite of its high *ac* impedance. This might interfere with circuit operation. A capacitor (0.1 mfd or larger) in series with the primary will eliminate this possible source of trouble. A transformer that has the correct impedance used might be difficult to find at a reasonable price. A considerable reduction in transformer impedance can be tolerated if the impedance ratio is unchanged without changing the final ohms-per-volt sensitivity. For this example an impedance ratio of 50,000 ohms to 500 ohms will be satisfactory if the transformer can handle the input signal level linearly.

If the lowest range of the basic meter in our first example had been 5 *v*, the new lowest *ac* range would have been 50 *v*. This would have been objectionable. Here's an approach that can be applied to a multimeter or even a basic dc meter movement which overcomes this objection. The Heathkit MM-1 meter cited in example 1 has a 150 microampere lowest current range on the selector switch. Set the meter to this range and connect it to a rectifier bridge consisting of 4 Raytheon 1N66 diodes (see Fig. 9). Instrument the circuit as shown in Table B. The input impedance of the rectifier-meter combination was 4,000 ohms for full scale meter deflection. The sensitivity was 6,650 ohms-per-volt.

Next, the meter-bridge combination was connected in the circuit shown in Fig. 10. The transformer, a Microtran M8, was connected for 15,000 ohms primary impedance (red and blue leads), and 600 ohms secondary impedance matching (brown and violet leads). The impedance ratio is 25, and the square root of this ratio is 5. The transformer primary impedance predicted by the theory is 25 x 4,000 or 100,000 ohms, and the sensitivity is predicted as 5 x 6,650 or 33,200 ohms-per-volt. The voltage input to the transformer primary for full scale deflection should be 100,000 ohms divided by the sensitivity, 33,200 ohms-per-volt. The predicted primary voltage is 3 *v*. The actual voltages measured in the circuit are given in the caption for Fig. 10. Using the method shown in Table B, these voltages yield the same results as those predicted above within a reasonable percentage of error.

The linearity of the instrument can be improved by setting the meter pointer about 3% to 5% up scale from zero.

TABLE B

In Fig. 9, signal generator output is adjusted for full scale deflection of meter "M" at 1,000 cycles, V_1 and V_2 are measured with an audio voltmeter such as the Heathkit AV-2.

Then:

a) $V_3 = V_1 - V_2$

b) $I = \frac{V_2}{R}$

c) $Z_{in} = \frac{V_3}{I}$

For example 2, measured values are:

$R = 1K$, $V_1 = .75V$, $V_2 = .15V$.

Then,

a) $V_3 = .75 - .15 = .6v$

b) $I = \frac{.15}{1000} = .15MA$

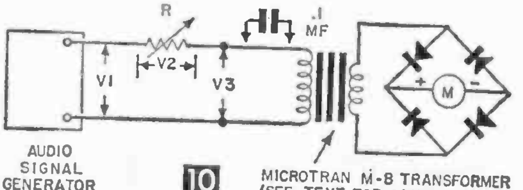
c) $Z_{in} = \frac{.6}{.15 \times .001} = 4{,}000\ \Omega$

and Ω/V sensitivity $= \frac{4000}{.6} = 6{,}650\ \frac{\Omega}{V}$

MATERIALS LIST—HOME-MADE TRANSISTOR LAB KIT

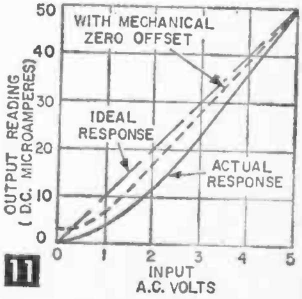
Desig.	Description
R2	10K, ½w resistor
R1, R3	220K, ½w resistor
R4	10K miniature volume control with switch (Lafayette VC-28)
R5*	50K miniature volume control (Lafayette VC-36)
C1, C2	10 mfd., 15v. miniature electrolytic capacitors (Lafayette CF-122)
	tuning capacitor (Lafayette MS-215)
	antenna coil (Lafayette MS-299)
T1, T2	transistor (Raytheon CK722 or GE 2N107)
D	diode (GE 1N64)
	three transistor sockets (Lafayette MS-149)
	flea clips (Lafayette MS-263)
	miniature perforated board (Lafayette MS-305)
	two miniature knobs (Lafayette MS-185)
	one pointer knob (Allied 55H074)
	miniature phone jack (Lafayette MS-282)
	minigator clips for connecting leads (Mueller 30)
	perforated Masonite board (Lafayette ML-81)
	brackets
	six batteries (Burgess #1)

* Not used in any of the circuits presented in text, but handy to have for experimental work.



10

Method used for experimental verification of calculations: V1 = 5 volts; R (60,000 ohms) adjusted for full-scale deflection of M. V2 was 1.9 volts. Calculated value of Z-in is 103 K ohms, sensitivity is 33,400 ohms per volt using the measured values.



The linearity of a transformer-diode-rectifier-meter type ac voltmeter can be improved by off-setting the meter needle from zero and calculating series resistance for exact fit at full scale.

11

Use the mechanical zero set with zero voltage input to do this. Do it before the measurements shown in Fig. 9 are made. This automatically accounts for the upscale dial position in calculations and adjusts the full scale point. The results of the technique are shown in Fig. 11.

It is apparent that the method of the second example provided a lower bottom ac voltage range than the first method. This improvement resulted from the increased sensitivity of the rectifier-meter combination and the lower impedance ratio of the transformer windings. The decrease in transformer impedance ratio reduced the sensitivity.

ELECTRONICS ANAGRAM

Here is an anagram puzzle that will challenge your knowledge of electronics. To be absolutely sure you do not fill in the wrong word or abbreviation, read each clue very carefully. Many are designed to intentionally mislead.—JOHN A. COMSTOCK

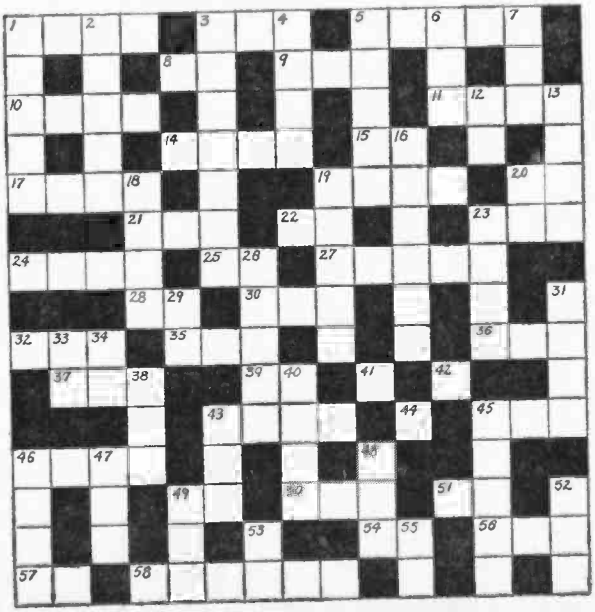
(For the solution, see page 154.)

ACROSS:

1) A point of maximum current or voltage in a stationary wave system.
3) Form of phono turntable drive.
5) Done with an insulated tool to avoid detuning effects of body capacitance.
8) Volt-ampere (abbr.).
9) A concentrated number of these will burn the screen of a cathode-ray tube.
10) Unit of loudness.
11) Volts times amperes.
14) Carries electrons in motion.
15) Capacitors block it.
17) A type of frequency meter.
19) The rms value of an alternating current wave.
20) One-millionth of an ampere.
21) A radiator of electromagnetic waves.
22) Inductive opposition to ac (abbr.).
23) Done to locate a microphonic tube.
24) A particular type of test instrument widely used (abbr.).
25) Potential placed on a certain vacuum tube element (letters symbol).
27) Done to improve operating characteristics of electronic components.
28) An amplifier that handles power (abbr.).
29) A TV station's picture signal is put on a carrier wave in this manner (abbr.).
30) A circuit that can bite.
31) Matching transformer.
32) A primary color used in color TV.
35) Unit of conductance.
36) What a volume, gain, or tone control is.
37) A coil that opposes RF currents.
39) Connection not made (abbr.).
41) Figure of merit (letters symbol).
42) Transformer, trimmer (letters symbol).
43) EMF unit.
44) Capacitance (letters symbol).
45) Single side band (abbr.).
46) A noise made by electrons in vacuum tubes.
49) Modulation similar to frequency modulation (abbr.).
50) Term connected with 'scopes.
51) Main oscillator (abbr.).
54) An inert gas (abbr.)
56) What a ham calls his radio outfit.
57) Controlled by radio (abbr.).
58) An antenna system of two or more vertical radiators.

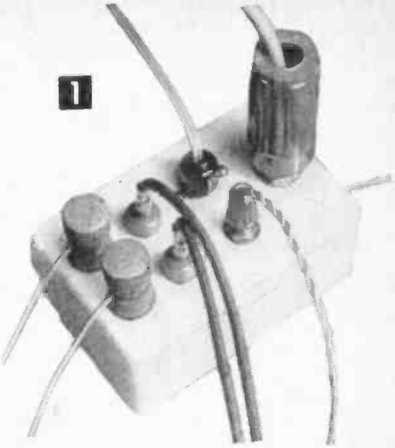
DOWN:

1) An electro-acoustic unit of power.
2) Fleming invented the first one.
3) To send radio waves into space.
4) A particular type of transducer.
5) The electron catcher of a vacuum tube.
6) Code that is periodically interrupted.
7) Number of interconnected stations.
12) The kind of signal ordinarily superimposed on a carrier wave (abbr.).
13) Captures certain frequencies and disposes of them.
16) A positive ion.
18) To eliminate audio echoes.
19) Same meaning as #5 down.
20) Same as #20 across.
26) Plays recordings.
33) Voltage drop measured across a resistor (letters symbol).
34) A device that finds directions.
38) A tube that utilizes an electron gun (abbr.).
40) Temporary connector.
43) A meter that measures volts, ohms, and amperes (abbr.).
45) Might blow a fuse.
46) Emits sound waves (abbr.).
47) A meter rating.
48) Type of transistor (abbr.).
52) A gain compensating circuit (abbr.).
53) Output power.
55) C-bias (letters symbol).

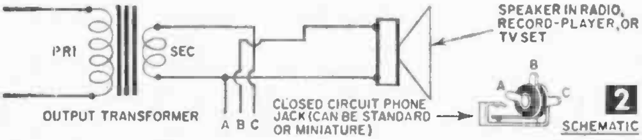


Portable Earphone Plug Box

You can quickly connect various sizes and types of earphone jacks to your radio, Hi-Fi, recorder or TV set with this versatile "Jack in the Box"


1

Built in less than an hour, this "Jack Box" accommodates five kinds of non-interchangeable earphone and speaker connections, permitting instant hookup of many combinations.



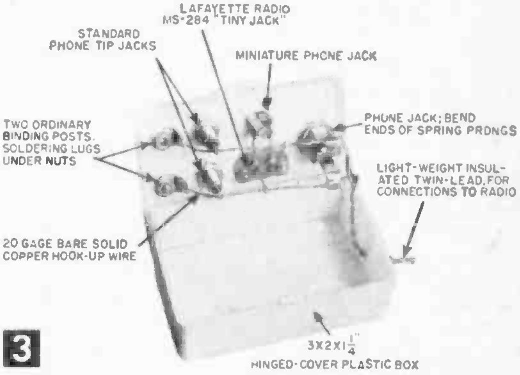
2 SCHEMATIC

HERE'S an easy project for you Hi-Fi fans and experimenters who are so often annoyed by the fact that earphones as well as radios, record players, recorders, etc. come with non-interchangeable plugs and jacks.

If you want to plug in earphones that fit one piece of equipment, into another, you may have to either cut the wire and put on a new plug, or make a special adapter—by then, the program you wanted to hear is over. Here is an unusual answer to the problem; a plug box (Fig. 1) that accepts every common kind of plug. Also, it can be used to connect several earphones, or speakers at once, and will come in handy for test work and hi-fi experimenting.

Figure 1 shows a 3 x 2 x 1¼" deep hinged plastic box. In its lid are mounted two binding posts, a pair of standard phone tip jacks, and three other commonly used phone jacks. You don't need a blueprint giving sizes and locations of holes. In fact, you may want to modify the layout to fit the special needs of your equipment. Just mount the parts where you please, making sure they are not too crowded. All the holes are quickly made by reaming up to size with the small pointed end of a pen-knife blade.

Wire all the plugs in parallel (Fig. 2), with 20 gage solid copper wire soldered at each connection. If the spring prongs on the large phone jack are too long, bend the ends over to fit. Solder a length of light twin lead, or twisted lead wire to the prongs of the phone jack, and bring it out through a hole in the box side.



3

Holes in plastic box lid for mounting parts are reamed up to size with small knife blade. The jacks are wired in parallel, with solid copper hook-up wire.

The phone box is connected to the radio, record player, or TV speaker through a circuit opening jack. When the phone box is plugged in, the speaker is off; remove the plug, and the speaker is automatically reconnected.

Some *ac-dc* table radios ground one side of the output transformer, and of the speaker coil, directly to the chassis. If there is a wire leading from one side of the speaker coil directly to the metal chassis, your set is this type. With such a set, your earphones would be "hot" when the power plug of the radio is inserted one way into the power outlet. Eliminate the hazard simply by unsoldering the two chassis connections and wiring them directly together without electrically contacting the chassis.

Before touching any chassis parts, especially of TV sets, pull the power plug, and discharge the high-voltage capacitors, which can cause fatal shock.

If you are a stereo fan, you will easily be able to adapt the plug box to a "twin channel" design. A larger plastic box will provide space for mounting two sets of jacks, and the unit will make it easy to experiment.—ART TRAUFFER

MATERIALS LIST—PHONE PLUG BOX

No. Req.	Size and Description
1	3" long x 2" wide x 1¼" plastic box with deep-hinged cover (available in 10-cent stores, etc.)
1	Standard single phone jack, Switchcraft #12B (Allied 41H-632)
2	Miniature phone jacks of the type needed to fit your plugs
2	Standard phone tip jacks
2	Standard binding posts, with soldering lugs to fit
1	Short length lightweight insulated twin-lead, or twisted-lead wire
Misc.	Machine screws, nuts, washers as required

2

Save Over $90—Build Your Own

ELECTRIC GUITAR

By J. EVANS KNAPP

Craft Print Project No. 277

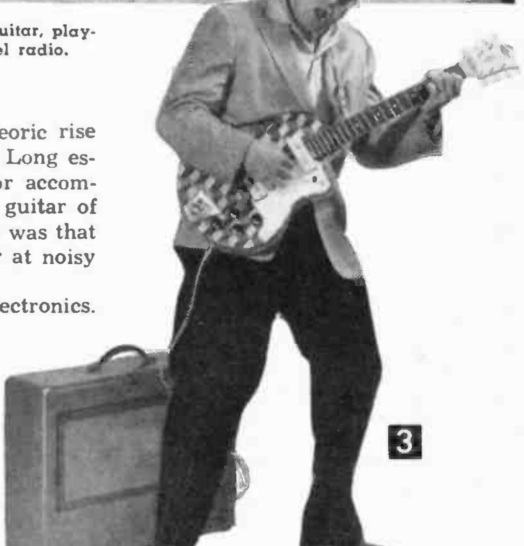
1

Perfect formula for serenading a lovely lady: one electric guitar, playing through the phonograph connection of a table-model radio.

VERY few instruments have enjoyed the meteoric rise in popularity the guitar has in recent years. Long established as an ideal portable instrument for accompanying ballads, country and western singers, the guitar of not so many years ago still had its limitations. One was that its music was too soft to be used in orchestras (or at noisy parties).

That's not true today, thanks to the magic of electronics. For, when you hook up an amplifier to a guitar, you automatically give it the same stature as a piano—and far more versatility. You get, not only a full range of volume, but a complete control of tone—everything from throbbing base for rhythm chords to pure, treble melody notes to lead or back up the singer. You find, suddenly that guitars can "talk" sweet or sassy, soft or sharp, boogie beat or ballad strum.

A good guitar deserves a good carrying case. Make the box dimensioned in Fig. 20A, using glue and ¾ in. nails at all joints. Then, mark a line on the ends and sides 2 in. from the top and saw the box in two parts, making a top and bottom section. Sand all edges, rounding them

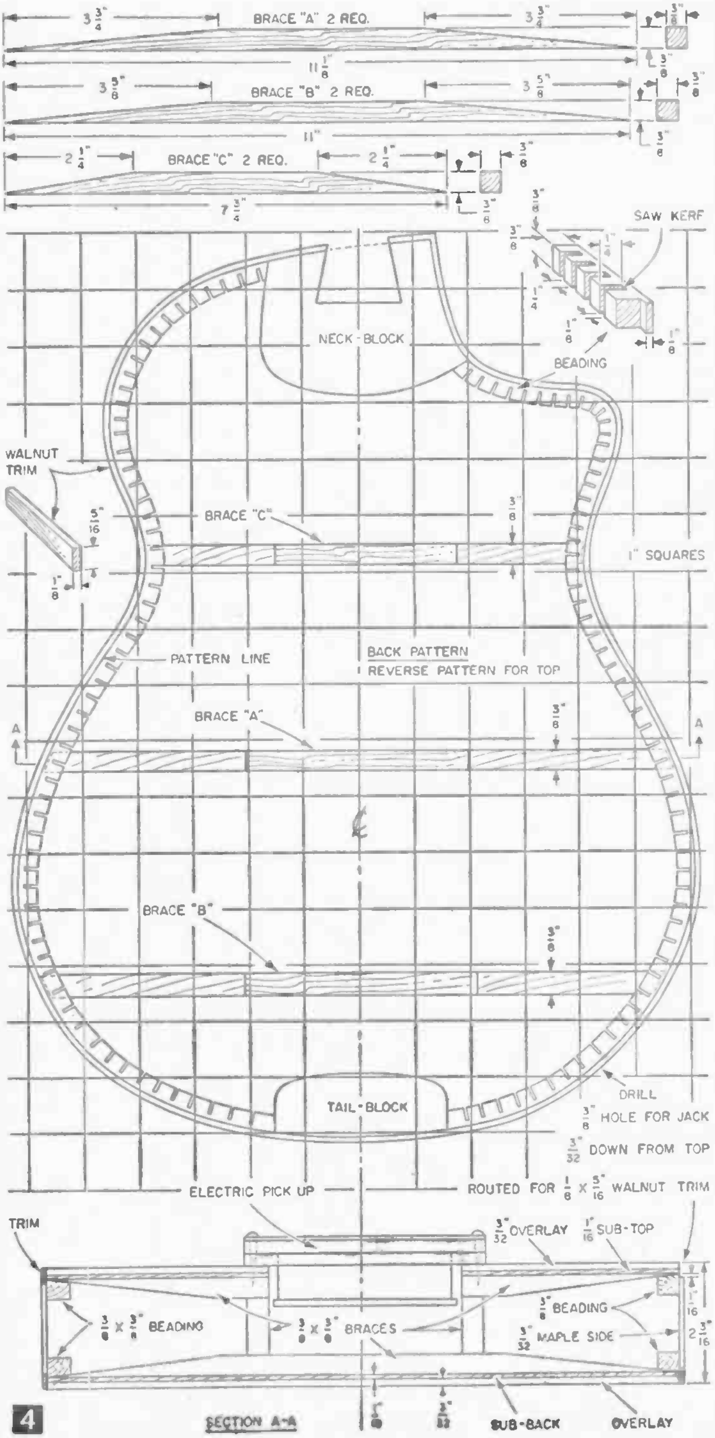


3

Electric guitar hooked up to a commercial music amplifier. Looks as if this fellow enjoys his rock-billy crooning.

slightly and cover the outside of both top and bottom sections with leatherette. Use waterproof glue or cement and wrap the leatherette around on the inside surface about ½ in.

Next, place 2½ in. thick blocks of balsa along the sides and ends of the bottom section and place your guitar on top of the blocks. Mark around the guitar forming a pattern or outline of the instrument on the balsa blocks. Allow about 1/16 in. clearance all around for the plush fabric covering. Remove the blocks, cut to shape and replace for testing. Also make up the neck block and latch, and the compartment sides. With all of the blocks cut to size, place them in the bottom section together with the guitar to see that everything fits well. Make any adjustments needed and cut a 1/16 x ⅜ rabbet along the upper edges of the blocks that contact the box sides. Then glue the blocks to case bottom and sides.



4

When covering the blocks with the plush fabric, cement the fabric to the tops first. Allowing enough material to fold over the inside edge about ½ in. and force the other edge down into the rabbet with a dull knife (Sec. A-A, Fig. 20). Then cement a strip around the vertical sides of the blocks, allowing about ½ in. of material to fold flat against the bottom and turn in at the top where it is sewed to the top covering. For the bottom, cut a piece of cardboard the shape of the recess, cover with fabric wrapped around the edges and cement to the bottom of the case. To line the inside of the top or cover, cut pieces of cardboard to cover the sides and underside of top, cover with fabric and cement (Fig. 20).

Fasten the top of the case to the bottom with 1 in. brass butt hinges, install a pair of suitcase catches and suitcase handle to the other side.

Electric guitars are not only more versatile, but they are far easier to play than non-electrics.

But What Will It Cost? The price of guitars ranges from $15 to $25 for a second-hand, low cost, non-electric one, up to $500 or better for a few of the electrics some professionals use. One excellent commercial model electric with four volume and tone controls and about the same size as the one shown in Figure 1, costs around $136 new, with its case. In contrast, this guitar with its case will cost you about $40 to $45 for materials.

You can, of course, use it with a special musical amplifier such as that shown in Fig. 3. But such amplifiers are costly, and a better solution for the budget-minded, is to play the guitar through a radio (Fig. 1) or an old tape recorder (Fig. 11).

Start construction by making a full-size drawing of the guitar body (Fig. 4), on single weight illustration board. (Because it is impossible to show these parts full size on the magazine page, full-size drawings are available. See box at end of this article.) Follow the line marked *pattern line* because this represents the inside surface of the body sides and is the size to which you will have to make the center portion of the bending form. With a knife, carefully cut out the drawing. Draw in the neck and tail blocks, but do not cut them out at this time.

MATERIALS LIST—ELECTRIC GUITAR

No.	Size and Description	Use
2 pc	2¼ x 10 x 24″ pine or hemlock	side bending form
2 pc	¾ x 5⅝″ six foot pine	steam box
2 pc	¾ x 3″ six foot pine	steam box
2 pc	½ x 16 x 20″ plywood	gluing clamp
1 pc	1⅞ x 2¼ x 3½″ pine or hemlock	neck-block
1 pc	1⅛ x 1⅞ x 2¾″ pine	tail-block
2 pc	3/16 x 13½ x 39″ plywood	case

The above can be purchased from your local lumber yard.

No.	Size and Description	Use
1 pc	¾ x 1⅞ x 60″ maple	sides
1 pc	¾ x 4 x 24″ maple	overlay
1 pc	¾ x 4 x 24″ walnut	overlay
1 pc	¾ x 4 x 24″ mahogany	overlay
1 pc	2½ x 4¾ x 30″ maple	neck
2 pc	¼ x 5 x 39″ poplar	case
2 pc	¼ x 5 x 13″ poplar	case
4 pc	⅛ x 8 x 20″ pine or poplar	sub-top and back
1 pr	1″ butt hinges	case
1 pr	suitcase catches	case
1	suitcase handle	case
½ pt	paste wood filler, natural transparent	
1 pt	clear gloss varnish	

The above can be purchased from Craftsman Wood Service, 2729 So. Mary St., Chicago 8, Ill., or from Albert Constantine & Son Inc., 2058 Eastchester Road, New York 61, N. Y.

No.	Size and Description	Use
12	¼ x 1¼″ Alnico magnets	

Magnets can be purchased from Ronald Eyrich, 12720 Robin Lane, Brookfield, Wisconsin. (12 for $3.00, postpaid.)

No.	Size and Description	Use
½ lb	#40 Nylclad magnet wire	pickup coils
6 ft	#20 single strand shielded grid wire	hookups
6 ft	varnished spaghetti	hookup
2	1 Meg type 11-137 volume controls	hookups
2	500K type 13-133 tone controls	hookups
4	¾″ walnut knobs	hookups
1	type 11 Little-Jax phone jack	hookups
1	type 1452 2 pole 3 pos. shorting type lever action switch	hookups
2	.001 600 stock 305 Olson capacitors	hookup
1 roll	Scotch #33 plastic backed electrical tape	

The above can be purchased from Allied Radio Co., 100 N. Western Ave., Chicago 80, Ill.

No.	Size and Description	Use
1 pr	#2140W patent or machine heads	
1	#2158 rosewood adjustable bridge	
1	#2172 bone fingerboard nut	
1	#2179 rosewood oval 25¼″ scale fingerboard	
1	#2160 trapeze tailpiece	
1 set	#3044 Lektro-Magnetic strings for the electric Spanish guitar	

The above numbered parts are from catalog of Continental Music, 717 Chicago Ave., Evanston, Ill., and Atlanta, Ga., (distributors). Purchase from your local music store, or from Carvin Co., Box 287, Covina, Calif.

No.	Size and Description	Use
1 pc	4 x 25½″ tooling leather	lanyard
1	⅝″ keeper	lanyard
1	⅝″ watch band buckle	lanyard
1	No. 3202 swivel lanyard hook	lanyard
1	Lignum Vitae circle (Edgeslicker)	lanyard
1 pt	Neat-Lac	lanyard
	beeswax	lanyard

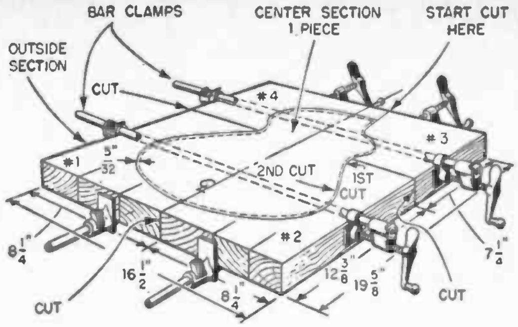
The above can be purchased from Tandy Leather Co., Box 791, Fort Worth, Texas.

No.	Size and Description	Use
1 pc	5/16 x 1½ x 4½″ white opaque plastic	pickup
1 pc	¼ x 3 x 4½″ white opaque plastic	pickup
1 pc	1/16 x 6½ x 12″ white opaque plastic	pickup and pick guard

The above plastics can be purchased from Cadillac Plastic Co., 727 W. Lake St., Chicago.

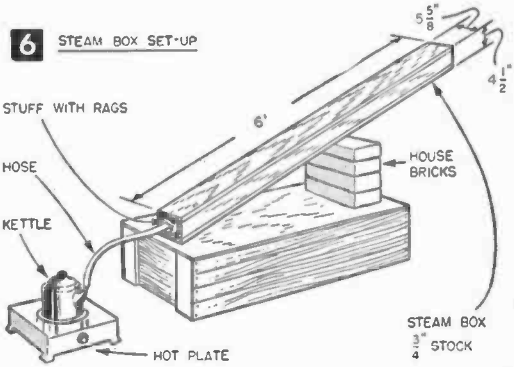
No.	Size and Description	Use
2 yds	36″ width upholstery fabric	case
3 yds	36″ width Duron plastic	case
28	¼ x 4″ carriage bolts	gluing clamp
28	¼″ thumb or wing nuts	gluing clamp
1 box	#18 ¾″ wire brads	case

The above can be bought from your local Montgomery Ward Co.

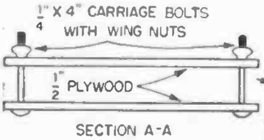


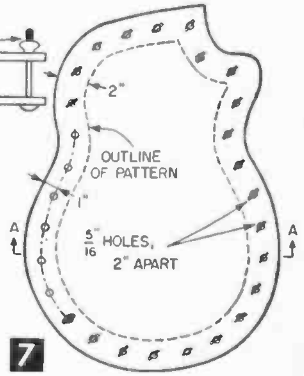
5 BENDING FORM

SEVERAL PIECES OF 2¼″ THICK STOCK, GLUED TOGETHER TO MAKE ONE PIECE



6 STEAM BOX SET-UP





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The bending form (Fig. 5) consists of five sections; one center section, and four outside sections surrounding the center section. Make the form from any soft wood you may have on hand by gluing up 2¼ in. thick pieces to make up a block 16½ x 20 in. Use *Weldwood* or *Elmer's Waterproof* glue because the part to be bent will be moist from being steamed.

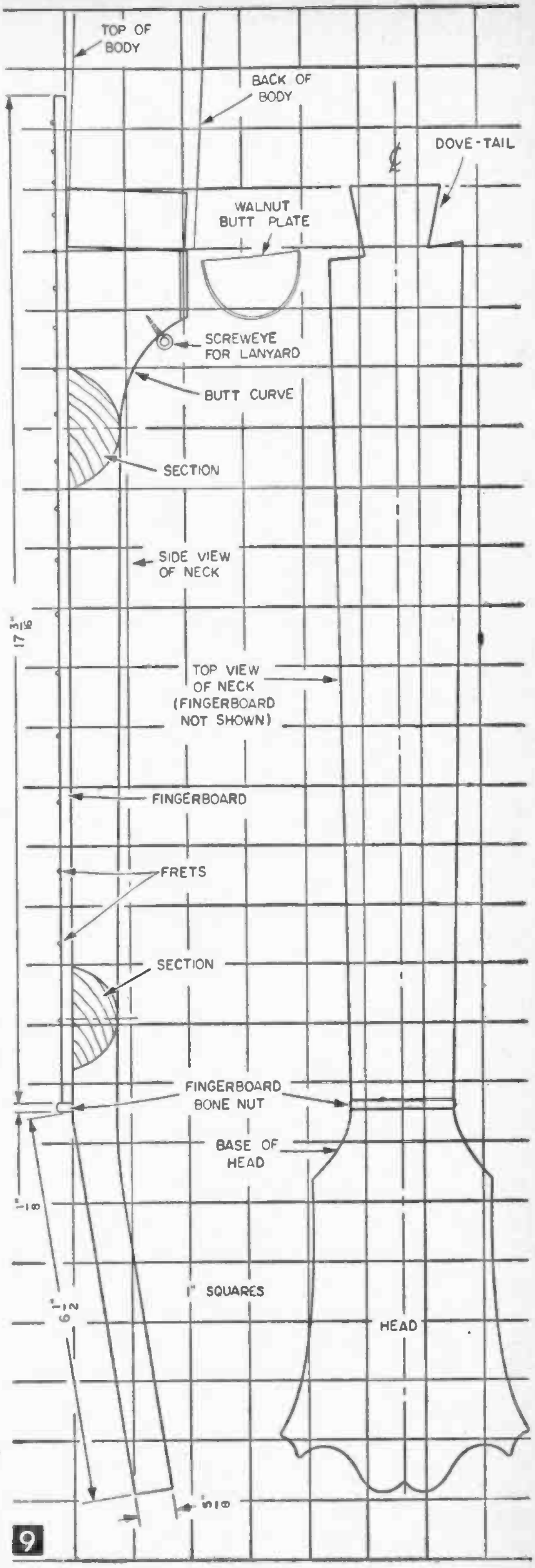
Mark a centerline on the block dividing the 16½ in. width and fasten the pattern on the center of the block with two thumbtacks. With a sharply pointed pencil, draw around the pattern and then, using a compass as a marking gage, draw a second line around the pattern 5/32 in. from the first line. Starting at the top of the body design as indicated in Fig. 5, saw the five bending form pieces to shape on a bandsaw or jigsaw. The material between the two lines is waste, so make your saw cuts in this waste material leaving just a trace of the penciled lines on the center and outside form sections. Two saw cuts will be required. With the center portion cut out, rout out a 1/2 x 1/2 in. rabbet around the top corner as shown in sec. A-A of Fig. 4, to provide clearance for the 3/8 x 3/8 in. beading. Then saw the outside form into four sections.

Make the steam box Fig. 6 next. Set it up on a low bench or box and prop up one end with some house bricks or block of wood. To generate the steam, place a tea kettle on a hot plate and attach a short length of hose over the kettle spout. Insert the other end of the hose into the steam box and stuff some rags around the hose to hold it in place.

You are now ready to start the actual construction of the guitar by steam bending and forming the body sides. For this you will need a 3/32 x 1 7/8 x 60 in. piece of maple. Since this thickness cannot be purchased, rip a 3/16 in. thick strip with a circular saw from the 3/4 x 2 1/4 x 60 in. piece of stock called for in the materials list. Dress this strip down on a thickness planer to 3/32 in. If you do not have a planer, you can use a jointer by backing the strip with a length of scrap stock to support it while pushing it through the jointer. A belt sander could also be used. However, in this case rip the stock 1/8 in. thick and sand to 3/32 in.

Place the finished piece on edge in the steam box and stuff the top of the box with rags. When the water in the kettle begins to boil steam will fill the box and satu-

8



9

rate the maple strip. By the time the water in the kettle has boiled down to within ½ in. of the bottom the strip should be flexible enough to bend around the form. Holding the middle of the strip against the center section of the form at the bottom where the tail block will be, bend the strip around the form and clamp the #1 and #2 outside form sections in place with a bar clamp. Then continue bending the strip around the center form and cut the ends off where they join (Fig. 4). Clamp the #3 and #4 outside form sections in place with a bar clamp. Now, carefully turn the entire form over and clamp with two more bar clamps positioned at right angles to the first bar clamps as in Fig. 5. Set the form aside for a day to dry away from artificial heat, as it might cause the strip to check and crack.

In the meantime make the gluing clamp (Fig. 7), form two pieces of ½ x 16 x 20¼ in. plywood. Again using the full-size pattern of the guitar body, center it on the plywood and, with a compass, draw a line around the pattern 2 in. out from the edge of the pattern. Tack the two pieces of plywood together and saw them out. With the pieces still tacked together, lay out and drill 5⁄16 in. holes for the ¼ x 4 in. carriage bolts (Fig. 7).

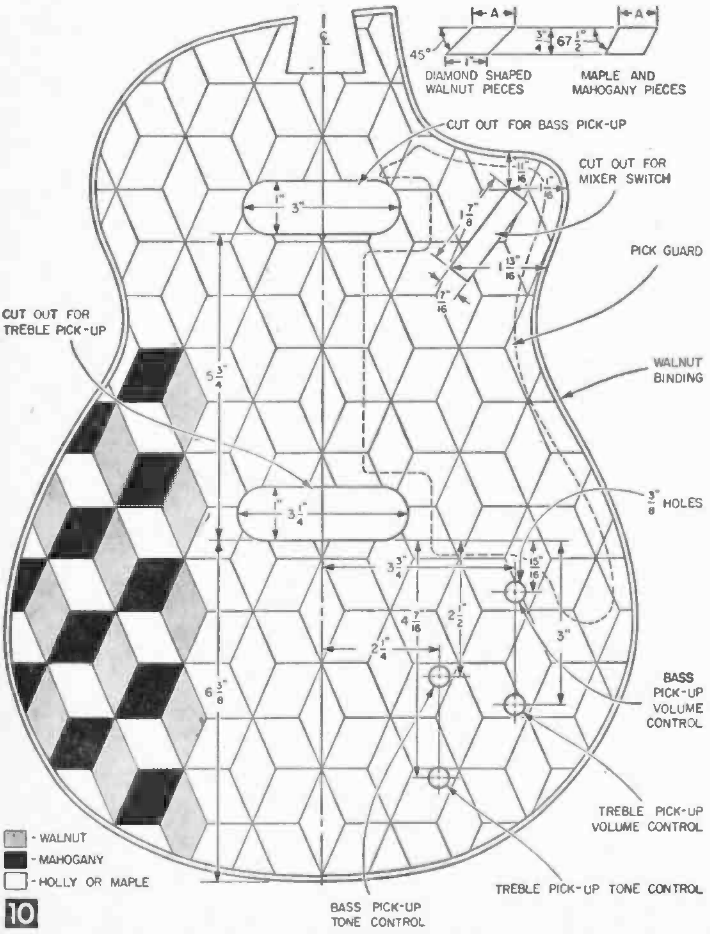
The sub-top and sub-back (Fig. 4) are next on the agenda. Although the original guitar has the inlaid cubic design on both the top and the back, you may wish to inlay the top only, in which case you need not make a sub-back. Instead, substitute the sub-back with inlay, with a single piece of ⅛ in. thick maple plywood.

To make the sub-top, and sub-back if you intend to inlay the bottom, glue two pieces of ⅛ x 8 x 18 in. pine or spruce together edge to edge to form a 16 x 18 in. piece. Then sand the glued-up pieces to 1⁄16 in. thickness with a belt sander.

Using the full-size pattern and a compass set at ⅛ in. lay out the body outline on the sub-top so that it will be ⅛ in. oversize all around. Tack the top and back pieces together and cut to shape with a jigsaw. Then separate the pieces and, on the back of each, mark the locations of braces A, B, and C in Fig. 4. Make the ⅜ x ⅜ in. braces as detailed in Fig. 4 and glue to the undersides of the sub-top and back.

Next, lay out the neck and tail blocks (Fig. 4) on 1⅞ in. pine and saw them to shape. Then place the blocks in their respective positions on top the center bending form section and mark around them for cutting, cut out form, place the blocks in position and glue them to the bent side strip. Now, with the side strip and blocks in the bending form, make up the ⅜ x ⅜ in. beading strips by cutting ¼ in. deep saw kerfs ¼ in. apart as detailed in Fig. 4. Coat the uncut side of the beading with glue and place them in the rabbet cut in the center bending form so that the glued sides contact the guitar body sides. Be sure the beading is flush with the top edges of the guitar sides and use small wedges between the beading and the rabbet sides to keep the beading in contact with the guitar sides until the glue dries. Do not install beading on the bottom edge of the sides now.

While the glue is drying, make up the guitar neck (Fig. 9) from a solid block of maple. Be sure that the maple you use for the neck is thoroughly dry because green wood will warp and shorten the life of the instrument. The edge grain should be the side of the neck and the flat grain the top. First make full-size, cut out patterns of the neck side, top and templates, from the neck sections (Fig. 9). Be sure to make the dovetail slightly larger than the cutout for it in neck block so that the neck can be snugly



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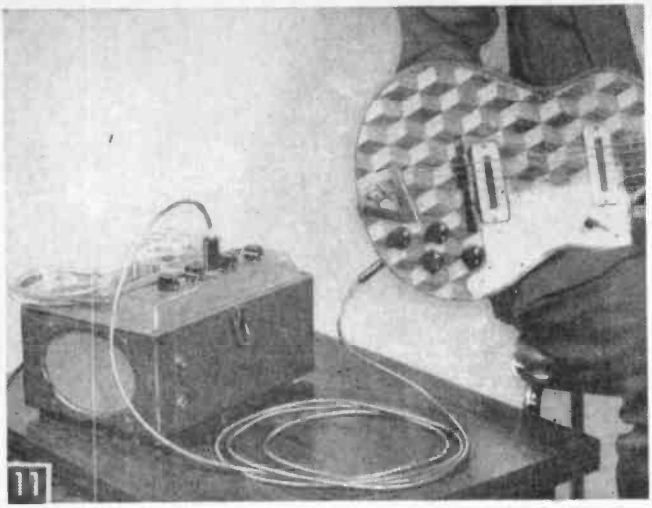


11

Here a small tape recorder (purchased second-hand for $40) not only serves as an amplifier for the guitar, but also will record what you play if you want to hear it later—an invaluable method for improving your playing. And, an extension speaker plugged into that jack on the front of the recorder will give you some stereophonic effects.

fitted to the body later. Transfer the shape of the side patterns to the maple stock first and saw from the end of the head to the butt curve at the dovetail end of the neck. Do not cut the scrap piece off, but back out the saw. Then make the other cut, which is the top surface of the head.

Now, using the top pattern of the neck, transfer its shape to the top of the maple stock. Beginning at the dovetail, saw to the location of the nut on both sides, back out the saw on each cut. Then make cuts at right angles to the long cuts you just made at the location of the nut, removing the scrap side pieces. Also cut off the bottom scrap piece. To make the cuts on the sides of the head square with the top surface of the head, turn the neck bottom-side up and transfer the shape of the head on the underside of the neck. When sawing the neck sides, tilt the neck up so that the top surface of the head is flat against the jigsaw table. File the underside of the neck with a coarse wood rasp to the shape of the templates and sand.

Set the neck aside for the moment and remove the center bending form from the guitar body but leave the outside bending form pieces around the body. Then glue the bottom ⅜ x ⅜ in. beading to the lower edge of the body sides. Use masking tape to hold the beading in place. When the glue dries remove the body from the form and carefully sand the edges of the sides and beadings square and flush. Place the sub-top on the body arranging it so the edges of the top project about 1/16 in. beyond the sides all around. Since the braces on the underside of the sub-top rest against the beading, mark and file the beading to provide clearance for the braces. The underside of sub-top must fit flat against the beading. Glue the sub-top to the body and clamp in gluing clamp (Fig. 7) by tightening all thumb nuts down snug. Remove from clamp when dry and sand edges flush with body sides. Glue the sub-bottom on later.

Your next step is to overlay the top with contrasting woods as in Figs. 8 and 10. First lay out the centerline from the neck block to the tail block on the sub-top. The three pieces of hardwood (maple or holly, walnut and mahogany) that the overlays are cut from should all be exactly the same width (¾ in.). Using a planer blade in the circular saw, rip the hardwood into 3/32 x ¾ in. strips. Set the miter gage at 45° and saw 150 diamond-shaped pieces (Fig. 10) from the walnut strips. Then reset the miter gage to 22½° and cut 150 pieces each from the maple and mahogany strips. Find length A of these pieces (Fig. 10) by measuring length A on the diamond shaped pieces. After cutting six or eight of these pieces make a test assembly with some diamond-shaped pieces to make sure they fit perfectly.

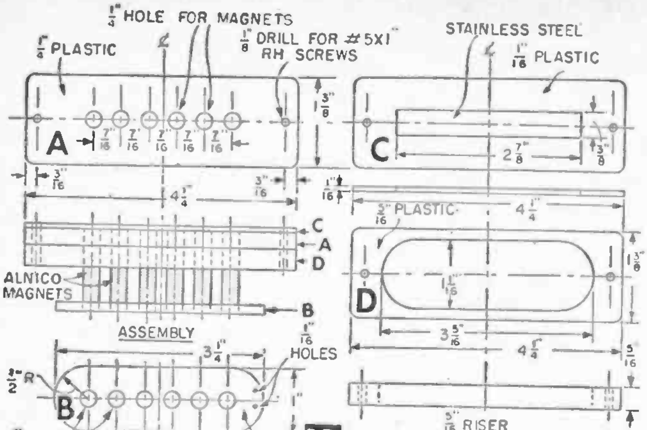
After all the pieces are cut, start the overlay by gluing a line of diamond-shaped walnut pieces on the centerline of the sub-top as in Fig. 10. Ignore the cutouts for the pickups at this time since these openings will be cut later. Continue gluing the other pieces in position, working from center to edges. After the glue dries, trim edges and sand flush with sides. Sand the top.

To install the walnut trim around the outside top edge (Fig. 4), first rout all around the top edge 3/32 in. deep and to a depth 1/16 in. below the sub-top (Sec. A-A Fig. 4). Rip saw a strip of ⅛ x ¼ in. walnut and place it in the steam box. When flexible, bend it around the routed body and secure with masking tape. After the strip has dried, remove the tape and strip, apply glue to the routed edges and again tape the walnut strip in place. When the glue dries, remove the tape and sand the walnut trim strip flush with the top and sides.

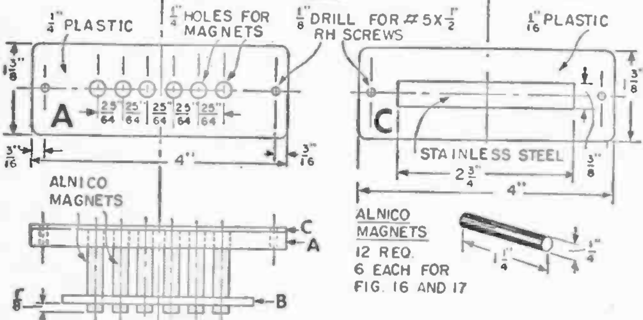
Make cutouts in the top for pickups and mixer, and drill the holes for the tone controls. First lay out the cutouts and hole locations as in Fig. 10 and then saw out with a deep-throat coping saw. Use a ⅜ in. machine drill for the holes.

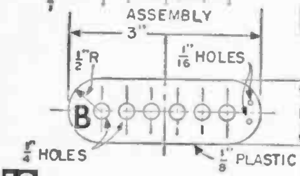
Now, set this part aside and take up the previously made neck piece. On the top side of the head, lay out the 7/32 in. holes and the three diamond-shaped walnut inlay pieces (Fig. 14). Drill the holes and rout or chisel out the head to a depth of 1/16 in. for the walnut inlays. Glue the inlays in place and sand flush.

Fasten the neck to the body so that the centerline of the neck and the centerline of the body are in perfect alignment. This is very important because a slight discrepancy will throw the strings completely out of alignment and the strings will not come over the fingerboard where they belong. Use a combination coarse and fine rasp to fit the dovetail on the neck to dovetail

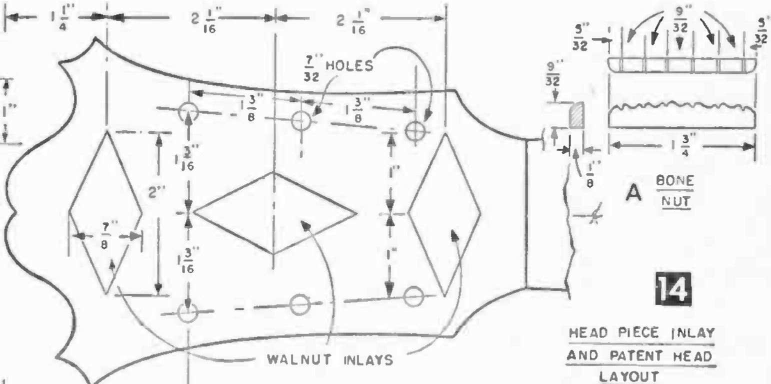


12 TREBLE OR MELODY PICK UP





13 BASS OR CHORD PICK UP



14 HEAD PIECE INLAY AND PATENT HEAD LAYOUT

15 ALIGNING GUITAR NECK TO BODY

in the body.

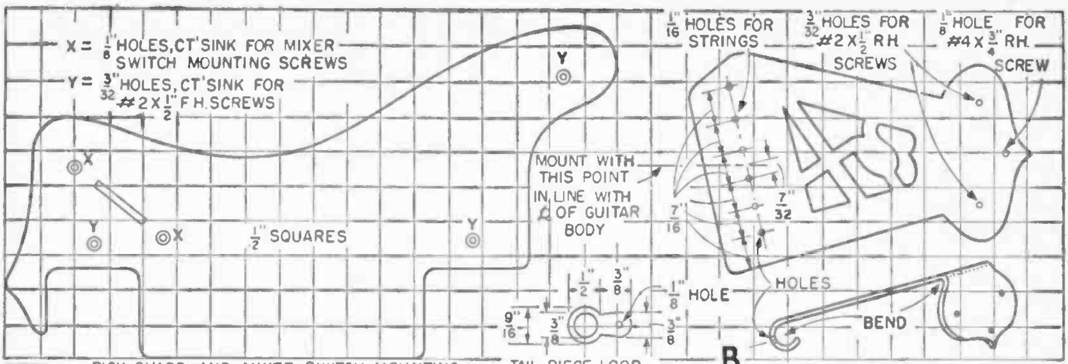
The top surface of the neck should be a slight angle with the top surface of the body when tested with a straightedge as in Fig. 15. If you file away too much stock, use wooden shims to fill in where needed. When you are satisfied with a good fit, glue the neck to the body with *Weldwood* glue and let dry.

Before fastening the back of the body in place, make and install the electrical parts that go inside the body. Starting with the treble pickup, make piece A from ¼ in. plastic and piece B from ⅛ in. plastic according to dimensions given in Fig. 16. When drilling the ¼ in. holes for the Alnico magnets, center piece B on top of piece A, tape together and drill through both pieces at once. Assemble both pieces at opposite ends of six ¼ in. dia. magnets 1¼ in. long by inserting the magnets through the ¼ in. holes. Cement magnets in place with household cement.

Now, wrap one turn of Scotch #33 electrical tape around all six magnets forming a core on which to wind a coil. Thread an 8 in. length of #20 shielded grid wire through one of the 1/16 in. holes in piece B and solder the end of a spool of #40 *Nylclad* heavy magnet wire to the #20 wire. Wind the #40 wire around all of the magnets at once in even layers to form a coil. It will take about 3,500 ft. of magnet wire, or about 6,500 turns on the coil which should test approximately 3,700 ohms on an ohmmeter. If you do not have an ohmmeter, have the coil tested at your local radio repair shop. Complete the coil by soldering the end of the coil to another 8 in. length of #20 shielded grid wire, threaded through the other 1/16 in. hole, and wrap four turns of #33 electrical tape around the entire coil.

Make the top piece (C in Fig. 12) from 1/16 in. thick plastic, cut out the center and tightly fit a piece of stainless steel into the opening. Cement in place if necessary. Also make up piece D in Fig. 12 and place over the coil under piece A. Place piece C on top of piece A and tape the three pieces together. Then drill the ⅛ in. holes for the #5 x ¾ in. *rh* screws.

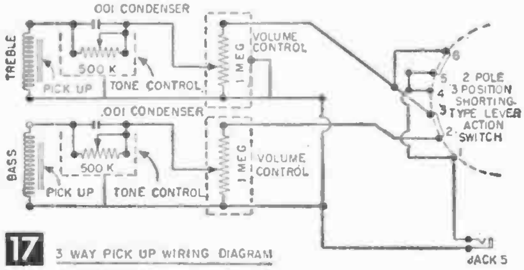
The bass or chord pickup (Fig. 13) is similar to the treble pickup with the exception that the magnets project ⅛ in. below the bottom piece B and no riser piece is used. Wind the coil with 6,900 turns of #40 *Nylclad* magnet wire. The



16 A PICK GUARD AND MIXER SWITCH MOUNTING 1/16" WHITE OPAQUE PLASTIC

TAIL PIECE LOOP 12 GA STAINLESS STEEL

B TAIL PIECE -12 GA. STAINLESS STEEL

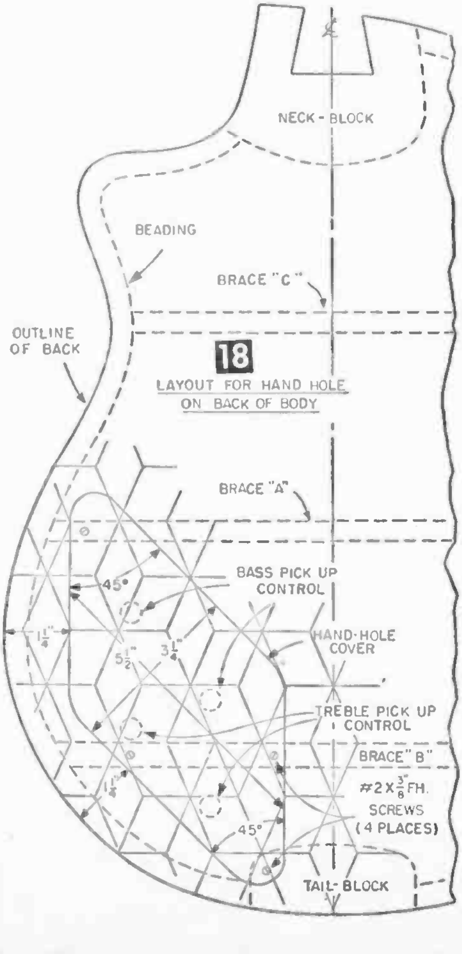


17 3 WAY PICK UP WIRING DIAGRAM

coil should test at about 4,000 ohms. Next sand the top with #8 wet or dry sandpaper using it dry. Then apply natural transparent paste wood filler according to directions on the can. When thoroughly dry, again sand with #8 sandpaper and apply a coat of clear gloss varnish. Only varnish the top at this time, being careful that the varnish does not run down the sides. After the varnish dries, sand with #8 wet or dry sandpaper, using it wet.

Now, mount the pickups, tone and volume controls and mixer switch to the top in their proper places as shown in Fig. 10. Then drill a ⅜ in. hole through the lower, right hand side (shown in Fig. 4) and mount the phone jack. Although the mixer switch is set into the opening cut in the top, it is actually fastened to the pick guard. Make the pick guard of 1/16 in. thick white opaque plastic as detailed in Fig. 16A. Fasten the mixer switch to the guard and fasten the guard to the body top with three screws.

With all of the electrical parts in place, hook them up with soldered connections using #20 single-strand, shielded grid wire in varnished spaghetti according to the wiring diagram as shown in Fig. 17.



18 LAYOUT FOR HAND HOLE ON BACK OF BODY

Fitting the back of the body in place is your next step. Use a pad of old blankets to lay the instrument on while you are working on the back. If you do not intend to inlay the back as you did the top, make the back of ⅛ in. maple plywood. If you do intend to inlay the back use the previously cut 1/16 in. thick subback. Lay out the hand hole opening (Fig. 18) on the back piece and saw it out with a fine jeweler's saw blade in a coping saw. This opening will provide access to the electrical wiring in the event servicing is required. Fit braces A, B and C in Fig. 18, trimming the ⅜ x ⅜ in. beading where needed as you did for the top of the body. Be sure to install the ⅜ x ⅜ in. vertical braces between the top and bottom center braces on each side of the pickup hole cut in the body top as in Sec. A-A, Fig. 4.

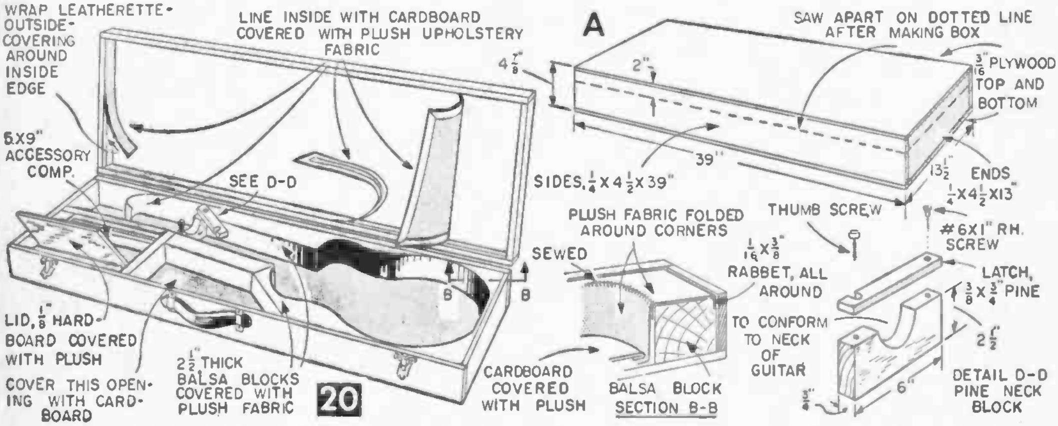
Now, glue the back piece to the body and clamp with the gluing clamp as you did when gluing the top. The inside of one piece of the gluing clamp will have to be cut out to clear the pickups and switches protruding on the top of the body. Tape the piece you cut out for the hand hole in place and glue the inlay pieces in position as you did on the top. When you come to the edges of the hand hole, cut the pieces of inlay to conform to the opening and glue in place. Place a piece of paper between the cut edges of the inlay pieces so that the hand-hole cover will not become glued shut. When finished, fasten cover to body with four #2 x ½ in. *fh* screws, countersunk. Trim and sand the edges of the back flush with the sides and sand the inlaid surface flat and smooth. Then rout out the edge for the walnut binding and install the binding as you did around the top.

The fingerboard and bone nut which are purchased parts need only be trimmed to fit as is shown in Fig. 9. The 12th fret should be 12⅝ in. from the bone nut. Glue in place on the neck. When dry, sand and finish the back, sides and neck as you did the top. Use paste wood filler on the inlay surface only and do not apply any type of finish on the fingerboard or nut. When the first coat of varnish has dried, wet sand the entire instrument, except the fingerboard and nut, and apply two more coats of varnish, sanding between coats. The final coat of varnish can be rubbed down with 2/0 pumice and rottenstone.

You can make the tail piece or purchase one at your local music store. To make one, draw the one shown in Fig. 16B full-size on paper and transfer to 12 gage stainless steel. Saw this out with a metal-cutting blade on a scroll saw. Drill the holes and bend to shape. Also make the tail-piece loop (Fig. 16B). Then mount the tail piece and loop to the guitar body so that the center of the six drilled holes for the strings is exactly in line with the body centerline. The leather lanyard can also be purchased or you can make your own according to the dimensions given in Fig. 19.

Next, install the purchased patent or machine heads to the underside of the neck head as in Fig. 13. To string up your instrument, use *Lektro-Magnetic* strings for the electric Spanish guitar. After stringing, set the rosewood adjustable bridge in place.

Since this instrument is made on the 25-¼ in. scale, the bridge will be 12⅝ in. from the 12th fret on the fingerboard. You are now ready to tune your guitar.



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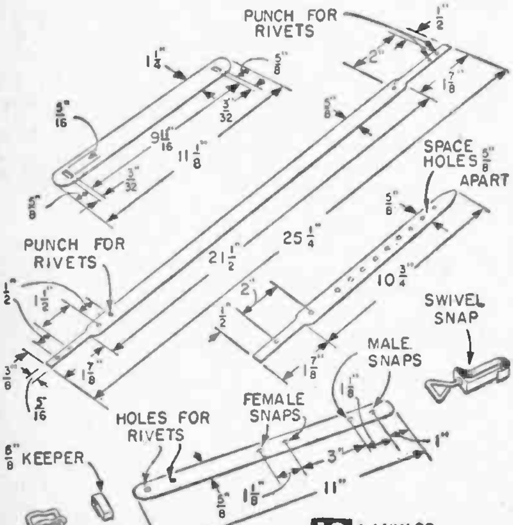

19 LANYARD

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SOLUTION TO ELECTRONICS ANAGRAM

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N	O	D	E	■	R	I	M	■	A	L	I	G	N	■
E	■	I	■	V	A	■	I	O	N	■	C	■	E	■
P	H	O	N	■	D	■	K	■	O	■	W	A	T	T
E	■	D	■	W	I	R	E	■	D	C	■	C	■	R
R	E	E	D	■	A	■	■	P	E	A	K	■	M	A
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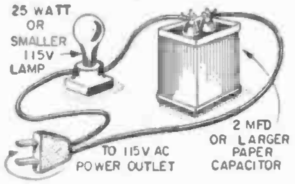
■	■	■	R	■	V	O	L	T	■	C	■	S	S	B
S	H	O	T	■	O	■	I	■	N	■	■	H	■	■
P	■	P	■	P	M	■	P	I	P	■	M	O	■	A
K	■	V	■	A	■	P	■	■	N	E	■	R	I	G
R	C	■	A	D	C	O	C	K	■	G	■	T	■	C

Why Does the Lamp Light?



• For an interesting electrical experiment, take a *paper* capacitor of 2 *mfd* or larger from your junkbox. *Do not use an electrolytic capacitor in this setup as it may explode.* Paper capacitors were extensively used in the power units of early radios and are still extensively used in modern amateur transmitters, so such a paper capacitor should not be hard to find. Test the capacitor by connecting an ohmmeter across its terminals. If the capacitor is good, the ohmmeter will indicate (after a quick "kick") an open circuit through the unit.

Now connect your capacitor in *series* with a cleat lamp socket and screw in a 25-watt, or smaller, bulb. When you connect the series combination to the *ac* power line, you will note that the bulb lights up, although not at full brilliance.

Since the ohmmeter had just shown us that the capacitor is an *open circuit*, how, then, can the lamp light?

A capacitor is made of two separate conducting sheets with a good insulating substance (such as oiled paper) between them. Practically, no electrons can move through the paper to complete the circuit between the plates, yet an *ac* current passes.

Although the ohmmeter indicated an open circuit through the capacitor, the needle did "kick" when the test leads were first applied. This kick is the clue to our apparent paradox; it represents electrical energy flowing in to *charge* the capacitor. A good capacitor may thus retain a stored charge for hours. The electrical energy in this charge may be nearly completely recovered from the capacitor.

The voltage across the *ac* power line periodically reverses itself 60 (50 in some parts of the country) times per second. Now, when a capacitor is connected across such a line it is forced to charge and discharge twice during each complete reversal, or 120 times each second. Each time it charges or discharges, electrons move through its connecting wires. Since our lamp is connected in one of these wires, this charge-discharge current causes it to light.

This principle is universally applied to separate *ac* from *dc* (unchanging) currents throughout vacuum-tube and transistor circuits.—C. F. ROCKEY.

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25 Years Ago in Radio

A QUARTER of a century ago, *White's Radio Log* was 12 years old and commercial broadcasting itself was not much older. Yet as these pages reproduced from the March 1934 issue of *White's* show, broadcasting was even then a healthy medium of entertainment. Some of the programs popular in 1934 are still on the air (and most of 1934's sponsors are still going strong). Indeed, the programming of the Thirties may seem to many to have been radio's golden age, flawed possibly by immaturity, but lusty and vital all the same. Here—for those of you old enough to remember—is what you were listening to 25 years ago. And here—for those of you who missed it—is what your fathers heard, and grow nostalgic about today.

NETWORK RADIO PROGRAMS OF MARCH 1934

C., CBS Network Stations. N.F., WEAF; N.Z., WJZ—both NBC Networks. Eastern Standard Time used exclusively. Sponsors' names appear in parentheses.

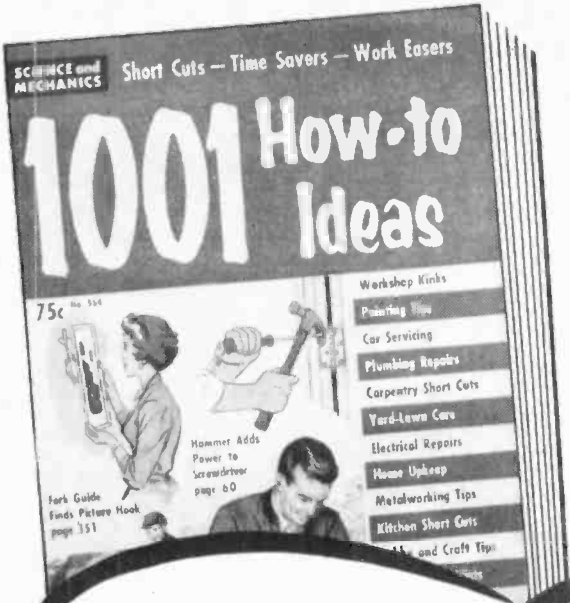
A & P Gypsies (Great A & P Tea Co.)	Monday, 9:00 p.m., N.F.
Abe Lyman's Orch.: Frank Munn (Sterling Products)	Friday, 9:00 p.m., N.F.
Adventures of Tom Mix and his Ralston Straight Shooters (Ralston Purina Co.),	Mon.-Wed.-Fri., 5:30 p.m., also Wed.-Fri., 6:30 p.m., N.F.
Albert Payson Terhume (Spratts Ptd., Ltd.)	Sunday, 4:00 p.m., N.Z.
Albert Spalding (Fletcher's Castoria)	Wednesday, 8:30 p.m., C.
American Album of Familiar Music (Bayer Co., Inc.)	Sunday, 9:30 p.m., N.F.
American Revue (American Oil Co.)	Sunday, 7:00 p.m., C.
Amos 'n' Andy (Pepsodent Co.)	Daily except Sat. & Sun., 7 p.m., also western, 11:00 p.m., N.Z.
An Evening in Paris (Bourjois Sales Corp.)	Sunday, 8:00 p.m., C.
Armour Program, featuring Phil Baker (Armour Co.)	Friday, 9:30 p.m., N.Z.
Baby Rose Marie (Tasty Yeast, Inc.)	Sunday, 12:15 p.m., N.Z.
Bar X Days and Nights (Health Products Co.)	Sunday, 2:00 p.m., N.Z.
Ben Bernie's Blue Ribbon Orchestra (Premier-Pabst Sales Co.),	Tues., 9 p.m., 12 midnight, N.F.
Benny Meroff's Review (Plough, Inc.)	Wednesday, 10 p.m., N.Z.
Betty and Bob (General Mills, Inc.)	Daily except Sat. & Sun., 4:00 p.m., N.Z.
Betty Moore, Interior Decorator (Benjamin Moore & Co.)	Wednesday, 11:30 a.m., N.F.
Big Ben Dream Drama (Western Clock Co.)	Sunday, 5:00 p.m., N.F.
Big Hollywood Show (Phillips Dental Magnesia)	Sunday, 2:30 p.m., C.
Big Show (Ex-Lax Co.)	Monday, 9:30 p.m., C.
Bill and Ginger (C. F. Mueller Co.)	Monday, Wednesday, Friday, 10:15 a.m., C.
Billy Bachelor (Wheatena Corp.)	Daily except Saturday, 7:15 p.m., N.F.
Bing Crosby, Gus Arnheim's Orch., Mills Bros. (John Woodbury Co.)	Monday, 8:30 p.m., C.
Boake Carter (Philco Radio & Television Corp.)	Daily except Sat. & Sun., 7:45 p.m., C.
Bobby Benson and Sunny Jim (Hecker H-O Co.)	Daily except Sat. & Sun., 6:15 & 8:15 p.m., C.
Broadway Melodies (American Home Products Corp.)	Sunday, 2:00 p.m., C.
Buck Rogers in the 25th Century (Cocomalt)	Mon., Tues., Wed., Thurs., 6:00 & 7:30 p.m., C.
Buick Presents (Buick Motor Co.)	Monday & Thursday, 9:15 p.m., C.
Byrd Expedition Broadcast (General Foods Corp.)	Saturday, 10:00 p.m., C.
Cadillac Concert (Cadillac Motor Car Co.)	Sunday, 6:00 p.m., N.Z.
Camel Caravan (R. J. Reynolds Tobacco Co.)	Tuesday & Thursday, 10:00 p.m., C.
Capt. Henry's Maxwell House Show Boat (General Foods Corp.)	Thursday, 9:00 p.m., N.F.
Carborundum Band (Carborundum Co.)	Saturday, 9:30 p.m., C.
Charm Secrets (Lavoris Co.)	Tuesday & Thursday, 11:15 a.m., C.
Chase & Sanborn Hour (Standard Brands, Inc.)	Sunday, 8:00 p.m., N.F.
Chevrolet Program (Chevrolet Motor Co.)	Sunday, 10:00 p.m., N.F.
Cities Service Program (Cities Service Co.)	Friday, 8:00 p.m., N.F.
Clara, Lu 'n' Em (Colgate-Palmolive-Peet Co.)	Daily except Sat. & Sun., 10:15 a.m., N.Z.
Climalene Carnival (The Climalene Co.)	Tuesday & Thursday, 11:30 a.m., N.F.
Conoco Travel Adventures (Continental Oil Co.)	Wednesday, 10:30 p.m., N.Z.
Contented Program (Carnation Milk)	Monday, 10:00 p.m., N.F.
Cook Travelogues (Thomas Cook & Son)	Sunday, 2:30 p.m., N.F.
Cooking Close-Ups (Pillsbury Flour Mills)	Monday, Wednesday, Friday, 11:00 a.m., C.
Corn Cob Pipe Club of Virginia (Larus & Brothers Co.)	Wednesday, 10 p.m., N.F.
Cruise of the Seth Parker (Frigidaire Corp.)	Tuesday, 10:00 p.m., N.F.
Dangerous Paradise (John H. Woodbury Co.)	Wednesday and Friday, 8:30 p.m., N.Z.
Death Valley Days (Pacific Coast Borax Co.)	Thursday, 9:00 p.m., N.Z.
Del Monte Ship of Joy (California Packing Corp.)	Monday, 9:30 p.m., N.F.
Djer Kiss Recital (Vadsco Sales Corp.)	Monday, 8:30 p.m., N.Z.
Don Quixote Dramatization (Jeddo-Highland Coal Co.)	Thurs., Fri., Sat., 7:15 p.m., N.Z.
Easy Aces (Wyeth Chemical Co.)	Tuesday, Wednesday, Thursday, Friday, 1:30 p.m., C.
Eddie Duchin and his Orchestra (Pepsodent Co.)	Tues., Thurs., Sat., 9:30 p.m., N.Z.
Edwin C. Hill (Barbasol Co.)	Daily except Saturday & Sunday, 8:15 & 11:30 p.m., C.
Eno Crime Clues (Harold S. Ritchie & Co.)	Tuesday & Wednesday, 8 p.m., N.Z.
First Nighter (Campana Corp.)	Friday, 10:00 p.m., N.F.
Fitch Program (F. W. Fitch Co.)	Sunday, 7:45 p.m., N.F.

Fleischmann Hour (Standard Brands, Inc.)	Thursday, 8:00 p.m., N.F.
Forty-five Minutes in Hollywood (Borden Co.)	Saturday, 8:00 p.m., C.
Fox Fur Trappers (I. J. Fox, Inc.)	Tuesday, 7:30 p.m., N.F.
Frank Crummit and Julia Sanderson (General Baking Co.)	Sunday, 5:30 p.m., C.
Fred Allen's Sal Hepatica Revue (Bristol-Myers Co.)	Wednesday, 9:30 p.m., N.F.
Fred Waring's Pennsylvanians (Ford Motor Co.)	Sunday, 8:30 p.m., Thursday, 9:30 p.m., C.
Galaxy of Stars (Red Star Yeast & Products Co.)	Tues., Thurs. & Sat., 11:00 a.m., N.F.
Garden of Tomorrow (Tennessee Corp.)	Sunday, 10:30 a.m., N.F.
Gems of Melody (Carleton & Hovey Co.)	Sun., 2:45 p.m., N.F., Wed., 7:15 p.m., N.Z.
Gene Arnold and the Commodores (Crazy Crystals Water Co.),	Sun., Wed., Fri., 2:00 p.m., N.F., Mon. & Thurs., 12 noon, N.Z.
Goldbergs (Pepsodent Co.)	Daily except Saturday & Sunday, 7:45 p.m., N.F.
Grand Hotel (Campana Corp.)	Sunday, 5:30 p.m., N.Z.
Gulf Headliners (Gulf Refining Co.)	Sunday, 9:00 p.m., N.Z.
Hall of Fame (Lehn & Fink Products Co.)	Sunday, 10:30 p.m., N.F.
Happy Bakers (Continental Baking Co.)	Monday, Wednesday & Friday, 8:00 p.m., C.
Hoover Sentinels Concert (The Hoover Co.)	Sunday, 4:30 p.m., N.F.
Horlick's Adventures in Health (Horlick Malted Milk Co.),	Tuesday & Thursday, 8:30 p.m., Tuesday, 11:45 p.m., N.Z.
Household Musical Memories (Household Finance Corp.)	Tuesday, 9:00 p.m., N.Z.
Ipana Troubadours (Bristol-Myers Co.)	Wednesday, 9:00 p.m., N.F.
Irene Rich in Hollywood (Welch Grape Juice Co.)	Sun., 3:15 p.m., Wed., 7:45 p.m., N.Z.
Jack Armstrong, All American Boy (General Mills, Inc.)	Daily except Sun., 5:30 & 6:30 p.m., C.
Jack Frost's Melody Moments (National Sugar Refining Co.)	Monday, 9:30 p.m., N.Z.
Jane Ellison's Magic Recipes (The Borden Sales Co.)	Wednesday, 11:45 a.m., C.
Jack Pearl (Standard Brands, Inc.)	Wednesday, 8:00 p.m., N.F.
Joan Marrow (J. W. Marrow Mfg. Co.)	Tuesday & Thursday, 1:15 p.m., C.
Jergens Program (Andrew Jergens Co.)	Sunday, 9:30 & 11:15 p.m., N.Z.
Josephine Gibson Hostess Council (H. J. Heinz Co.)	Mon., Wed., Fri., 10:00 a.m., N.Z.
Judy and Jane (J. A. Folger & Co.)	Daily except Saturday & Sunday, 2:30 p.m., N.F.
Just Plain Bill (Kolynos Sales Co.)	Daily except Saturday & Sunday, 2:00 & 7:15 p.m., C.
Lady Esther Serenade (Lady Esther Co.)	Sun., 3:00 p.m., Tues. & Wed., 8:30 p.m., N.F.
Lazy Dan, the Minstrel Man (American Home Products Corp.)	Sunday, 1:30 p.m., C.
Leo Reisman's Orch. with Phil Duey (Philip Morris & Co.)	Tuesday, 8:00 p.m., N.F.
Let's Listen to Harris (Northam Warren Corp.)	Friday, 9:00 p.m., N.Z.
Little Miss Bab-O's Surprise Party (B. T. Babbitt Co., Inc.)	Sunday, 1:00 p.m., N.F.
Little Italy (Delaware, Lack. & Western Coal Co.)	Tuesday & Thursday, 6:45 p.m., C.
Little Orphan Annie (Wander Co.)	Daily except Sunday, 5:45 p.m., 6:45 p.m., N.Z.
Lowell Thomas (Sun Oil Co.)	Daily except Saturday & Sunday, 6:45 p.m., N.Z.
Madam Sylvia of Hollywood (Ralston Purina Co.)	Tuesday, 10:30 p.m., N.F.
Maltex Program (Malted Cereals Co.)	Sunday, 1:30 p.m., N.F.
Manhattan Merry-Go-Round (R. L. Watkins Co.)	Sunday, 9:00 p.m., N.F.
Marie the Little French Princess (Affiliated Prod., Inc.),	Tues., Wed., Thurs., Fri., 1:00 p.m., C.
March of Time (Remington Rand, Inc.)	Friday, 8:30 p.m., C.
Metropolitan Opera Broadcast (American Tobacco Co.)	Saturday, 1:45 p.m., N.F. & N.Z.
Minneapolis Symphony Orchestra (General Household Utility Co.)	Tuesday, 9:30 p.m., C.
Molle Show (The Molle Co.)	Monday, Wednesday, Thursday, 7:30 p.m., N.F.
Music by Gershwin (Health Products Corp.)	Monday & Friday, 7:30 p.m., N.Z.
Music on the Air with Jimmy Kemper (Tide Water Oil Sales Co.),	Mon., Wed., Fri., 7:30 p.m., C.
Myrt & Marge (Wm. Wrigley, Jr., Co.)	Daily except Sat. & Sun., 7:00 & 10:45 p.m., C.
Mystery Chef (R. B. Davis Co.)	Tues. & Thurs., 9:45 a.m., C.; Wed. & Fri., 9:00 a.m., N.Z.
Nat Shilkret and his Salon Orchestra (Smith Bros.)	Sunday, 9:45 p.m., N.Z.
National Barn Dance (Dr. Miles Laboratories)	Saturday, 11:00 p.m., N.Z.
Nestle's Chocolate (Lamont-Corliss & Co.)	Friday, 8:00 p.m., N.Z.
Old Gold Program (P. Lorillard Co.)	Wednesday, 10:00 p.m., C.
Oldsmobile Presents (Old's Motor Works)	Tuesday & Friday, 9:15 p.m., C.
Oxol Feature (J. L. Prescott Co.)	Monday, Tuesday, Wednesday, Friday, 5:45 p.m., C.
Oxydol's Own Ma Perkins (Procter & Gamble Co.),	Daily except Saturday & Sunday, 3:00 & 4:30 p.m., N.F.
Patri's Dramas of Childhood (Cream of Wheat Corp.)	Sunday, 10:00 p.m., C.
Paul Whiteman and his Orchestra (Kraft Phenix Cheese Corp.)	Thursday, 10 p.m., N.F.
Pet Milky Way (Pet Milk Sales Corp.)	Tuesday & Thursday, 11:00 a.m., C.
Philadelphia Orchestra (Liggett & Myers Tobacco Co.)	Daily except Sunday, 9:00 p.m., C.
Playboys (M. J. Breiten-Bach Co.—Pepto Mangan)	Sunday, 10:45 a.m., C.
Plough's Musical Cruiser (Plough, Inc.)	Wednesday, 10:00 p.m., N.Z.
Pond's Program (Lamont-Corliss & Co.)	Friday, 9:30 p.m., N.F.
Pontiac Presents (Buick-Oldsmobile-Pontiac Sales Co.)	Saturday, 9:30 p.m., C.
Princess Pat Players (Princess Pat, Ltd.)	Sunday, 4:30 p.m., Monday, 10:30 p.m., N.Z.
Pure Oil Program (Pure Oil Co.)	Saturday, 9:00 p.m., N.Z.
Real Silk Show (Real Silk Hosiery Mills)	Sunday, 7:00 p.m., N.Z.
Red Davis, Dramatic Sketch (Beech-nut Packing Co.)	Mon., Wed. & Fri., 8:45 p.m., N.Z.
Richard Hudnut Presents Marvelous Melodies (Hudnut Sales Co., Inc.)	Friday, 9:30 p.m., C.
Rin Tin Tin Thriller (Chappel Bros., Inc.—Ken-L-Ration)	Sunday, 7:45 p.m., C.
Rings of Melody (Perfect Circle Co.)	Sunday, 2:30 p.m., N.Z.
Romance of Helen Trent (Edna Wallace Hopper, Inc.)	Daily except Sat. & Sun., 2:15 p.m., C.
Roses and Drums (Union Central Life Ins. Co.)	Sunday, 5:00 p.m., C.
Saturday Night Terraplane Party (Hudson Motor Car Co.)	Saturday, 10:00 p.m., N.F.
Sealed Power Side Show (Sealed Power Corp.)	Monday, 8:00 p.m. & 12 midnight, N.Z.
Seven Star Revue (Corn Products Refining Co.)	Sunday, 9:00 p.m., C.
Silver Dust (Gold Dust Corp.)	Tuesday, Thursday & Saturday, 7:30 p.m., C.

Sinclair Greater Minstrels (Sinclair Refining Co.)	Monday, 9:00 p.m., N.Z.
Singing Lady (Kellogg Co.)	Daily except Saturday & Sunday, 5:30 p.m., 6:30 p.m., N.Z.
Skippy (Phillips Dental Magnesia)	Daily except Saturday & Sunday at 5:00 & 6:00 p.m., C.
Smiling Ed McConnell (Acme White Lead & Color Works),	Sunday, 6:30 p.m., Wednesday & Friday, 12:30 p.m., C.
Soconyland Sketch (Standard Oil Co. of N. Y.)	Monday, 8:00 p.m., N.F.
Songs Your Mother Used to Sing (Wyeth Chemical Co.)	Sunday, 6:00 p.m., C.
Stamp Adventurer's Club (Louden Packing Co.)	Thursday, 5:45 & 6:45 p.m., C.
Sweetheart Melodies (Manhattan Soap Co.)	Thursday, 11:30 a.m., N.F.
Swift Garden Program (Swift & Co.)	Sunday, 3:30 p.m., N.F.
Swift Review (Swift & Co.)	Friday, 10 p.m., C.
Talkie Picture Time (Luxor, Ltd.)	Sunday, 5:30 p.m., N.F.
Texaco Fire Chief Band; Ed Wynn (Texas Co.)	Tuesday, 9:30 p.m., N.F.
Tito Guizar's Mid-day Serenade (Brillo Mfg. Co.)	Sunday, 12:30 p.m., C.
Today's Children (Pillsbury Flour Mills Co.)	Daily except Sat. & Sun., 10:30 a.m., N.Z.
Tony Wons with Keenan & Philips (S. C. Johnson & Son)	Tues. & Thurs., 11:30 a.m., C.
Tower Health Exercises (Metropolitan Life Ins. Co.)	Daily except Sun., 6:45 to 8:00 a.m., N.F.
Trade & Mark (Smith Brothers, Inc.)	Saturday, 8:45 p.m., C.
True Story Court of Human Relations (True Story Pub. Co.)	Sunday, 7:00 p.m., N.F.
Voice of Firestone (Firestone Tire & Rubber Co.)	Monday, 8:30 & 11:30 p.m., N.F.
Voice of Romance (Rieser Co., Inc.)	Saturday, 6:15 p.m., C.
Warden Lawes in "20,000 Years in Sing Sing" (Wm. R. Warner Co.)	Wed., 9 p.m., N.Z.
Ward's Family Theatre (Ward Baking Co.)	Sunday, 6:45 & 7:30 p.m., C.
Waves of Romance (Rieser & Co.)	Sunday, 5:15 p.m., N.F.
Wayne King's Orchestra (Lady Esther Co.)	Monday, 10:00 p.m., C.
White Owl Program (General Cigar Co.)	Wednesday, 9:30 p.m., C.
Wildroot Institute (Wildroot Co.)	Sunday, 4:15 p.m., N.F.
Will Osborne and His Orchestra (Corn Products Refining Co.)	Mon., Wed., Fri., 10:45 a.m., C.
Wizard of Oz (General Food Corp.)	Monday, Wednesday & Friday, 5:45 p.m., N.F.
Vince Program with John McCormack (Wm. R. Warner Co.)	Wednesday, 9:30 p.m., N.Z.
Voice of Experience (Wasey Products, Inc.),	Daily except Sun., 12 noon; also Tues., 8:30 & 11:45 p.m., Thurs., 8:30 p.m., C.
Yeast Foamers (Northwestern Yeast Co.)	Sunday, 3:30 p.m., N.Z.
Ye Happy Minstrel and Tiny Band (Wheatena Corp.),	Mon., Wed., Sat., 6:45 p.m.; Tues. & Thurs., 4:45 p.m., C.
Zoel Parenteau's Orchestra (Worcester Salt Co.)	Friday, 6:45 p.m., C.

☞ For some auditors, listening to a favorite program was a ritual. At 7:00, for example, everyone stopped everything and the country listened to Amos 'n' Andy. Here are the programs of a typical 1934 weeknight (Wednesday in this instance), and the times you tuned them in.

6:45 to 8:00 a.m.	Tower Health Exercises	N.F.
9:00 a.m.	The Mystery Chef	N.Z.
10:00 a.m.	Josephine Gibson Hostess Council,	N.Z.
10:15 a.m.	Bill and Ginger	C.
10:15 a.m.	Clara, Lu 'n' Em	N.Z.
10:30 a.m.	Today's Children	N.Z.
10:45 a.m.	Will Osborne and his Orch.	C.
11:00 a.m.	Cooking Close-Ups	C.
11:30 a.m.	Betty Moore, Interior Decorator	N.F.
11:45 a.m.	Jane Ellison's Magic Recipes	C.
12:00 noon.	Gene Arnold and the Commodores,	N.F.
12:00 noon.	The Voice of Experience	C.
12:30 p.m.	Smiling Ed McConnell	C.
1:00 p.m.	Marie, the Little French Princess	C.
1:30 p.m.	Easy Aces	C.
2:00 p.m.	Just Plain Bill	C.
2:15 p.m.	Romance of Helen Trent	C.
2:30 p.m.	Judy and Jane	N.F.
3:00 p.m.	Oxydol's Program	N.F.
4:00 p.m.	Betty and Bob	N.Z.
4:30 p.m.	Oxydol's Program	N.F.
5:00 p.m.	Skippy	C.
5:30 p.m.	Adventures of Tom Mix	N.F.
5:30 p.m.	Jack Armstrong, All American Boy,	C.
5:30 p.m.	Singing Lady	N.Z.
5:45 p.m.	Little Orphan Annie	N.Z.
5:45 p.m.	The Oxol Feature	C.
5:45 p.m.	Wizard of Oz	N.F.
6:00 p.m.	Buck Rogers in the 25th Century	C.
6:00 p.m.	Skippy	C.
6:15 p.m.	Bobby Benson and Sunny Jim	C.
6:30 p.m.	Adventures of Tom Mix	N.F.
6:30 p.m.	Household Music Box	C.
6:30 p.m.	Jack Armstrong, All American Boy,	C.
6:30 p.m.	Singing Lady	N.Z.
6:45 p.m.	Little Orphan Annie	N.Z.
6:45 p.m.	Lowell Thomas	N.Z.
6:45 p.m.	Ye Happy Minstrel & Tiny Band	C.
7:00 p.m.	Amos 'n' Andy	N.Z.
7:00 p.m.	Myrt and Marge	C.
7:15 p.m.	Billy Batchelor	N.F.
7:15 p.m.	Gems of Melody	N.Z.
7:15 p.m.	Just Plain Bill	C.
7:30 p.m.	Buck Rogers in the 25th Century	C.
7:30 p.m.	The Molle Show	N.F.
7:30 p.m.	Music on the Air with Jimmy Kemper	C.
7:45 p.m.	Boake Carter	C.
7:45 p.m.	Goldberg's	N.F.
7:45 p.m.	Irene Rich in Hollywood	N.Z.
8:00 p.m.	Eno Crime Clues	N.Z.
8:00 p.m.	Happy Bakers	C.
8:00 p.m.	Royal Gelatin Review with Jack Pearl	N.F.
8:15 p.m.	Bobby Benson and Sunny Jim	C.
8:15 p.m.	Edwin C. Hill, "The Human Side of the News"	C.
8:30 p.m.	Albert Spalding	C.
8:30 p.m.	Dangerous Paradise	N.Z.
8:30 p.m.	Lady Esther Serenade	N.F.
8:45 p.m.	"Red Davis" Dramatic Sketch	N.Z.
9:00 p.m.	Ipana Troubadours	N.F.
9:00 p.m.	Philadelphia Orchestra	C.
9:00 p.m.	Warden Lawes in "20,000 Years in Sing Sing"	N.Z.
9:30 p.m.	Fred Allen's Revue	N.F.
9:30 p.m.	Vince Program with John McCormack	N.Z.
9:30 p.m.	White Owl Program	C.
10:00 p.m.	Plough's Musical Cruiser	N.Z.
10:00 p.m.	Corn Cob Pipe Club	N.F.
10:00 p.m.	Old Gold Program	C.
10:30 p.m.	Conoco Adventures	N.Z.
10:45 p.m.	Myrt and Marge	C.
11:00 p.m.	Amos 'n' Andy	N.Z.
11:30 p.m.	Edwin C. Hill, "The Human Side of the News"	C.



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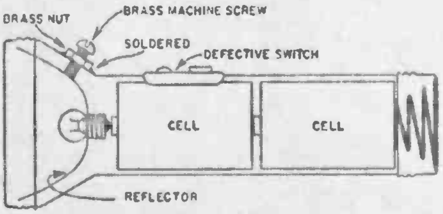

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WHITE'S RADIO LOG

An up-to-date broadcasting directory
AM, FM, TV and Short-Wave Stations

Vol. 37 No. 1

QUICK REFERENCE INDEX

U. S. and Canadian AM Stations by Frequency

U.S. stations listed alphabetically by states within groups, Canadian stations precede U.S.

Abbreviations: Kc., frequency in kilocycles; W.P., watt power; d—operates daytime only. Wave length is given in meters

Kc. Wave Length	W.P.
540—555.5	
CBK Regina, Sask.	50000
KVIP Redding, Calif.	1000d
KFMB San Diego, Calif.	5000
WGTO Cypress Gardens, Florida	50000d
WDAK Columbus, Ga.	5000
KBRV Soda Springs, Idaho	500d
KWMT Ft. Dodge, Iowa	1000d
WDVM Pocomoke City, Md.	500d
WCNG Canonsburg, Pa.	250d
WDXN Clarksville, Tenn.	250d
WRIC Richlands, Va.	1000d
550—545.1	
CFNB Fredericton, N.B.	50000
CFBR Sudbury, Ont.	1000
CHLN Three Rivers, Que.	5000
CKPG Prince George, B.C.	250
KENI Anchorage, Alaska	5000
KOY Phoenix, Ariz.	5000
KAFY Bakersfield, Calif.	1000
KRAI Craig, Colo.	1000
WGGA Gainesville, Ga.	5000
KMVI Wailuku, Hawaii	1000
KFRM Concordia, Kansas	5000d
WCBI Columbus, Miss.	1000
KSD St. Louis, Mo.	5000
KOPR Butte, Mont.	1000
WGR Buffalo, N.Y.	5000
WDBM Statesville, N.C.	500d
KFYR Bismarck, N.Dak.	5000
WKRC Cincinnati, Ohio	5000
KOAC Corvallis, Oreg.	5000
WHLM Bloomsburg, Pa.	500
WPAB Ponce, P.R.	5000
WPAW Pawtucket, R.I.	1000d
KCRS Midland, Tex.	5000
KTSA San Antonio, Tex.	5000
WDEV Waterbury, Vt.	5000
WSVA Harrisonburg, Va.	5000
WSAU Wausau, Wis.	5000
560—535.4	
CFRA Ottawa, Ont.	5000
CJKL Kirkland Lake, Ont.	5000
CFOS Owen Sound, Ont.	1000
WOOF Dothan, Ala.	5000d
KYUM Yuma, Ariz.	1000
KSFO San Fran., Calif.	5000
KLZ Denver, Colo.	5000
WQAM Miami, Fla.	5000
WIND Chicago, Ill.	5000
WMIK Middlesboro, Ky.	500d
WGAN Portland, Maine	5000
WHYN Springfield, Mass.	1000
WMIC Monroe, Mich.	500d
WEBC Duluth, Minn.	5000
KWTO Springfield, Mo.	5000
KMON Great Falls, Mont.	5000
WGAI Elizabeth City, N.C.	1000
WFIL Philadelphia, Pa.	5000
WIS Columbia, S.C.	5000
WHBQ Memphis, Tenn.	5000
KFDM Beaumont, Tex.	5000
KPQ Wenatchee, Wash.	5000
WJLS Beckley, W.Va.	5000
570—526.0	
CKEK Cranbrook, B.C.	1000
CKCQ Quesnel, B.C.	1000
CJEM Edmundston, N.B.	1000
WCAS Gadsden, Ala.	5000d
KCNO Alturas, Calif.	1000
KLAC Los Angeles, Calif.	5000
WGMS Washington, D.C.	50000
WACL Waycross, Ga.	5000
WKYB Paducah, Ky.	1000
WVMI Biloxi, Miss.	1000d
KGRT Las Cruces, N.Mex.	1000d
WMCA New York, N.Y.	5000
WSYR Syracuse, N.Y.	5000
WWNC Asheville, N.C.	5000
WSHE Raleigh, N.C.	500d
WKBN Youngstown, Ohio	5000
WNAX Yankton, S.Dak.	5000
WFAA Dallas, Tex.	5000
WBAP Ft. Worth, Tex.	5000
KLUB Salt Lake City, Utah	5000
KVI Seattle, Wash.	5000
WMAM Marinette, Wis.	250
580—516.9	
CFCL Timmins, Ont.	1000
CJFX Antigonish, N.S.	5000
CKEY Toronto, Ont.	5000
CKPR Ft. William, Ont.	5000
CKUA Edmonton, Alta.	1000
CKY Winnipeg, Man.	5000
WABT Tuskegee, Ala.	500d
KTAN Tucson, Ariz.	5000
KMJ Fresno, Calif.	5000
KUBC Montrose, Colo.	5000
WDBO Orlando, Fla.	5000
WGAC Augusta, Ga.	5000
KFXD Nampa, Idaho	5000
WILL Urbana, Ill.	5000d
KSAC Manhattan, Kans.	5000
WIBW Topeka, Kans.	5000
KALB Alexandria, La.	5000
WTAG Worcester, Mass.	5000
WELD Tupelo, Miss.	1000
WAGR Lumberton, N.C.	500d
WHP Harrisburg, Pa.	5000
WKAQ San Juan, P.R.	5000
WRKH Rockwood, Tenn.	1000d
KDAV Lubbock, Tex.	500d
WCHS Charleston, W.Va.	5000
WKTY LaCrosse, Wis.	5000
590—508.2	
CFAR FlinFlon, Man.	1000
CKAR Huntsville, Ont.	1000
CKRS Jonquiere, Que.	1000
VOCM St. Johns, N.F.	10000
WRAG Carrollton, Ala.	1000d
KBHS Hot Springs, Ark.	5000d
KFXM San Bernardino, Cal.	1000
KCSJ Pueblo, Colo.	1000
WDLP Panama City, Fla.	1000
WPLO Atlanta, Ga.	5000
KGMB Honolulu, Hawaii	5000
KID Idaho Falls, Idaho	5000
WVLK Lexington, Ky.	5000
WEEI Boston, Mass.	5000
WKZO Kalamazoo, Mich.	5000
WOW Omaha, Nebr.	5000
WROW Albany, N.Y.	5000
WGTM Wilson, N.C.	5000
KUGN Eugene, Oreg.	5000
WARM Scranton, Pa.	5000
WMBS Uniontown, Pa.	1000
KTBC Austin, Tex.	5000
KSUB Cedar City, Utah	1000
WLVA Lynchburg, Va.	1000
KHQ Spokane, Wash.	5000
600—499.7	
CFCF Montreal, Que.	5000
CFCH North Bay, Ont.	1000
CFQC Saskatoon, Sask.	5000
CJOR Vancouver, B.C.	5000
CKCL Truro, N.S.	1000
WIRB Enterprise, Ala.	1000
KCLS Flagstaff, Ariz.	5000
KVCV Redding, Calif.	1000
KFSD San Diego, Calif.	5000
WICC Bridgeport, Conn.	1000
WPDQ Jacksonville, Fla.	5000
WMT Cedar Rapids, Iowa	5000
WYFE New Orleans, La.	1000d
WFST Caribou, Maine	5000d
WCAO Baltimore, Md.	5000
WLST Escanaba, Mich.	1000d
WTAC Flint, Mich.	1000
KGEZ Kalispell, Mont.	2000
WCVP Murphy, N.C.	1000d
WSJS Winston-Salem, N.C.	5000

Kc.	Wave Length	W.P.
KSJB	Jamestown, N.D.	5000
WFRM	Coudersport, Pa.	1000d
WAEL	Mayaguez, P.R.	1000
WREC	Memphis, Tenn.	5000
KROD	El Paso, Tex.	5000
KERB	Kermit, Tex.	1000d
KTBB	Tyler, Tex.	1000

610—491.5

Kc.	Wave Length	W.P.
CHNC	New Carlisle, Que.	5000
CJAT	Trail, B.C.	1000
CKKL	Thompson, Man.	1000
CKTB	St. Catharines, Ont.	5000
WSGN	Birmingham, Ala.	5000
KAVL	Lancaster, Calif.	1000
KFRC	San Francisco, Calif.	5000
WCKR	Miami, Fla.	5000
WCEH	Hawkinsville, Ga.	500d
KUAM	Agana, Guam	1000
WRUS	Russellville, Ky.	500d
KDAL	Duluth, Minn.	5000
WDAF	Kansas City, Mo.	5000
KOJM	Havre, Mont.	1000
WGIR	Manchester, N.H.	5000
KGGM	Albuquerque, N.Mex.	5000
WAYS	Charlotte, N.C.	5000
WTVN	Columbus, Ohio	5000
WIP	Philadelphia, Pa.	5000
KILT	Houston, Tex.	5000
KVNU	Logan, Utah	1000
WSLS	Roanoke, Va.	5000
KEPR	Kennewick, Wash.	5000

620—483.6

Kc.	Wave Length	W.P.
CKCK	Regina, Sask.	5000
KTAR	Phoenix, Ariz.	5000
KNGS	Hanford, Calif.	1000
KWSD	Mt. Shasta, Calif.	1000d
KSTR	Grand Junction, Colo.	5000d
WSUN	St. Petersburg, Fla.	5000
WTRP	LaGrange, Ga.	1000d
KWAL	Wallace, Idaho	1000
KMNS	Sioux City, Iowa	1000
WTMT	Louisville, Ky.	500d
WLBZ	Bangor, Maine	5000
WJDX	Jackson, Miss.	5000
WVNJ	Newark, N.J.	5000
WHEN	Syracuse, N.Y.	5000
WDNC	Durham, N.C.	5000
KGW	Portland, Oreg.	5000
WHJB	Greensburg, Pa.	1000
WCAY	Cayce, S.C.	500d
WATE	Knoxville, Tenn.	5000
KWFT	Wichita Falls, Tex.	5000
WCAX	Burlington, Vt.	5000
WWNR	Beckley, W.Va.	1000
WTMJ	Milwaukee, Wis.	5000

630—475.9

Kc.	Wave Length	W.P.
CFCO	Chatham, Ont.	1000
CHLT	Sherbrooke, Que.	5000
CFCY	Charlottetown, P.E.I.	5000
CJET	Smith Falls, Ont.	1000
CKRC	Winnipeg, Man.	5000
CKOV	Kelowna, B.C.	1000
CKYL	Peace River, Alta.	1000
WAVU	Albertville, Ala.	1000d
WJDB	Thomasville, Ala.	1000d
KJNO	Juneau, Alaska	1000
KVMA	Magnolia, Ark.	1000d
KIDD	Monterey, Calif.	1000
KHOW	Denver, Colo.	5000
WMAL	Washington, D.C.	5000
WSAV	Savannah, Ga.	5000
KIDO	Boise, Idaho	5000
WLAP	Lexington, Ky.	5000
KTIB	Thibodaux, La.	500
WJMS	Ironwood, Mich.	1000
KDWB	So. St. Paul, Minn.	5000
KXOK	St. Louis, Mo.	5000
KGVW	Belgrade, Mont.	1000d
KOH	Reno, Nev.	5000
KLEA	Lovington, N.Mex.	500
WIRC	Hickory, N.C.	1000d
WMFD	Wilmington, N.C.	1000
WEJL	Scranton, Pa.	500d
WPRO	Providence, R.Y.	5000
KGFX	Pierre, S.Dak.	250
KMAC	San Antonio Tex.	5000
KGDN	Edmunds, Wash.	1000d
KZUN	Opportunity, Wash.	500d

640—468.5

Kc.	Wave Length	W.P.
CBN	St. John's, N.F.	10000
KFI	Los Angeles, Calif.	50000
WOI	Ames, Iowa	5000d
WHKK	Akron, Ohio	1000
WNAD	Norman, Okla.	1000d

650—461.3

Kc.	Wave Length	W.P.
KPOA	Honolulu, Hawaii	10000
WSM	Nashville, Tenn.	50000
KRCT	Baytown, Texas	250d

660—454.3

Kc.	Wave Length	W.P.
KFAR	Fairbanks, Alaska	10000
KOWH	Omaha, Nebr.	500d
WRCA	New York, N.Y.	50000
WESC	Greenville, S.C.	5000d
KSKY	Dallas, Tex.	1000

670—447.5

Kc.	Wave Length	W.P.
WMAQ	Chicago, Ill.	50000

680—440.9

Kc.	Wave Length	W.P.
CHFA	Edmonton, Alta.	5000
CHLO	St. Thomas, Ont.	1000
CJOB	Winnipeg, Man.	10000
CKGB	Timmins, Ont.	5000
KNBC	San Fran., Calif.	50000
WPIN	St. Petersburg, Fla.	1000d
WCTT	Corbin, Ky.	1000
WCBM	Baltimore, Md.	10000
WNAC	Lawrence, Mass.	50000
WDBC	Escanaba, Mich.	1000
KFEQ	St. Joseph, Mo.	5000
WINR	Binghamton, N.Y.	1000
WRVM	Rochester, N.Y.	250d
WPTF	Raleigh, N.C.	50000
WISR	Butler, Pa.	250d
WAPA	San Juan, P.Rico.	10000
WMPS	Memphis, Tenn.	10000
KENS	San Antonio, Tex.	50000
KOMW	Omak, Wash.	1000d

690—434.5

Kc.	Wave Length	W.P.
CBU	Vancouver, B.C.	10000
CBF	Montreal, Que.	50000
WVOK	Birmingham, Ala.	50000d
KVNA	Flagstaff, Ariz.	1000
KEVT	Tucson, Ariz.	250d
KBBA	Benton, Ark.	250d
KAPI	Pueblo, Colo.	250d
WADS	Ansonia, Conn.	500d
WAPE	Jacksonville, Fla.	25000d
KULA	Honolulu, Hawaii	10000
KBLI	Blackfoot, Idaho	1000d
KGGF	Coffeyville, Kans.	10000
WTIX	New Orleans, La.	5000
KSTL	St. Louis, Mo.	1000d
KRCO	Prineville, Oreg.	1000d
KUSD	Vermillion, S.Dak.	1000d
KHEY	El Paso, Tex.	10000
KPET	Lamesa, Tex.	250
KZEY	Tyler, Tex.	250d
WCYB	Bristol, Va.	10000d
WNNT	Warsaw, Va.	250d
WELD	Fisher, W.Va.	500d

700—428.3

Kc.	Wave Length	W.P.
WLW	Cincinnati, Ohio	50000

710—422.3

Kc.	Wave Length	W.P.
CJSP	Leamington, Ont.	250d
CFRG	Gravelbourg, Sask.	5000d
CKVM	Ville Marie, Que.	1000
WKRG	Mobile, Ala.	1000
KMPC	Los Angeles, Calif.	50000
KICN	Denver, Colo.	5000
WGBS	Miami, Fla.	50000
WROM	Rome, Ga.	1000d
KEEL	Shreveport, La.	10000
WHB	Kansas City, Mo.	10000
WOR	New York, N.Y.	50000
DZRH	Manila, P.I.	10000
WKJB	Mayaguez, P.Rico	1000
WTPR	Paris, Tenn.	250d
KGNC	Amarillo, Tex.	10000
KURV	Edinburg, Tex.	250
KIRO	Seattle, Wash.	50000
WDSM	Superior, Wis.	5000

720—416.4

Kc.	Wave Length	W.P.
WGN	Chicago, Ill.	50000

730—410.7

Kc.	Wave Length	W.P.
CJNR	Blind River, Ont.	1000
CKAC	Montreal, Que.	50000
CKDM	Dauphin, Man.	1000
CKLG	No. Vancouver, B.C.	10000
KFQD	Anchorage, Alaska	10000
WJMW	Athens, Ala.	1000d
KNBY	Newport, Ark.	1000d
WKTG	Thomasville, Ga.	1000d
KBLR	Goodland, Kans.	1000d
WFMW	Madisonville, Ky.	250d
WMTC	Vancleve, Ky.	1000d
KTRY	Bastrop, La.	250d
WARB	Covington, La.	250d
WMMS	Bath, Maine	500d
WACE	Chicopee, Mass.	1000d
KWRE	Warrenton, Mo.	500d
KWOA	Worthington, Minn.	1000d
KURL	Billings, Mont.	500d
WDOS	Oneonta, N.Y.	1000d
WFMC	Goldsboro, N.C.	1000d
WOHS	Shelby, N.C.	1000d
WHRW	Bowling Green, Ohio	250d
KBOY	Medford, Oreg.	1000d
WNAK	Nanticoke, Pa.	1000d
WPIT	Pittsburgh, Pa.	1000d
WPAL	Charleston, S.C.	1000d
WLIL	Lenoir, Tenn.	1000d
KKSN	Grand Prairie, Tex.	500d
KSVN	Ogden, Utah	1000d
WPIK	Alexandria, Va.	1000d
WMNA	Gretna, Va.	1000d
KULE	Ephrata, Wash.	1000d

740—405.2

Kc.	Wave Length	W.P.
CBXA	Edmonton, Alta.	250
CBL	Toronto, Ont.	50000
WBAM	Montgomery, Ala.	50000d
KUEQ	Phoenix, Ariz.	1000d
KBIG	Avalon, Calif.	10000d
KCBS	San Francisco, Calif.	50000
KSSS	Colo. Springs, Colo.	250d
KVFC	Cortez, Colo.	1000d
WKIS	Orlando, Fla.	5000
KYME	Boise, Idaho	500d
WVLN	Olney, Ill.	250d
KBOE	Oskaloosa, Iowa	250d
WNOP	Newport, Ky.	1000d
WFRB	Frostburg, Md.	250d
WTAO	Cambridge, Mass.	250d
KPBM	Carlsbad, N.Mex.	1000d
WGSM	Huntington, N.Y.	1000d
WMBL	Morehead City, N.C.	1000d
WPAQ	Mount Airy, N.C.	10000d
KRMG	Tulsa, Okla.	50000
WVCH	Chester, Pa.	1000d
WIBS	Santurce, P.Rico	10000d
WBAW	Barnwell, S.C.	500d
WIRJ	Humboit, Tenn.	250d
WJIG	Tullahoma, Tenn.	250d
KTRH	Houston, Tex.	50000

750—399.8

Kc.	Wave Length	W.P.
WSB	Atlanta, Ga.	50000
WBMD	Baltimore, Md.	1000d
KMMJ	Grand Island, Neb.	1000
WHEB	Portsmouth, N.H.	1000
KSEO	Durant, Okla.	250d
KXL	Portland, Oreg.	10000
WPDX	Clarksburg, W.Va.	1000d

760—394.5

Kc.	Wave Length	W.P.
KGU	Honolulu, Hawaii	10000
WJR	Detroit, Mich.	50000
WCPS	Tarboro, N.C.	1000

770—389.4

Kc.	Wave Length	W.P.
KUOM	Minneapolis, Minn.	5000d
WCAL	Northfield, Minn.	5000d
WEW	St. Louis, Mo.	1000d
KOB	Albuquerque, N. Mex.	50000
WABC	New York, N.Y.	50000
KXA	Seattle, Wash.	1000

780—384.4

Kc.	Wave Length	W.P.
WBBM	Chicago, Ill.	50000
WJAG	Norfolk, Neb.	1000
WCKB	Dunn, N.C.	1000d
WBBO	Forest City, N.C.	1000d
KSPI	Stillwater, Okla.	250d
WARL	Arlington, Va.	1000d

790—379.5

Kc.	Wave Length	W.P.
CBY	Corner Brook, N.F.	1000
CKMR	Newcastle, N.B.	1000
CKSO	Sudbury, Ont.	5000
WTUG	Tuscaloosa, Ala.	500d
KCEE	Tucson, Ariz.	1000d
KOSY	Texarkana, Ark.	1000
KDAN	Eureka, Calif.	5000d
KABC	Los Angeles, Calif.	5000
WLBE	Leesburg, Fla.	5000
WPFA	Pensacola, Fla.	1000d
WQXI	Atlanta, Ga.	5000
WGRA	Cairo, Ga.	1000d
KXXX	Colby, Kans.	5000d
WAKY	Louisville, Ky.	5000
WRUM	Rumford, Me.	1000d
WSGW	Saginaw, Mich.	1000
KGHL	Billings, Mont.	5000
WWNY	Watertown, N.Y.	1000
WLSV	Wellsville, N.Y.	1000d
WTNC	Thomasville, N.C.	1000d
WKLM	Wilmington, N.C.	500d
KXGO	Fargo, N.Dak.	5000
KWIL	Albany, Oreg.	1000
WAEB	Allentown, Pa.	500
WPIC	Sharon, Pa.	1000d
WEAN	Providence, R.I.	5000
WWBD	Bamberg, S.C.	1000d
WETB	Johnson City, Tenn.	1000d
WMC	Memphis, Tenn.	5000
KTHT	Houston, Tex.	5000
KFYO	Lubbock, Tex.	5000
WSIG	Mount Jackson, Va.	1000d
WTAR	Norfolk, Va.	5000
KVOS	Bellingham, Wash.	1000
KNEW	Spokane, Wash.	5000
WEAQ	Eau Claire, Wis.	5000
WEAU	Washington, Wis.	5000

800—374.8

Kc.	Wave Length	W.P.
CHAB	Moose Jaw, Sask.	10000
CKOK	Penticton, B.C.	10000
CFOB	Ft. Frances, Ont.	1000
CJBQ	Belleville, Ont.	1000
CKLW	Windsor, Ont.	50000
CHRC	Quebec, Que.	10000
CJAD	Montreal, Que.	10000
VOWR	St. Johns, N.F.	1000
WHOS	Decatur, Ala.	1000d
WMGY	Montgomery, Ala.	1000d
KINY	Juneau, Alaska	5000
KAGH	Crossett, Ark.	250d
KVOM	Morrilton, Ark.	250d
KIKK	Bakersfield, Calif.	250d
KHIL	Brighton, Colo.	500d
WLAD	Danbury, Conn.	250d
WMBM	Miami Beach, Fla.	1000d
WSUZ	Palatka, Fla.	1000d
WJAT	Swainsboro, Ga.	1000d
KXIC	Iowa City, Iowa	1000d
WRUS	Russellville, Ky.	1000d
WBOK	New Orleans, La.	1000d
WCCM	Lawrence, Mass.	1000d
KREI	Farmington, Mo.	1000d
KDBM	Dillon, Mont.	1000d
WKDN	Camden, N.J.	1000d
KTOW	Okla. City, Okla.	250d
KPDQ	Portland, Oreg.	1000d
WCHA	Chambersburg, Pa.	1000d
DZPI	Manila, P.I.	10000
WDSC	Dillon, S.C.	1000d
WEAB	Greer, S.C.	250d
WDEH	Sweetwater, Tenn.	1000d
KDDD	Dumas, Tex.	250d
KBUH	Brigham City, Utah	250d
WSVS	Crewe, Va.	1000d
WKEE	Huntington, W.Va.	1000d
WDUX	Waupaca, Wis.	1000d

810—370.2

Kc.	Wave Length	W.P.
CFAX	Saanich, B.C.	1000d
KGO	San Francisco, Calif.	50000
WABW	Annapolis, Md.	250d
KCMO	Kansas City, Mo.	50000
WGY	Schenectady, N.Y.	50000
WKBC	N.Wilkesboro, N.C.	1000d
WCEC	Rocky Mount, N.C.	1000d
WEDO	McKeesport, Pa.	1000d
WKVM	San Juan, P.R.	25000

820—365.6

Kc.	Wave Length	W.P.
WAIT	Chicago, Ill.	5000d
WIKY	Evansville, Ind.	250d
WOSU	Columbus, Ohio	5000d
KIKI	Honolulu, Hawaii	250
WFAA	Dallas, Tex.	50000
WBAP	Ft. Worth, Tex.	50000

830—361.2

Kc.	Wave Length	W.P.
WCCO	Minneapolis, Minn.	50000
KBOA	Kennett, Mo.	1000d
WNYC	New York, N.Y.	1000d

840—356.9

Kc.	Wave Length	W.P.
WKAB	Mobile, Ala.	1000d
WKNB	New Britain, Conn.	1000d
WHAS	Louisville, Ky.	50000
WVPO	Stroudsburg, Pa.	250d

850—352.7

Kc.	Wave Length	W.P.
CKVL	Verdun, Que.	50000
CKRD	Red Deer, Alta.	1000
WYDE	Birmingham, Ala.	10000
KOA	Denver, Colo.	50000
WRUF	Gainesville, Fla.	5000
WEAT	W. Palm Beach, Fla.	1000
KIMO	Hilo, Hawaii	1000
WHDH	Boston, Mass.	50000
WKBZ	Muskegon, Mich.	1000
KFUO	St. Louis, Mo.	5000d
WKIX	Raleigh, N.C.	10000
WJW	Cleveland, Ohio	5000
WEEU	Reading, Pa.	1000
WABA	Aguadilla, P.R.	250
WRAP	Norfolk, Va.	5000
KTAC	Tacoma, Wash.	1000

860—348.6

Kc.	Wave Length	W.P.
CJBC	Toronto, Ont.	50000
WHRT	Hartselle, Ala.	250d
WAMI	Opp, Ala.	1000d
KIFN	Phoenix, Ariz.	1000d
KOSE	Osceola, Ark.	1000d
KWRF	Warren, Ark.	250d
KTRB	Modesto, Calif.	10000
WKKO	Cocoa, Fla.	1000d
WERD	Atlanta, Ga.	1000d
WDMG	Douglas, Ga.	5000d
WMRI	Marion, Ind.	250d
KWPC	Muscatine, Iowa	250d
KOAM	Pittsburg, Kans.	10000
WSON	Henderson, Ky.	500d
WAYE	Dundalk, Md.	500d
WSBS	Gt. Barrington, Mass.	250d
KNUJ	New Ulm, Minn.	1000d
WMAG	Forest, Miss.	500d
WFMO	Fairmont, N.C.	1000d
WAMO	Homestead, Pa.	250d
WTEL	Philadelphia, Pa.	250d
WLBG	Laurens, S.C.	1000d
WIVK	Knoxville, Tenn.	1000d
WMTS	Murfreesboro, Tenn.	250d
KFST	Ft. Stockton, Tex.	250d
KPAN	Hereford, Tex.	250d
KSFA	Nacogdoches, Tex.	1000d
KONO	San Antonio, Tex.	5000d
KWHO	Salt Lake City, Utah	1000d
WEVA	Emporia, Va.	1000d
WOAY	Oak Hill, W.Va.	10000d
WFOX	Milwaukee, Wis.	250d

870—344.6

Kc.	Wave Length	W.P.
KIEV	Glendale, Calif.	250d
KAIM	Kaimuki, Hawaii	1000
WWL	New Orleans, La.	50000
WKAR	E. Lansing, Mich.	5000d
WHCU	Ithaca, N.Y.	1000d
WGTL	Kannapolis, N.C.	1000d
KJIM	Ft. Worth, Tex.	250d
WFLO	Farmville, Va.	1000d

880—340.7

Kc.	Wave Length	W.P.
WCBS	New York, N.Y.	50000

Kc.	Wave Length	W.P.
WRRZ	Clinton, N.C.	1000d
WRFD	Worthington, Ohio	5000d

890—336.9

WLS	Chicago, Ill.	50000
WHNC	Henderson, N.C.	1000d
KBYE	Okla. City, Okla.	1000d

900—333.1

CKTS	Sherbrooke, Que.	1000
CHML	Hamilton, Ont.	5000
CHNO	Sudbury, Ont.	10000
CJBR	Rimouski, Que.	10000
CKJL	St. Jerome, Que.	1000
CJVI	Victoria, B.C.	10000
CKBI	Prince Albert, Sask.	10000
CJGX	Yorkton, Sask.	10000
WATV	Birmingham, Ala.	1000d
WGOK	Mobile, Ala.	1000d
WOZK	Ozark, Ala.	1000d
KPRB	Fairbanks, Alaska	10000
KHOZ	Harrison, Ark.	1000d
KBIF	Centerville, Calif.	1000d
WJWL	Georgetown, Del.	1000d
WSWN	Belle Glade, Fla.	1000d
WMOP	Ocala, Fla.	1000d
WCGA	Calhoun, Ga.	1000d
WCRY	Macon, Ga.	250d
WJIV	Savannah, Ga.	1000d
KSIR	Wichita, Kan.	250
WKYW	Louisville, Ky.	1000d
WLSI	Pikeville, Ky.	1000d
KREH	Oakdale, La.	250d
WCME	Brunswick, Maine	500d
WATC	Gaylord, Mich.	1000d
KTIS	Minneapolis, Minn.	1000d
WDDT	Greenville, Miss.	1000d
KFAL	Fulton, Mo.	1000d
KJSK	Columbus, Nebr.	1000d
WOTW	Nashau, N.H.	1000d
WBRV	Boonville, N.Y.	1000d
WSPN	Saratoga Sprgs., N.Y.	250d
WAYN	Rockingham, N.C.	1000d
WIAM	Williamston, N.C.	1000d
KFNW	Fargo, N.Oak.	1000d
WAND	Canton, Ohio	500d
WFRO	Fremont, Ohio	500d
WCPA	Clearfield, Pa.	1000d
WFLN	Philadelphia, Pa.	1000d
WKXV	Knoxville, Tenn.	1000d
WCOR	Lebanon, Tenn.	500d
KALT	Atlanta, Tex.	1000d
KMCO	Conroe, Tex.	500d
KFLD	Floydada, Tex.	250d
KCLW	Hamilton, Tex.	250d
WAFC	Staunton, Va.	1000d
KUEN	Wenatchee, Wash.	500
WATK	Antigo, Wis.	250d

910—329.5

CJDV	Drumheller, Alta.	1000
CKLY	Lindsay, Ont.	1000
CBO	Ottawa, Ont.	5000
CFJC	Kamloops, B.C.	10000
CHRL	Roberval, Que.	1000
KPHO	Phoenix, Ariz.	5000
KLCN	Blytheville, Ark.	5000d
KAMD	Camden, Ark.	1000
KDEO	El Cajon, Calif.	1000
KEWB	Oakland, Calif.	5000
KOXR	Oxnard, Calif.	1000d
KPOF	nr. Denver, Colo.	5000
WHAY	New Britain, Conn.	5000
WPLA	Plant City, Fla.	1000d
WGAF	Valdosta, Ga.	5000
WAKO	Lawrenceville, Ill.	500d
WSUI	Iowa City, Iowa	5000
WLCS	Baton Rouge, La.	1000
WABI	Bangor, Maine	5000
WFDF	Flint, Mich.	5000
WCOC	Meridian, Miss.	5000
KOYN	Billings, Mont.	1000d
KYSS	Missoula, Mont.	1000d
KBIM	Roswell, N.Mex.	5000d
WLAS	Jacksonville, N.C.	1000d
KCJB	Minot, N.Dak.	1000
WPFB	Middletown, Ohio	1000
KGLC	Miami, Okla.	1000
KURY	Brookings, Oreg.	500
WAVL	Apollo, Pa.	1000d
WGBI	Scranton, Pa.	1000
WSBA	York, Pa.	1000
WPRP	Ponce, P.R.	5000
WORD	Spartanburg, S.C.	1000
WJHL	Johnson City, Tenn.	5000
WEPG	S. Pittsburgh, Tenn.	500d
KRIO	McAllen, Tex.	1000
KRRV	Sherman, Tex.	1000
KALL	Salt Lake City, Utah	1000
WWRJ	White River Junction, Vermont	1000d
WRNL	Richmond, Va.	5000
WHYE	Roanoke, Va.	1000d
KORD	Pasco, Wash.	1000d
KQDE	Renton, Wash.	1000
KISN	Vancouver, Wash.	1000
WHSM	Hayward, Wis.	1000d
WDOR	Sturgeon Bay, Wis.	500d

920—325.9

CJCH	Halifax, N.S.	10000
CJCJ	Woodstock, N.B.	1000
CKNX	Wingham, Ont.	2500
WCTA	Adalusia, Ala.	5000
WWWR	Russellville, Ala.	1000d
KARK	Little Rock, Ark.	5000
KDES	Palm Springs, Calif.	1000d
KVEC	San Luis Dbispo, Cal.	1000
KIUP	Durango, Colo.	5000
KREX	Grd. Junction, Colo.	5000
KLMR	Lamar, Colo.	1000
WMEG	Eau Gallie, Fla.	1000d
WGST	Atlanta, Ga.	5000
KAHU	Waiphau, Hawaii	1000
WMOK	Metropolis, Ill.	1000d
WBAA	W. Lafayette, Ind.	5000
KFNF	Shenandoah, Iowa	1000
WTCW	Whitesburg, Ky.	1000d
WBOX	Bogalusa, La.	1000d
KTOC	Jonesboro, La.	500d
WPIX	Lexington Pk., Md.	500d
WMPL	Hancock, Mich.	1000d
KDHL	Faribault, Minn.	1000
KWAD	Wadena, Minn.	1000
KRAM	Las Vegas, Nev.	1000
KOLO	Reno, Nev.	1000
KQEO	Albuquerque, N.Mex.	1000
WTTM	Trenton, N.J.	1000
WKRT	Cortland, N.Y.	1000
WGHQ	Saugerties, N.Y.	1000d
WBBB	Burlington, N.C.	5000d
WMNI	Columbus, Ohio	500
KGAL	Lebanon, Oreg.	1000
WKVA	Lewistown, Pa.	1000d
WJAR	Providence, R.I.	5000
WTNO	Orangeburg, S.C.	1000d
KEZU	Rapid City, S.Dak.	1000d
WLIV	Livingston, Tenn.	1000d
KELP	El Paso, Tex.	1000
KECK	Odessa, Tex.	1000
KTLW	Texas City, Tex.	1000d
KITN	Olympia, Wash.	1000d
KXLY	Spokane, Wash.	5000
WMMN	Fairmont, W.Va.	5000
WOKY	Milwaukee, Wis.	1000

930—322.4

CFBC	Saint John, N.B.	5000
CJCA	Edmonton, Alta.	10000
CJON	St. John's, N.F.	10000
WETO	Gadsden, Ala.	1000d
KTKN	Ketchikan, Alaska	1000
KAPR	Douglas, Ariz.	1000d
KHJ	Los Angeles, Calif.	5000
~~KIUP~~	Durango, Colo.	5000
WKSB	Milford, Del.	500d
WJAX	Jacksonville, Fla.	5000
WKXY	Sarasota, Fla.	1000
WMGR	Bainbridge, Ga.	5000d
KSEI	Pocatello, Idaho	5000
WTAD	Quincy, Ill.	5000
WKCT	Bowling Green, Ky.	1000
WFMD	Frederick, Md.	1000
WREB	Holyoke, Mass.	500d
WBCK	Battle Creek, Mich.	1000
WSLI	Jackson, Miss.	5000
KWOC	Poplar Bluff, Mo.	1000
KOFI	Kalispell, Mont.	5000d
KOGA	Ogallala, Nebr.	500d
WWNH	Rochester, N.H.	5000d
WPAT	Paterson, N.J.	5000
WBEN	Buffalo, N.Y.	5000
WIST	Charlotte, N.C.	5000
WRRF	Washington, N.C.	5000
WEOL	Elyria, Ohio	1000
WKY	Oklahoma City, Okla.	5000
KAGI	Grants Pass, Oreg.	1000
WCNR	Bloomsburg, Pa.	1000d
KSON	Aberdeen, S.D.	1000
WSEV	Sevierville, Tenn.	5000d
KDET	Center, Tex.	1000d
KENY	Bellingham-Ferndale Wash.	1000d
WSAZ	Huntington, W.Va.	5000
WLBL	Auburndale, Wis.	5000d

940—319.0

CBM	Montreal, Que.	50000
CJGX	Yorkton, Sask.	10000
CJIB	Vernon, B.C.	1000
KFRE	Fresno, Calif.	50000
WINZ	Miami, Fla.	50000
WMAZ	Macon, Ga.	50000
WMIX	Mt. Vernon, Ill.	1000
KIOA	Des Moines, Iowa	10000
WYLD	New Orleans, La.	1000
WESA	Charleroi, Pa.	250
WIPR	San Juan, P.R.	10000
KIXZ	Amarillo, Tex.	1000

950—315.6

CKNB	Campbellton, N.B.	1000
CKBB	Barrie, Ont.	5000
WRMA	Montgomery, Ala.	1000d
KXJK	Forrest City, Ark.	5000d
KFSA	Ft. Smith, Ark.	1000
KAHI	Auburn, Calif.	1000d
KIMN	Denver, Colo.	5000
WFBS	Ft. Walton Bch., Fla.	1000d
WLOF	Orlando, Fla.	5000
WGTA	Summerville, Ga.	1000d
WGOV	Valdosta, Ga.	5000
KBOI	Boise, Idaho	5000
KLER	Orofino, Idaho	500d
WAAF	Chicago, Ill.	1000d
WXLW	Indianapolis, Ind.	5000d
KOEL	Oelwein, Iowa	1000
KJRG	Newton, Kans.	500d
WBVL	Barbourville, Ky.	1000d
WAGM	Presque Isle, Maine	5000
WORL	Boston, Mass.	5000d
WWJ	Detroit, Mich.	5000
KRSI	St. Louis Park, Minn.	1000d
WBKH	Hattiesburg, Miss.	5000d
KLIK	Jefferson City, Mo.	5000d
WBBF	Rochester, N.Y.	1000
WIBX	Utica, N.Y.	5000
WPET	Greensboro, N.C.	500d
WNCC	Barnesboro, Pa.	500d
WPEN	Philadelphia, Pa.	5000
WSPA	Spartanburg, S.C.	5000
KWAT	Watertown, S.Dak.	1000
WAGG	Franklin, Tenn.	1000d
KDSX	Denison, Tex.	500
KPRC	Houston, Tex.	5000
KSEL	Lubbock, Tex.	1000
WXGI	Richmond, Va.	1000d
KJR	Seattle, Wash.	5000
WKAZ	Charleston, W.Va.	5000
WKTL	Sheboygan, Wis.	500d

960—312.3

CFAC	Calgary, Alta.	10000
CHNS	Halifax, N.S.	10000
CKWS	Kingston, Ont.	5000
WBRC	Birmingham, Ala.	5000
WMOZ	Mobile, Ala.	1000
KOOL	Phoenix, Ariz.	5000
KAVR	Apple Valley, Calif.	5000d
KNEZ	Lompoc, Calif.	500
KABL	Oakland, Calif.	1000
WELI	New Haven, Conn.	5000
WGRO	Lake City, Fla.	500d
WJCM	Sebring, Fla.	1000d
WRFC	Athens, Ga.	5000
KSRA	Salmon, Idaho	1000d
WSBT	South Bend, Ind.	5000
KMA	Shenandoah, Iowa	5000
WPRT	Prestonsburg, Ky.	1000d
KROF	Abbeville, La.	1000d
WBOC	Salisbury, Md.	5000
WFGM	Fitchburg, Mass.	1000
WHAK	Rogers City, Mich.	5000d
KLTF	Little Falls, Minn.	500d
WABG	Greenwood, Miss.	1000
KFVS	Cape Girardeau, Mo.	1000
KNEB	Scottsbluff, Nebr.	1000
KWYK	Farmington, N.Mex.	1000d
WEAV	Plattsburg, N.Y.	5000
WFTC	Kinston, N.C.	5000
WWST	Wooster, Ohio	1000d
KGWA	Enid, Okla.	1000
KLAD	Klamath Falls, Oreg.	5000d
WHYL	Carlisle, Pa.	5000d
WADP	Kane, Pa.	1000d
WATS	Sayre, Pa.	1000d
WBEU	Beaufort, S.C.	1000d
WBMC	McMinnville, Tenn.	500d
KIMP	Mt. Pleasant, Tex.	1000d
KGKL	San Angelo, Tex.	5000
KOVO	Provo, Utah	5000
WDBJ	Roanoke, Va.	5000
KALE	Richland, Wash.	1000
WTCH	Shawano, Wis.	1000

970—309.1

CKCH	Hull, Que.	5000
WERH	Hamilton, Ala.	5000d
WTBF	Troy, Ala.	5000
KNEA	Jonesboro, Ark.	1000d
KBIS	Bakersfield, Calif.	1000
KCHV	Coachella, Calif.	1000d
KBEE	Modesto, Calif.	1000
KFEL	Pueblo, Colo.	1000d
WFLA	Tampa, Fla.	5000
WIIN	Atlanta, Ga.	5000d
WVOP	Vidalia, Ga.	5000d
KHBC	Hilo, Hawaii	1000
KAYT	Rupert, Idaho	1000d
WMAY	Springfield, Ill.	1000
WAVE	Louisville, Ky.	5000
KSYL	Alexandria, La.	1000
WCSH	Portland, Maine	5000
WAMD	Aberdeen, Md.	500d
WESO	Southbridge, Mass.	1000d
WJAN	Ishpeming, Mich.	5000d
WKHM	Jackson, Mich.	1000
KOOK	Billings, Mont.	5000
KJLT	No. Platte, Nebr.	5000d
WNTA	Newark, N.J.	5000
WEBR	Buffalo, N.Y.	5000
WCHN	Norwich, N.Y.	500d
WRCS	Ahoskie, N.C.	1000d
WWIT	Canton, N.C.	1000d
WDAY	Fargo, N.Dak.	5000
WICA	Ashtabula, Ohio	5000
WATH	Athens, Ohio	1000d
KAKC	Tulsa, Okla.	1000
KOIN	Portland, Oreg.	5000
WWSW	Pittsburgh, Pa.	5000
WJMX	Florence, S.C.	5000
KNOK	Ft. Worth, Tex.	1000d
KREM	Spokane, Wash.	5000
WWYO	Pineville, W.Va.	1000d
WHA	Madison, Wis.	5000d

980—305.9

CKNW	New Westminster, Brit. Columbia	5000
CFPL	London, Ont.	10000
CBV	Quebec, Que.	5000
CHEX	Peterboro, Ont.	5000
CKRM	Regina, Sask.	5000
WKLF	Clanton, Ala.	1000d
KINS	Eureka, Calif.	5000
KEAP	Fresno, Calif.	500d
~~KFWB~~	Los Angeles, Calif.	5000
KGLN	GlenwoodSprgs., Colo.	1000d
WSUB	Groton, Conn.	1000
WRC	Washington, D.C.	5000
WDVH	Gainesville, Fla.	5000d
WTOT	Marianna, Fla.	1000d
WBOP	Pensacola, Fla.	500d
WLOD	Pompano Beach, Fla.	1000d
WKLY	Hartwell, Ga.	1000d
WBBN	Perry, Ga.	500d
WRIP	Rossville, Ga.	500d
KUPI	Idaho Falls, Idaho	1000d
WITY	Danville, Ill.	1000
KOKA	Shreveport, La.	5000d
WCAP	Lowell, Mass.	1000d
WPBC	Minneapolis, Minn.	1000d
WAPF	McComb, Miss.	1000d
KMBC	Kansas City, Mo.	5000
KSGM	Ste. Genevieve, Mo.	500
KVER	Clovis, N.Mex.	1000
KMIN	Grants, N. Mex.	1000d
WTRY	Troy, N.Y.	5000
WKLM	Wilmington, N.C.	5000d
WAAA	Win.-Salem, N.C.	1000d
WONE	Dayton, Ohio	5000
WILK	Wilkes-Barre, Pa.	5000
KDSJ	Deadwood, S.Dak.	1000
WSIX	Nashville, Tenn.	5000
KFRD	Rosenberg, Tex.	1000d
KSVC	Richfield, Utah	5000
WFHG	Bristol, Va.	5000
WMEK	Chase City, Va.	500d
KUTI	Yakima, Wash.	5000d
WHAW	Weston, W.Va.	1000d
WCUB	Manitowoc, Wis.	1000d
WPRE	Prairie du Chien, Wis.	500d

990—302.8

CBW	Winnipeg, Man.	50000
CBT	Grand Falls, N.F.	1000
WWWF	Fayette, Ala.	1000d
WTCB	Flomaton, Ala.	500d
KTKT	Tucson, Ariz.	10000d
KKIS	Pittsburg, Calif.	5000
KLIR	Denver, Colo.	1000d
WBZY	Torrington, Conn.	1000d
WHOO	Orlando, Fla.	10000
WDWD	Dawson, Ga.	1000d
WCAZ	Carthage, Ill.	1000d
WITZ	Jasper, Ind.	1000d
KAYL	Storm Lake, Iowa	250d
KRSL	Russell, Kans.	250d
WJMR	New Orleans, La.	250d
KCLP	Rayville, La.	250d
WABO	Waynesboro, Miss.	250d
KRMO	Monett, Mo.	250d
KSVP	Artesia, N.Mex.	1000
WEEB	Southern Pines, N.C.	1000d
WJEH	Gallipolis, Ohio	1000d
WTIG	Massillon, Ohio	250d
KABY	Albany, Oreg.	250d
WIBG	Philadelphia, Pa.	50000
WVSC	Somerset, Pa.	250d
WPRA	Mayaguez, P.R.	10000
WAKN	Aiken, S.C.	1000d
WNOX	Knoxville, Tenn.	10000
KWAM	Memphis, Tenn.	1000d
KTRM	Beaumont, Tex.	1000
KAML	Kenedy, Tex.	250
KSYD	Wichita Falls, Tex.	10000
KTUT	Tooele, Utah	1000d
WNRV	Narrows, Va.	1000d
WANT	Richmond, Va.	1000d
WKLJ	Sparta, Wis.	250

1000—299.8

CKBW	Bridgewater, N.S.	1000
WCFL	Chicago, Ill.	50000
KTOK	Okla. City, Okla.	5000
KSTA	Coleman, Tex.	250d
KJAT	Henderson, Tex.	250d
WHWB	Rutland, Vt.	1000d
KOMO	Seattle, Wash.	50000

1010—296.9

CBX	Edmonton, Alta.	50000
CFRB	Toronto, Ont.	50000
KVNC	Winslow, Ariz.	1000
KLRA	Little Rock, Ark.	10000
KCHJ	Delano, Calif.	5000
KCMJ	Palm Sprgs., Calif.	1000
KSAY	San Fran., Calif.	10000d
WCNU	Crestview, Fla.	1000d
WZRO	Jacksonville Beach, Florida	1000d
WGUN	Decatur, Ga.	50000d
WCSI	Columbus, Ind.	500d
KSMN	Mason City, Iowa	1000d
KIND	Independence, ~~Kans.~~	250d
KDLA	DeRidder, La.	1000d
WSID	Baltimore, Md.	1000d
KCHI	Chillicothe, Mo.	250d
KJCF	Festus, Mo.	250d
KRVN	Lexington, Nebr.	25000d
WINS	New York, N.Y.	50000
WABZ	Albermarle, N.C.	1000d
WELS	Kinston, N.C.	1000d
WITT	Lewisburg, Pa.	250d
WHIN	Gallatin, Tenn.	1000d
WORM	Savannah, Tenn.	250d
KBUY	Amarillo, Tex.	5000

Kc.	Wave Length	W.P.
KMLW	Marlin, Tex.	250d
WELK	Charlottesville, Va.	1000d
WMEV	Marion, Va.	1000d
WCST	Berkeley Sprgs., W.Va.	250d
WSPT	Stevens Pt., Wis.	1000d
1020—293.9		
KPOP	Los Angeles, Calif.	5000
WCIL	Carbondale, Ill.	1000d
WPEO	Peoria, Ill.	1000d
KDKA	Pittsburgh, Pa.	50000
1030—291.1		
WBZ	Boston, Mass.	50000
WBZA	Springfield, Mass.	1000
KOB	Albuquerque, N.Mex.	10000
KCTA	Corpus Christi, Tex.	50000d
1040—288.3		
KHVH	Honolulu, Hawaii	5000
WHO	Des Moines, Iowa	50000
KTXL	Dallas, Tex.	1000d
WIVI	Christiansted, V.I.	250
1050—285.5		
CFGP	Grande Prairie, Alta.	10000
CKSB	St. Boniface, Man.	10000
CJIC	Sault Ste. Marie, Ont.	250
CHUM	Toronto, Ont.	5000
WRFS	Alexander City, Ala.	1000d
WCRI	Scottsboro, Ala.	250d
KVWM	Show Low, Ariz.	250d
KVLC	Little Rock, Ark.	1000d
KOFY	San Mateo, Calif.	1000d
KWSO	Wasco, Calif.	1000d
KLMO	Longmont, Colo.	250d
WJSB	Crestview, Fla.	1000d
WIVY	Jacksonville, Fla.	1000d
WHBO	Tampa, Fla.	250d
WRMF	Titusville, Fla.	500d
WJAZ	Albany, Ga.	1000d
WAUG	Augusta, Ga.	1000d
WBIE	Marietta, Ga.	500d
KZIN	Coeur D'Alene, Idaho	250d
WDZ	Decatur, Ill.	1000d
KNCO	Garden City, Kans.	1000d
WZIP	Covington, Ky.	1000d
WKTM	Mayfield, Ky.	1000d
KLPL	Lake Providence, La.	250d
KCIJ	Shreveport, La.	250d
WGAY	Silver Sprg., Md.	1000d
WPAG	Ann Arbor, Mich.	1000d
KLOH	Pipestone, Minn.	1000d
WACR	Columbus, Miss.	1000d
KSIS	Sedalia, Mo.	1000d
KRBO	Las Vegas, Nev.	500d
WBNC	Conway, N.H.	1000d
WSEN	Baldwinsville, N.Y.	250d
WSTS	Massena, N.Y.	1000d
WMGM	New York, N.Y.	50000
WBTL	Farmville, N.C.	250d
WFSC	Franklin, N.C.	500d
WLON	Lincolnton, N.C.	1000d
WWGP	Sanford, N.C.	1000d
KCCO	Lawton, Okla.	250d
KFMJ	Tulsa, Okla.	1000d
KUBE	Pendleton, Oreg.	1000d
KEED	Springfield, Oreg.	1000d
WBUT	Butler, Pa.	250d
WLYC	Williamsport, Pa.	1000d
WSMT	Sparta, Tenn.	1000d
KLEN	Killeen, Tex.	250d
WGAT	Gate City, Va.	250d
WBRG	Lynchburg, Va.	1000d
WCMS	Norfolk, Va.	1000d
KNBX	Kirkland, Wash.	1000d
WCEF	Parkersburg, W.Va.	1000d
WECL	Eau Claire, Wis.	1000d
WLIP	Kenosha, Wis.	250d
KWIV	Douglas, Wyo.	250d
1060—282.8		
CFCN	Calgary, Alta.	10000
CJLR	Quebec, Que.	5000
KPAY	Chico, Calif.	10000
WNOE	New Orleans, La.	50000
WHFB	Benton Harbor, Mich.	1000d
WMAP	Monroe, N.C.	250d
WCMW	Canton, Ohio	1000d
WRCV	Philadelphia, Pa.	50000
1070—280.2		
CBA	Sackville, N.B.	50000
CHOK	Sarnia, Ont.	5000
WAPI	Birmingham, Ala.	50000
KNX	Los Angeles, Calif.	50000
WVCG	Coral Gables, Fla.	1000d
WIBC	Indianapolis, Ind.	50000
KFBI	Wichita, Kans.	10000
KHMO	Hannibal, Mo.	5000
WHPE	High Point, N.C.	1000d
WDIA	Memphis, Tenn.	50000
KOPY	Alice, Tex.	1000
WKOW	Madison, Wis.	10000
1080—277.6		
CHED	Edmonton, Alta.	10000
KSCO	Santa Cruz, Calif.	1000
WTIC	Hartford, Conn.	50000
WKLO	Louisville, Ky.	5000
WOAP	Owosso, Mich.	250d
WINE	Kenmore, N.Y.	1000d
WEWO	Laurinburg, N.C.	1000d
KWJJ	Portland, Oreg.	10000
WEEP	Pittsburgh, Pa.	1000d
KRLD	Dallas, Tex.	50000
1090—275.1		
CHEC	Lethbridge, Alta.	5000
CHIC	Brampton, Ont.	250
CHRS	St. Jean, Que.	1000
KTHS	Little Rock, Ark.	50000
WCRA	Effingham, Ill.	250d
KNWS	Waterloo, Iowa	1000d
WBAL	Baltimore, Md.	50000
WILD	Boston, Mass.	1000d
WMUS	Muskegon, Mich.	1000d
KING	Seattle, Wash.	50000
1100—272.6		
KJBS	San Francisco, Calif.	1000d
WLBB	Carrollton, Ga.	250d
WHLI	Hempstead, N.Y.	10000d
KYW	Cleveland, Ohio	50000
WGPA	Bethlehem, Pa.	250d
1110—270.1		
CFTJ	Galt, Ont.	250
KRLA	Pasadena, Calif.	10000
WALT	Tampa, Fla.	10000d
KIPA	Hilo, Hawaii	1000
WMBI	Chicago, Ill.	5000d
KFAB	Omaha, Nebr.	50000
WBT	Charlotte, N.C.	50000
KBND	Bend, Oreg.	5000
WNAR	Norristown, Pa.	500d
WVJP	Caguas, P.R.	250
WHIM	Providence, R.I.	1000d
1120—267.7		
WUST	Bethesda, Md.	250d
KMOX	St. Louis, Mo.	50000
WWOL	Buffalo, N.Y.	1000d
KCLE	Cleburne, Tex.	250d
1130—265.3		
CKWX	Vancouver, B.C.	50000
KSDO	San Diego, Calif.	5000
KWKH	Shreveport, La.	50000
WCAR	Detroit, Mich.	50000
WDGY	Minneapolis, Minn.	50000
WNEW	New York, N.Y.	50000
1140—263.0		
CKXL	Calgary, Alta.	10000
KRAK	Stockton, Calif.	5000
WMIE	Miami, Fla.	10000
KGEM	Boise, Idaho	10000
WSIV	Pekin, Ill.	1000d
KLPR	Oklahoma City, Okla.	1000d
WITA	San Juan, P.R.	500
KSOO	Sioux Falls, S.Dak.	10000
KORC	Mineral Wells, Tex.	250
WRVA	Richmond, Va.	50000
1150—260.7		
CKSA	Lloydminster, Alta.	1000
CHSJ	Saint John, N.B.	5000
CKDC	Hamilton, Ont.	5000
CKX	Brandon, Man.	5000
CKTR	Three Rivers, Que.	5000
WBCA	Bay Minette, Ala.	1000d
WGEA	Geneva, Ala.	1000d
WJRO	Tuscaloosa, Ala.	5000
KCKY	Coolidge, Ariz.	1000
KXLR	No. Little Rock, Ark.	5000
KFSG	Los Angeles, Calif.	2500
KRKD	Los Angeles, Calif.	5000
KJAX	Santa Rosa, Calif.	5000
KGMC	Englewood, Colo.	1000d
WCNX	Middletown, Conn.	500d
WDEL	Wilmington, Del.	5000
WNDB	Daytona Bch., Fla.	1000
WTMP	Tampa, Fla.	5000d
WFPM	Fort Valley, Ga.	1000d
WJEM	Valdosta, Ga.	1000d
KANI	Oahu, Hawaii	1000
WGGH	Marion, Ill.	5000d
KWKY	Des Moines, Iowa	1000
KSAL	Salina, Kans.	5000
WMST	Mt. Sterling, Ky.	500d
WLOC	Mumfordville, Ky.	1000d
WJBO	Baton Rouge, La.	5000
WGHM	Skowhegan, Maine	5000d
WCOP	Boston, Mass.	5000
WCEN	Mt. Pleasant, Mich.	1000
KASM	Albany, Minn.	500d
KRMS	Osage Beach, Mo.	1000d
KSEN	Shelby, Mont.	1000
KDEF	Albuquerque, N.Mex.	1000d
WRUN	Utica, N.Y.	5000
WFNS	Burlington, N.C.	1000d
WGBR	Goldsboro, N.C.	5000
WCUE	Akron, Ohio	1000d
WIMA	Lima, Ohio	1000
KNED	McAlester, Okla.	1000
KAGD	Klamath Falls, Oreg.	5000
WHUN	Huntingdon, Pa.	1000d
WKPA	New Kensington, Pa.	1000d
WORA	Mayaguez, P.R.	1000
WRNO	Orangeburg, S.C.	5000
WTYC	Rock Hill, S.C.	1000d
WSNW	Seneca Township, South Carolina	1000d
WAPO	Chattanooga, Tenn.	5000
WCRK	Morristown, Tenn.	1000
WTAW	Bryan, Tex.	1000d
KCCT	Corpus Christi, Tex.	1000d
KOYE	El Paso, Tex.	1000d
KJBC	Midland, Tex.	1000d
KPNG	Port Neches, Tex.	1150
KOLJ	Quanah, Tex.	500d
KOFE	Pullman, Wash.	1000d
KAYO	Seattle, Wash.	5000
KKEY	Vancouver, Wash.	1000d
WELC	Welch, W.Va.	1000d
WAXX	Chippewa Falls, Wis.	5000d
WISN	Milwaukee, Wis.	5000
1160—258.5		
WJJD	Chicago, Ill.	50000
KSL	Salt Lake City, Utah	50000
1170—256.3		
CFNS	Saskatoon, Sask.	1000
WCOV	Montgomery, Ala.	10000
KCBQ	San Diego, Calif	50000
KLOK	San Jose, Calif.	10000
WLBH	Mattoon, Ill.	250d
KSTT	Davenport, Iowa	1000
KVOO	Tulsa, Okla.	50000
WLEO	Ponce, P.R.	250
KPUG	Bellingham, Wash.	1000
WWVA	Wheeling, W.Va.	50000
1180—254.1		
WLDS	Jacksonville, Ill.	1000d
WHAM	Rochester, N.Y.	50000
1190—252.0		
KNBA	Vallejo, Calif.	250d
WOWO	Ft. Wayne, Ind.	50000
WANN	Annapolis, Md.	1000d
WKOX	Fram'gham, Mass.	1000d
WLIB	New York, N.Y.	1000d
KEX	Portland, Oreg.	50000
KLIF	Dallas, Tex.	50000
WDTV	St. John, V.I.	1000
1200—249.9		
WOAI	San Antonio, Tex.	50000
1210—247.8		
WCNT	Centralia, Ill.	1000d
WKNX	Saginaw, Mich.	1000d
WADE	Wadesboro, N.C.	1000d
WAVI	Dayton, Ohio	250d
WCAU	Philadelphia, Pa.	50000
1220—245.8		
CJOC	Lethbridge, Alta.	10000
CKDA	Victoria, B.C.	10000
CJRL	Kenora, Ont.	1000
CKEC	New Glasgow, N.S.	250
CKCW	Moncton, N.B.	10000
CJSS	Cornwall, Ont.	1000
CKSM	Shawinigan, Quebec	1000
WEDR	Birmingham, Ala.	1000d
WPRN	Butler, Ala.	1000d
KVSA	McGehee, Ark.	1000d
KIBE	Palo Alto, Calif.	1000d
KFSC	Denver, Colo.	1000d
WTTT	Arlington, Fla.	250d
WKBX	Kissimmee, Fla.	250d
WFEC	Miami, Fla.	250d
WCLB	Camilla, Ga.	1000d
WPLK	Rockmart, Ga.	250d
WSFT	Thomaston, Ga.	250d
WLPO	LaSalle, Ill.	1000d
WKRS	Waukegan, Ill.	1000d
WSLM	Salem, Ind.	1000d
KJAN	Atlantic, Iowa	250d
KOFO	Ottawa, Kans.	250d
WFKN	Franklin, Ky.	250d
KBCL	Bossier City, La.	250d
WLBI	Denham Springs, La.	250d
WSME	Sanford, Maine	1000d
WBCH	Hastings, Mich.	250d
WAVN	Stillwater, Minn.	1000d
WMDC	Hazlehurst, Miss.	250d
KBHM	Branson, Mo.	1000d
KGMO	Cape Girardeau, Mo.	250d
KLPW	Union, Mo.	250d
WKBK	Keene, N.H.	1000d
WGNY	Newburgh, N.Y.	1000d
WJMK	N. Syracuse, N.Y.	1000d
WKMT	Kings Mtn., N.C.	1000d
WREV	Reidsville, N.C.	250d
WENC	Whiteville, N.C.	1000d
KEYD	Oakes, N.Dak.	1000d
WGAR	Cleveland, Ohio	50000
WERT	Van Wert, Ohio	250d
KGYN	Guymon, Okla.	1000d
WJUN	Mexico, Pa.	250d
WRIB	Providence, R.I.	1000d
WALO	Walterboro, S.C.	1000d
WFWL	Camden, Tenn.	250
WCPH	Etowah, Tenn.	1000d
WHEY	Millington, Tenn.	250
KLBS	Livingston, Tex.	250d
KZEE	Weatherford, Tex.	250d
WLSD	Big Stone Gap, Va.	1000d
WFAX	Falls Church, Va.	1000d
KASY	Auburn, Wash.	250d
1230—243.8		
CFCW	Camrose, Alta.	1000
CHFC	Churchill, Man.	250
CFKL	Schefferville, Que.	250
CFGR	Gravelbourg, Sask.	250
CFYT	Dawson City, Yukon T.	100
CJBQ	Belleville, Ont.	250
CFPA	Port Arthur, Ont.	1000
CKEC	New Glasgow, N.S.	1000
CKLD	Thetford Mines, Que.	250
CKMP	Midland, Ont.	250
VOAR	St. John's, Nfld.	100
CKVD	Val D'Or, Que.	250
WAUD	Auburn, Ala.	250
WJBB	Haleyville, Ala.	250
WBHP	Huntsville, Ala.	250
WNUZ	Talledega, Ala.	250
WTBC	Tuscaloosa, Ala.	250
KIFW	Sitka, Alaska	250
KSUN	Bisbee, Ariz.	250
KAAA	Kingman, Ariz.	250
KRIZ	Phoenix, Ariz.	250
KCON	Conway, Ark.	250
KFPW	Ft. Smith, Ark.	250
KBTM	Jonesboro, Ark.	250
KGEE	Bakersfield, Calif.	250
KWTC	Barstow, Calif.	250
KIBS	Bishop, Calif.	250
KXO	El Centro, Calif.	250
KDAC	Ft. Bragg, Calif.	250
KGFJ	Los Angeles, Calif.	250
KPRL	Paso Robles, Calif.	250
KRDG	Redding, Calif.	250
KWG	Stockton, Calif.	250
KEXO	Grand Junc., Colo.	250
KLVC	Leadville, Colo.	250
KDZA	Pueblo, Colo.	250
KGEK	Sterling, Colo.	250
WINF	Manchester, Conn.	250
WGGG	Gainesville, Fla.	250
WONN	Lakeland, Fla.	250
WMAF	Madison, Fla.	250
WSBB	New Smyrna Bch., Fla.	250
WNVY	Pensacola, Fla.	250
WCNH	Quincy, Fla.	250
WJNO	W. Palm Beach, Fla.	250
WBIA	Augusta, Ga.	250
WBLJ	Dalton, Ga.	250
WFOM	Marietta, Ga.	250
WSOK	Savannah, Ga.	250
WAYX	Waycross, Ga.	250
KBAR	Burley, Idaho	250
KORT	Grangeville, Idaho	250
KRXK	Rexburg, Idaho	250
WJBC	Bloomington, Ill.	250
WQUA	Moline, Ill.	250
WHCO	Sparta, Ill.	250
WJOB	Hammond, Ind.	250
WSAL	Logansport, Ind.	250
WTCJ	Tell City, Ind.	250
WBOW	Terre Haute, Ind.	250
KFJB	Marshalltown, Iowa	250
WHIR	Danville, Ky.	250
WHOP	Hopkinsville, Ky.	250
WMLF	Pineville, Ky.	250
KLIC	Monroe, La.	250
WJBW	New Orleans, La.	250
KSLO	Opelousas, La.	250
WQDY	Calais, Maine	250
WITH	Baltimore, Md.	250
WCUM	Cumberland, Md.	250
WMNB	No. Adams, Mass.	250
WESX	Salem, Mass.	250
WNEB	Worcester, Mass.	250
WJEF	Grand Rapids, Mich.	250
WIKB	Iron River, Mich.	250
WMPC	Lapeer, Mich.	250
WSOO	Slt. Ste. Marie, Mich.	250
WSTR	Sturgis, Mich.	250
WKLK	Cloquet, Minn.	250
KYSM	Mankato, Minn.	250
KTRF	Thief Riv. Flls., Minn.	250
KWNO	Winona, Minn.	250
WCMA	Corinth, Miss.	250
WHSY	Hattiesburg, Miss.	250
WSSO	Starkville, Miss.	250
WAZF	Yazoo City, Miss.	250
KOOE	Joplin, Mo.	250
KLWT	Lebanon, Mo.	250
KNCM	Moberly, Mo.	250
KANA	Anaconda, Mont.	250
KBMN	Bozeman, Mont.	250
KXLO	Lewiston, Mont.	250
KOLL	Libby, Mont.	250
KTNC	Falls City, Nebr.	100
KHAS	Hastings, Nebr.	250
KELY	Ely, Nev.	250
KLAS	Las Vegas, Nev.	250
KDOT	Reno, Nev.	250
WKCB	Berlin, N.H.	250
WTSV	Claremont, N.H.	250
WCMC	Wildwood, N.J.	100
KALG	Alamogordo, N.Mex.	250
KOTS	Deming, N.Mex.	250
KYVA	Gallup, N.Mex.	250
KFUN	Las Vegas, N.Mex.	250
KSWS	Roswell, N.Mex.	250
WNIA	Cheektowaga, N.Y.	250
WENY	Elmira, N.Y.	250
WHUC	Hudson, N.Y.	250
WLFH	Little Falls, N.Y.	250
WFAS	White Plains, N.Y.	250

Kc.	Wave Length	W.P.
WSKY	Asheville, N.C.	250
WFAI	Fayetteville, N.C.	250
WMFR	High Point, N.C.	250
WISP	Kinston, N.C.	250
WNNC	Newton, N.C.	250
WCBT	Roanoke Rap., N.C.	250
KDIX	Dickinson, N.Dak.	250
WCPO	Cincinnati, Ohio	250
WCOL	Columbus, Ohio	250
WIRO	Ironton, Ohio	250
WTOL	Toledo, Ohio	250
KADA	N. of Ada, Okla.	250
WBBZ	Ponca City, Okla.	250
KVAS	Astoria, Oreg.	250
KRNS	Burns, Oreg.	250
KODS	Coos Bay, Oreg.	250
KGRD	Gresham, Oreg.	250
KYJC	Medford, Oreg.	250
KQIK	Lakeview, Oreg.	250
WBVP	Beaver Falls, Pa.	250
WEEX	Easton, Pa.	250
WKBD	Harrisburg, Pa.	250
WCRO	Johnstown, Pa.	250
WBPZ	Lock Haven, Pa.	250
WNIK	Arecibo, P.R.	250
WERI	Westerly, R.I.	250
WAIM	Anderson, S.C.	250
WNDK	Columbia, S.C.	250
WOLS	Florence, S.C.	250
KISD	Sioux Falls, S.Dak.	250
WMMT	McMinnville, Tenn.	250
KSIX	Corpus Christi, Tex.	250
KDLK	Del Rio, Tex.	250
KNUZ	Houston, Tex.	250
KERV	Kerrville, Tex.	250
KLVT	Levelland, Tex.	250
KEEE	Nacogdoches, Tex.	250
KOSA	Odessa, Tex.	250
KHHH	Pampa, Tex.	250
KSEY	Seymour, Tex.	250
KCMC	Texarkana, Tex.	250
KSST	Sulphur Sprgs., Tex.	250
KWTX	Waco, Tex.	250
KMUR	Murray, Utah	250
KOAL	Price, Utah	250
WJOY	Burlington, Vt.	250
WBBI	Abingdon, Va.	250
WCFV	Clifton Forge, Va.	250
WFVA	Fredericksburg, Va.	250
WNOR	Norfolk, Va.	250
KQTY	Everett, Wash.	250
KLYK	Spokane, Wash.	250
KREW	Sunnyside, Wash.	250
WLOG	Logan, W.Va.	250
WTAP	Parkersburg, W.Va.	250
WHBY	Appleton, Wis.	250
WCLO	Janesville, Wis.	250
WHVF	Wausau, Wis.	250
KVOC	Casper, Wyo.	250

1240—241.8

CFLM	La Tuque, Que.	1000
CFNW	Norman Wells, Northwest Terr.	100
CFPR	Prince Rupert, B.C.	250
CFWH	Whitehorse, Y.T.	250
CJAV	Port Alberni, B.C.	250
CJCS	Stratford, Ont.	250
CJRW	Summerside, P.E.I.	250
CKBS	St. Hyacinthe, Que.	250
CKLS	LaSarre, Que.	250
WEBJ	Brewton, Ala.	250
WULA	Eufaula, Ala.	250
WOWL	Florence, Ala.	250
WARF	Jasper, Ala.	250
KWJB	So. of Globe, Ariz.	250
KOFA	Yuma, Ariz.	250
KVRC	Arkadelphia, Ark.	250
KAGH	Crossett, Ark.	250
KHOZ	Harrison, Ark.	250
KWAK	Stuttgart, Ark.	250
KPLY	Creseent City, Calif.	250
KRDU	Dinuba, Calif.	250
KMBY	Monterey, Calif.	250
KPPC	Pasadena, Calif.	100
~~KRKS~~	Ridgecrest, Calif.	250
KROY	Sacramento, Calif.	250
KRND	San Bernardino, Calif.	250
KSON	San Diego, Calif.	250
KSMA	Santa Maria, Calif.	250
KSUE	Susanville, Calif.	250
KRDD	Colo. Sprgs., Colo.	250
KDGO	Durango, Colo.	250
KSLV	Monte Vista, Colo.	250
KCRT	Trinidad, Colo.	250
WWCO	Waterbury, Conn.	250
WBGC	Chipley, Fla.	250
WLCO	Eustis, Fla.	250
WINK	Fort Myers, Fla.	250
WMMB	Melbourne, Fla.	250
WFOY	St. Augustine, Fla.	250
WBHB	Fitzgerald, Ga.	250
WDUN	Gainesville, Ga.	250
WLAG	LaGrange, Ga.	250
WBML	Macon, Ga.	250
WWNS	Statesboro, Ga.	250
WPAX	Thomasville, Ga.	250
WTWA	Thomson, Ga.	250
KANI	Kailua, Hawaii	250
KVNI	Coeur d'Alene, Idaho	250
KWIK	Pocatello, Idaho	250
WCRW	Chicago, Ill.	100
WEDC	Chicago, Ill.	250
WSBC	Chicago, Ill.	250
WEBQ	Harrisburg, Ill.	250
WTAX	Springfield, Ill.	250
WSDR	Sterling, Ill.	100
WHBU	Anderson, Ind.	250

Kc.	Wave Length	W.P.
KDEC	Decorah, Iowa	250
KWLC	Decorah, Iowa	250
KBIZ	Ottumwa, Iowa	250
KICD	Spencer, Iowa	250
KIUL	Garden City, Kans.	250
KAKE	Wichita, Kans.	250
WINN	Louisville, Ky.	250
WFTM	Maysville, Ky.	250
WPKE	Pikeville, Ky.	250
WSFC	Somerset, Ky.	250
KASO	Minden, La.	250
KANE	New Iberia, La.	250
WCOU	Lewiston, Maine	250
WCEM	Cambridge, Md.	250
WJEJ	Hagerstown, Md.	250
WHAI	Greenfield, Mass.	250
WOCB	W. Yarmouth, Mass.	250
WATT	Cadillac, Mich.	250
WCBY	Cheboygan, Mich.	250
WJPD	Ishpeming, Mich.	250
WJIM	Lansing, Mich.	250
WMFG	Hibbing, Minn.	250
WJON	St. Cloud, Minn.	250
WMPA	Aberdeen, Miss.	250
WGRM	Greenwood, Miss.	250
WGCM	Gulfport, Miss.	250
WMOX	Meridian, Miss.	250
WMIS	Natchez, Miss.	250
KFMO	Flat River, Mo.	250
KWOS	Jefferson City, Mo.	250
KNEM	Nevada, Mo.	250
KBMY	Billings, Mont.	250
KLTZ	Glasgow, Mont.	250
KXLJ	Helena, Mont.	250
KFOR	Lincoln, Nebr.	250
KODY	North Platte, Nebr.	250
KELK	Elko, Nev.	250
WKBR	Manchester, N.H.	250
WSNJ	Bridgeton, N.J.	250
KAVE	Carlsbad, N.Mex.	250
KCLV	Clovis, N.Mex.	250
WGBB	Freeport, N.Y.	250
WGVA	Geneva, N.Y.	250
WJTN	Jamestown, N.Y.	250
WVOS	Liberty, N.Y.	250
WNBZ	Saranac Lake, N.Y.	250
WSNY	Schenectady, N.Y.	250
WATN	Watertown, N.Y.	250
WPNF	Brevard, N.C.	250
WSOC	Charlotte, N.C.	250
WCNC	Elizabeth City, N.C.	250
WJNC	Jacksonville, N.C.	250
WRAL	Raleigh, N.C.	250
KDLR	Devils Lake, N.Dak.	250
WBBW	Youngstown, Ohio	250
WHIZ	Zanesville, Ohio	250
KVSO	Ardmore, Okla.	250
KBEK	Elk City, Okla.	250
KBEL	Idabel, Okla.	250
KOKL	Okmulgee, Okla.	250
KFLY	Corvallis, Oreg.	1000d
KKID	Pendleton, Oreg.	250
KPRB	Redmond, Oreg.	250
KRXL	Roseburg, Oreg.	250
WRTA	Altoona, Pa.	250
WLEM	Emporium, Pa.	1000
WHUM	Reading, Pa.	250
WKOK	Sunbury, Pa.	250
WBAX	Wilkes-Barre, Pa.	250
WALO	Humacao, P.R.	250
WWON	Woonsocket, R.I.	250
WKOK	Newberry, S.C.	250
WBEJ	Elizabethton, Tenn.	250
WEKR	Fayetteville, Tenn.	250
WBIR	Knoxville, Tenn.	250
WKDA	Nashville, Tenn.	250
WENK	Union City, Tenn.	250
KVLF	Alpine, Tex.	250
KEAN	Brownwood, Tex.	100
KORA	Bryan, Tex.	250
KOCA	Kilgore, Tex.	250
KSOX	Raymondville, Tex.	250
KXOX	Sweetwater, Tex.	250
WSKI	Montpelier, Vt.	250
WSSV	Petersburg, Va.	250
WROV	Roanoke, Va.	250
WTON	Staunton, Va.	250
KXLE	Ellensburgh, Wash.	250
KGY	Olympia, Wash.	250
WKOY	Bluefield, W.Va.	250
WTIP	Charleston, W.Va.	250
WDNE	Elkins, W.Va.	250
WOMT	Manitowoc, Wis.	250
WIBU	Poynette, Wis.	250
WOBT	Rhinelander, Wis.	250
WJMC	Rice Lake, Wis.	250
KFBC	Cheyenne, Wyo.	250
KLUK	Evanston, Wyo.	250
KASL	Newcastle, Wyo.	250
KRAL	Rawlins, Wyo.	250
KTHE	Thermopolis, Wyo.	250

1250—239.9

CHWO	Oakville, Ont.	1000
CKBL	Matane, Que.	5000
CKRB	Ville St. Georges, Que.	5000
CKSB	St. Boniface, Man.	1000
WZOB	Ft. Payne, Ala.	1000d
WETU	Wetumpka, Ala.	5000d
KFAY	Fayetteville, Ark.	500d
KAJI	Little Rock, Ark.	1000
KHOT	Madera, Calif.	500d
~~KTMS~~	Santa Barbara, Calif.	1000
KXXI	Golden, Colo.	1000d
WNER	Live Oak, Fla.	1000d
WRIM	Pahokee, Fla.	500d
WDAE	Tampa, Fla.	5000

Kc.	Wave Length	W.P.
WYTH	Madison, Ga.	1000d
WIZZ	Streator, Ill.	500d
WGL	Ft. Wayne, Ind.	1000
WRAY	Princeton, Ind.	1000d
KFKU	Lawrence, Kans.	5000
WREN	Topeka, Kans.	5000
WLCK	Scottsville, Ky.	500d
WGUY	Bangor, Maine	5000d
WARE	Ware, Mass.	1000
WWBC	Bay City, Mich.	1000d
KOTE	Fergus Falls, Minn.	1000
KCUE	Red Wing, Minn.	1000d
WHNY	McComb, Miss.	5000
KVLV	Fallon, Nev.	1000d
WMTR	Morristown, N.J.	1000d
WIPS	Ticonderoga, N.Y.	1000d
WBRM	Marion, N.C.	1000d
WCHO	Washington Court House, Ohio	500d
WPEL	Montrose, Pa.	1000d
WCAE	Pittsburgh, Pa.	5000
WNOW	York, Pa.	1000d
WTMA	Charleston, S.C.	5000
WKBL	Covington, Tenn.	1000d
KFTV	Paris, Tex.	500d
KPAC	Port Arthur, Tex.	5000
KUKA	San Antonio, Tex.	500d
KSML	Seminole, Tex.	1000d
KVEL	Vernal, Utah	1000d
WDVA	Danville, Va.	5000
WYSR	Franklin, Va.	1000d
WNRG	Grundy, Va.	1000d
KWSC	Pullman, Wash.	5000
KTW	Seattle, Wash.	1000
WEMP	Milwaukee, Wis.	5000

1260—238.0

CFRN	Edmonton, Alta.	10000
DYBU	Cebu, P.I.	1000
WCRT	Birmingham, Ala.	5000d
KPIN	Casa Grande, Ariz.	1000d
KCCB	Corning, Ark.	500d
KBHC	Nashville, Ark.	500d
~~KGIL~~	San Fernando, Calif.	1000
KYA	San Francisco, Calif.	5000
WWDC	Washington, D.C.	5000
WFTW	Fort Walton Beach, Florida	1000d
WMMA	Miami, Fla.	5000d
WWPF	Palatka, Fla.	1000
WHAB	Baxley, Ga.	5000d
WTJH	East Point, Ga.	5000d
KIFI	Idaho Falls, Idaho	5000
KWEI	Weiser, Ida.	1000d
WIBV	Belleville, Ill.	1000d
WFBM	Indianapolis, Ind.	5000
KFGQ	Boone, Iowa	250d
KWHK	Hutchinson, Kans.	1000
WXOK	Baton Rouge, La.	1000d
WEZE	Boston, Mass.	5000
WALM	Albion, Mich.	1000d
WJBL	Holland, Mich.	500d
KROX	Crookston, Minn.	1000
KDUZ	Hutchinson, Minn.	1000d
WGVM	Greenville, Miss.	1000d
WNSL	Laurel, Miss.	1000d
KGBX	Springfield, Mo.	5000
KIMB	Kimball, Nebr.	1000d
WBUD	Trenton, N.J.	5000
KVSF	Santa Fe, N.Mex.	1000
WNDR	Syracuse, N.Y.	5000
WGWR	Asheboro, N.C.	1000d
WCOJ	Edenton, N.C.	1000d
WDOK	Cleveland, Ohio	5000
WNXT	Portsmouth, Ohio	5000
KWSH	Wewoka-Seminole, Oklahoma	1000
KMCM	McMinnville, Oreg.	1000
WERC	Erie, Pa.	5000
WPHB	Philipsburg, Pa.	1000d
WISO	Ponce, P.R.	1000
WMUU	Greenville, S.C.	1000d
WJOT	Lake City, S.C.	1000d
KWYR	Winner, S.Dak.	5000d
WMFS	Chattanooga, Tenn.	1000d
WMCH	Church Hill, Tenn.	1000d
WOKN	Dickson, Tenn.	1000d
WCLC	Jamestown, Tenn.	1000d
KSPL	Diboll, Tex.	1000d
KBLP	Falfurrias, Tex.	500d
KWFR	San Angelo, Tex.	1000d
KTUE	Tulia, Tex.	1000d
KTAE	Taylor, Tex.	1000d
WCHV	Charlottesville, Va.	5000
WBCR	Christiansburg, Va.	1000d
KWIQ	Moses Lake, Wash.	1000d
WVVW	Grafton, W.Va.	500d
WWIS	Black River Falls, Wis.	1000d
WEKZ	Monroe, Wis.	1000d
KPOW	Powell, Wyo.	5000

1270—236.1

CHAT	Medicine Hat, Alta.	1000
CHWK	Chilliwack, B.C.	10000
CJCB	Sydney, N.S.	5000
CFGT	St. Joseph d'Alma, Quebec	1000
WGSV	Guntersville, Ala.	1000d
WAIP	Prichard, Ala.	1000d
KBYR	Anchorage, Alaska	1000
KDJI	Holbrook, Ariz.	1000d
KPAP	Redding, Calif.	1000d
KCOK	Tulare, Calif.	1000
WNOG	Naples, Fla.	500d
WHIY	Orlando, Fla.	5000d

Kc.	Wave Length	W.P.
WTAL	Tallahassee, Fla.	5000
WGBA	Columbus, Ga.	5000d
WJJC	Commerce, Ga.	1000d
KTFI	Twin Falls, Idaho	5000
WEIC	Charleston, Ill.	1000d
WHBF	Rock Island, Ill.	5000
WCMR	Elkhart, Ind.	500
WWCA	Gary, Ind.	1000
WORX	Madison, Ind.	1000d
KSCB	Liberal, Kans.	1000d
WAIN	Columbia, Ky.	1000d
WFUL	Fulton, Ky.	1000d
KVCL	Winnfield, La.	1000d
WSPR	Springfield, Mass.	1000
WXYZ	Detroit, Mich.	5000
KWEB	Rochester, Minn.	500d
WLSM	Louisville, Miss.	1000d
KUSN	St. Joseph, Mo.	1000d
WTSN	Dover, N.H.	5000
WDVL	Vineland, N.J.	500d
KRAC	Alamogordo, N.Mex.	1000d
WHLD	Niagara Falls, N.Y.	5000d
WDLA	Walton, N.Y.	1000d
WCGC	Belmont, N.C.	1000
WMPM	Smithfield, N.C.	1000d
KBOM	Mandan, N.Dak.	1000
WILE	Cambridge, Ohio	1000d
KWPR	Claremore, Okla.	500d
KAJO	Grants Pass, Oreg.	1000d
WLBR	Lebanon, Pa.	1000
WBHC	Hampton, S.C.	1000d
KIHO	Sioux Falls, S.Dak.	1000
WLIK	Newport, Tenn.	5000d
KIOX	Bay City, Tex.	1000
KHEM	Big Spring, Tex.	1000d
KEPS	Eagle Pass, Tex.	1000d
KFJZ	Fort Worth, Tex.	5000
WYUO	Newport News, Va.	1000d
KCVL	Colville, Wash.	1000d
KBAM	Longview, Wash.	1000d
WKYR	Keyser, W.Va.	5000d

1280—234.2

CJMS	Montreal, Que.	5000
CKCV	Quebec, Que.	5000
WPID	Piedmont, Ala.	1000d
WNPT	Tuscaloosa, Ala.	5000
KHEP	Phoenix, Ariz.	1000d
KFOX	Long Beach, Calif.	1000
~~KJOY~~	Stockton, Calif.	1000
KTLN	Denver, Colo.	5000
WSUX	Seaford, Del.	1000d
WDSP	DeFuniak Springs, Florida	5000d
WQIK	Jacksonville, Fla.	5000d
WIPC	Lake Wales, Fla.	1000d
WIBB	Macon, Ga.	1000d
WMRO	Aurora, Ill.	250d
WGBF	Evansville, Ind.	5000
KCOB	Newton, Iowa	1000d
KSOK	Arkansas City, Kans.	1000
WCPM	Cumberland, Ky.	1000d
WDSU	New Orleans, La.	5000
KWCL	Oak Grove, La.	500d
WEIM	Fitchburg, Mass.	5000
WFYC	Alma, Mich.	1000d
WTCN	Minneapolis, Minn.	5000
KVOX	Moorhead, Minn.	1000
WSJC	Magee, Miss.	500d
KDKD	Clinton, Mo.	1000d
KYRO	Potosi, Mo.	500d
KCNI	Broken Bow, Nebr.	1000d
KTOO	Henderson, Nev.	5000d
WHBI	Newark, N.J.	2500
KZUM	Farmington, N.Mex.	5000d
KHOB	Hobbs, N.Mex.	1000d
WADO	New York, N.Y.	5000
WVET	Rochester, N.Y.	5000d
WRSA	Saratoga Sprgs., N.Y.	1000
WSAT	Salisbury, N.C.	1000
WONW	Defiance, Ohio	500
WLMJ	Jackson, Ohio	1000d
KLCO	Poteau, Okla.	1000d
KERG	Eugene, Oreg.	5000
WBRX	Berwick, Pa.	500d
WHVR	Hanover, Pa.	5000
WKST	New Castle, Pa.	5000
WCMN	Arecibo, P.R.	1000
WANS	Anderson, S.C.	1000
WJAY	Mullins, S.C.	1000d
WJGD	Columbia, Tenn.	1000d
WDNT	Dayton, Tenn.	1000d
KNIT	Abilene, Tex.	500d
KWHI	Brenham, Tex.	1000d
KLUE	Longview, Tex.	1000d
KNAK	Salt Lake City, Utah	5000
WYVE	Wytheville, Va.	1000d
KIT	Yakima, Wash.	5000
WMNF	Richwood, W.Va.	1000d
WNAM	Neenah, Wis.	1000

1290—232.4

CFAM	Altona, Man.	5000
CKSL	London, Ont.	5000
WTHG	Jackson, Ala.	1000d
WMLS	Sylacauga, Ala.	1000d
KEOS	Flagstaff, Ariz.	1000
KCUB	Tucson, Ariz.	1000
KDMS	El Dorado, Ark.	5000d
KUOA	Siloam Sprgs., Ark.	5000d
KHSL	Chico, Calif.	5000
KPER	Gilroy, Calif.	1000d

Kc.	Wave Length	W.P.
KITO	San Bernardino, Calif.	5000
WCCC	Hartford, Conn.	500d
WTUX	Wilmington, Del.	1000d
WTMC	Ocala, Fla.	5000
WSCM	Panama City Beach, Florida	500d
WIRK	W. Palm Bch., Fla.	5000
WOEC	Americus, Ga.	1000d
WCHK	Canton, Ga.	1000d
WTOC	Savannah, Ga.	5000
KYTE	Pocatello, Idaho	1000d
WIRL	Peoria, Ill.	5000
WCBL	Benton, Ky.	1000d
KJEF	Jennings, La.	1000d
WHGR	Houghton Lake, Michigan	5000d
WNIL	Niles, Mich.	500d
WOIA	Saline, Mich.	500d
KBMO	Benson, Minn.	500d
WBLE	Batesville, Miss.	1000d
KALN	Thayer, Mo.	1000d
KGVO	Missoula, Mont.	5000
KOIL	Omaha, Nebr.	5000
WKNE	Keene, N.H.	5000
KSRC	Socorro, N.M.	1000d
WGLI	Babylon, N.Y.	1000
WNBF	Binghamton, N.Y.	5000
WHKY	Hickory, N.C.	5000
WEYE	Sanford, N.C.	1000d
WOMP	Bellaire, Ohio	1000d
WHIO	Dayton, Ohio	5000
KUMA	Pendleton, Oreg.	5000
KLIQ	Portland, Oreg.	1000d
WTRN	Tyrone, Pa.	1000d
WICE	Providence, R.I.	500d
WFIG	Sumter, S.C.	1000
WATO	Oak Ridge, Tenn.	1000
KBLT	Big Lake, Tex.	1000d
KIVY	Crockett, Tex.	500d
KRGV	Weslaco, Tex.	5000
KTRN	Wichita Falls, Tex.	5000
WPVA	Colonial Hgts., Va.	5000d
WAGE	Leesburg, Va.	1000d
WVOW	Logan, W.Va.	5000
WMIL	Milwaukee, Wis.	1000d
WCOW	Sparta, Wis.	1000d

1300—230.6

CBAF	Moncton, N.B.	5000
WTLS	Tallassee, Ala.	1000d
KWCB	Searcy, Ark.	1000d
KROP	Brawley, Calif.	1000
KYNO	Fresno, Calif.	1000
KWKW	Pasadena, Calif.	1000
KVOR	Colo. Sprgs., Colo.	1000
WAVZ	New Haven, Conn.	1000
WRKT	Cocoa Beach, Fla.	500d
WSOL	Tampa, Fla.	5000d
WMTM	Moultrie, Ga.	5000d
WIMO	Winder, Ga.	1000d
KOZE	Lewiston, Idaho	5000
WTAQ	LaGrange, Ill.	500
WFRX	W. Frankfort, Ill.	1000d
WHLT	Huntington, Ind.	500d
WMFT	Terre Haute, Ind.	500d
KGLO	Mason City, Iowa	5000
WBLG	Lexington, Ky.	1000
WIBR	Baton Rouge, La.	1000
KLUE	Shreveport, La.	1000d
WFBR	Baltimore, Md.	5000
WJDA	Quincy, Mass.	1000d
WOOD	Grand Rapids, Mich.	5000
WRBC	Jackson, Miss.	5000
KMMO	Marshall, Mo.	1000d
KBRL	McCook, Nebr.	1000d
KPTL	Carson City, Nev.	5000
WAAT	Trenton, N.J.	250d
WOSC	Fulton, N.Y.	1000d
WGOL	Goldsboro, N.C.	1000d
WSYD	Mt. Airy, N.C.	5000
WERE	Cleveland, Ohio	5000
WMVO	Mt. Vernon, Ohio	500
KOME	Tulsa, Okla.	5000
KDOV	Medford, Oreg.	5000d
KACI	The Dalles, Oreg.	1000d
WTIL	Mayaguez, P.R.	1000
WCKI	Greer, S.C.	1000d
KOLY	Mobridge, S.Dak.	1000d
WMTN	Morristown, Tenn.	5000d
WMAK	Nashville, Tenn.	5000
KVET	Austin, Tex.	1000
KTFY	Brownfield, Tex.	1000d
KDL	Seattle, Wash.	5000
WCLG	Morgantown, W.Va.	1000d
WKLC	St. Albans, W.Va.	1000d

1310—228.9

CKOY	Ottawa, Ont.	5000
CJRH	Richmond Hill, Ont.	1000
WHEP	Foley, Ala.	1000d
WJAM	Marion, Ala.	5000d
KBUZ	Mesa, Ariz.	5000
KBOK	Malvern, Ark.	1000d
KWBR	Oakland, Calif.	1000
KTKR	Taft, Calif.	500d
KFKA	Greeley, Colo.	1000
WICH	Norwich, Conn.	1000
WOOO	Deland, Fla.	5000d
WAUC	Wauchula, Fla.	500d
WBRO	Waynesboro, Ga.	1000d
WBMK	West Point, Ga.	1000
KLIX	Twin Falls, Idaho	1000
WISH	Indianapolis, Ind.	5000
KOKX	Keokuk, Iowa	1000
WTTL	Madisonville, Ky.	500d
WOOC	Prestonsburg, Ky.	5000d
KIKS	Sulphur, La.	500
KUZN	W. Monroe, La.	1000d
WLOB	Portland, Maine	1000d
WORC	Worcester, Mass.	5000
WKMH	Dearborn, Mich.	5000
KRBI	St. Peter, Minn.	1000d
WXXX	Hattiesburg, Miss.	1000d
KFSB	Joplin, Mo.	5000
KFBB	Great Falls, Mont.	5000
WJLK	Asbury Park, N.J.	250
WCAM	Camden, N.J.	250
WVIP	Mt. Kisco, N.Y.	1000d
WTLB	Utica, N.Y.	1000
WISE	Asheville, N.C.	5000
WKTC	Charlotte, N.C.	1000
WTIK	Durham, N.C.	1000
KNOX	Grand Forks, N.Dak.	5000
WFAH	Alliance, Ohio	1000d
KNPT	Newport, Oreg.	5000
WBFD	Bedford, Pa.	1000d
WGSA	Ephrata, Pa.	1000d
WNAE	Warren, Pa.	5000d
WOKD	Kingstree, S.C.	5000d
WDOO	Chattanooga, Tenn.	5000
WDXI	Jackson, Tenn.	5000
WBNT	Oneida, Tenn.	1000d
KZIP	Amarillo, Tex.	1000d
WRR	Dallas, Tex.	5000
KOYL	Odessa, Tex.	500d
KUBO	San Antonio, Tex.	5000d
WEEL	Fairfax, Va.	500d
WGH	Newport News, Va.	5000
KARY	Prosser, Wash.	1000d
WIBA	Madison, Wis.	5000

1320—227.1

CJSO	Sorel, P.Q.	1000
CKKW	Kitchener, Ont.	1000
WAGF	Dothan, Ala.	1000
WENN	Homewood, Ala.	1000d
KWHN	Fort Smith, Ark.	5000
KRLW	Walnut Ridge, Ark.	1000d
KHSJ	Hemet, Calif.	500d
KUDE	Oceanside, Calif.	500
KCRA	Sacramento, Calif.	5000
KAVI	Rocky Ford, Colo.	1000d
WATR	Waterbury, Conn.	1000
WGMA	Hollywood, Fla.	1000d
WJHP	Jacksonville, Fla.	5000
WHIE	Griffin, Ga.	1000d
WNEG	Toccoa, Ga.	1000d
WKAN	Kankakee, Ill.	1000d
KMAQ	Maquoketa, Iowa	500d
KLWN	Lawrence, Kans.	500d
WBRT	Bardstown, Ky.	1000d
WNGO	Mayfield, Ky.	1000d
KVHL	Homer, La.	1000d
WICO	Salisbury, Md.	1000d
WARA	Attleboro, Mass.	1000
WILS	Lansing, Mich.	5000
WDMJ	Marquette, Mich.	1000
WCPC	Houston, Miss.	5000d
WRJW	Picayune, Miss.	5000d
KXLW	Clayton, Mo.	1000d
KOLT	Scottsbluff, Nebr.	5000
WWHG	Hornell, N.Y.	5000d
WAGY	Forest City, N.C.	500d
WCOG	Greensboro, N.C.	5000
KQDY	Minot, N.Dak.	1000d
WHOK	Lancaster, Ohio	1000d
KWDE	Clinton, Okla.	1000d
WKAP	Allentown, Pa.	1000
WAMP	Pittsburgh, Pa.	5000
WSCR	Scranton, Pa.	1000
WRID	Rio Piedras, P.R.	5000
WMSC	Columbia, S.C.	1000
KELO	Sioux Falls, S.Dak.	5000
WKIN	Kingsport, Tenn.	5000d
WMSR	Manchester, Tenn.	1000d
KVMC	Colo. City, Tex.	1000d
KXYZ	Houston, Tex.	5000
KCPX	Salt Lake City, Utah	5000
WLLY	Richmond, Va.	1000d
KXRO	Aberdeen, Wash.	1000
KHIT	Walla Walla, Wash.	1000d
WQMN	Superior, Wis.	1000d

1330—225.4

CBH	Halifax, N.S.	100
WROS	Scottsboro, Ala.	1000d
KMOP	Tucson, Ariz.	500d
KFAC	Los Angeles, Calif.	5000
WARN	Ft. Pierce, Fla.	1000d
WYSE	Lakeland, Fla.	1000d
WEBY	Milton, Fla.	5000d
WMEN	Tallahassee, Fla.	5000d
WMLT	Dublin, Ga.	5000d
WEAW	Evanston, Ill.	1000d
WRAM	Monmouth, Ill.	1000d
WRRR	Rockford, Ill.	1000d
WJPS	Evansville, Ind.	5000
KWWL	Waterloo, Iowa	5000
KFH	Wichita, Kans.	5000
WMDR	Morehead, Ky.	1000d
KVOL	Lafayette, La.	1000
WASA	Havre deGrace, Md.	1000d
WCRB	Waltham, Mass.	5000
WTRX	Flint, Mich.	1000
WLDL	Minneapolis, Minn.	5000
WCRR	Corinth, Miss.	500d
WJPR	Greenville, Miss.	1000
WDAL	Meridian, Miss.	1000d
KUKU	Willow Springs, Mo.	500d
KGAK	Gallup, N.Mex.	5000
WEVD	New York, N.Y.	5000
WPOW	New York, N.Y.	5000
WEBO	Oswego, N.Y.	1000d
WHAZ	Troy, N.Y.	1000
WFIN	Findlay, Ohio	1000d
WKOV	Wellston, Ohio	500d
KPOJ	Portland, Oreg.	5000
WBLF	Bellefonte, Pa.	500
WICU	Erie, Pa.	5000
WLAT	Conway, S.C.	5000d
WFBC	Greenville, S.C.	5000
WAEW	Crossville, Tenn.	1000d
WTRO	Dyersburg, Tenn.	500d
KMIL	Cameron, Tex.	500d
KSWA	Graham, Tex.	500d
KINE	Kingsville, Tex.	1000d
KOOK	Tyler, Tex.	1000d
WBTM	Danville, Va.	5000
WESR	Tasley, Va.	1000d
KFKF	Bellevue, Wash.	1000d
WETZ	New Martinsville, West Virginia	1000d
WHBL	Sheboygan, Wis.	1000
KOVE	Lander, Wyo.	1000

1340—223.7

CFGB	Goose Bay, Nfld.	250
CFSL	Weyburn, Sask.	250
CFYK	Yellow Knife, N.W.T.	150
CHAD	Amos, Que.	250
CJLS	Yarmouth, N.S.	250
CHRD	Drummondville, Que.	250
CJQC	Quebec, Que.	250
CKAR-1	Parry Sound, Ont.	250
CKOX	Woodstock, Ont.	250
WKUL	Cullman, Ala.	250
WJOI	Florence, Ala.	250
WGWC	Selma, Ala.	250
WFEB	Sylacauga, Ala.	250
KIBH	Seward, Alaska	250
KIKO	Miami, Ariz.	250
KNOG	Nogales, Ariz.	250
KZOK	Prescott, Ariz.	250
KBTA	Batesville, Ark.	250
KBRS	Springdale, Ark.	250
KENL	Arcata, Calif.	250
KMAK	Fresno, Calif.	250
KSFE	Needles, Calif.	250
KATY	San Luis Obispo, Calif.	250
KIST	Santa Barbara, Calif.	250
KOMY	Watsonville, Calif.	250
KDEN	Denver, Colo.	250
KVRH	Salida, Colo.	250
WNHC	New Haven, Conn.	250
WODK	Washington, D.C.	250
WTAN	Clearwater, Fla.	250
WROD	Daytona Bch., Fla.	250
WDSR	Lake City, Fla.	250
WTYS	Marianna, Fla.	250
WQXT	Palm Beach, Fla.	250
WNSM	Valparaiso-Niceville, Fla.	250
WGAU	Athens, Ga.	250
WAKE	Atlanta, Ga.	250
WBBQ	Augusta, Ga.	250
WGAA	Cedartown, Ga.	250
WOKS	Columbus, Ga.	250
WBBT	Lyons, Ga.	250
WTIF	Tifton, Ga.	250
KPST	Preston, Idaho	250
WSOY	Decatur, Ill.	250
WJPF	Herrin, Ill.	250
WJOL	Joliet, Ill.	250
WBIW	Bedford, Ind.	250
WTRC	Elkhart, Ind.	250
WLBC	Muncie, Ind.	250
KROS	Clinton, Iowa	250
KLIL	Estherville, Iowa	250
KCKN	Kansas City, Kans.	250
KSEK	Pittsburg, Kans.	250
WCMI	Ashland, Ky.	250
WNBS	Murray, Ky.	250
WEKY	Richmond, Ky.	250
KGAN	Bastrop, La.	250
KRMD	Shreveport, La.	250
WFAU	Augusta, Maine	250
WHOU	Houlton, Maine	250
WGAW	Gardner, Mass.	250
WNBH	New Bedford, Mass.	250
WBRK	Pittsfield, Mass.	250
WLEW	Bad Axe, Mich.	250
WLAV	Grand Rap., Mich.	250
WCSR	Hillsdale, Mich.	100
WMTE	Manistee, Mich.	250
WAGN	Menominee, Mich.	250
WMBN	Petoskey, Mich.	250
WEXL	Royal Oak, Mich.	250
KDLM	Detroit Lakes, Minn.	250
WEVE	Eveleth, Minn.	250
KROC	Rochester, Minn.	250
KWLM	Willmar, Minn.	250
WJMB	Brookhaven, Miss.	250
WAML	Laurel, Miss.	250
KXED	Mexico, Mo.	250
KSMD	Salem, Mo.	250
KICK	Springfield, Mo.	250
KCAP	Helena, Mont.	250
KPRK	Livingston, Mont.	250
KATL	Miles City, Mont.	250
KQTE	Missoula, Mont.	250
KFGT	Fremont, Nebr.	100
KGFW	Kearney, Nebr.	250
KSID	Sidney, Nebr.	250
KORK	Las Vegas, Nev.	250
KBET	Reno, Nev.	250
WDCR	Hanover, N.H.	250
WMID	Atlantic City, N.J.	250
KNDE	Aztec, N.M.	250
KSIL	Silver City, N.Mex.	250
WMBO	Auburn, N.Y.	250
WENT	Gloversville, N.Y.	250
WJOC	Jamestown, N.Y.	250
WUSJ	Lockport, N.Y.	250
WMSA	Massena, N.Y.	250
WALL	Middletown, N.Y.	250
WIRY	Plattsburg, N.Y.	250
WJRI	Lenoir, N.C.	250
WTSB	Lumberton, N.C.	250
WOXF	Oxford, N.C.	250
WOOW	Washington, N.C.	250
WGNI	Wilmington, N.C.	250
WAIR	Winston-Salem, N.C.	250
KGPC	Grafton, N.D.	250
WNCO	Ashland, Ohio	250
WOUB	Athens, Ohio	250
WIZE	Springfield, Ohio	250
WSTV	Steubenville, Ohio	250
KIHN	Hugo, Okla.	250
KOCY	Okla. City, Okla.	250
KLOO	Corvallis, Ore.	250
KIHR	Hood River, Oreg.	250
KFIR	North Bend, Oreg.	250
WFBG	Altoona, Pa.	250
WCVI	Connellsville, Pa.	250
WSAJ	Grove City, Pa.	100
WKRZ	Oil City, Pa.	250
WHAT	Philadelphia, Pa.	250
WRAW	Reading, Pa.	250
WBRE	Wilkes-Barre, Pa.	250
WWPA	Williamsport, Pa.	250
WGRF	Aguadilla, P.R.	250
WOKE	Charleston, S.C.	250
WRHI	Rock Hill, S.C.	250
WSSC	Sumter, S.C.	250
KIJV	Huron, S.D.	250
KRSD	Rapid City, S.Dak.	250
WBAC	Cleveland, Tenn.	250
WKRM	Columbia, Tenn.	250
WGRV	Greenville, Tenn.	250
WKGN	Knoxville, Tenn.	250
WHHM	Memphis, Tenn.	250
WCDT	Winchester, Tenn.	250
KWKC	Abilene, Tex.	250
KAND	Corsicana, Tex.	250
KSET	El Paso, Tex.	250
KNAF	Fredericksburg, Tex.	250
KDUB	Lubbock, Tex.	250
KRBA	Lufkin, Tex.	250
KVKM	Monahans, Tex.	250
KPDN	Pampa, Tex.	250
KOLE	Port Arthur, Tex.	250
KTXL	San Angelo, Tex.	250
KVIC	N. of Victoria, Tex.	250
WTWN	St. Johnsbury, Vt.	250
WSTA	Charlotte Amalie, V.I.	250
WKEY	Covington, Va.	250
WHAP	Hopewell, Va.	250
WJMA	Orange, Va.	250
KAGT	Anacortes, Wash.	250
KPKW	Pasco, Wash.	250
KAPA	Raymond, Wash.	250
KMEL	Wenatchee, Wash.	250
WHAR	Clarksburg, W.Va.	250
WEPM	Martinsburg, W.Va.	250
WMON	Montgomery, W.Va.	250
WOVE	Welch, W.Va.	250
WLDY	Ladysmith, Wis.	250
WRIT	Milwaukee, Wis.	250
WFHR	Wis. Rapids, Wis.	250
KOWB	Laramie, Wyo.	250
KWOR	Worland, Wyo.	250

1350—222.1

CHOV	Pembroke, Ont.	1000
CJDC	Dawson Creek, B.C.	1000
CHGB	St. Anne de la Pocatiere, Que.	1000
CKLB	Oshawa, Ont.	10000
CKEN	Kentville, N.S.	1000
WELB	Elba, Ala.	1000d
WGAD	Gadsden, Ala.	5000
KAAB	Hot Springs, Ark.	1000
KLYD	Bakersfield, Calif.	1000d
KCKC	San Bernardino, Calif.	500
KSRO	Santa Rosa, Calif.	1000
KGHF	Pueblo, Colo.	5000
WNLK	Norwalk, Conn.	500
WPCT	Putnam, Conn.	1000d
WDCF	Dade City, Fla.	1000d
WRPB	Warner Robins, Ga.	1000d
KRLC	Lewiston, Idaho	5000
WEEK	Peoria, Ill.	1000
WJBD	Salem, Ill.	500d
WIOU	Kokomo, Ind.	1000
KRNT	Des Moines, Iowa	5000
KMAN	Manhattan, Kans.	500d
WLOU	Louisville, Ky.	5000d
WSMB	New Orleans, La.	5000
WDEA	Ellsworth, Me.	1000d
WHMI	Howell, Mich.	500
KDID	Ortonville, Minn.	1000d
WCMP	Pine City, Minn.	1000d
WKOZ	Kosciusko, Miss.	5000d
KCHR	Charleston, Mo.	1000d
KBRX	O'Neill, Nebr.	1000d
WLNH	Laconia, N.H.	5000d
KABQ	Albuquerque, N.M.	5000
WCBA	Corning, N.Y.	1000d
WHIP	Mooresville, N.C.	1000d
KQDI	Bismarck, N.D.	500d
WADC	Akron, Ohio	5000
WCHI	Chillicothe, Ohio	500d
KRHD	Duncan, Okla.	250
KTLQ	Tahlequah, Okla.	1000d

Kc.	Wave Length	W.P.
WORK	York, Pa.	5000
WDAR	Darlington, S.C.	500d
WGSW	Greenwood, S.C.	1000d
WRKM	Carthage, Tenn.	500d
KTXJ	Jasper, Tex.	1000d
KCOR	San Antonio, Tex.	5000
WBLT	Bedford, Va.	1000d
WNVA	Norton, Va.	5000d
WAVY	Portsmouth, Va.	5000
WPDR	Portage, Wis.	1000d

1360—220.4

Kc.	Wave Length	W.P.
WWWB	Jasper, Ala.	1000d
WMFC	Monroeville, Ala.	1000d
WELR	Roanoke, Ala.	1000d
KRUX	Glendale, Ariz.	5000
KLYR	Clarksville, Ark.	500d
KFFA	Helena, Ark.	1000
KFIV	Modesto, Calif.	1000
KRCK	Ridgecrest, Calif.	1000d
KGB	San Diego, Calif.	1000
WDRC	Hartford, Conn.	5000
WOBS	Jacksonville, Fla.	5000d
WKAT	Miami Beach, Fla.	5000
WIOD	Sanford, Fla.	500d
WINT	Winter Haven, Fla.	1000d
WAZA	Bainbridge, Ga.	1000d
WLAW	Lawrenceville, Ga.	1000d
WLBK	DeKalb, Ill.	500d
WVMC	Mt. Carmel, Ill.	500d
KXGI	Ft. Madison, Iowa	1000d
KSCJ	Sioux City, Iowa	5000
KBTO	El Dorado, Kans.	500d
WFLW	Monticello, Ky.	1000d
KDBC	Mansfield, La.	1000d
KVIM	New Iberia, La.	1000d
KTLD	Tallulah, La.	500d
WEBB	Dundalk, Md.	5000d
WLYN	Lynn, Mass.	1000d
WKMI	Kalamazoo, Mich.	5000
KLRS	Mountain Grove, Mo.	1000d
WNNJ	Newton, N.J.	500d
WWBZ	Vineland, N.J.	1000
WKOP	Binghamton, N.Y.	5000
WMNS	Olean, N.Y.	1000d
WCHL	Chapel Hill, N.C.	1000d
KEYZ	Williston, N.D.	5000
WSAI	Cincinnati, Ohio	5000
KUIK	Hillsboro, Oreg.	1000d
WMCK	McKeesport, Pa.	1000
WPPA	Pottsville, Pa.	1000
WELP	Easley, S.C.	1000d
WLCM	Lancaster, S.C.	1000d
WNAH	Nashville, Tenn.	1000d
KRAY	Amarillo, Tex.	500d
KACT	Andrews, Tex.	1000d
KWBA	Baytown, Tex.	1000
KRYS	Corpus Christi, Tex.	1000
KXOL	Ft. Worth, Tex.	5000
WBOB	Galax, Va.	1000d
WHBG	Harrisonburg, Va.	5000d
KFOR	Grand Coulee, Wash.	1000d
KMO	Tacoma, Wash.	5000
WHJC	Matawan, W.Va.	1000d
WMOV	Ravenswood, W.Va.	1000d
WBAY	Green Bay, Wis.	5000
WISV	Viroqua, Wis.	500d
WMNE	Menomonie, Wis.	1000d
KVRS	Rock Springs, Wyo.	1000

1370—218.8

Kc.	Wave Length	W.P.
WBYE	Calera, Ala.	1000d
KBUC	Corona, Calif.	1000
KEEN	San Jose, Calif.	5000
KGEN	Tulare, Calif.	1000d
WHYS	Ocala, Fla.	1000d
WCOA	Pensacola, Fla.	5000
WAXE	Vero Beach, Fla.	1000d
WBGR	Jesup, Ga.	1000d
WFDR	Manchester, Ga.	1000d
WKLE	Washington, Ga.	1000d
WPRC	Lincoln, Ill.	500d
WTTS	Bloomington, Ind.	5000
WGRY	Gary, Ind.	500d
KDTH	Dubuque, Iowa	1000
KGNO	Dodge City, Kans.	5000
WGOH	Grayson, Ky.	5000d
KAPB	Marksville, La.	1000d
WKIK	Leonardtown, Md.	1000d
WGHN	Grand Haven, Mich.	500d
KSUM	Fairmont, Minn.	1000
WDOB	Canton, Miss.	1000d
KWRT	Boonville, Mo.	1000d
KCRV	Caruthersville, Mo.	1000d
KXLF	Butte, Mont.	5000
KAWL	York, Nebr.	500d
WFEA	Manchester, N.H.	5000
WALK	Patchogue, N.Y.	500d
WSAY	Rochester, N.Y.	5000
WLTC	Gastonia, N.C.	1000d
WTAB	Tabor City, N.C.	5000d
KFJM	Grand Forks, N.D.	1000d
WSPD	Toledo, Ohio	5000
KAST	Astoria Oreg.	1000
WOTR	Corry, Pa.	1000
WPAZ	Pottstown, Pa.	1000d
WKMC	Roaring Sprgs., Pa.	1000d
WIVV	Vieques, P.R.	1000
WDEF	Chattanooga, Tenn.	5000
WDXE	Lawrenceburg, Tenn.	1000d
WRGS	Rogersville, Tenn.	1000d
KOKE	Austin, Tex.	1000d
KFRO	Longview, Tex.	1000
KUKD	Post, Tex.	500d
KSOP	Salt Lake City, Utah	1000d
WBTN	Bennington, Vt.	500d
WHEE	Martinsville, Va.	1000d
WJWS	South Hill, Va.	1000d
KPOR	Quincy, Wash.	1000d
WMOO	Moundsville, W.Va.	1000d
WCCN	Neillsville, Wis.	5000d
KVWO	Cheyenne, Wyo.	1000

1380—217.3

Kc.	Wave Length	W.P.
CFDA	Victoriaville, Que.	1000
CKPC	Brantford, Ont.	10000
CKLC	Kingston, Ont.	5000
WGYV	Greenville, Ala.	1000d
KDXE	N. Little Rock, Ark.	1000d
KBVM	Lancaster, Calif.	1000d
KGMS	Sacramento, Calif.	1000
KSBW	Salinas, Calif.	5000
KFLJ	Walsenburg, Colo.	1000d
WAMS	Wilmington, Del.	1000
WLIZ	Lake Worth, Fla.	500d
WQXQ	Ormond Bch., Fla.	1000d
WLCY	St. Petersburg, Fla.	5000
WAOK	Atlanta, Ga.	5000
WRWH	Cleveland, Ga.	500d
KPOI	Honolulu, Hawaii	5000
WKJG	Ft. Wayne, Ind.	5000
KCIM	Carroll, Iowa	1000
WMTA	Central City, Ky.	500d
WWKY	Winchester, Ky.	1000d
WYNK	Baton Rouge, La.	500d
WTTH	Port Huron, Mich.	1000
KLIZ	Brainerd, Minn.	1000d
KAGE	Winona, Minn.	1000d
WDLT	Indianola, Miss.	500d
KUDL	Kansas City, Mo.	1000d
KWK	St. Louis, Mo.	5000
KUVR	Holdredge, Nebr.	500d
WAWZ	Zarephath, N.J.	5000
WBNX	New York, N.Y.	5000
WLOS	Asheville, N.C.	5000
WTOB	Winston-Salem, N.C.	5000
WWIZ	Lorain, Ohio	500d
WPKO	Waverly, Ohio	1000d
KSWO	Lawton, Okla.	1000
KMUS	Muskogee, Okla.	1000
KBCH	Ocean Lake, Oreg.	1000d
KSRV	Ontario, Oreg.	5000
WACB	Kittanning, Pa.	1000d
WAYZ	Waynesboro, Pa.	1000d
WNRI	Woonsocket, R.I.	1000d
WAGS	Bishopville, S.C.	1000d
KOTA	Rapid City, S.Dak.	5000
KJET	Beaumont, Tex.	1000d
KBWD	Brownwood, Tex.	1000
KCRN	Crane, Tex.	1000d
KTSM	El Paso, Tex.	1000
KMUL	Muleshoe, Tex.	500d
KBOP	Pleasanton, Tex.	1000d
WSYB	Rutland, Vt.	5000
WMBG	Richmond, Va.	5000
KRKO	Everett, Wash.	1000
WBEL	Beloit, Wis.	5000

1390—215.7

Kc.	Wave Length	W.P.
CKLN	Nelson, B.C.	1000
WHMA	Anniston, Ala.	5000
KDQN	DeQueen, Ark.	500d
KAMO	Rogers, Ark.	1000d
KGER	Long Beach, Calif.	5000
KTUR	Turlock, Calif.	1000
KFML	Denver, Colo.	1000d
WAVP	Avon Park, Fla.	1000d
WGES	Chicago, Ill.	5000
WFIW	Fairfield, Ill.	500d
WJCD	Seymour, Ind.	1000d
KCLN	Clinton, Iowa	1000d
KCBC	Des Moines, Iowa	1000
KNCK	Concordia, Kans.	500d
WANY	Albany, Ky.	1000d
WKIC	Hazard, Ky.	5000d
KNOE	Monroe, La.	5000
WCAT	Orange, Mass.	1000d
WPLM	Plymouth, Mass.	1000d
WCER	Charlotte, Mich.	1000d
KRFO	Owatonna, Minn.	500d
WROA	Gulfport, Miss.	1000d
WQIC	Meridian, Miss.	5000d
KENN	Farmington, N.Mex.	5000
WEOK	Poughkeepsie, N.Y.	1000d
WRIV	Riverhead, N.Y.	1000d
WFBL	Syracuse, N.Y.	5000
WFNC	Fayetteville, N.C.	5000
WKRK	Murphy, N.C.	1000d
WEED	Rocky Mount, N.C.	5000
WADA	Shelby, N.C.	500d
KLPM	Minot, N.Dak.	5000
WOHP	Bellefontaine, Ohio	500d
WFMJ	Youngstown, Ohio	5000
KCRC	Enid, Okla.	1000
KSLM	Salem, Oreg.	5000
WLAN	Lancaster, Pa.	1000
WHPB	Belton, S.C.	500d
WCSC	Charleston, S.C.	5000
WTJS	Jackson, Tenn.	5000
KULP	El Campo, Tex.	500d
KBEC	Waxahachie, Tex.	500d
KLGN	Logan, Utah	1000d
WEAM	Arlington, Va.	5000
WWOD	Lynchburg, Va.	5000
KLOQ	Yakima, Wash.	1000

1400—214.2

Kc.	Wave Length	W.P.
CKBC	Bathurst, N.B.	250
CKCY	Sault Ste. Marie, Ont.	250
CKRN	Rouyn, Que.	250
CKSW	Swift Current, Sask.	250
WMSL	Decatur, Ala.	250
WXAL	Demopolis, Ala.	250
WFPA	Ft. Payne, Ala.	250
WJLD	Homewood, Ala.	250
WJHO	Opelika, Ala.	250
KSEW	Sitka, Alaska	250
KCLF	Clifton, Ariz.	250
KONI	Phoenix, Ariz.	250
KTUC	Tucson, Ariz.	250
KVOY	Yuma, Ariz.	250
KELD	El Dorado, Ark.	250
KCLA	Pine Bluff, Ark.	250
KWYN	Wynne, Ark.	250
KRE	Berkeley, Calif.	250
KREO	Indio, Calif.	250
KSDA	Redding, Calif.	250
KCOY	Santa Maria, Calif.	250
KSPA	Santa Paula, Calif.	250
KUKI	Ukiah, Calif.	250
KONG	Visalia, Calif.	250
KRLN	Canon City, Colo.	250
KDTA	Delta, Colo.	250
KFTM	Ft. Morgan, Colo.	250
KBZZ	La Junta, Colo.	250
WSTC	Stamford, Conn.	250
WILI	Willimantic, Conn.	250
WFTL	Ft. Lauderdale, Fla.	250
WIRA	Ft. Pierce, Fla.	250
WRHC	Jacksonville, Fla.	250
WPRY	Perry, Fla.	250
WTRR	Sanford, Fla.	250
WCOS	Alma, Ga.	250
WSGC	Elberton, Ga.	250
WNEX	Macon, Ga.	250
WMGA	Moultrie, Ga.	250
WCOH	Newnan, Ga.	250
WGSA	Savannah, Ga.	250
KART	Jerome, Idaho	250
KRPL	Moscow, Idaho	250
KSPT	Sandpoint, Idaho	250
WDWS	Champaign, Ill.	250
WGIL	Galesburg, Ill.	250
WEOA	Evansville, Ind.	250
WBAT	Marion, Ind.	250
KCOG	Centerville, Iowa	100
KVFD	Fort Dodge, Iowa	250
KVOE	Emporia, Kans.	250
KAYS	Hays, Kans.	250
WCYN	Cynthiana, Ky.	100
WIEL	Elizabethtown, Ky.	250
WFTG	London, Ky.	250
WFPR	Hammond, La.	250
KAOK	Lake Charles, La.	250
WRDO	Augusta, Maine	250
WIDE	Biddeford, Maine	250
WWIN	Baltimore, Md.	250
WALE	Fall River, Mass.	250
WLLH	Lowell, Mass.	250
WHMP	Northampton, Mass.	250
WELL	Battle Creek, Mich.	250
WJLB	Detroit, Mich.	250
WHDF	Houghton, Mich.	250
WMAB	Munising, Mich.	250
WSAM	Saginaw, Mich.	250
WSJM	St. Joseph, Mich.	250
WTCM	Traverse City, Mich.	250
KMHL	Marshall, Minn.	250
WMIN	Mpls.-St. Paul, Minn.	250
WHLB	Virginia, Minn.	250
WBIP	Booneville, Miss.	250
WNAG	Grenada, Miss.	250
WFOR	Hattiesburg, Miss.	250
WJQS	Jackson, Miss.	250
WMBC	Macon, Miss.	250
KFRU	Columbia, Mo.	250
KSIM	Sikeston, Mo.	250
KTTS	Springfield, Mo.	250
KXGN	Glendive, Mont.	250
KXLK	Great Falls, Mont.	250
KCOW	Alliance, Nebr.	250
KLIN	Lincoln, Nebr.	250
KBMI	Henderson, Nev.	250
KWNA	Winnemucca, Nev.	250
WTSL	Hanover, N.H.	250
KGFL	Roswell, N. Mex.	250
KTRC	Santa Fe, N.Mex.	250
KCHS	Truth or Consequences, New Mexico	250
KTNM	Tucumcari, N.Mex.	250
WOND	Pleasantville, N.J.	250
WABY	Albany, N.Y.	250
WBNY	Buffalo, N.Y.	250
WELM	Elmira, N.Y.	250
WSLB	Ogdensburg, N.Y.	250
WBMA	Beaufort, N.C.	250
WGBG	Greensboro, N.C.	250
WKDX	Hamlet, N.C.	250
WSIC	Statesville, N.C.	250
WLSE	Wallace, N.C.	250
WHCC	Waynesville, N.C.	250
KEYJ	Jamestown, N.Dak.	250
WPAY	Portsmouth, Ohio	250
KWON	Bartlesville, Okla.	250
KTMC	McAlester, Okla.	250
KNOR	Norman, Okla.	250
KWIN	Ashland, Oreg.	250
KOMB	Cottage Grove, Oreg.	250
WEST	Easton, Pa.	250
WJET	Erie, Pa.	250
WHGB	Harrisburg, Pa.	250
WJAC	Johnstown, Pa.	250
WKBI	St. Marys, Pa.	250
WICK	Scranton, Pa.	250
WRAK	Williamsport, Pa.	250
WHOA	San Juan, P.R.	250
WPCC	Clinton, S.C.	500
WCOS	Columbia, S.C.	250
WGTN	Georgetown, S.C.	250
WTHE	Spartanburg, S.C.	250
WJZM	Clarksville, Tenn.	250
WHUB	Cookeville, Tenn.	250
WLSB	Copper Hill, Tenn.	250
WKPT	Kingsport, Tenn.	250
WGAP	Maryville, Tenn.	250
WHAL	Shelbyville, Tenn.	250
KRUN	Ballinger, Tex.	250
KBYG	Big Spring, Tex.	100
KUNO	Corpus Christi, Tex.	250
KILE	nr. Galveston, Tex.	250
KGVL	Greenville, Tex.	250
KEBE	Jacksonville, Tex.	250
KIUN	Pecos, Tex.	250
KEYE	Perryton, Tex.	250
KVOP	Plainview, Tex.	250
KDWT	Stamford, Tex.	250
KTEM	Temple, Tex.	250
KTFS	Texarkana, Tex.	250
KVOU	Uvalde, Tex.	250
KIXX	Provo, Utah	250
WDOT	Burlington, Vt.	250
WINA	Charlottesville, Va.	250
WLOW	Portsmouth, Va.	250
WHLF	So. Boston, Va.	250
WINC	Winchester, Va.	250
KWLK	Longview, Wash.	250
KRSC	Othello, Wash.	250
KTNT	Tacoma, Wash.	250
WBOY	Clarkesburg, W.Va.	250
WRON	Ronceverte, W.Va.	250
WKWK	Wheeling, W.Va.	250
WBTH	Williamson, W.Va.	250
WATW	Ashland, Wis.	250
WBIZ	Eau Claire, Wis.	250
WDUZ	Green Bay, Wis.	250
WRJN	Racine, Wis.	250
WRDB	Reedsburg, Wis.	250
WRIG	Wausau, Wis.	250
KATI	Caspar, Wyo.	250
KODI	Cody, Wyo.	250

1410—212.6

Kc.	Wave Length	W.P.
CFUN	Vancouver, B.C.	10000
WALA	Mobile, Ala.	5000
KTCS	Fort Smith, Ark.	500d
KERN	Bakersfield, Calif.	500
KTEE	Carmel, Calif.	500d
KMYC	Marysville, Calif.	5000
KCAL	Redlands, Calif.	1000d
KCOL	Ft. Collins, Colo.	1000
WPOP	Hartford, Conn.	5000
WDOV	Dover, Del.	1000d
WMYR	Fort Myers, Fla.	5000
WBIL	Leesburg, Fla.	1000d
WDAX	McRae, Ga.	1000d
WLAQ	Rome, Ga.	1000
WRMN	Elgin, Ill.	500d
WTIM	Taylorville, Ill.	1000d
KGRN	Grinnell, Iowa	500d
KLEM	LeMars, Iowa	1000d
KCLO	Leavenworth, Kans.	500d
KWBB	Wichita, Kans.	5000
WLBJ	Bowling Green, Ky.	5000
WHLN	Harlan, Ky.	5000d
KDBS	Alexandria, La.	1000d
WGRD	Grand Rap., Mich.	1000d
KLFD	Litchfield, Minn.	500d
WDSK	Cleveland, Miss.	1000d
WBKN	Newton, Miss.	500d
WHTG	Eatontown, N.J.	500d
WDOE	Dunkirk, N.Y.	500
WEGO	Concord, N.C.	1000d
WSRC	Durham, N.C.	1000d
WING	Dayton, Ohio	5000
KPAM	Portland, Oreg.	5000d
WLSH	Lansford, Pa.	1000d
KQV	Pittsburgh, Pa.	5000
WYMB	Manning, S.C.	1000d
WCMT	Martin, Tenn.	1000d
KBUD	Athens, Tex.	250d
KBAN	Bowie, Tex.	500d
KVLB	Cleveland, Tex.	500
KXIT	Dalhart, Tex.	500d
KADO	Marshall, Tex.	500
KRIG	Odessa, Tex.	1000
KBAL	San Saba, Tex.	500d
KNAL	Victoria, Tex.	500
WRIS	Roanoke, Va.	5000d
WKBH	LaCrosse, Wis.	5000
KWYO	Sheridan, Wyo.	1000

1420—211.1

Kc.	Wave Length	W.P.
CJMT	Chicoutimi, Que.	1000
CKOM	Saskatoon, Sask.	5000
WACT	Tuscaloosa, Ala.	5000d
KHFH	Sierra Vista, Ariz.	1000d
KPOC	Pocahontas, Ark.	1000d
KSTN	Stockton, Calif.	1000
WLIS	Old Saybrook, Conn.	500d
WBRD	Bradenton, Fla.	1000
WDBF	Delray Beach, Fla.	500d
WSTN	St. Augustine, Fla.	1000d
WAVO	Avondale Estates, Ga.	500d
WRBL	Columbus, Ga.	5000
WLET	Toccoa, Ga.	5000d
WINI	Murphysboro, Ill.	500d
WIMS	Michigan City, Ind.	1000
WOC	Davenport, Iowa	5000
KJCK	Junction City, Kans.	1000d
WTCR	Ashland, Ky.	5000d
WHBN	Harrodsburg, Ky.	1000d

Kc.	Wave Length	W.P.
WVJS	Owensboro, Ky.	1000
KPEL	Lafayette, La.	1000
WBSM	New Bedford, Mass.	1000
WBEC	Pittsfield, Mass.	1000
WAMM	Flint, Mich.	500
KTOE	Mankato, Minn.	5000
WSUH	Oxford, Miss.	1000d
WQBC	Vicksburg, Miss.	1000
KBTN	Neosho, Mo.	500d
KOOO	Omaha, Nebr.	500d
WALY	Herkimer, N.Y.	1000d
WACK	Newark, N.Y.	500
WLNA	Peekskill, N.Y.	1000d
WMYN	Mayodan, N.C.	500
WGAS	S. Gastonia, N.C.	500d
WVOT	Wilson, N.C.	1000
WHK	Cleveland, Ohio	5000
KTJS	Hobart, Okla.	1000d
KYNG	Coos Bay, Oreg.	1000d
WCOJ	Coatesville, Pa.	5000
WCED	DuBois, Pa.	5000
WEUC	Ponce, P.R.	1000
WCRE	Cheraw, S.C.	1000d
KABR	Abredeen, S.D.	1000d
WEMB	Erwin, Tenn.	1000d
WKSR	Pulaski, Tenn.	1000
KFYN	Bonham, Tex.	250d
KTRE	Lufkin, Tex.	1000
KGNB	New Braunfels, Tex.	1000d
KPEP	San Angelo, Tex.	1000d
WWSR	St. Albans, Vt.	1000d
WDDY	Gloucester, Va.	1000d
WKTF	Warrenton, Va.	5000d
KITI	Chehalis, Wash.	1000d
KUJ	Walla Walla, Wash.	5000
WPLY	Plymouth, Wis.	500d

1430—209.7

Kc.	Wave Length	W.P.
CKFH	Toronto, Ont.	5000
WFHK	Pell City, Ala.	1000d
KHBM	Monticello, Ark.	1000d
KAMP	El Centro, Calif.	1000d
KARM	Fresno, Calif.	5000
KALI	Pasadena, Calif.	5000
KOSI	Aurora, Colo.	5000
WSDB	Homestead, Fla.	500d
WLAK	Lakeland, Fla.	5000
WPCF	Panama City, Fla.	5000
WGFS	Covington, Ga.	1000d
WRCD	Dalton, Ga.	1000d
WWGS	Tifton, Ga.	5000d
WCMY	Ottawa, Ill.	500d
WIRE	Indianapolis, Ind.	5000
KASI	Ames, Iowa	1000d
KMRC	Morgan City, La.	500d
WNAV	Annapolis, Md.	1000
WHIL	Medford, Mass.	5000d
WION	Ionia, Mich.	500d
WBRB	Mt. Clemens, Mich.	500d
WLAU	Laurel, Miss.	5000d
WIL	St. Louis, Mo.	5000
KRGI	Grand Island, Nebr.	1000
WNJR	Newark, N.J.	5000
WENE	Endicott, N.Y.	5000
WMNC	Morganton, N.C.	5000d
WRXO	Roxboro, N.C.	1000d
WFOB	Fostoria, Ohio	1000
WCLT	Newark, Ohio	500d
KALV	Alva, Okla.	500
KTUL	Tulsa, Okla.	5000
KGAY	Salem, Oreg.	5000d
WVAM	Altoona, Pa.	1000
WFRA	Franklin, Pa.	500d
WBLR	Batesburg, S.C.	5000d
WATP	Marion, S.C.	1000d
KBRK	Brookings, S.Dak.	500d
WENO	Madison, Tenn.	5000d
WHER	Memphis, Tenn.	1000
KSTB	Breckenridge, Tex.	1000d
KSIJ	Gladewater, Tex.	1000d
KCOH	Houston, Tex.	1000d
KLO	Ogden, Utah	5000
KBRC	Mt. Vernon, Wash.	5000
WEIR	Weirton, W.Va.	1000
WBEV	Beaver Dam, Wis.	1000d

1440—208.2

Kc.	Wave Length	W.P.
CFCP	Courtenay, B.C.	1000
WHHY	Montgomery, Ala.	5000
KPOK	Scottsdale, Ariz.	5000d
KOKY	Little Rock, Ark.	5000d
KVON	Napa, Calif.	500
KPRO	Riverside, Calif.	1000
WBIS	Bristol, Conn.	500d
WABR	Winter Park, Fla.	5000
WWCC	Bremen, Ga.	1000d
WGIG	Brunswick, Ga.	5000
WRAJ	Anna, Ill.	500d
WPRS	Paris, Ill.	500d
WGEM	Quincy, Ill.	1000
WRDK	Rockford, Ill.	1000
WPGW	Portland, Ind.	500d
KCHE	Cherokee, Iowa	500d
KJAY	Topeka, Kans.	5000
WKLX	Paris, Ky.	1000d
WEZJ	Williamsburg, Ky.	500d
KMLB	Monroe, La.	5000
WAAB	Worcester, Mass.	5000
WBCM	Bay City, Mich.	1000
WCHB	Inkster, Mich.	1000d
KEVE	Golden Valley, Minn.	5000
WMVB	Millville, N.J.	1000d
WBAB	Babylon, N.Y.	500d
WJJL	Niagara Falls, N.Y.	1000d
WBLA	Elizabethtown, N.C.	1000d
WBUY	Lexington, N.C.	5000d
KILO	Grand Forks, N.D.	1000
WHHH	Warren, Ohio	5000
KMED	Medford, Oreg.	5000
KODL	The Dalles, Oreg.	1000
WCDL	Carbondale, Pa.	5000d
WGCB	Red Lion, Pa.	1000d
WQOK	Greenville, S.C.	5000
WZYX	Cowan, Tenn.	1000d
WHDM	McKenzie, Tenn.	500d
KFDA	Amarillo, Tex.	5000
KEYS	Corpus Christi, Tex.	1000
KDNT	Denton, Tex.	1000
KETX	Livingston, Tex.	1000d
WKLV	Blackstone, Va.	5000d
WHIS	Bluefield, W.Va.	5000
WAJR	Morgantown, W.Va.	5000
WJPG	Green Bay, Wis.	5000

1450—206.8

Kc.	Wave Length	W.P.
CBG	Gander, Nfld.	250
CFAB	Windsor, N.S.	250
CFJR	Brockville, Ont.	1000
CHEF	Granby, P.Q.	1000
CJOY	Guelph, Ont.	250
WDNG	Anniston, Ala.	250
WEZB	Bessemer, Ala.	250
WDIG	Dothan, Ala.	250
WFUN	Huntsville, Ala.	250
WLAY	Muscle Shoals City, Ala.	250
KLAM	Cordova, Alaska	250
KAWT	Douglas, Ariz.	250
KNOT	Prescott, Ariz.	250
KOLD	Tucson, Ariz.	250
KHOG	Fayetteville, Ark.	250
KENA	Mena, Ark.	250
KYOR	Blythe, Calif.	250
KOWN	Escondido, Calif.	250
KPAL	Palm Springs, Calif.	250
KTIP	Porterville, Calif.	250
KSAN	San Francisco, Calif.	250
KROG	Sonora, Calif.	250
KVEN	Ventura, Calif.	250
KAGR	Yuba City, Calif.	100
KGIW	Alamosa, Colo.	250
KYOU	Greeley, Colo.	250
WNAB	Bridgeport, Conn.	250
WILM	Wilmington, Del.	250
WOL	Washington, D.C.	250
WWJB	Brooksville, Fla.	250
WMFJ	Daytona Beach, Fla.	250
WSKP	Miami, Fla.	250
WBSR	Pensacola, Fla.	250
WSPB	Sarasota, Fla.	250
WSTU	Stuart, Fla.	250
WTNT	Tallahassee, Fla.	250
WGPC	Albany, Ga.	250
WBHF	Cartersville, Ga.	250
WCON	Cornelia, Ga.	250
WKEU	Griffin, Ga.	250
WMVG	Milledgeville, Ga.	250
WCCP	Savannah, Ga.	250
WVLD	Valdosta, Ga.	250
KEOK	Payette, Idaho	250
KEEP	Twin Falls, Idaho	250
WHFC	Cicero, Ill.	250
WKEI	Kewanee, Ill.	100
WCVS	Springfield, Ill.	250
WANE	Ft. Wayne, Ind.	250
WASK	Lafayette, Ind.	250
WAOV	Vincennes, Ind.	250
KPIG	Cedar Rapids, Iowa	250
KWBW	Hutchinson, Kans.	250
WTCO	Campbellsville, Ky.	250
WWXL	Manchester, Ky.	250
WPAD	Paducah, Ky.	250
KSIG	Crowley, La.	250
KNOC	Natchitoches, La.	250
WNPS	New Orleans, La.	250
WRKD	Rockland, Maine	250
WKTQ	South Paris, Maine	250
WTBO	Cumberland, Md.	250
WMAS	Springfield, Mass.	250
WATZ	Alpena Township, Mich.	250
WHTC	Holland, Mich.	250
WMIQ	Iron Mtn., Mich.	250
WIBM	Jackson, Mich.	250
WKLA	Ludington, Mich.	250
WHLS	Port Huron, Mich.	250
KATE	Albert Lea, Minn.	250
KBUN	Bemidji, Minn.	250
KBMW	Breckenridge, Minn.	250
WELY	Ely, Minn.	250
KFAM	St. Cloud, Minn.	250
WROX	Clarksdale, Miss.	250
WCJU	Columbia, Miss.	250
WJXN	Jackson, Miss.	250
WOKK	Meridian, Miss.	250
WNAT	Natchez, Miss.	250
WRDB	West Point, Miss.	250
WMBH	Joplin, Mo.	250
KIRX	Kirksville, Mo.	250
KOKO	Warrensburg, Mo.	250
KWPM	West Plains, Mo.	250
KXXL	Bozeman, Mont.	250
KUDI	Great Falls, Mont.	250
KXLL	Missoula, Mont.	250
KVCK	Wolf Point, Mont.	250
KWBE	Beatrice, Nebr.	250
KCSR	Chadron, Nebr.	250
KONE	Reno, Nev.	250
WKXL	Concord, N.H.	250
WFPG	Atlantic City, N.J.	250
WCTC	New Brunswick, N.J.	250
KLOS	Albuquerque, N.Mex.	250
KLMX	Clayton, N.Mex.	250
KOBE	Las Cruces, N.Mex.	250
KENM	Portales, N.Mex.	250
WHDL	Allegany, N.Y.	250
WCLI	Corning, N.Y.	250
WWSC	Glen Falls, N.Y.	250
WHDL	Olean, N.Y.	250
WKIP	Poughkeepsie, N.Y.	250
WKAL	Rome, N.Y.	250
WATA	Boone, N.C.	250
WGNC	Gastonia, N.C.	250
WHVH	Henderson, N.C.	250
WHKP	Hendersonville, N.C.	250
WHIT	New Bern, N.C.	250
WJER	Dover, Ohio	250
WMOH	Hamilton, Ohio	250
WLEC	Sandusky, Ohio	250
KWHW	Altus, Okla.	250
KGFF	Shawnee, Okla.	250
KSIW	Woodward, Okla.	250
KWRO	Coquille, Oreg.	250
KORE	Eugene, Oreg.	1000
KFLW	Klamath Falls, Oreg.	250
KLBM	La Grande, Oreg.	250
KBPS	Portland, Oreg.	250
WLEU	Erie, Pa.	250
WGET	Gettysburg, Pa.	250
WDAD	Indiana, Pa.	250
WPAM	Pottsville, Pa.	250
WMPT	So. Williamsport, Pa.	250
WMAJ	State College, Pa.	250
WJPA	Washington, Pa.	250
WNEL	Caguas, P.R.	250
WWRt	W. Warwick, R.I.	250
WQSN	Charleston, S.C.	250
WCRS	Greenwood, S.C.	250
WMYB	Myrtle Beach, S.C.	250
WHSC	Hartsville, S.C.	250
KBFS	Belle Fourche, S.Dak.	250
KYNT	Yankton, S.Dak.	250
WLAR	Athens, Tenn.	250
WOGA	Chattanooga, Tenn.	250
WDSG	Dyersburg, Tenn.	250
WLAF	LaFollette, Tenn.	100
WGNS	Murfreesboro, Tenn.	250
KRIC	Beaumont, Tex.	250
KBEN	Carrizo Sprgs., Tex.	250
KCTI	Gonzales, Tex.	250
KMBL	Junction, Tex.	250
KCYL	Lampasas, Tex.	250
KMHT	Marshall, Tex.	250
KCMR	McCamey, Tex.	250
KNET	Palestine, Tex.	250
KSNY	Snyder, Tex.	250
KURA	Moab, Utah	250
KEYY	Provo, Utah	250
KDXU	St. George, Utah	250
WTSA	Brattleboro, Vt.	250
WFTR	Front Royal, Va.	250
WREL	Lexington, Va.	250
WMVA	Martinsville, Va.	250
WLPM	Suffolk, Va.	250
KBKW	Aberdeen, Wash.	250
KCLX	Colfax, Wash.	250
KRSC	Othello, Wash.	100
KONP	Port Angeles, Wash.	250
KAYE	Puyallup, Wash.	250
WPAR	Parkersburg, W.Va.	250
KFIZ	Fond du Lac, Wis.	250
WDLB	Marshfield, Wis.	250
WPFP	Park Falls, Wis.	250
WRCO	Richland Center, Wis.	250
KBBS	Buffalo, Wyo.	250
KWRL	Riverton, Wyo.	250

1460—205.4

Kc.	Wave Length	W.P.
CJNB	N. Battleford, Sask.	10000
WFMH	Cullman, Ala.	5000d
WPNX	Phenix City, Ala.	5000
KCCL	Paris, Ark.	500d
KTYM	Inglewood, Calif.	1000d
KDON	Salinas, Calif.	5000
KYSN	Colo. Sprgs., Colo.	1000
WBAR	Bartow, Fla.	1000d
WZEP	DeFuniak Springs, Florida	1000d
WMBR	Jacksonville, Fla.	5000
WDMF	Buford, Ga.	1000d
WROY	Carmi, Ill.	1000d
WKAM	Goshen, Ind.	1000d
WOCH	North Vernon, Ind.	500d
KSO	Des Moines, Iowa	5000
KCRB	Chanute, Kans.	1000d
WRVK	Mt. Vernon, Ky.	500d
WAIL	Baton Rouge, La.	5000
KBSF	Springhill, La.	1000d
WBET	Brockton, Mass.	1000
WBRN	Big Rapids, Mich.	1000d
WPON	Pontiac, Mich.	500
KDMA	Montevideo, Minn.	1000
WELZ	Belzoni, Miss.	1000d
KADY	St. Charles, Mo.	5000d
KRNY	Kearney, Nebr.	5000d
KENO	Las Vegas, Nev.	1000
WOKO	Albany, N.Y.	5000
WVOX	New Rochelle, N.Y.	500d
WHEC	Rochester, N.Y.	5000
WFVG	Fuquay Sprgs., N.C.	1000d
WMMH	Marshall, N.C.	500d
WBNS	Columbus, Ohio	5000
WPVL	Painesville, Ohio	500d
KPLK	Dallas, Oreg.	1000d
WMBA	Ambridge, Pa.	500d
WCMB	Harrisburg, Pa.	5000
WBCU	Union, S.C.	1000
WGOG	Walhalla, S.C.	500d
WJAK	Jackson, Tenn.	1000d
WEEN	Lafayette, Tenn.	1000d
KBRZ	Freeport, Tex.	500d
KLLL	Lubbock, Tex.	1000d
WACO	Waco, Tex.	1000
WPRW	Manassas, Va.	500d
WRAD	Radford, Va.	5000
KIMA	Yakima, Wash.	5000
WRAC	Racine, Wis.	500d

1470—204.0

Kc.	Wave Length	W.P.
CHOW	Welland, Ontario	500d
WBLO	Evergreen, Ala.	1000d
KBLO	Hot Springs, Ark.	1000d
KBMX	Coalinga, Calif.	500d
KUTY	Palmdale, Calif.	1000d
KXOA	Sacramento, Calif.	1000
WMMW	Meriden, Conn.	1000d
WPOM	Pompano Beach, Fla.	5000d
WDCL	Tarpon Sprgs., Fla.	5000d
WAAG	Adel, Ga.	1000d
WDOL	Athens, Ga.	1000d
WCLA	Claxton, Ga.	1000
WRGA	Rome, Ga.	5000
WMBD	Peoria, Ill.	5000
WCBC	Anderson, Ind.	1000d
KTRI	Sioux City, Iowa	5000
KWVY	Waverly, Iowa	1000d
KARE	Atchison, Kans.	1000
WSAC	Fort Knox, Ky.	1000d
KPLC	Lake Charles, La.	5000
WLAM	Lewiston, Maine	5000
WJDY	Salisbury, Md.	5000d
WTTR	Westminster, Md.	1000d
WSRO	Marlborough, Mass.	1000d
WNBP	Newburyport, Mass.	500d
WKMF	Flint, Mich.	1000
WKLZ	Kalamazoo, Mich.	500d
KANO	Anoka, Minn.	1000d
WCHJ	Brookhaven, Miss.	1000d
WNAU	New Albany, Miss.	500d
KGHM	Brookfield, Mo.	500d
KTCB	Malden, Mo.	1000d
WTKO	Ithaca, N.Y.	1000d
WPDM	Potsdam, N.Y.	1000d
WBIG	Greensboro, N.C.	5000
WPNC	Plymouth, N.C.	1000d
WTOE	Spruce Pine, N.C.	1000d
WOHO	Toledo, Ohio	1000
KVLH	Pauls Valley, Okla.	250d
KVIN	Vinita, Okla.	500d
WSAN	Allentown, Pa.	5000
WFAR	Farrell, Pa.	1000d
WOIC	Columbia, S.C.	5000d
WEAG	Alcoa, Tenn.	1000d
WHER	Memphis, Tenn.	1000d
WVOL	Nashville, Tenn.	1000d
KRBC	Abilene, Tex.	5000
KWRD	Henderson, Tex.	500d
KCNY	San Marcos, Tex.	250d
KELA	Centralia, Wash.	5000
KSEM	Moses Lake, Wash.	5000
WPLH	Huntington, W.Va.	5000d
WBKV	West Bend, Wis.	500d
KTWO	Casper, Wyo.	5000

1480—202.6

Kc.	Wave Length	W.P.
WABB	Mobile, Ala.	5000
KHAT	Phoenix, Ariz.	500
KGLU	Safford, Ariz.	1000
KTCN	Berryville, Ark.	1000
KIEM	Eureka, Calif.	5000
KYOS	Merced, Calif.	5000
KWIZ	Santa Ana, Calif.	1000
WAPG	Arcadia, Fla.	1000d
WEZY	Cocoa, Fla.	1000d
WTHR	Panama Beach, Fla.	500d
WYZE	Atlanta, Ga.	5000d
WRDW	Augusta, Ga.	5000
WTHI	Terre Haute, Ind.	1000
WRSW	Warsaw, Ind.	500
KLEE	Ottumwa, Iowa	500d
KBKC	Mission, Kans.	1000d
KLEO	Wichita, Kans.	5000
WKOA	Hopkinsville, Ky.	1000d
WNKY	Neon, Ky.	1000d
WTLO	Somerset, Ky.	1000d
KJOE	Shreveport, La.	1000d
WSAR	Fall River, Mass.	5000
WMAX	Grand Rapids, Michigan	1000d
WIOS	Tawas City, Mich.	1000d
KAUS	Austin, Minn.	1000
KGCX	Sidney, Mont.	5000
KLMS	Lincoln, Nebr.	1000
KWEW	Hobbs, N. Mex.	5000
WLEA	Hornell, N.Y.	1000d
WHOM	New York, N.Y.	5000
WREM	Remsen, N.Y.	1000d
WWOK	Charlotte, N.C.	1000d
WYRN	Louisburg, N.C.	500d
WMSJ	Sylva, N.C.	5000d
WHBC	Canton, Ohio	5000
WCIN	Cincinnati, Ohio	1000d
WTRA	Latrobe, Pa.	500d
WDAS	Philadelphia, Pa.	5000
WISL	Shamokin, Pa.	1000
WLOK	Memphis, Tenn.	5000d
KBOX	Dallas, Tex.	5000
KLVL	Pasadena, Tex.	1000
WCFR	Springfield, Vt.	1000d
WBBL	Richmond, Va.	5000
WLEE	Richmond, Va.	5000
WBLU	Salem, Va.	5000d
KPVA	Camas, Wash.	1000d

Kc.	Wave Length	W.P.
KFHA	Lakewood, Wash.	1000d
WISM	Madison, Wis.	1000

1490—201.2

CFRC	Kingston, Ont.	100
CKCR	Kitchener, Ont.	250
CKBM	Montaquy, Que.	250
WANA	Anniston, Ala.	250
WAJF	Decatur, Ala.	250
WRLD	Lanett, Ala.	250
WHBB	Selma, Ala.	250
KYCA	Prescott, Ariz.	250
KAIR	Tucson, Ariz.	250
KXAR	Hope, Ark.	250
KTLO	Mtn. Home, Ark.	250
KDRS	Paragould, Ark.	250
KOTN	Pine Bluff, Ark.	250
KXRJ	Russellville, Ark.	250
KMAP	Bakersfield, Calif.	250
KPAS	Banning, Calif.	250
KBLA	Burbank, Calif.	250
KTCO	Calexico, Calif.	250
KOWL	Lake Tahoe, Calif.	250
KAFP	Petaluma, Calif.	250
KBLF	Red Bluff, Calif.	250
KDB	Santa Barbara, Calif.	250
KSYC	Yreka, Calif.	250
KBOL	Boulder, Colo.	250
KCMS	Manitou Sprgs., Colo.	100
KOLO	Sterling, Colo.	250
WNLC	New London, Conn.	250
WTOR	Torrington, Conn.	250
WTRL	Bradenton, Fla.	250
WJBS	DeLand, Fla.	250
WMET	Miami Beach, Fla.	250
WSRA	Milton, Fla.	250
WRGR	Starke, Fla.	250
WTTB	Vero Beach, Fla.	250
WSIR	Winter Haven, Fla.	250
WMOG	Brunswick, Ga.	250
WMJM	Cordele, Ga.	250
WMRE	Monroe, Ga.	250
WSFB	Quitman, Ga.	250
WSNT	Sandersville, Ga.	250
WSYL	Sylvania, Ga.	250
KTOH	Lihue, Hawaii	250
KCID	Caldwell, Idaho	250
WKRO	Cairo, Ill.	250
WDAN	Danville, Ill.	250
WAMV	East St. Louis, Ill.	250
WOPA	Oak Park, Ill.	250
WKBV	Richmond, Ind.	250
WNDU	South Bend, Ind.	250
KBUR	Burlington, Iowa	250
WDBQ	Dubuque, Iowa	250
KRIB	Mason City, Iowa	250
KTOP	Topeka, Kans.	250
WFKY	Frankfort, Ky.	250
WKAY	Glasgow, Ky.	250
WOMI	Owensboro, Ky.	250
WSIP	Paintsville, Ky.	250
WIKC	Bogalusa, La.	250
KEUN	Eunice, La.	250
KCIL	Houma, La.	250
KRUS	Ruston, La.	250
WPOR	Portland, Maine	250
WTVL	Waterville, Maine	250
WARK	Hagerstown, Md.	250
WHAV	Haverhill, Mass.	250
WMRC	Milford, Mass.	250
WTXL	W. Springfield, Mass.	250
WABJ	Adrian, Mich.	250
WCBQ	Fremont, Mich.	250
WMDN	Midland, Mich.	250
KXRA	Alexandria, Minn.	250
KOZY	Grand Rapids, Minn.	250
KLGR	Redwd. Falls, Minn.	100
WLOX	Biloxi, Miss.	250
WCLD	Cleveland, Miss.	250
WHOC	Philadelphia, Miss.	250
WTUP	Tupelo, Miss.	250
WVIM	Vicksburg, Miss.	250
KDMO	Carthage, Mo.	250
KTTR	Rolla, Mo.	250
KDRO	Sedalia, Mo.	250
KBOW	Butte, Mont.	250
KBON	Omaha, Nebr.	250
WLDB	Atlantic City, N.J.	250
KRSN	Los Alamos, N.Mex.	250
KRTN	Raton, N.Mex.	250
WCSS	Amsterdam, N.Y.	250
WBTA	Batavia, N.Y.	250
WKNY	Kingston, N.Y.	250
WICY	Malone, N.Y.	250
WDLC	Port Jervis, N.Y.	250
WOLF	Syracuse, N.Y.	250
WSSB	Durham, N.C.	250
WFLB	Fayetteville, N.C.	250
WLOE	Leaksville, N.C.	250
WRNB	New Bern, N.C.	250
WRMT	Rocky Mount, N.C.	250
WSTP	Salisbury, N.C.	250
KNDC	Hettinger, N.Dak.	250
KOVC	Valley City, N.Dak.	250
WBEX	Chillicothe, Ohio	250
WJMO	Cleveland Hghts., Ohio	250
WOHI	E. Liverpool, Ohio	250
WMOA	Marietta, Ohio	250
WMRN	Marion, Ohio	250
KWRW	Guthrie, Okla.	100
KBIX	Muskogee, Okla.	250
KBKR	Baker, Oreg.	250
KRNR	Roseburg, Oreg.	250
KBZY	Salem, Oreg.	250
WESB	Bradford, Pa.	250
WAZL	Hazleton, Pa.	250
WARD	Johnstown, Pa.	250
WGAL	Lancaster, Pa.	250
WBCB	Levittown, Pa.	250
WMRF	Lewiston, Pa.	250
WMGW	Meadville, Pa.	250
WNBT	Wellsboro, Pa.	250
WMDD	Fajardo, P.R.	250
WGCD	Chester, S.C.	250
WMRB	Greenville, S.C.	250
KORN	Mitchell, S.Dak.	250
WOPI	Bristol, Tenn.	250
WDXB	Chattanooga, Tenn.	250
WJJM	Lewisburg, Tenn.	250
WDXL	Lexington, Tenn.	250
KNOW	Austin, Tex.	250
KIBL	Beeville, Tex.	250
KBST	Big Spring, Tex.	250
KHUZ	Borger, Tex.	250
KNEL	Brady, Tex.	250
KSAM	Huntsville, Tex.	250
KVOZ	Laredo, Tex.	250
KUCO	Littlefield, Tex.	250
KPLT	Paris, Tex.	250
KGKB	Tyler, Tex.	250
KVWC	Vernon, Tex.	250
KVOG	Ogden, Utah	250
WIKE	Newport, Vt.	250
WCVA	Culpeper, Va.	250
WVEC	Hampton, Va.	250
WAYB	Waynesboro, Va.	250
KBRO	Bremerton, Wash.	250
KLOG	Kelso, Wash.	250
KENE	Toppenish, Wash.	250
KTEL	Walla Walla, Wash.	250
WHMS	Charleston, W.Va.	250
WTCS	Fairmont, W.Va.	250
WLOH	Princeton, W.Va.	250
WGEZ	Beloit, Wis.	250
WLCX	LaCrosse, Wis.	250
WIGM	Medford, Wis.	250
WOSH	Oshkosh, Wis.	250
KIML	Gillette, Wyo.	250
KRTR	Thermopolis, Wyo.	250
KGOS	Torrington, Wyo.	250

1500—199.9

CHUC	Port Hope, Ont.	1000
KXRX	San Jose, Calif.	1000
WTOP	Washington, D.C.	50000
WKIZ	Key West, Fla.	250
WJBK	Detroit, Mich.	10000
KSTP	St. Paul, Minn.	50000
KTXO	Sherman, Tex.	250

1510—199.1

CKOT	Tillsonburg, Ont.	1000d
KASK	Ontario, Calif.	1000
KTIM	San Rafael, Calif.	1000d
KUDY	Littleton, Colo.	1000
WKAI	Macomb, Ill.	250d
WMEX	Boston, Mass.	5000
KANS	Independence, Mo.	1000d
WLAC	Nashville, Tenn.	50000
KCTX	Childress, Tex.	250d
KSTV	Stephenville, Tex.	250d
KGA	Spokane, Wash.	50000
WAUX	Waukesha, Wis.	250d

1520—197.4

KACY	Port Hueneme, Calif.	250
WHOW	Clinton, Ill.	1000d
KSIB	Creston, Iowa	1000d
WKBW	Buffalo, N.Y.	50000
WFYI	Mineola, N.Y.	250d
KOMA	Okla. City, Okla.	50000
KGON	Oregon City, Oreg.	10000
WWWW	Rio Piedras, P.R.	250

1530—196.1

KFBK	Sacramento, Calif.	50000
WCKY	Cincinnati, Ohio	50000
KGBT	Harlingen, Tex.	50000

1540—195.0

ZNS	Nassau, B.W.I.	5000
KPOL	Los Angeles, Calif.	10000
WSMI	Litchfield, Ill.	1000d
WBNL	Boonville, Ind.	250d
WLOI	LaPorte, Ind.	250d
KXEL	Waterloo, Iowa	50000
KNEX	McPherson, Kans.	250d
KLKC	Parsons, Kans.	250d
WDON	Wheaton, Md.	250d
WPTR	Albany, N.Y.	50000
WIFM	Elkin, N.C.	250d
WABQ	Cleveland, Ohio	1000d
WJMJ	Philadelphia, Pa.	50000d
WPTS	Pittston, Pa.	1000d
WPME	Punxsutawney, Pa.	1000d
WADK	Newport, R.I.	1000d
KCUL	Ft. Worth, Tex.	10000
KGBC	Galveston, Tex.	1000
WTKM	Hartford, Wis.	500d

1550—193.5

CBE	Windsor, Ont.	10000
WAAY	Huntsville, Ala.	5000
KOBY	San Fran., Calif.	10000
KENT	Shreveport, La.	1000
KRES	St. Joseph, Mo.	5000
WLOA	Braddock, Pa.	1000d
WBSC	Bennetsville, S.C.	10000

1560—192.3

CFRS	Simcoe, Ont.	250d
KPMC	Bakersfield, Calif.	10000
WBYS	Canton, Ill.	250d
KSWI	Council Bluffs, Iowa	500d
WDXR	Paducah, Ky.	1000
WQXR	New York, N.Y.	50000
WTNS	Coshocton, Ohio	1000d
WTOD	Toledo, Ohio	1000d
KWCO	Chickasha, Okla.	1000
WENA	Bayamon, P.R.	250
KHBR	Hillsboro, Tex.	250d

1570—191.1

CHUB	Nanaimo, B.C.	10000
CFRY	Portage la Prairie, Manitoba	250d
CBI	Sidney, N.S.	1000
CFOR	Orillia, Ont.	10000
WCRL	Oneonta, Ala.	250d
WRWJ	Selma, Ala.	1000d
KBJT	Fordyce, Ark.	250d
KRKC	King City, Calif.	250d
KCVR	Lodi, Calif.	1000d
KACE	Riverside, Calif.	1000d
KLOV	Loveland, Colo.	250d
WTWB	Auburndale, Fla.	1000d
WPAP	Fernandina Beach, Florida	1000d
WJOE	Ward Ridge, Fla.	250d
WCPK	College Park, Ga.	1000d
WGSR	Millen, Ga.	250d
WOKZ	Alton, Ill.	1000d
WFRL	Freeport, Ill.	1000d
WBEE	Harvey, Ill.	1000d
WTAY	Robinson, Ill.	250d
WILO	Frankfort, Ind.	250d
WAWK	Kendallville, Ind.	250d
WOWI	New Albany, Ind.	1000d
KMCD	Fairfield, Iowa	250d
KJFJ	Webster City, Iowa	250d
KNDY	Marysville, Kans.	250d
KWSK	Pratt, Kans.	250d
WKKS	Vanceburg, Ky.	250d
WABL	Amite, La.	500d
KLLA	Leesville, La.	250d
KMAR	Winnsboro, La.	500d
WAQE	Towson, Md.	1000d
WPEP	Taunton, Mass.	1000d
WDEW	Westfield, Mass.	1000d
WMRP	Flint, Mich.	1000d
WFUR	Grand Rapids, Michigan	1000d
KMRS	Morris, Minn.	1000d
WONA	Winona, Miss.	1000d
KLEX	Lexington, Mo.	250d
WFLR	Dundee, N.Y.	1000d
WBUZ	Fredonia, N.Y.	250d
WNCA	Siler City, N.C.	1000d
WHOT	Campbell, Ohio	250d
WCLW	Mansfield, Ohio	250d
WPTW	Piqua, Ohio	250d
KTAT	Frederick, Okla.	250d
KOLS	Pryor, Okla.	1000d
KGGG	Forest Grove, Oreg.	1000d
KOHU	Hermiston, Oreg.	1000d
WBUX	Doylestown, Pa.	1000d
WAKU	Latrobe, Pa.	1000d
WMLP	Milton, Pa.	1000d
WFGN	Gaffney, S.C.	250d
WLSC	Loris, S.C.	1000d
WHLP	Centerville, Tenn.	1000d
WCLE	Cleveland, Tenn.	1000d
WTRB	Ripley, Tenn.	1000d
KVLG	La Grange, Tex.	250d
KZOL	Muleshoe, Tex.	250d
KTER	Terrell, Tex.	250d
WKIC	Salt Lake City, Utah	500d
WSWV	Pennington Gap, Va.	1000d
WYTI	Rocky Mount, Va.	1000d
WEER	Warrenton, W.Va.	500d
WAPL	Appleton, Wis.	1000d

1580—189.2

CBJ	Chicoutimi, Que.	10000
WJHB	Talladega, Ala.	1000d
KPCA	Marked Tree, Ark.	250d
KFDF	Van Buren, Ark.	1000d
KWIP	Merced, Calif.	500d
KDAY	Santa Monica, Cal.	50000d
KPIK	Colorado Sprgs., Colo.	5000d
WWIL	Ft. Lauderdale, Fla.	1000
WGRC	Green Cove Springs, Florida	500d
WIOK	Mount Dora, Fla.	1000d
WRFB	Tallahassee, Fla.	5000d
WCLS	Columbus, Ga.	1000d
WLBA	Gainesville, Ga.	5000d
WDQN	DuQuoin, Ill.	250d
WBBA	Pittsfield, Ill.	250d
WKID	Urbana, Ill.	250d
WCNB	Connersville, Ind.	250d
WJVA	South Bend, Ind.	1000d
WAMW	Washington, Ind.	250d
KCHA	Charles City, Iowa	500d
WFMA	Davenport, Iowa	500d
KDSN	Denison, Iowa	500d
WGOR	Georgetown, Ky.	250d
WMTL	Leitchfield, Ky.	250d
WPKY	Princeton, Ky.	250d
KLUV	Haynesville, La.	250d
KLOU	Lake Charles, La.	1000
WPGC	Bradbury Hgts., Md.	10000d
WOWE	Allegan, Mich.	250d
KDOM	Windom, Minn.	250d
WAMY	Amory, Miss.	5000d
WGLC	Centreville, Miss.	250d
WESY	Leland, Miss.	1000
WPMP	Pascagoula, Miss.	1000d
KBIA	Columbia, Mo.	250d
KNIM	Maryville, Mo.	250d
WCRV	Washington, N.J.	500d
KHAM	Albuquerque, N.Mex.	1000d
WPAC	Patchogue, N.Y.	5000d
KZKY	Albemarle, N.C.	250d
WTYN	Tryon, N.C.	250d
WVKO	Columbus, Ohio	1000d
KLTR	Blackwell, Okla.	250d
WCOY	Columbia, Pa.	500d
WANB	Waynesburg, Pa.	250d
WBPD	Orangeburg, S.C.	1000d
WYCL	York, S.C.	250d
KGAF	Gainesville, Tex.	250d
KIRT	Mission, Tex.	1000d
KTLU	Rusk, Tex.	500d
KWED	Seguin, Tex.	1000d
KEVA	Shamrock, Tex.	250d
WILA	Danville, Va.	1000d
WPUV	Pulaski, Va.	5000d
WTTN	Watertown, Wis.	250d

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WATM	Atmore, Ala.	5000d
WVNA	Tuscumbia, Ala.	5000d
KPBA	Pine Bluff, Ark.	1000d
KSJO	San Jose, Calif.	1000
KUDU	Ventura, Calif.	1000
WBRY	Waterbury, Conn.	5000
WILZ	St. Petersburg Beach, Florida	1000d
WELE	S. Daytona Bch., Fla.	1000d
WALB	Albany, Ga.	1000
WLFA	Lafayette, Ga.	5000d
WNMP	Evanston, Ill.	1000d
WAIK	Galesburg, Ill.	5000d
WGEE	Indianapolis, Ind.	5000d
WPCO	Mt. Vernon, Ind.	500d
KWBG	Boone, Iowa	1000
KVGB	Great Bend, Kans.	5000
WLBN	Lebanon, Ky.	1000d
KEVL	White Castle, La.	1000d
WTVB	Coldwater, Mich.	5000
WDOG	Marine City, Mich.	1000d
WOKJ	Jackson, Miss.	5000d
KDEX	Dexter, Mo.	1000d
KPRS	Kansas City, Mo.	1000d
KMAM	Tularosa, N.Mex.	1000d
WEHH	Elmira Heights-Horseheads, N.Y.	500d
WNYS	Salamanca, N.Y.	1000d
WGTC	Greenville, N.C.	5000d
WNOS	High Point, N.C.	1000d
WAKR	Akron, Ohio	5000
WSRW	Hillsboro, Ohio	500d
KHEN	Henryetta, Okla.	500d
KTIL	Tillamook, Oreg.	250
WXRF	Guayama, P.R.	1000
WCBG	Chambersburg, Pa.	5000d
WEEZ	Chester, Pa.	1000
WYNG	Warwick, R.I.	1000d
WABV	Abbeville, S.C.	1000d
WACA	Camden, S.C.	1000d
KCCR	Pierre, S.Dak.	1000d
WJSO	Jonesboro, Tenn.	5000d
WDBL	Springfield, Tenn.	1000d
KGAS	Carthage, Tex.	1000d
KERC	Eastland, Tex.	500d
KINT	El Paso, Tex.	1000d
KYOK	Houston, Tex.	5000
KCBD	Lubbock, Tex.	1000
KBUS	Mexia, Tex.	500d
KTOD	Sinton, Tex.	1000d
WEZL	Richmond, Va.	5000d
KTIX	Seattle, Wash.	5000d
WSWW	Platteville, Wis.	1000d
WTRW	Two Rivers, Wis.	1000d
KCHY	Cheyenne, Wyo.	1000d

1600—187.5

CHVC	Niagara Falls, Ont.	5000
WEUP	Huntsville, Ala.	1000d
WAPX	Montgomery, Ala.	1000
KGST	Fresno, Calif.	1000d
KWOW	Pomona, Calif.	1000
KUBA	Yuba City, Calif.	1000
KLAK	Lakewood, Colo.	1000
WKEN	Dover, Del.	500d
WKTX	Atlantic Beach, Fla.	1000d
WKWF	Key West, Fla.	500
WHEW	Riviera Beach, Fla.	1000d
WOKB	Winter Garden, Fla.	1000d
WGKA	Atlanta, Ga.	1000d
WMCW	Harvard, Ill.	500d
WBTO	Linton, Ind.	500d
WARU	Peru, Ind.	1000d
KLGA	Algona, Iowa	5000d
KCRG	Cedar Rapids, Iowa	5000
KMDO	Ft. Scott, Kans.	500d
WNES	Central City, Ky.	500d
WSTL	Eminence, Ky.	500d
KFNV	Ferriday, La.	1000d

KLFT	Golden Meadow, La.	1000d
KLVI	Vivian, La.	500d
WINX	Rockville, Md.	1000
WBOS	Brookline, Mass.	5000
WTYM	East Longmeadow, Mass.	5000d
WHRV	Ann Arbor, Mich.	1000
WTRU	Muskegon, Mich.	5000
WKDL	Clarksdale, Miss.	1000d
KATZ	St. Louis, Mo.	5000
KTTN	Trenton, Mo.	500d
WONG	Oneida, N.Y.	1000d
WWRL	Woodside, N.Y.	5000
WGIV	Charlotte, N.C.	1000d
WIOU	Fayetteville, N.C.	1000d
WFRC	Reidsville, N.C.	1000
WKSK	W. Jefferson, N.C.	1000d
WBLY	Springfield, Ohio	1000d
KUSH	Cushing, Okla.	1000d
KASH	Eugene, Oreg.	1000
WHOL	Allentown, Pa.	500d
WEZN	Elizabethtown, Pa.	500d
WFIS	Fountain Inn, S.C.	1000d
WGUS	N. Augusta, S.C.	500
WHBT	Harriman, Tenn.	5000d
WKBJ	Milan, Tenn.	1000d
KBBB	Borger, Tex.	500d
KBOR	Brownsville, Tex.	1000
KWEL	Midland, Tex.	1000
KCFH	Cuero, Tex.	500d
KMAE	McKinney, Tex.	1000d
KOGT	Orange, Tex.	1000
KBBC	Centerville, Utah	1000d
WBOF	Virginia Bch., Va.	1000d
WHLL	Wheeling, W.Va.	5000d
WCWC	Ripon, Wis.	5000d

U. S. and Canadian AM Stations by Location

Abbreviations: C.L., call letters; Kc., frequency in kilocycles; N.A., network affiliation—A: American Broadcasting Co., C: Columbia Broadcasting System, Inc.; M: Mutual Broadcasting System; N: National Broadcasting Co., Inc.

Location	*C.L.*	*Kc.*	*N.A.*
Abbeville, La.	KROF	960	
Abbeville, S.C.	WABV	1590	
Aberdeen, Md.	WAMD	970	
Aberdeen, Miss.	WMPA	1240	
Aberdeen, S.Dak.	KABR	1220	
	KSDN	930	A
Aberdeen, Wash.	KBKW	1450	
	KXRO	1320	M
Abilene, Tex.	KRBC	1470	A
	KNIT	1280	
	KWKC	1340	M
Abingdon, Va.	WBBI	1230	
Ada, Okla.	KADA	1230	A
Adel, Ga.	WAAG	1470	
Adrian, Mich.	WABJ	1490	A
Agana, Guam	KUAM	610	N
Aguadilla, P.R.	WABA	850	
	WGRF	1340	
Ahoskie, N.C.	WRCS	970	
Aiken, S.C.	WAKN	990	
Akron, Ohio	WAKR	1590	A
	WADC	1350	C
	WCUE	1150	
	WHKK	640	M
Alamogordo, N.M.	KALG	1230	M
	KRAC	1270	
Alamosa.Colo.	KGIW	1450	M
Albany, Ga.	WALB	1590	A
	WGPC	1450	C
	WJAZ	1050	
Albany, Ky.	WANY	1390	
Albany, Minn.	KASM	1150	
Albany, N.Y.	WABY	1400	
	WOKO	1460	M
	WPTR	1540	A
	WROW	590	C
Albany, Oreg.	KWIL	790	M
	KABY	990	
Albemarle, N.C.	WABZ	1010	
	WZKY	1580	
Albert Lea, Minn.	KATE	1450	A
Albertville, Ala.	WAVU	630	
Albion, Mich.	WALM	1260	
Albuquerque, N.M.	KABQ	1350	
	KDEF	1150	
	KGGM	610	C
	KOB	1030	N
	KQEO	920	M
	KLOS	1450	
	KHAM	1580	A
Alcoa, Tenn.	WEAG	1470	
Alexander City, Ala.	WRFS	1050	
Alexandria, La.	KALB	580	A
	KDBS	1410	
	KSYL	970	N
Alexandria, Minn.	KXRA	1490	A
Alexandria, Va.	WPIK	730	M
Algona, Iowa	KLGA	1600	
Alice, Tex.	KOPY	1070	
Allegan, Mich.	WOWE	1580	
Allentown, Pa.	WHOL	1600	
	WAEB	790	
	WKAP	1320	
	WSAN	1470	C
Alliance, Nebr.	KCOW	1400	
Alliance, Ohio	WFAH	1310	
Alma, Ga.	WCOS	1400	
Alma, Mich.	WFYC	1280	
Alpena Township, Mich.	WATZ	1450	
Alpine, Tex.	KVLF	1240	M
Alton, Ill.	WOKZ	1570	
Altona, Man.	CFAM	1290	
Altoona, Pa.	WFBG	1340	N
	WRTA	1240	A
	WVAM	1430	C
Alturas, Calif.	KCNO	570	
Altus, Okla.	KWHW	1450	
Alva, Okla.	KALV	1430	
Amarillo,.Tex.	KBUY	1010	M
	KFDA	1440	A
	KGNC	710	N
	KIXZ	940	C
	KRAY	1360	
	KZIP	1310	
Ambridge, Pa.	WMBA	1460	
Americus, Ga.	WDEC	1290	
Ames, Iowa	KSAI	1430	
	WOI	640	
Amherst, N.S.	CKDH	1400	
Amite, La.	WABL	1570	
Amory, Miss.	WAMY	1580	
Amos, Que.	CHAD	1340	
Amsterdam, N.Y.	WCSS	1490	
Anaconda, Mont.	KANA	1230	
Anacortes, Wash.	KAGT	1340	
Anchorage, Alaska	KBYR	1270	
	KFQD	730	C·A
	KENI	550	A·M·N
Andalusia, Ala.	WCTA	920	
Anderson, Ind.	WCBC	1470	M
	WHBU	1240	C
Anderson, S.C.	WAIM	1230	C
	WANS	1280	M
Andrews, Tex.	KACT	1360	
Annapolis, Md.	WANN	1190	
	WABW	810	
	WNAV	1430	
Ann Arbor, Mich.	WHRV	1600	A
	WPAG	1050	
Anna, Ill.	WRAJ	1440	
Anniston, Ala.	WANA	1490	
	WDNG	1450	A
	WHMA	1390	
Anoka, Minn.	KANO	1470	
Ansonia, Conn.	WADS	690	
Antigo, Wis.	WATK	900	
Artesia, N.M.	KSVP	990	M
Antigonish, N.S.	CJFX	580	
Apollo, Pa.	WAVL	910	
Apple Valley, Cal.	KAVR	960	
Appleton, Wis.	WAPL	1570	
	WHBY	1230	M
Arcadia, Fla.	WAPG	1480	
Arcata, Calif.	KENL	1340	
Ardmore, Okla.	KVSO	1240	A
Arecibo, P.R.	WCMN	1280	
	WMIA	1070	
	WNIK	1230	
Arkadelphia, Ark.	KVRC	1240	M
Arkan. City, Kans.	KSOK	1280	
Arlington, Fla.	WTTT	1220	
Arlington, Va.	WARL	780	
	WEAM	1390	
Artesia, N.M.	KSVP	990	M
Asbury Park, N.J.	WJLK	1310	
Asheboro, N.C.	WGWR	1260	
Asheville, N.C.	WISE	1310	
	WLOS	1380	N·M·A
	WSKY	1230	
	WWNC	570	C
Ashland, Ky.	WCMI	1340	C
	WTCR	1420	
Ashland, Ohio	WNCO	1340	
Ashland, Oreg.	KWIN	1400	M
Ashland, Wis.	WATW	1400	
Ashtabula, Ohio	WICA	970	
Astoria, Oreg.	KAST	1370	M
	KVAS	1230	
Atchison, Kans.	KARE	1470	
Athens, Ala.	WJMW	730	
Athens, Ga.	WGAU	1340	C
	WDOL	1470	
	WRFC	960	
Athens, Ohio	WATH	970	
	WOUB	1340	
Athens, Tenn,	WLAR	1450	M
Athens, Tex.	KBUD	1410	
Atlanta, Ga.	WPLO	590	C
	WAKE	1340	
	WAOK	1380	
	WERD	860	
	WGKA	1600	
	WGST	920	A
	WIIN	970	
	WQXI	790	
	WSB	750	N
	WYZE	1480	M
Atlanta, Tex.	KALT	900	
Atlantic, Iowa	KJAN	1220	
Atlantic Beach, Fla.	WKTX	1600	
Atlantic City, N.J.	WFPG	1450	C
	WLDB	1490	M
	WMID	1340	A
Atmore, Ala.	WATM	1590	
Attleboro, Mass.	WARA	1320	
Auburn, Ala.	WAUD	1230	A
Auburn, Calif.	KAHI	950	
Auburn, N.Y.	WMBO	1340	M
Auburn, Wash.	KASY	1220	
Auburndale, Fla.	WTWB	1570	
Augusta, Ga.	WAUG	1050	
	WBBQ	1340	M
	WBIA	1230	N
	WGAC	580	A
	WRDW	1480	C
Augusta, Maine	WRDO	1400	N
	WFAU	1340	M
Aurora, Colo.	KOSI	1430	
Aurora, Ill.	WMRO	1280	
Austin, Minn.	KAUS	1480	M
Austin, Tex.	KNOW	1490	A
	KTBC	590	C
	KOKE	1370	
	KVET	1300	M
Avalon, Calif.	KBIG	740	
Avon Park, Fla.	WAVP	1390	
Avondale Estates, Ga.	WAVO	1420	
Aztec, N. Mex.	KNDE	1340	
Babylon, N.Y.	WBAB	1440	
	WGLI	1290	
Bad Axe, Mich.	WLEW	1340	
Bainbridge, Ga.	WMGR	930	
	WAZA	1360	
Baker, Oreg.	KBKR	1490	
Bakersfield, Calif.	KAFY	550	M
	KBIS	970	
	KERN	1410	C
	KGEE	1230	
	KIKK	800	
	KLYD	1350	
	KMAP	1490	
	KPMC	1560	A
Baldwinsville, N.Y.	WSEN	1050	
Ballinger, Tex.	KRUN	1400	
Baltimore, Md.	WBAL	1090	N
	WBMD	750	
	WCAO	600	
	WCBM	680	C
	WFBR	1300	
	WITH	1230	
	WSID	1010	
	WWIN	1400	A·M
Bamberg, S.C.	WWBD	790	
Bangor, Maine	WABI	910	A·M
	WGUY	1250	C
	WLBZ	620	N
Banning, Calif.	KPAS	1490	
Barboursville, Ky.	WBVL	950	
Bardstown, Ky.	WBRT	1320	
Barnesboro, Pa.	WNCC	950	
Barnwell, S.C.	WBAW	740	
Barrie, Ont.	CKBB	950	
Barstow, Calif.	KWTC	1230	A
Bartlesville, Okla.	KWON	1400	M
Bartow, Fla.	WBAR	1460	
Bastrop, La.	KTRY	730	
	KGAN	1340	
Batavia, N.Y.	WBTA	1490	M
Batesburg, S.C.	WBLR	1430	
Batesville, Ark.	KBTA	1340	
Batesville, Miss.	WBLE	1290	
Bath, Maine	WMMS	730	
Bathurst, N.B.	CKBC	1400	
Baton Rouge, La.	WAIL	1460	M
	WYNK	1380	
	WIBR	1300	
	WJBO	1150	N
	WLCS	910	
	WXOK	1260	
Battle Creek, Mich.	WBCK	930	
	WELL	1400	A
Baxley, Ga.	WHAB	1260	
Bay City, Mich.	WBCM	1440	A
	WWBC	1250	
Bay City, Tex.	KIOX	1270	M
Bay Minette, Ala.	WBCA	1150	
Bayamon, P.R.	WENA	1560	
Baytown, Tex.	KRCT	650	
	KWBA	1360	
Beatrice, Nebr.	KWBE	1450	
Beaufort, N.C,	WBMA	1400	
Beaufort, S.C.	WBEU	960	
Beaumont, Tex.	KFDM	560	A
	KJET	1380	
	KRIC	1450	
	KTRM	990	
Beaver Dam, Wis.	WBEV	1430	
Beaver Falls, Pa.	WBVP	1230	
Beckley, W. Va.	WJLS	560	C
	WWNR	620	
Bedford, Ind.	WBIW	1340	
Bedford, Pa.	WBFD	1310	
Bedford, Va.	WBLT	1350	
Beeville, Tex.	KIBL	1490	
Belgrade, Mont.	KGVW	630	
Bellaire, Ohio	WOMP	1290	M
Bellefontaine, Ohio	WDHP	1390	
Bellefonte, Pa.	WBLF	1330	
Bell Fourche, S.Dak.	KBFS	1450	
Belle Glade, Fla.	WSWN	900	
Belleville, Ont.	CJBQ	800	
Belleville, Ill.	WIBV	1260	
Bellevue, Wash.	KFKF	1330	
Bellingham, Wash.	KPUG	1170	M
	KVOS	790	A
Bellingham-Ferndale, Wash.	KENY	930	
Belmont, N.C.	WCGC	1270	M·A
Beloit, Wis.	WBEL	1380	
	WGEZ	1490	M
Belton, S.C.	WHPB	1390	
Belzoni, Miss.	WELZ	1460	
Bemidji, Minn.	KBUN	1450	M
Bend, Oreg.	KBND	1110	A
Bennetsville, S.C.	WBSC	1550	M
Bennington, Vt.	WBTN	1370	
Benson, Minn.	KBMO	1290	
Benton, Ark.	KBBA	690	
Benton, Ky.	WCBL	1290	
Benton Harbor, Mich.	WHFB	1060	
Berkeley, Calif.	KRE	1400	
Berkeley Springs, W.Va.	WCST	1010	
Berlin, N.H.	WKCB	1230	
Berryville, Ark.	KTCN	1480	
Berwick, Pa.	WBRX	1280	
Bessemer, Ala.	WEZB	1450	
Bethesda, Md.	WUST	1120	
Bethlehem, Pa.	WGPA	1100	
Biddeford, Maine	WIDE	1400	M
Big Lake, Tex.	KBLT	1290	
Big Rapids, Mich.	WBRN	1460	
Big Sprg., Tex.	KBST	1490	A
	KHEM	1270	
	KBYG	1400	M
Big Stone Gap, Va.	WLSD	1220	
Bijou, Calif.	KOWL	1490	
Biloxi, Miss.	WLOX	1490	M
	WVMI	570	
Billings, Mont.	KBMY	1240	M
	KGHL	790	N
	KDOK	970	C
	KOYN	910	
	KURL	730	
Binghamton, N.Y.	WINR	680	N
	WKOP	1360	M
	WNBF	1290	C
Birmingham, Ala.	WAPI	1070	N
	WBRC	960	C
	WCRT	1260	A
	WEDR	1220	
	WATV	900	
	WSGN	610	
	WYDE	850	
	WVOK	690	
Bisbee, Ariz.	KSUN	1230	A
Bishop, Calif.	KIBS	1230	A
Bishopville, S.C.	WAGS	1380	
Bismarck, N.Dak.	KFYR	550	N
	KQDI	1350	
Bismarck-Mandan, N.Dak.	KBOM	1270	
Black River Falls, Wis.	WWIS	1260	
Blackfoot, Idaho	KBLI	690	
Blackstone, Va.	WKLV	1440	
Blackwell, Okla.	KLTR	1580	
Blind River, Ont.	CJNR	730	
Bloomington, Ill.	WJBC	1230	A
Bloomington, Ind.	WTTS	1370	A
Bloomsburg, Pa.	WCNR	930	
	WHLM	550	
Bluefield, W.Va.	WHIS	1440	N
	WKOY	1240	M
Blythe, Calif.	KYOR	1450	A
Blytheville, Ark.	KLCN	910	
Bogalusa, La.	WIKC	1490	N
	WBOX	920	
Boise, Idaho	KBOI	950	C
	KGEM	1140	M
	KIDO	630	N
	KYME	740	
Bonham, Tex.	KFYN	1420	
Boone, Iowa	KFGQ	1260	
	KWBG	1590	
Boone, N.C.	WATA	1450	
Boonville, Ind.	WBNL	1540	
Boonville, Mo.	KWRT	1370	
Booneville, Miss.	WBIP	1400	A
Boonville, N.Y.	WBRV	900	
Borger, Tex.	KHUZ	1490	M
	KBBB	1600	
Bossier City, La.	KBCL	1220	
Boston, Mass.	WBZ	1030	
	WCOP	1150	
	WILD	1090	
	WNAC	680	M·N
	WEZE	1260	N
	WEEI	590	C
	WHDH	850	
	WMEX	1510	
	WORL	950	
Boulder, Colo.	KBOL	1490	
Bowie, Tex.	KBAN	1410	
Bowling Green, Ky.	WKCT	930	A
	WLBJ	1410	M
Bowl. Green, Ohio	WHRW	730	
Bozeman, Mont.	KXXL	1450	N
	KBMN	1230	
Bradbury Hgts., Md.	WPGC	1580	
Braddock, Pa.	WLOA	1550	
Bradenton, Fla.	WTRL	1490	
	WBRD	1420	
Bradford, Pa.	WESB	1490	M
Brady, Tex.	KNEL	1490	
Brainerd, Minn.	KLIZ	1380	

Location	C.L.	Kc.	N.A.
Brampton, Ont.	CHIC	1090	
Brandon, Man.	CKX	1150	
Branson, Mo.	KBHM	1220	
Brattleboro, Vt.	WTSA	1450	
Brawley, Calif.	KROP	1300	A
Breckenridge, Minn.	KBMW	1450	
Breckenridge, Tex.	KSTB	1430	
Bremen, Ga.	WWCC	1440	
Bremerton, Wash.	KBRO	1490	
Brenham, Tex.	KWHI	1280	
Brevard, N.C.	WPNF	1240	M-N
Brewton, Ala.	WEBJ	1240	M
Bridgeport, Conn.	WICC	600	M
	WNAB	1450	A
Bridgeton, N.J.	WSNJ	1240	
Bridgewater, N.S.	CKBW	1000	
Brigham City, Utah	KBUH	800	
Brighton, Colo.	KHIL	800	
Bristol, Conn.	WBIS	1440	
Bristol, Tenn.	WOPI	1490	N
Bristol, Va.	WCYB	690	A
	WFHG	980	M
Brockton, Mass.	WBET	1460	
Brockville, Ont.	CFJR	1450	
Broken Bow, Nebr.	KCNI	1280	
Brookfield, Mo.	KGHM	1470	
Brookhaven, Miss.	WCHJ	1470	
	WJMB	1340	M
Brookings, Oreg.	KURY	910	
Brookings, S.Dak.	KBRK	1430	
Brookline, Mass.	WBOS	1600	
Brooklyn, N.Y.	WPOW	1330	
Brooksville, Fla.	WWJB	1450	
Brownfield, Tex.	KTFY	1300	
Brownsville, Tex.	KBOR	1600	A
Brownwood, Tex.	KBWD	1380	M
	KEAN	1240	
Brunswick, Ga.	WGIG	1440	A
	WMOG	1490	
Brunswick, Maine	WCME	900	
Bryan, Tex.	KORA	1240	M
	WTAW	1150	
Buffalo, N.Y.	WBEN	930	C
	WBNY	1400	
	WEBR	970	M
	WGR	550	
	WKBW	1520	N
	WWOL	1120	A
Buffalo, Wyo.	KBBS	1450	
Buford, Ga.	WDMF	1460	
Burbank, Calif.	KBLA	1490	
Burley, Idaho	KBAR	1230	A-M
Burlington, Iowa	KBUR	1490	A
Burlington, N.C.	WBBB	920	M
	WFNS	1150	
Burlington, Vt.	WCAX	620	C
	WDOT	1400	
	WJOY	1230	A
Burns, Oreg.	KRNS	1230	
Butler, Ala.	WPRN	1220	
Butler, Pa.	WBUT	1050	
	WISR	680	
Butte, Mont.	KBOW	1490	C
	KOPR	550	M
	KXLF	1370	N
Cadillac, Mich.	WATT	1240	M
Caguas, P.R.	WNEL	1450	
	WRDL	1450	
	WVJP	1110	
Cairo, Ga.	WGRA	790	
Cairo, Ill.	WKRO	1490	
Calais, Maine	WQDY	1230	
Caldwell, Idaho	KCID	1490	
Calera, Ala.	WBYE	1370	
Calexico, Calif.	KICO	1490	
Calgary, Alta.	CFAC	960	
	CFCN	1060	
	CKXL	1140	
Calhoun, Ga.	WCGA	900	
Camas, Wash.	KPVA	1480	
Cambridge, Md.	WCEM	1240	
Cambridge, Mass.	WTAO	740	A
Cambridge, Ohio	WILE	1270	
Camden, Ark.	KAMD	910	
Camden, N.J.	WCAM	1310	
	WKDN	800	
Camden, S. C.	WACA	1590	
Camden, Tenn.	WFWL	1220	
Cameron, Tex.	KMIL	1330	
Camilla, Ga.	WCLB	1220	
Campbell, Ohio	WHOT	1570	
Campbellsville, Ky.	WTCO	1450	
Campbellton, N.B.	CKNB	950	
Camrose, Alta.	CFCW	1230	
Canon City, Colo.	KRLN	1400	M
Canonsburg, Pa.	WCNG	540	
Canton, Ga.	WCHK	1290	
Canton, Ill.	WBYS	1560	
Canton, Miss.	WDOB	1370	
Canton, N.C.	WWIT	970	
Canton, Ohio	WAND	900	
	WCMW	1060	
	WHBC	1480	A
Cape Girardeau, Mo.	KFVS	960	
	KGMO	1220	
Carbondale, Ill.	WCIL	1020	
Carbondale, Pa.	WCDL	1440	
Caribou, Maine	WFST	600	
Carlisle, Pa.	WHYL	960	
Carlsbad, N.Mex.	KAVE	1240	C
	KPBM	740	
Carmel, Calif.	KTEE	1410	
Carmi, Ill.	WROY	1460	
Carrizo Springs, Tex.	KBEN	1450	
Carroll, Iowa	KCIM	1380	
Carrollton, Ala.	WRAG	590	
Carrollton, Ga.	WLBB	1100	
Carson City, Nev.	KPTL	1300	

Location	C.L.	Kc.	N.A.
Cartersville, Ga.	WBHF	1450	M
Carthage, Ill.	WCAZ	990	
Carthage, Mo.	KDMO	1490	
Carthage, Tenn.	WRKM	1350	
Carthage, Tex.	KGAS	1590	
Caruthersville, Mo.	KCRV	1370	
Casa Grande, Ariz.	KPIN	1260	
Casper, Wyo.	KTWO	1470	C
	KATI	1400	
	KVOC	1230	A-M
Cayce, S.C.	WCAY	620	
Cedar City, Utah	KSUB	590	C
Cedar Rapids, Iowa	KCRG	1600	M
	KPIG	1450	
	WMT	600	C
Cedartown, Ga.	WGAA	1340	
Center, Tex.	KDET	930	
Centerville, Iowa	KCOG	1400	
Centerville, Tenn.	WHLP	1570	
Centerville, Utah	KBBC	1600	
Central City, Ky.	WNES	1600	
	WMTA	1380	
Centralia, Ill.	WCNT	1210	
Centralia & Chehalis, Wash.	KELA	1470	
Centreville, Miss.	WGLC	1580	
Chadron, Nebr.	KCSR	1450	
Chambersburg, Pa.	WCHA	800	
	WCBG	1590	
Champaign, Ill.	WDWS	1400	C
Chanute, Kans.	KCRB	1460	
Chapel Hill, N.C.	WCHL	1360	
Charleroi, Pa.	WESA	940	
Charles City, Iowa	KCHA	1580	
Charleston, Ill.	WEIC	1270	
Charleston, Mo.	KCHR	1350	
Charleston, S.C.	WCSC	1390	C
	WOKE	1340	A-M
	WPAL	730	
	WQSN	1450	
	WTMA	1250	N
Charleston, W.Va.	WCAW	1400	
	WCHS	580	C
	WHMS	1490	A
	WKAZ	950	N
	WTIP	1240	M
Charlotte, Mich.	WCER	1390	
Charlotte, N.C.	WBT	1110	C
	WAYS	610	A
	WGIV	1600	
	WKTC	1310	
	WIST	930	M
	WSOC	1240	N
	WWOK	1480	
Charlotte Amalie, V.I.	WSTA	1340	
Charlottesville, Va.	WCHV	1260	A
	WELK	1010	
	WINA	1400	M
Charlottetown, P.E.I.	CFCY	630	
Chase City, Va.	WMEK	980	
Chatham, Ont.	CFCO	630	
Chattanooga, Tenn.	WOGA	1450	M
	WAPO	1150	A
	WDEF	1370	N
	WDOD	1310	C
	WDXB	1490	
	WMFS	1260	
Cheboygan, Mich.	WCBY	1240	
Cheektowaga, N.Y.	WNIA	1230	
Chehalis, Wash.	KITI	1420	
Chelan, Wash.	KOZI	1220	
Cheraw, S.C.	WCRE	1420	
Cherokee, Iowa	KCHE	1440	
Chester, Pa.	WEEZ	1590	
	WVCH	740	
Chester, S.C.	WGOD	1490	
Cheyenne, Wyo.	KFBC	1240	A
	KCHY	1590	
	KVWO	1370	M
Chicago, Ill.	WAAF	950	
	WAIT	820	
	WBBM	780	C
	WCFL	1000	
	WCRW	1240	
	WEDC	1240	
	WGES	1390	
	WGN	720	M
	WIND	560	
	WJJD	1160	
	WLS	890	A
	WMAQ	670	N
	WMBI	1110	
	WSBC	1240	
Chickasha, Okla.	KWCO	1560	
Chico, Calif.	KHSL	1290	C
	KPAY	1060	
Chicopee, Mass.	WACE	730	
Chicoutimi, Que.	CBJ	1580	
	CJMT	1420	
Childress, Tex.	KCTX	1510	
Chillicothe, Mo.	KCHI	1010	
Chillicothe, Ohio	WBEX	1490	A
	WCHI	1350	
Chilliwack, B.C.	CHWK	1270	
Chipley, Fla.	WBGC	1240	
Chippewa Falls, Wis.	WAXX	1150	
Christiansburg, Va.	WBCR	1260	
Christiansted, V.I.	WIVI	1040	
Church Hill, Tenn.	WMCH	1260	
Churchill, Man.	CHFC	1230	
Cicero, Ill.	WHFC	1450	
Cincinnati, Ohio	WCKY	1530	
	WCIN	1480	
	WCPD	1230	
	WKRC	550	C
	WLW	700	N-A

Location	C.L.	Kc.	N.A.
	WSAI	1360	
Clanton, Ala.	WKLF	980	
Claremore, Okla.	KWPR	1270	
Claremont, N.H.	WTSV	1230	
Clarksburg, W.Va.	WBOY	1400	N
	WHAR	1340	M
	WPDX	750	
Clarksdale, Miss.	WROX	1450	M
	WKDL	1600	
Clarksville, Ark.	KLYR	1360	
Clarksville, Tenn.	WJZM	1400	M
	WDXN	540	
Clarksville, Tex.	KCAR	1350	
Claxton, Ga.	WCLA	1470	
Clayton, Mo.	KXLW	1320	
	KFUO	850	
Clayton, N.Mex.	KLMX	1450	
Clearfield, Pa.	WCPA	900	
Clearwater, Fla.	WTAN	1340	
Cleburne, Tex.	KCLE	1120	
Cleveland, Ga.	WRWH	1380	
Cleveland, Miss.	WCLD	1490	
	WDSK	1410	
Cleveland, Ohio	KYW	1100	
	WDOK	1260	M
	WERE	1300	
	WGAR	1220	C
	WHK	1420	
	WABQ	1540	
	WJW	850	N
Cleveland, Tenn.	WBAC	1340	M
	WCLE	1570	
Cleveland, Tex.	KVLB	1410	
Cleve. Hgts., Ohio	WJMO	1490	A
Clifton, Ariz.	KCLF	1400	A
Clifton Forge, Va.	WCFV	1230	
Clinton, Ill.	WHOW	1520	
Clinton, Iowa	KCLN	1390	
	KROS	1340	M
Clinton, Mo.	KDKD	1280	
Clinton, N.C.	WRRZ	880	A
Clinton, Okla.	KWOE	1320	
Clinton, S.C.	WPCC	1400	
Cloquet, Minn.	WKLK	1230	
Clovis, N.Mex.	KCLV	1240	
	KVER	980	
Coachella, Calif.	KCHV	970	
Coalinga, Calif.	KBMX	1470	
Coatesville, Pa.	WCOJ	1420	
Cocoa, Fla.	WKKO	860	
	WEZY	1480	
Cocoa Beach, Fla.	WRKT	1300	
Cody, Wyo.	KODI	1400	A
Coeur d'Alene, Ida.	KVNI	1240	M
	KZIN	1050	
Coffeyville, Kans.	KGGF	690	A
Colby, Kans.	KXXX	790	
Coldwater, Mich.	WTVB	1590	
Coleman, Tex.	KSTA	1000	
Colfax, Wash.	KCLX	1450	
College Park, Ga.	WCPK	1570	
Colonial Heights, Va.	WPVA	1290	
Colorado City, Tex.	KVMC	1320	
Colo. Sprgs., Colo.	KRDO	1240	
	KPIK	1580	
	KVOR	1300	C
	KSSS	740	
	KYSN	1460	M
Columbia, Ky.	WAIN	1270	
Columbia, Miss.	WCJU	1450	M
Columbia, Mo.	KFRU	1400	A
	KBIA	1580	
Columbia, Pa.	WCOY	1580	
Columbia, S.C.	WCOS	1400	A
	WIS	560	N
	WMSC	1320	C
	WNOK	1230	
	WOIC	1470	
Columbia, Tenn.	WJGD	1280	
	WKRM	1340	
Columbus, Ga.	WDAK	540	N
	WRBL	1420	C
	WGBA	1270	M
	WCLS	1580	
	WOKS	1340	
Columbus, Ind.	WCSI	1010	
Columbus, Miss.	WACR	1050	
	WCBI	550	M
Columbus, Nebr.	KJSK	900	
Columbus, Ohio	WBNS	1460	C
	WCOL	1230	A
	WMNI	920	
	WOSU	820	
	WTVN	610	
	WVKO	1580	
Colville, Wash.	KCVL	1270	
Commerce, Ga.	WJJC	1270	
Concord, N.H.	WKXL	1450	C
Concord, N.C.	WEGD	1410	
Concordia, Kans.	KNCK	1390	
	KFRM	550	A
Connellsville, Pa.	WCVI	1340	
Connersville, Ind.	WCNB	1580	
Conroe, Tex.	KMCO	900	
Conway, Ark.	KCON	1230	
Conway, N.H.	WBNC	1050	
Conway, S.C.	WLAT	1330	M
Cookeville, Tenn.	WHUB	1400	C
Coolidge, Ariz.	KCKY	1150	C
Coos Bay, Oreg.	KOOS	1230	M
	KYNG	1420	
Copper Hill, Tenn.	WLSB	1400	
Coquille, Oreg.	KWRO	1450	
Coral Gables, Fla.	WVCG	1070	
Corbin, Ky.	WCTT	680	M
Cordele, Ga.	WMJM	1490	M
Cordova, Alaska	KLAM	1450	
Corinth, Miss.	WCMA	1230	

Location	C.L.	Kc.	N.A.
	WCRR	1330	
Cornelia, Ga.	WCON	1450	
Corner Brook, Nfld.	CBY	790	
Corning, Ark.	KCCB	1260	
Corning, N.Y.	WCBA	1350	
	WCLI	1450	A
Cornwall, Ont.	CJSS	1220	
Corona, Calif.	KBUC	1370	
Corpus Christi, Tex.	KCTA	1030	M
	KCCT	1150	
	KEYS	1440	
	KRYS	1360	N
	KSIX	1230	A-C
	KUNO	1400	
Corry, Pa.	WOTR	1370	
Corsicana, Tex.	KAND	1340	
Cortez, Colo.	KVFC	740	
Cortland, N.Y.	WKRT	920	
Corvallis, Oreg.	KOAC	550	
	KFLY	1240	
	KLOO	1340	
Coshocton, Ohio	WTNS	1560	
Cottage Grove, Oreg.	KOMB	1400	
Coudersport, Pa.	WFRM	600	
Council Bluffs, Iowa	KSWI	1560	M-A
Courtenay, B.C.	CFCP	1440	
Covington, Ga.	WGFS	1430	
Covington, Ky.	WZIP	1050	M
Covington, La.	WARB	730	
Covington, Tenn.	WKBL	1250	
Covington, Va.	WKEY	1340	A
Cowan, Tenn.	WZYX	1440	
Craig, Colo.	KRAI	550	
Cranbrook, B.C.	CKEK	570	
Crane, Tex.	KCRN	1380	
Crescent City, Calif.	KPLY	1240	
Creston, Iowa	KSIB	1520	
Crestview, Fla.	WCNU	1010	
	WJSB	1050	
Crewe, Va.	WSVS	800	
Crockett, Tex.	KIVY	1290	
Crookston, Minn.	KROX	1260	
Crossett, Ark.	KAGH	800	
Crossville, Tenn.	WAEW	1330	
Crowley, La.	KSIG	1450	M
Cuero, Tex.	KCFH	1600	
Cullman, Ala.	WFMH	1460	
	WKUL	1340	
Culpeper, Va.	WCVA	1490	M
Cumberland, Ky.	WCPM	1280	
Cumberland, Md.	WCUM	1230	C
	WTBO	1450	
Cushing, Okla.	KUSH	1600	
Cypress Gardens, Fla.	WGTO	540	
Cynthiana, Ky.	WCYN	1400	
Dade City, Fla.	WDCF	1350	
Dalhart, Tex.	KXIT	1410	
Dallas, Oreg.	KPLK	1460	
Dallas, Tex.	KRLD	1080	C
	KIXL	1040	
	KSKY	660	
	KLIF	1190	
	WFAA	570	A
	WFAA	820	N
	KBOX	1480	
	WRR	1310	M
The Dalles, Oreg.	KACI	1300	
	KODL	1440	A
Dalton, Ga.	WBLJ	1230	M
	WRCD	1430	
Danbury, Conn.	WLAD	800	
Danville, Ill.	WDAN	1490	C
	WITY	980	
Danville, Ky.	WHIR	1230	M
Danville, Va.	WBTM	1330	A
	WDVA	1250	M
	WILA	1580	
Darlington, S.C.	WDAR	1350	
Dauphin, Man.	CKDM	1050	
Davenport, Iowa	WOC	1420	N
	KFMA	1580	
	KSTT	1170	M
Dawson, Ga.	WDWD	990	
Dawson, Yukon T.	CFYT	1230	
Dawson Creek, B.C.	CJDC	1350	
Dayton, Ohio	WHIO	1290	C
	WING	1410	
	WONE	980	
	WAVI	1210	
Dayton, Tenn.	WDNT	1280	
Daytona Beach, Fla.	WNDB	1150	M-A
	WMFJ	1450	
	WROD	1340	
Deadwood, S.Dak.	KDSJ	980	
Dearborn, Mich.	WKMH	1310	
Decatur, Ala.	WHOS	800	
	WAJF	1490	
	WMSL	1400	M
Decatur, Ga.	WGUN	1010	
Decatur, Ill.	WDZ	1050	
	WSOY	1340	C
Decorah, Iowa	KDEC	1240	
	KWLC	1240	
Defiance, Ohio	WONW	1280	
De Funiak Springs, Fla.	WDSP	1280	
	WZEP	1460	
De Kalb, Ill.	WLBK	1360	
De Land, Fla.	WJBS	1490	
	WOOO	1310	
Delano, Calif.	KCHJ	1010	
Delray, Bch., Fla.	WDBF	1420	

Location	C.L.	Kc.	N.A.
Del Rio, Tex.	KDLK	1230	
Delta, Colo.	KDTA	1400	
Deming, N.Mex.	KOTS	1230	
Demopolis, Ala.	WXAL	1400	M
Denham Sprgs., La.	WLBI	1220	
Denison, Iowa	KDSN	1580	
Denison, Tex.	KDSX	950	
Denton, Tex.	KDNT	1440	
Denver, Colo.	KDEN	1340	
	KFML	1390	
	KHOW	630	A
	KIMN	950	M
	KLIR	990	
	KLZ	560	C
	KICN	710	
	KOA	850	N
	KPOF	910	
	KFSC	1220	
	KTLN	1280	
De Queen, Ark.	KDQN	1390	
DeRidder, La.	KDLA	1010	
Des Moines, Iowa	KCBC	1390	A
	KIOA	940	
	KRNT	1350	C
	KSO	1460	
	KWKY	1150	M
	WHO	1040	N
Detroit, Mich.	WCAR	1130	
	WJBK	1500	
	WJLB	1400	
	WJR	760	
	WWJ	950	N
	WXYZ	1270	A
Detroit Lakes, Minn.	KDLM	1340	
Devils Lake, N.Dak.	KDLR	1240	M
Dexter, Mo.	KDEX	1590	
Diboll, Tex.	KSPL	1260	
Dickinson, N.Dak.	KDIX	1230	
Dickson, Tenn.	WDKN	1260	
Dillon, Mont.	KDBM	800	
Dillon, S.C.	WDSC	800	A
Dinuba, Calif.	KRDU	1240	
Dodge City, Kans.	KGND	1370	M
Dothan, Ala.	WAGF	1320	
	WDIG	1450	M
	WOOF	560	
Douglas, Ariz.	KAWT	1450	M
	KAPR	930	
Douglas, Ga.	WDMG	860	
Douglas, Wyo.	KWIV	1050	
Dover, Del.	WDOV	1410	
	WKEN	1600	
Dover, N.H.	WTSN	1270	
Dover, Ohio	WJER	1450	
Doylestown, Pa.	WBUX	1570	
Drumheller, Alta.	CJDV	910	
Drummondville, Que.	CHRD	1340	
Dublin, Ga.	WMLT	1330	
	WXLI	1440	
Du Bois, Pa.	WCED	1420	C
Dubuque, Iowa	KDTH	1370	A
	WDBQ	1490	M
Duluth, Minn.	KOAL	610	C
	WEBC	560	
	WREX	1080	
Dumas, Tex.	KDDD	800	
Duncan, Okla.	KRHD	1350	M
Dundalk, Md.	WAYE	860	
	WEBB	1360	
Dundee, N.Y.	WFLR	1570	
Dunkirk, N.Y.	WDOE	1410	
Dunn, N.C.	WCKB	780	
Du Quoin, Ill.	WOQN	1580	
Durango, Colo.	KIUP	930	
	KDGO	1240	
Durant, Okla.	KSFO	750	
Durham, N.C.	WDNC	620	C
	WSRC	1410	
	WSSB	1490	
	WTIK	1310	A
Dyersburg, Tenn.	WDSG	1450	
	WTRO	1330	
Eagle Pass, Tex.	KEPS	1270	
Easley, S.C.	WELP	1360	
E. Grand Forks, Minn.	KRAD	1590	
Eastland, Tex.	KERC	1590	
E. Lansing, Mich.	WKAR	870	
E. Liverpool, Ohio	WOHI	1490	A
East Longmeadow, Mass.	WTYM	1600	
E. Point, Ga.	WTJH	1260	
E. St. Louis, Ill.	WAMV	1490	A
Easton, Pa.	WEEX	1230	
	WEST	1400	N
Eatontown, N.J.	WHTG	1410	
Eau Claire, Wis.	WEAQ	790	N
	WBIZ	1400	M
	WECL	1050	
Eau Gallie, Fla.	WMEG	920	
Edenton, N.C.	WCDJ	1260	
Edinburg, Tex.	KURV	710	
Edmonds, Wash.	KGDN	630	
Edmonton, Alta.	CBX	1010	
	CBXA	740	
	CFRN	1260	
	CHED	1080	
	CHFA	680	
	CJCA	930	
	CKUA	580	
Edmundston, N.C.	CJEM	570	
Effingham, Ill.	WCRA	1090	
Elba, Ala.	WELB	1350	
Elberton, Ga.	WSGC	1400	
El Cajon, Calif.	KDEO	910	A
El Campo, Tex.	KULP	1390	
El Centro, Calif.	KXO	1230	M
	KAMP	1430	
El Dorado, Ark.	KDMS	1290	
	KELD	1400	A
Eldorado, Kans.	KBTO	1360	
Elgin, Ill.	WRMN	1410	
Elizabeth City, N.C.	WCNC	1240	
	WGAI	560	
Elizabethton, Tenn.	WBEJ	1240	
Elizabethtown, Ky.	WIEL	1400	
Elizabethtown, N.C.	WBLA	1450	M
Elizabethtown, Pa.	WEZN	1600	
Elk City, Okla.	KBEK	1240	A
Elkhart, Ind.	WTRC	1340	N
	WCMR	1270	
Elkin, N.C.	WIFM	1540	
Elkins, W.Va.	WDNE	1240	
Elko, Nev.	KELK	1240	M
Ellensburg, Wash.	KXLE	1240	
Ellsworth, Me.	WDEA	1350	
Elmira, N.Y.	WELM	1400	A-C
	WENY	1230	N
Elmira Heights-Horseheads, N.Y.	WEHH	1590	M
El Paso, Tex.	KROD	600	C
	KELP	920	
	KHEY	690	
	KINT	1590	
	KOYE	1150	
	KSET	1340	M
	KTSM	1380	N
Ely, Minn.	WELY	1450	M
Ely, Nev.	KELY	1230	
Elyria, Ohio	WEOL	930	
Eminence, Ky.	WSTL	1600	
Emporia, Kans.	KVOE	1400	
Emporia, Va.	WEVA	860	
Emporium, Pa.	WLEM	1250	
Endicott, N.Y.	WENE	1430	A
Englewood, Colo.	KGMC	1150	
Enid, Okla.	KCRC	1390	A
	KGWA	960	M
Enterprise, Ala.	WIRB	600	
Ephrata, Pa.	WGSA	1310	
Ephrata, Wash.	KULF	730	
Erie, Pa.	WERC	1260	A
	WICU	1330	N
	WJET	1400	
	WLEU	1450	
Erwin, Tenn.	WEMB	1420	
Escanaba, Mich.	WDBC	680	M
	WLST	600	A
Escondido, Calif.	KOWN	1450	
Estherville, Iowa	KLIL	1340	
Etowah, Tenn.	WCPH	1220	
Eufaula, Ala.	WULA	1240	M
Eugene, Oreg.	KORE	1450	M
	KASH	1600	A
	KERG	1280	C
	KUGN	590	N
Eunice, La.	KEUN	1490	M
Eureka, Calif.	KINS	980	C
	KDAN	790	
	KIEM	1480	M
Eustis, Fla.	WLCO	1240	
Evanston, Ill.	WEAW	1330	
	WNMP	1590	
Evanston, Wyo.	KLUK	1240	
Evansville, Ind.	WEOA	1400	C
	WGBF	1280	N
	WIKY	820	
	WJPS	1330	A
Eveleth, Minn.	WEVE	1340	M
Everett, Wash.	KRKO	1380	
	KQTY	1230	
Evergreen, Ala.	WBLO	1470	
Fairbanks, Alaska	KFAR	660	A.M.N
	KFRB	900	C-A
Fairfax, Va.	WEEL	1310	
Fairfield, Ill.	WFIW	1390	
Fairfield, Iowa	KMCD	1570	
Fairmont, Minn.	KSUM	1370	M
Fairmont, N.C.	WFMO	860	
Fairmont, W.Va.	WMMN	920	C
	WTCS	1490	A
Fajardo, P.R.	WMDD	1490	
Falfurrias, Tex.	KPSO	1260	
Fallon, Nev.	KULV	1250	
Fall River, Mass.	WALE	1400	M
	WSAR	1480	A
Falls Church, Va.	WFAX	1220	
Falls City, Nebr.	KTNC	1230	
Fargo, N.Dak.	WDAY	970	N
	KFNW	900	
	KXGO	790	A
Faribault, Minn.	KDHL	920	
Farmington, Mo.	KREI	800	
Farmington, N.M.	KENN	1390	
	KWYK	960	
	KZUM	1280	
Farmville, N.C.	WBTL	1050	
Farmville, Va.	WFLO	870	
Farrell, Pa.	WFAR	1470	
Fayette, Ala.	WWWF	990	
Fayetteville, Ark.	KHOG	1450	
	KFAY	1250	M
Fayetteville, N.C.	WFAI	1230	C
	WFNC	1390	M
	WFLB	1490	A
	WIDU	1600	
Fayetteville, Tenn.	WEKR	1240	M
Fergus Falls, Minn.	KOTE	1250	M
Fernandina Beach, Fla.	WPAP	1570	
Ferriday, La.	KFNV	1600	
Festus, Mo.	KXEN	1010	
Findlay, Ohio	WFIN	1330	
Fisher, W.Va.	WELD	690	A
Fitchburg, Mass.	WEIM	1280	M
	WFGM	960	
Fitzgerald, Ga.	WBHB	1240	M
Flagstaff, Ariz.	KCLS	600	N
	KVNA	690	A
	KEOS	1290	
Flat River, Mo.	KFMO	1240	M
Flin Flon, Man.	CFAR	590	
Flint, Mich.	WFDF	910	N
	WTRX	1330	A
	WAMM	1420	
	WMRP	1570	
	WKMF	1470	
	WTAC	600	A
Flomaton, Ala.	WTCB	990	
Florence, Ala.	WJOI	1340	M
	WOWL	1240	A
Florence, S.C.	WJMX	970	A
	WOLS	1230	
Floydada, Tex.	KFLD	900	
Foley, Ala.	WHEP	1310	
Fond du Lac, Wis.	KFIZ	1450	M
Fordyce, Ark.	KBJT	1570	
Forest, Miss.	WMAG	860	
Forest City, N.C.	WBBO	780	
	WAGY	1320	
Forest Grove, Oreg.	KGGG	1570	
Forrest City, Ark.	KXJK	950	
Ft. Bragg, Calif.	KDAC	1230	
Ft. Collins, Colo.	KCOL	1410	
Ft. Dodge, Iowa	KVFD	1400	M
	KWMT	540	A
Ft. Frances, Ont.	CFOB	800	
Ft. Knox, Ky.	WSAC	1470	
Ft. Lauderdale, Fla.	WFTL	1400	
	WWIL	1580	
Ft. Lupton, Colo.	KHIL	800	
Ft. Madison, Iowa	KXGI	1360	
Ft. Morgan, Colo.	KFTM	1400	
Ft. Myers, Fla.	WINK	1240	C
	WMYR	1410	
Ft. Payne, Ala.	WFPA	1400	
	WZOB	1250	
Ft. Pierce, Fla.	WARN	1330	
	WIRA	1400	
Ft. Scott, Idaho	KMDO	1600	
Ft. Smith, Ark.	KFPW	1230	C
	KFSA	950	A
	KTCS	1410	M
	KWHN	1320	
Ft. Stockton, Tex.	KFST	860	
Ft. Valley, Ga.	WFPM	1150	
Ft. Walton Beach, Fla.	WFBS	950	
	WFTW	1260	
Ft. Wayne, Ind.	WGL	1250	A
	WOWO	1190	
	WANE	1450	C
	WKJG	1380	N
Ft. William, Ont.	CKPR	580	
Ft. Worth, Tex.	KJIM	870	
	KCUL	1540	
	KFJZ	1270	
	KNOK	970	
	WBAP	570	A
	WBAP	820	N
	KXOL	1360	
Fostoria, Ohio	WFOB	1430	
Fountain Inn, S.C.	WFIS	1600	
Framingham, Mass.	WKOX	1190	
Frankfort, Ind.	WILO	1570	
Frankfort, Ky.	WFKY	1490	M
Franklin, Ky.	WFKN	1220	
Franklin, N.C.	WFSC	1050	
Franklin, Pa.	WFRA	500	
Franklin, Tenn.	WAGG	950	
Franklin, Va.	WYSR	1250	
Frederick, Md.	WFMD	930	C
Frederick, Okla.	KTAT	1570	
Fredericksburg, Tex.	KNAF	1340	M
Fredericksburg, Va.	WFVA	1230	A
Fredericton, N.B.	CFNB	550	
Fredonia, N.Y.	WBUZ	1570	
Freeport, Ill.	WFRL	1570	
Freeport, N.Y.	WGBB	1240	
Freeport, Tex.	KBRZ	1460	
Fremont, Mich.	WCBQ	1490	
Fremont, Nebr.	KHUB	1340	
Fremont, Ohio	WFRO	900	
Fresno, Calif.	KARM	1430	A
	KBIF	900	
	KEAP	980	
	KFRE	940	C
	KGST	1600	
	KMAK	1340	
	KMJ	580	N
	KYNO	1300	
Front Royal, Va.	WFTR	1450	M
Frostburg, Md.	WFRB	740	
Fulton, Ky.	WFUL	1270	
Fulton, Mo.	KFAL	900	
Fulton, N.Y.	WOSC	1300	
Fuquay Sprgs., N.C.	WFVG	1460	
Gadsden, Ala.	WGAD	1350	A
	WETO	930	M
	WCAS	570	
Gaffney, S.C.	WFGN	1570	
Gainesville, Fla.	WDVH	980	
	WGGG	1230	A
	WRUF	850	M
Gainesville, Ga.	WGGA	550	M
	WDUN	1240	
	WLBA	1580	
Gainesville, Tex.	KGAF	1580	
Galax, Va.	WBOB	1360	M
Galesburg, Ill.	WGIL	1400	
	WAIK	1590	
Gallatin, Tenn.	WHIN	1010	
Gallipolis, Ohio	WJEH	990	
Gallup, N. Mex.	KGAK	1330	A
	KYVA	1230	
Galt, Ont.	CKGR	1110	
Galveston, Tex.	KILE	1400	
	KGBC	1540	
Gander, Nfld.	CBG	1450	
Garden City, Kans.	KNCO	1050	
	KIUL	1240	M
Gardner, Mass.	WGAW	1340	
Gary, Ind.	WWCA	1270	
	WGRY	1370	
Gastonia, N.C.	WGNC	1450	A
	WLTC	1370	
Gate City, Va.	WGAT	1050	
Gaylord, Mich.	WATC	900	
Geneva, Ala.	WGEA	1150	
Geneva, N.Y.	WGVA	1240	A
Georgetown, Del.	WJWL	900	
Georgetown, Ky.	WGOR	1580	
Georgetown, S.C.	WGTN	1400	M
Gettysburg, Pa.	WGET	1450	
Gillette, Wyo.	KIML	1490	
Gilroy, Calif.	KPER	1290	
Gladewater, Tex.	KSIJ	1430	
Glasgow, Ky.	WKAY	1490	
Glasgow, Mont.	KLTZ	1240	
Glendale, Ariz.	KRUX	1360	
Glendale, Calif.	KIEV	870	
Glendive, Mont.	KXGN	1400	
Glen Falls, N.Y.	WWSC	1450	A
Glenwood Sprgs., Colo.	KGLN	980	M
Globe, Ariz.	KWJB	1240	A
Gloucester, Va.	WDDY	1420	
Gloversville-Johnston, N.Y.	WENT	1340	C
Golden, Colo.	KXXI	1250	
Golden Meadow, La.	KLFT	1600	
Golden Valley, Minn.	KEVE	1440	M
Goldsboro, N.C.	WFMC	730	
	WGBR	1150	A
	WGOL	1300	
Gonzales, Tex.	KCTI	1450	
Goodland, Kans.	KBLR	730	M
Goose Bay, Nfld.	CFGB	1340	
Goshen, Ind.	WKAM	1460	
Grafton, N.D.	KGPC	1340	
Grafton, W.Va.	WVVW	1260	
Graham, Tex.	KSWA	1330	
Granby, Que.	CHEF	1450	
Grand Falls, Nfld.	CBT	990	
Grand Forks, N.Dak.			
Grand Coulee, Wash.	KFDR	1360	
	KFJM	1370	
	KILO	1440	C
	KNOX	1310	M
Grand Haven, Mich.	WGHN	1370	
Grand Island, Nebr.	KMMJ	750	A
	KRGI	1430	
Grand Junction, Colo.	KREX	920	M
	KEXO	1230	
	KSTR	620	
Grande Prairie, Alta.	CFGP	1050	
Grand Prairie, Tex.	KKSN	730	
Grand Rapids, Mich.	WJEF	1230	C
	WFUR	1570	
	WGRD	1410	
	WLAV	1340	A
	WMAX	1480	M
	WOOD	1300	N
Grand Rapids, Minn.	KOZY	1490	M
Grangeville, Idaho	KORT	1230	
Grants, N.Mex.	KMIN	980	
Grants Pass, Oreg.	KAGI	1340	M
	KAJO	1270	
Gravelbourg, Sask.	CFGR	1230	
	CFRG	710	
Grayson, Ky.	WGOH	1370	
Gt. Barrington, Mass.	WSBS	860	
Gt. Bend, Kans.	KVGB	1590	N
Gt. Falls, Mont.	KFBB	1310	C
	KUDI	1450	
	KMON	560	M
	KXLK	1400	N
Greeley, Colo.	KFKA	1310	
	KYOU	1450	
Green Bay, Wis.	WBAY	1360	C
	WJPG	1440	M
	WDUZ	1400	A
Green Cove Springs, Fla.	WGRC	1580	
Greeneville, Tenn.	WGRV	1340	
Greenfield, Mass.	WHAI	1240	M
Greensboro, N.C.	WBIG	1470	C
	WCOG	1320	
	WGBG	1400	A
	WPET	950	
Greensburg, Pa.	WHJB	620	
Greenville, Ala.	WGYV	1380	

Location	C.L.	Kc.	N.A.
Greenville, Miss.	WJPR	1330	
	WDDT	900	
	WGVM	1260	
Greenville, N.C.	WGTC	1590	M
Greenville, S.C.	WESC	660	
	WFBC	1330	N
	WMRB	1490	A-M
	WMUU	1260	
	WQOK	1440	C
Greenville, Tex.	KGVL	1400	
Greenwood, Miss.	WABG	960	A
	WGRM	1240	N
Greenwood, S.C.	WCRS	1450	N
	WGSW	1350	
Greer, S.C.	WEAB	800	
	WCKI	1300	A
Grenada, Miss.	WNAG	1400	M
Gresham, Oreg.	KGRO	1230	
Gretna, Va.	WMNA	730	
Griffin, Ga.	WKEU	1450	M
	WHIE	1320	
Grinnell, Iowa	KGRN	1410	
Groton, Conn.	WSUB	980	
Grove City, Pa.	WSAJ	1340	
Grundy, Va.	WNRG	1250	
Guayama, P.R.	WXRF	1590	
Guelph, Ont.	CJOY	1450	
Gulfport, Miss.	WROA	1390	
	WGCM	1240	A
Guntersville, Ala.	WGSV	1270	
Guthrie, Okla.	KWRW	1490	
Guymon, Okla.	KGYN	1220	
Hagerstown, Md.	WARK	1490	C
	WJEJ	1240	A-M
Haleyville, Ala.	WJBB	1230	M
Halifax, N.S.	CBH	1330	
	CHNS	960	
	CJCH	920	
Hamilton, Ala.	WERH	970	
Hamilton, Ohio	WMOH	1450	
Hamilton, Ont.	CHML	900	
	CKOC	1150	
Hamilton, Tex.	KCLW	900	
Hamlet, N.C.	WKDX	1400	
Hammond, Ind.	WJOB	1230	
Hammond, La.	WFPR	1400	
Hampton, S.C.	WBHC	1270	
Hampton, Va.	WVEC	1490	
Hancock, Mich.	WMPL	920	
Hanford, Calif.	KNGS	620	
Hannibal, Mo.	KHMO	1070	
Hanover, N.H.	WTSL	1400	
	WDCR	1340	
Hanover, Pa.	WHVR	1280	
Harlan, Ky.	WHLN	1410	
Harlingen, Tex.	KGBT	1530	
Harriman, Tenn.	WHBT	1600	
Harrisburg, Ill.	WEBQ	1240	
Harrisburg, Pa.	WHGB	1400	A
	WCMB	1460	M
	WHP	580	C
	WKBO	1230	N
Harrison, Ark.	KHOZ	900	
Harrisonburg, Va.	WHBG	1360	
	WSVA	550	N
Harrodsburg, Ky.	WHBN	1420	
Hartford, Conn.	WDRC	1360	C
	WCCC	1290	
	WPOP	1410	M-A
	WTIC	1080	N
Hartford, Wis.	WTKM	1540	
Hartselle, Ala.	WHRT	860	
Hartsville, S.C.	WHSC	1450	M
Hartwell, Ga.	WKLY	980	
Harvard, Ill.	WMCW	1600	
Harvey, Ill.	WBEE	1570	
Hastings, Mich.	WBCH	1220	
Hastings, Nebr.	KHAS	1230	
Hattiesburg, Miss.	WBKH	950	
	WFOR	1400	N
	WHSY	1230	A
	WXXX	1310	
Haverhill, Mass.	WHAV	1490	
Havre, Mont.	KOJM	610	M
Havre de Grace, Md.	WASA	1330	
Hawkinsville, Ga.	WCEH	610	
Haynesville, La.	KLUV	1580	
Hays, Kans.	KAYS	1400	
Hayward, Wis.	WHSM	910	
Hazard, Ky.	WKIC	1390	M
Hazlehurst, Miss.	WMDC	1220	
Hazleton, Pa.	WAZL	1490	N-M
Helena, Ark.	KFFA	1360	M
Helena, Mont.	KCAP	1340	M
	KXLJ	1240	N
Hemet, Calif.	KHSJ	1320	
Hempstead, N.Y.	WHLI	1100	
Henderson, Ky.	WSON	860	
Henderson, Nev.	KBMI	1400	
	KTOO	1280	
Henderson, N.C.	WHNC	890	M
	WHVH	1450	
Henderson, Tex.	KJAT	1000	
	KWRD	1470	
Hendersonville, N.C.	WHKP	1450	A
Henryetta, Okla.	KHEN	1590	
Hereford, Tex.	KPAN	860	
Herkimer, N.Y.	WALY	1420	
Hermiston, Oreg.	KOHU	1570	
Herrin, Ill.	WJPF	1340	M
Hettinger, N.Dak.	KNDC	1490	
Hibbing, Minn.	WMFG	1240	N
Hickory, N.C.	WHKY	1290	A
	WIRC	630	
High Point, N.C.	WMFR	1230	A
	WNOS	1590	
	WHPE	1070	
Hillsboro, Ohio	WSRW	1590	
Hillsboro, Oreg.	KUIK	1360	
Hillsboro, Tex.	KHBR	1560	
Hillsdale, Mich.	WCSR	1340	
Hilo, Hawaii	KHBC	970	C
	KIPA	1110	
	KIMO	850	M
Hobart, Okla.	KTJS	1420	
Hobbs, N.Mex.	KWEW	1480	M
	KHOB	1280	
Holbrook, Ariz.	KDJI	1270	
Holdredge, Nebr.	KUVR	1380	
Holland, Mich.	WHTC	1450	
	WJBL	1260	
Hollywood, Fla.	WGMA	1320	
Holyoke, Mass.	WREB	930	
Homer, La.	KVHL	1320	
Homestead, Fla.	WSDB	1430	
Homestead, Pa.	WAMO	860	
Homewood, Ala.	WENN	1320	M
	WJLD	1400	
Honolulu, Hawaii	KGMB	590	C
	KPOI	1380	
	KIKI	830	
	KGU	760	N
	KHVH	1040	
	KPOA	630	M
	KULA	690	A
Hood River, Oreg.	KIHR	1340	
Hope, Ark.	KXAR	1490	
Hopewell, Va.	WHAP	1340	
Hopkinsville, Ky.	WHOP	1230	C
	WKOA	1480	
Hornell, N.Y.	WWHG	1320	
	WLEA	1480	M
Hot Springs, Ark.	KAAB	1350	A
	KBHS	590	
	KBLO	1470	M
Houghton, Mich.	WHDF	1400	
Houghton Lake, Mich.	WHGR	1290	
Houlton, Maine	WHOU	1340	
Houma, La.	KCIL	1490	N
Houston, Miss.	WCPC	1320	
Houston, Tex.	KCOH	1430	
	KILT	610	
	KNUZ	1230	
	KPRC	950	N
	KTHT	790	
	KTRH	740	C
	KXYZ	1320	A
	KYOK	1590	
Howell, Mich.	WHMI	1350	
Hudson, N.Y.	WHUC	1230	
Hugo, Okla.	KIHN	1340	
Hull, Que.	CKCH	970	
Humacao, P.R.	WALO	1240	
Humboldt, Tenn.	WIRJ	740	
Huntingdon, Pa.	WHUN	1150	
Huntington, Ind.	WHLT	1300	
Huntington, N.Y.	WGSM	740	
Huntington, W.Va.	WPLH	1470	M
	WKEE	800	M-A
	WSAZ	930	N
Huntsville, Ala.	WBHP	1230	M
	WEUP	1600	
	WFUN	1450	
	WAAY	1550	A
Huntsville, Ont.	CKAR	590	
Huntsville, Tex.	KSAM	1490	
Huron, S.Dak.	KIJV	1340	
Hutchinson, Kan.	KWBW	1450	N
	KWHK	1260	
Hutchinson, Minn.	KOUZ	1260	
Idabel, Okla.	KBEL	1240	
Idaho Falls, Idaho	KID	590	C
	KIFI	1260	A-M
	KUPI	980	
Independence, Kans.	KIND	1010	M
Independence, Mo.	KANS	1510	
Indiana, Pa.	WDAD	1450	C
Indianapolis, Ind.	WFBM	1260	A-M
	WGEE	1590	
	WIBC	1070	
	WIRE	1430	N
	WISH	1310	C
	WXLW	950	
Indianola, Miss.	WDLT	1380	
Indio, Calif.	KREO	1400	A
Inglewood, Calif.	KTYM	1460	
Inkster, Mich.	WCHB	1440	
International Falls, Minn.	KGHS	1230	
Ionia, Mich.	WION	1430	
Iowa City, Iowa	KXIC	800	
	WSUI	910	
Iron Mtn., Mich.	WMIQ	1450	A
Iron River, Mich.	WIKB	1230	M
Ironton, Ohio	WIRO	1230	M
Ironwood, Mich.	WJMS	630	M
Ishpeming, Mich.	WJPD	1240	
	WJAN	970	
Ithaca, N.Y.	WHCU	870	C
	WTKO	1470	A
Jackson, Ala.	WTHG	1290	M
Jackson, Mich.	WIBM	1450	A
	WKHM	970	M
Jackson, Miss.	WJDX	620	N
	WJQS	1400	C
	WJXN	1450	
	WOKJ	1590	
	WRBC	1300	M
	WSLI	930	
Jackson, Ohio	WLMJ	1280	
Jackson, Tenn.	WDXI	1310	
	WJAK	1460	
	WTJS	1390	A
Jacksonville, Fla.	WJAX	930	
	WAPE	690	
	WZOK	1320	A
	WIVY	1050	
	WMBR	1460	C
	WOBS	1360	
	WPDQ	600	
	WQIK	1280	
	WRHC	1400	
Jacksonville, Ill.	WLDS	1180	
Jacksonville, N.C.	WJNC	1240	M
	WLAS	910	
Jacksonville, Tex.	KEBE	1400	
Jacksonville Bch., Fla.	WZRO	1010	
Jamestown, N.Dak.	KEYJ	1400	M
	KSJB	600	C
Jamestown, N.Y.	WJTN	1240	A
	WJOC	1340	M
Jamestown, Tenn.	WCLC	1260	
Janesville, Wis.	WCLO	1230	M
Jasper, Ala.	WWWB	1360	
	WARF	1240	
Jasper, Ind.	WITZ	990	
Jasper, Tex.	KTXJ	1350	
Jefferson City, Mo.	KLIK	950	
	KWOS	1240	M
Jennings, La.	KJEF	1290	
Jerome, Idaho	KART	1400	
Jesup, Ga.	WBGR	1370	
Johnson City, Tenn.	WIHL	910	C
	WETB	790	M
Johnstown, Pa.	WJAC	1400	N
	WARD	1490	C
	WCRO	1230	M
Joliet, Ill.	WJOL	1340	
Jonesboro, Ark.	KBTM	1230	M
	KNEA	970	
Jonesboro, La.	KTOC	920	
Jonesboro, Tenn.	WJSO	1590	
Jonquiere, Que.	CKRS	590	
Joplin, Mo.	WMBH	1450	M
	KFSB	1310	
	KODE	1230	C
Junction, Tex.	KMBL	1450	
Junc. City, Kans.	KJCK	1420	
Juneau, Alaska	KINY	800	C-A
	KJNO	630	A-M-N
Kailua, Hawaii	KANI	1240	
Kaimuki, Hawaii	KAIM	870	
Kalamazoo, Mich.	WKZO	590	C
	WKLZ	1470	M
	WKMI	1360	
Kalispell, Mont.	KGEZ	600	M
	KOFI	930	
Kamloops, B.C.	CFJC	910	
Kane, Pa.	WADP	960	
Kankakee, Ill.	WKAN	1320	
Kannapolis, N.C.	WGTL	870	
Kans. City, Kans.	KCKN	1340	
Kansas City, Mo.	KCMD	810	C
	KMBC	980	A
	KPRS	1590	
	KUDL	1380	
	WDAF	610	N
	WHB	710	
Kearney, Nebr.	KGFW	1340	M
	KRNY	1460	
Keene, N.H.	WKNE	1290	N
	WKBK	1220	
Kelowna, B.C.	CKOV	630	
Kelso, Wash.	KLOG	1490	
Kendallville, Ind.	WAWK	1570	
Kenedy, Tex.	KAML	990	
Kenmore, N.Y.	WINE	1080	
Kennett, Mo.	KBOA	830	
Kennewick-Pasco-Richland, Wash.	KEPR	610	C
Kenora, Ont.	CJRL	1220	
Kenosha, Wis.	WLIP	1050	
Kentville, N.S.	CKEN	1350	
Keokuk, Iowa	KOKX	1310	
Kermit, Tex.	KERB	600	
Kerrville, Tex.	KERV	1230	
Ketchikan, Alaska	KTKN	930	C-A
Kewanee, Ill.	WKEI	1450	
Keyser, W.Va.	WKYR	1270	
Key West, Fla.	WKWF	1600	M
	WKIZ	1500	
Kilgore, Tex.	KOCA	1240	
Killeen, Tex.	KLEN	1050	M
Kimball, Nebr.	KIMB	1260	
King City, Calif.	KRKC	1570	
Kingman, Ariz.	KAAA	1230	A
Kings Mountain, N.C.	WKMT	1220	
Kingsport, Tenn.	WKIN	1320	
	WKPT	1400	N
Kingston, N.Y.	WKNY	1490	M
Kingston, Ont.	CFRC	1490	
	CKLC	1380	
	CKWS	960	
Kingstree, S.C.	WDKD	1310	
Kingsville, Tex.	KINE	1330	
Kinston, N.C.	WELS	1010	
	WFTC	960	A
	WISP	1230	M
Kirkland, Wash.	KNBX	1050	
Kirkland Lake, Ont.	CJKL	560	
Kirksville, Mo.	KIRX	1450	A
Kissimmee, Fla.	WKBX	1220	
Kitchener, Ont.	CKCR	1490	
	CKKW	1320	
Kittanning, Pa.	WACB	1380	
Klamath Falls, Oreg.	KAGO	1150	M
	KFLW	1450	A-C
	KLAD	960	
Knoxville, Tenn.	WBIR	1240	A
	WIVK	860	
	WATE	620	N
	WKGN	1340	M
	WKXV	900	
	WNOX	990	C
Kokomo, Ind.	WIOU	1350	C
Kosciusko, Miss.	WKOZ	1350	A
Laconia, N.H.	WLNH	1350	
LaCrosse, Wis.	WKBH	1410	N
	WLCX	1490	
	WKTY	580	A
Ladysmith, Wis.	WLDY	1340	
Lafayette, Ga.	WLFA	1590	
Lafayette, Ind.	WASK	1450	M
	WBAA	920	
Lafayette, La.	KPEL	1420	A
	KVOL	1330	N
Lafayette, Tenn.	WEEN	1460	
LaFollette, Tenn.	WLAF	1450	
LaGrande, Oreg.	KLBM	1450	
LaGrange, Ga.	WLAG	1240	M
	WTRP	620	
LaGrange, Ill.	WTAQ	1300	
LaGrange, Tex.	KVLG	1570	
LaJunta, Colo.	KBZZ	1400	M
Lake Charles, La.	KLOU	1580	
	KPLC	1470	N
	KAOK	1400	M
Lake City, Fla.	WDSR	1340	
	WGRO	960	
Lake City, S.C.	WJOT	1260	
Lakeland, Fla.	WLAK	1430	N
	WONN	1230	M
	WYSE	1330	
Lake Providence, La.	KLPL	1050	
Lake Tahoe, Calif.	KOWL	1490	
Lakeview, Oreg.	KQIK	1230	
Lake Wales, Fla.	WIPC	1280	
Lakewood, Colo.	KLAK	1600	
Lakewood, Wash.	KFHA	1480	
Lake Worth, Fla.	WLIZ	1380	
Lamar, Colo.	KLMR	920	M
Lamesa, Tex.	KPET	690	
Lampasas, Tex.	KCYL	1450	
Lancaster, Calif.	KAVL	610	
	KBVM	1380	
Lancaster, Ohio	WHOK	1320	
Lancaster, Pa.	WGAL	1490	N
	WLAN	1390	A-M
Lancaster, S.C.	WLCM	1360	
Lander, Wyo.	KOVE	1330	M
Lanett, Ala.	WRLD	1490	A
Lansford, Pa.	WLSH	1410	
Lansing, Mich.	WILS	1320	
	WJIM	1240	A-N
Lapeer, Mich.	WMPC	1230	
LaPorte, Ind.	WLOI	1540	
Laramie, Wyo.	KOWB	1340	M
Laredo, Tex.	KVOZ	1490	M
LaSalle, Ill.	WLPO	1220	
LaSarre, Que.	CKLS	1240	
LasCruces, N.Mex.	KOBE	1450	
	KGRT	570	
Las Vegas, Nev.	KENO	1460	A
	KLAS	1230	C
	KORK	1340	M
	KRAM	920	
	KRBO	1050	
Las Vegas, N.Mex.	KFUN	1230	A
Latrobe, Pa.	WAKU	1570	M
	WTRA	1480	
LaTuque, Que.	CFLM	1240	
Laurel, Miss.	WAML	1340	N
	WLAU	1600	A
	WNSL	1260	
Laurens, S.C.	WLBG	860	
Laurinburg, N.C.	WEWO	1080	
Lawrence, Kans.	KFKU	1250	
	KLWN	1320	
Lawrence, Mass.	WCCM	800	
Lawrenceburg, Tenn.	WDXE	1370	
Lawrenceville, Ga.	WLAW	1360	
Lawrenceville, Ill.	WAKO	910	
Lawton, Okla.	KSWO	1380	A
	KCCO	1050	
Leadville, Colo.	KLVC	1230	
Leaksville, N.C.	WLDE	1490	M
Leamington, Ont.	CJSP	710	
Leavenworth, Kans.	KCLO	1410	
Lebanon, Ky.	WLBN	1590	
Lebanon, Mo.	KLWT	1230	
Lebanon, Oreg.	KGAL	920	
Lebanon, Pa.	WLBR	1270	
Lebanon, Tenn.	WCOR	900	
Leesburg, Fla.	WLBE	790	M
	WBIL	1410	
Leesburg, Va.	WAGE	1290	
Leesville, La.	KLLA	1570	
Leitchfield, Ky.	WMTL	1580	
Leland, Miss.	WESY	1580	
LeMars, Iowa	KLEM	1410	
Lenoir, N.C.	WJRI	1340	M
Lenoir, Tenn.	WLIL	730	
Leonardtown, Md.	WKIK	1370	
Lethbridge, Alta.	CJOC	1220	
	CHEC	1090	
Levelland, Tex.	KLVT	1230	
Levittown, Pa.	WBCB	1490	
Lewisburg, Pa.	WITT	1010	
Lewisburg, Tenn.	WJJM	1490	M
Lewiston, Idaho	KRLC	1350	M
	KOZE	1300	
Lewiston, Maine	WCOU	1240	M

Location	C.L.	Kc.	N.A.
	WLAM	1470	A
Lewistown, Mont.	KXLO	1230	M
Lewistown, Pa.	WKVA	920	
	WMRF	1490	N
Lexington, Ky.	WLAP	630	
	WBLG	1300	A
	WVLK	590	M
Lexington, Mo.	KLEX	1570	
Lexington, Nebr.	KRVN	1010	
Lexington, N.C.	WBUY	1440	
Lexington, Tenn.	WDXL	1490	
Lexington, Va.	WREL	1450	N
Lexington Pk., Md.	WPTX	920	
Libby, Mont.	KOLL	1230	M
Liberal, Kans.	KSCB	1270	
Liberty, N.Y.	WVOS	1240	
Lihue, Hawaii	KTOH	1490	
Lima, Ohio	WIMA	1150	A
Lincoln, Ill.	WPRC	1370	
Lincoln, Nebr.	KFOR	1240	A
	KLIN	1400	
	KLMS	1480	
Lincolnton, N.C.	WLON	1050	
Lindsay, Ont.	CKLY	910	
Linton, Ind.	WBTO	1600	
Litchfield, Ill.	WSMI	1540	
Litchfield, Minn.	KLFD	1410	
Little Falls, Minn.	KLTF	960	
Little Falls, N.Y.	WLFH	1230	
Littlefield, Tex.	KUCO	1490	
Little Rock, Ark.	KARK	920	N
	KAJI	1250	M
	KLRA	1010	A
	KOKY	1440	
	KTHS	1090	C
	KVLC	1050	
Littleton, Colo.	KUDY	1510	
Live Oak, Fla.	WNER	1250	
Livingston, Mont.	KPRK	1340	M
Livingston, Tenn.	WLIV	920	
Livingston, Tex.	KETX	1440	
	KLBS	1220	
Lloydminster, Alta.	CKSA	1150	
Lock Haven, Pa.	WBPZ	1230	M
Lockport, N.Y.	WUSJ	1340	
Lodi, Calif.	KCVR	1570	
Logan, Utah	KVNU	610	M
	KLGN	1390	
Logan, W.Va.	WLOG	1230	M
	WVOW	1290	
Logansport, Ind.	WSAL	1230	M
Lompoc, Calif.	KNEZ	960	
London, Ky.	WFTG	1400	
London, Ont.	CFPL	980	
	CKSL	1290	
Long Beach, Calif.	KFOX	1280	
	KGER	1390	
Longmont, Colo.	KLMO	1050	
Longview, Tex.	KFRO	1370	A
	KLUE	1280	
Longview, Wash.	KEDO	1400	A
	KBAM	1270	
Lorain, Ohio	WWIZ	1380	
Loris, S.C.	WLSC	1570	
Los Alamos, N.Mex.	KRSN	1490	A
Los Angeles, Calif.	KABC	790	A
	KFI	640	N
	KHJ	930	M
	KFSG	1150	
	KFWB	980	
	KGFJ	1230	
	KFAC	1330	
	KLAC	570	
	KMPC	710	
	KNX	1070	C
	KPOL	1540	
	KPOP	1020	
	KRKD	1150	
Louisburg, N.C.	WYRN	1480	
Louisville, Ky.	WAVE	970	N
	WAKY	790	M
	WHAS	840	C
	WKLO	1080	A
	WINN	1240	
	WKYW	900	
	WLOU	1350	
	WTMT	620	
Louisville, Miss.	WLSM	1270	
Loveland, Colo.	KLOV	1570	
Lovington, N.Mex.	KLEA	630	
Lowell, Mass.	WCAP	980	
	WLLH	1400	M
Lubbock, Tex.	KCBD	1590	M-N
	KDAV	580	
	KDUB	1340	
	KFYO	790	C
	KLLL	1460	M
	KSEL	950	A
Ludington, Mich.	WKLA	1450	A
Lufkin, Tex.	KRBA	1340	A
	KTRE	1420	M
Lumberton, N.C.	WAGR	580	
	WTSB	1340	M
Lynchburg, Va.	WLVA	590	A
	WWOD	1390	M-N
	WBRG	1050	
Lynn, Mass.	WLYN	1360	
Lyons, Ga.	WBBT	1340	
Macomb, Ill.	WKAI	1510	
Macon, Ga.	WBML	1240	
	WCRY	900	
	WIBB	1280	
	WMAZ	940	C
	WNEX	1400	A-M
Macon, Miss.	WMBC	1400	
Madera, Calif.	KHOT	1250	
Madison, Fla.	WMAF	1230	
Madison, Ga.	WYTH	1250	
Madison, Ind.	WORX	1270	
Madison, Wis.	WHA	970	
	WIBA	1310	N
	WISM	1480	A-M
	WKOW	1070	C
Madison, Tenn.	WENO	1430	
Madisonville, Ky.	WFMW	730	
	WTTL	1310	
Magee, Miss.	WSJC	1280	
Magnolia, Ark.	KVMA	630	M
Malden, Mo.	KTCB	1470	
Malone, N.Y.	WICY	1490	M
Malvern, Ark.	KBOK	1310	
Manassas, Va.	WPRW	1460	
Manchester, Conn.	WINF	1230	
Manchester, Ga.	WFDR	1370	
Manchester, Ky.	WWXL	1450	
Manchester, N.H.	WFEA	1370	
	WGIR	610	C
	WKBR	1240	
Manchester, Tenn.	WMSR	1320	
Manhattan, Kans.	KSAC	580	
	KMAN	1350	
Manila, P.I.	DZPI	1800	M-C
	DZRH	710	N
Manistee, Mich.	WMTE	1340	
Manitou Springs, Colo.	KCMS	1490	
Manitowoc, Wis.	WCUB	980	
	WOMT	1240	M
Mankato, Minn.	KYSM	1230	N
	KTOE	1420	A
Manning, S.C.	WYMB	1410	
Mansfield, La.	KDBC	1360	
Mansfield, Ohio	WMAN	1400	A
	WCLW	1570	
Maquoketa, Iowa	KMAQ	1320	
Marianna, Fla.	WTYS	1340	M
	WTOT	980	
Marietta, Ga.	WFOM	1230	
	WBIE	1050	
Marietta, Ohio	WMOA	1490	M
Marine City, Mich.	WDOG	1590	
Marinette, Wis.	WMAM	570	N
Marion, Ala.	WJAM	1310	
Marion, Ill.	WGGH	1150	
Marion, Ind.	WBAT	1400	C
	WMRI	860	
Marion, N.C.	WBRM	1250	
Marion, Ohio	WMRN	1490	A
Marion, S.C.	WATP	1430	
Marion, Va.	WMEV	1010	A
Marked Tree, Ark.	KPCA	1580	
Marksville, La.	KAPB	1370	
Marlborough, Mass.	WSRO	1470	
Marlin, Tex.	KMLW	1010	
Marquette, Mich.	WDMJ	1320	M
Marshall, Minn.	KMHL	1400	A
Marshall, Mo.	KMMO	1300	
Marshall, N.C.	WMMH	1460	
Marshall, Tex.	KMHT	1450	
	KADO	1410	
Marshalltown, Iowa	KFJB	1230	
Marshfield, Wis.	WDLB	1450	
Martin, Tenn.	WCMT	1410	
Martinsburg, W.Va.	WEPM	1340	
Martinsville, Va.	WHEE	1370	
	WMVA	1450	N
Marysville, Calif.	KMYC	1410	M
Marysville, Kans.	KNDY	1570	
Maryville, Mo.	KNIM	1580	
Maryville, Tenn.	WGAP	1400	
Mason City, Iowa	KGLO	1300	C
	KRIB	1490	
	KSMN	1010	
Massena, N.Y.	WMSA	1340	A
	WSTS	1050	
Massillon, Ohio	WTIG	990	
Matane, Que.	CKBL	1250	
Matawan, W.Va.	WHJC	1360	
Mattoon, Ill.	WLBH	1170	
Mayaguez, P.R.	WAEL	600	
	WKJB	710	
	WORA	1150	
	WPRA	990	
	WTIL	1300	
Mayfield, Ky.	WKTM	1050	
	WNGO	1320	
Mayodan, N.C.	WMYN	1420	
Maysville, Ky.	WFTM	1240	M
McAlester, Okla.	KTMC	1400	
	KNED	1150	
McAllen, Tex.	KRIO	910	M
McCamey, Tex.	KCMR	1450	
McComb, Miss.	WHNY	1250	A
	WAPF	980	
McCook, Nebr.	KBRL	1300	M
McGehee, Ark.	KVSA	1220	
McKeesport, Pa.	WEDO	810	C
	WMCK	1360	
McKenzie, Tenn.	WHDM	1440	
McKinney, Tex.	KMAE	1600	
McMinnville, Oreg.	KMCM	1260	
McMinnville, Tenn.	WBMC	960	
	WMMT	1230	M
McPherson, Kans.	KNEX	1540	
McRae, Ga.	WDAX	1410	
Meadville, Pa.	WMGW	1490	
Medford, Mass.	WHIL	1430	
Medford, Oreg.	KMED	1440	N
	KDOV	1300	
	KBOY	730	
	KYJC	1230	A-C
Medford, Wis.	WIGM	1490	M
Medicine Hat, Alta.	CHAT	1270	
Melbourne, Fla.	WMMB	1240	M
Memphis, Tenn.	WHBQ	560	M
	WHER	1430	
	WMC	790	N
	WDIA	1070	
	WMPS	680	
	WHHM	1340	A
	WLOK	1480	
	WREC	600	C
	KWAM	990	
Mena, Ark.	KENA	1450	
Menominee, Mich.	WAGN	1340	A
Menomonie, Wis.	WMNE	1360	
Merced, Calif.	KYOS	1480	M
	KWIP	1580	
Meriden, Conn.	WMMW	1470	
Meridian, Miss.	WCOC	910	C
	WDAL	1330	
	WMOX	1240	
	WOKK	1450	A
	WQIC	1390	
Mesa, Ariz.	KBUZ	1310	
Metropolis, Ill.	WMOK	920	
Mexia, Tex.	KBUS	1590	
Mexico, Mo.	KXEO	1340	M
Mexico, Pa.	WJUN	1220	
Miami, Ariz.	KIKO	1340	
Miami, Fla.	WGBS	710	C
	WCKR	610	N
	WFFC	1220	
	WAME	1260	
	WMIE	1140	
	WQAM	560	
	WSKP	1450	
	WINZ	940	
Miami, Okla.	KGLC	910	
Miami Beach, Fla.	WMET	1490	
	WKAT	1360	M-A
	WMBM	800	
Michigan City, Ind.	WIMS	1420	
Middlesboro, Ky.	WMIK	560	
Middletown, Conn.	WCNX	1150	
Middletown, N.Y.	WALL	1340	
Middletown, Ohio	WPFB	910	
Midland, Mich.	WMDN	1490	
Midland, Ont.	CKMP	1230	
Midland, Tex.	KCRS	550	A
	KJBC	1150	
	KWEL	1600	
Milan, Tenn.	WKBJ	1600	
Miles City, Mont.	KATL	1340	M
Milford, Del.	WKSB	930	
Milford, Mass.	WMRC	1490	
Milledgeville, Ga.	WMVG	1450	M
Millen, Ga.	WGSR	1570	
Millington, Tenn.	WHEY	1220	
Millville, N.J.	WMVB	1440	
Milton, Fla.	WEBY	1330	M
	WSRA	1490	
Milton, Pa.	WMLP	1570	
Milwaukee, Wis.	WEMP	1250	
	WFOX	860	M
	WRIT	1340	
	WISN	1150	A
	WMIL	1290	
	WOKY	920	
	WTMJ	620	N
Minden, La.	KASO	1240	
Mineral Wells, Tex.	KORC	1140	
Mineola, N.Y.	WFYI	1520	
Minneapolis, Minn.	WCCO	830	C
	WLOL	1330	
	WMIN	1400	
	WDGY	1130	
	WPBC	980	
	WTCN	1280	A
	KTIS	900	
	KUOM	770	
Minot, N.Dak.	KLPM	1390	M
	KQDY	1320	
	KCJB	910	C
Mission, Kans.	KBKC	1480	
Mission, Tex.	KIRT	1580	
Missoula, Mont.	KGVO	1290	C
	KXLL	1450	N
	KQTE	1340	M
	KYSS	910	
Mitchell, S.Dak.	KORN	1490	M
Moab, Utah	KURA	1450	
Moberly, Mo.	KNCM	1230	
Mobile, Ala.	WALA	1410	N
	WABB	1480	A
	WGOK	900	
	WKAB	840	
	WKRG	710	C
	WMOZ	960	
Mobridge, S.Dak.	KOLY	1300	
Modesto, Calif.	KTRB	860	
	KBEE	970	
	KFIV	1360	A
Moline, Ill.	WQUA	1230	A
Monahans, Tex.	KVKM	1340	M
Moncton, N.B.	CBAF	1300	
	CKCW	1220	
Monett, Mo.	KRMO	990	
Monmouth, Ill.	WRAM	1330	
Monroe, Ga.	WMRE	1490	
Monroe, La.	KMLB	1440	A-N
	KLIC	1230	M
	KNOE	1390	
Monroe, Mich.	WQTE	560	
Monroe, N.C.	WMAP	1060	
Monroe, Wis.	WEKZ	1260	
Monroeville, Ala.	WMFC	1360	
Monterey, Calif.	KIDD	630	
	KMBY	1240	C
Montevideo, Minn.	KDMA	1450	A
Monte Vista, Colo.	KSLV	1240	
Montgomery, Ala.	WBAM	740	
	WCOV	1170	C
	WAPX	1600	A
	WHHY	1440	N
	WMGY	800	
	WRMA	950	
Montgomery, W.Va.	WMON	1340	M
Monticello, Ark.	KHBM	1430	
Monticello, Ky.	WFLW	1360	
Montmagny, Que.	CKBM	1490	
Montpelier-Barre, Vt.	WSKI	1240	A
Montreal, Que.	CBF	690	
	CBM	940	N
	CFCF	600	A
	CJAD	800	
	CJMS	1280	
	CKAC	730	C
Montrose, Colo.	KUBC	580	
Montrose, Pa.	WPEL	1250	
Mooresville, N.C.	WHIP	1350	
Moorhead, Minn.	KVOX	1280	M
Moosejaw, Sask.	CHAB	800	
Morehead, Ky.	WMOR	1330	
Morehead City, N.C.	WMBL	740	
Morgan City, La.	KMRC	1430	M
Morganton, N.C.	WMNC	1430	
Morgantown, W.Va.	WAJR	1440	N
	WCLG	1300	
Morrilton, Ark.	KVOM	800	
Morris, Minn.	KMRS	1570	
Morristown, N.J.	WMTR	1250	
Morristown, Tenn.	WCRK	1150	M
	WMTN	1300	
Moscow, Idaho	KRPL	1400	
Moses Lake, Wash.	KSEM	1470	
	KWIQ	1260	
Moultrie, Ga.	WMGA	1400	A
	WMTM	1300	
Moundsville, W.Va.	WMOD	1370	
Mountain Grove, Mo.	KLRS	1360	
Mountain Home, Ark.	KTLO	1490	
Mt. Airy, N.C.	WPAQ	740	
	WSYD	1300	M
Mt. Carmel, Ill.	WVMC	1360	
Mt. Clemens, Mich.	WBRB	1430	
Mt. Dora, Fla.	WMDF	1580	
Mt. Jackson, Va.	WSIG	790	
Mt. Kisco, N.Y.	WVIP	1310	
Mt. Pleasant, Mich.	WCEN	1150	
Mt. Pleasant, Tex.	KIMP	960	
Mt. Shasta, Calif.	KWSD	620	
Mt. Sterling, Ky.	WMST	1150	
Mt. Vernon, Ill.	WMIX	940	
Mt. Vernon, Ind.	WPCO	1590	
Mt. Vernon, Ky.	WRVK	1460	
Mt. Vernon, Ohio	WMVO	1300	
Mt. Vernon, Wash.	KBRC	1430	
Muleshoe, Tex.	KMUL	1380	
	KZOL	1570	
Mullins, S.C.	WJAY	1280	
Muncie, Ind.	WLBC	1340	C
Munfordville, Ky.	WLOC	1150	
Munising, Mich.	WMAB	1400	
Murfreesboro, Tenn.	WGNS	1450	
	WMTS	860	
Murphy, N.C.	WCVP	600	
	WKRK	1390	
Murphysboro, Ill.	WINI	1420	
Murray, Ky.	WNBS	1340	
Murray, Utah	KMUR	1230	
Muscatine, Iowa	KWPC	860	
Muscle Shoals City, Alabama	WLAY	1450	
Muskegon, Mich.	WKBZ	850	A
	WTRU	1600	
	WMUS	1090	
Muskogee, Okla.	KBIX	1490	A
	KMUS	1380	
Myrtle Beach, S.C.	WMYB	1450	
Nacogdoches, Tex.	KEEE	1230	A
	KSFA	860	
Nampa, Idaho	KFXD	580	
Nanaimo, B.C.	CHUB	1570	
Nanticoke, Pa.	WNAK	730	
Napa, Calif.	KVON	1440	
Naples, Fla.	WNOG	1270	
Narrows, Va.	WNRV	990	
Nashua, N.H.	WOTW	900	
	WSMN	1590	
Nashville, Ark.	KBHC	1260	
Nashville, Tenn.	WKDA	1240	
	WLAC	1510	C
	WMAK	1300	
	WNAH	1360	M
	WSIX	980	A
	WSM	650	N
	WVOL	1470	
Natchez, Miss.	WMIS	1240	N
	WNAT	1450	M
Natchitoches, La.	KNOC	1450	M
Needles, Calif.	KSFE	1340	
Neenah, Wis.	WNAM	1280	
Neillsville, Wis.	WCCN	1370	
Nelson, B.C.	CKLN	1390	
Neon, Ky.	WNKY	1480	
Neosho, Mo.	KBTN	1420	
Nevada, Mo.	KNEM	1240	
New Albany, Ind.	WOWI	1570	
New Albany, Miss.	WNAU	1470	
Newark, N.J.	WNTA	970	
	WHBI	1280	
	WNJR	1430	
	WVNJ	620	
Newark, N.Y.	WACK	1420	
Newark, Ohio	WCLT	1430	
New Bedford, Mass.	WBSM	1420	

Location	C.L.	Kc.	N.A.
	WNBH	1340	M
New Bern, N.C.	WHIT	1450	M
	WRNB	1490	
Newberry, S.C.	WKDK	1240	
New Braunfels, Tex.	KGNB	1420	
New Britain, Conn.	WHAY	910	A
	WKNB	840	
New Brunswick, N.J.	WCTC	1450	
Newburgh, N.Y.	WGNY	1220	
Newburyport, Mass.	WNBP	1470	
New Carlisle, Que.	CHNC	610	
Newcastle, N.B.	CKMR	790	
New Castle, Pa.	WKST	1280	M
Newcastle, Wyo.	KASL	1240	
New Glasgow, N.S.	CKEC	1230	
New Haven, Conn.	WAVZ	1300	
	WELI	960	
	WNHC	1340	A
New Iberia, La.	KANE	1240	
	KVIM	1360	
New Kensington, Pa.	WKPA	1150	
New London, Conn.	WNLC	1490	M
New Martinsville, W.Va.	WETZ	1330	M
Newnan, Ga.	WCOH	1400	M
New Orleans, La.	WDSU	1280	N
	WJBW	1230	
	WJMR	990	
	WBOK	800	
	WNOE	1060	
	WSMB	1350	A
	WNPS	1450	
	WTIX	690	
	WWL	870	C
	WYFE	600	
	WYLD	940	M
Newport, Ark.	KNBY	1280	
Newport, Ky.	WNOP	740	
Newport, Oreg.	KNPT	1310	
Newport, R.I.	WADK	1540	
Newport, Tenn.	WLIK	1270	
Newport, Vt.	WIKE	1490	
Newport News, Va.	WGH	1310	A
	WYUO	1270	
New Rochelle, N.Y.	WVOX	1460	
New Smyrna Beach, Fla.	WSBB	1230	M
Newton, Iowa	KCOB	1280	
Newton, Kans.	KJRG	950	
Newton, Miss.	WBKN	1410	
Newton, N.J.	WNNJ	1360	
Newton, N.C.	WNNC	1230	
New Ulm, Minn.	KNUJ	860	
New Westminster, B.C.	CKNW	980	
New York, N.Y.	WABC	770	A
	WBNX	1380	
	WCBS	880	C
	WEVD	1330	
	WHOM	1480	
	WINS	1010	
	WLIB	1190	
	WMCA	570	
	WMGM	1050	
	WNEW	1130	
	WNYC	830	
	WOR	710	M
	WADO	1280	
	WPOW	1330	
	WQXR	1560	
	WRCA	660	N
Niagara Falls, N.Y.	WHLD	1270	
	WJJL	1440	
Niagara Falls, Ont.	CHVC	1600	
Niles, Mich.	WNIL	1290	
Nogales, Ariz.	KNOG	1340	A
Norfolk, Nebr.	WJAG	780	
Norfolk, Va.	WTAR	790	C
	WCMS	1050	
	WNOR	1230	
	WRAP	850	
Norman, Okla.	WNAD	640	
	KNOR	1400	
Norristown, Pa.	WNAR	1110	
N. Adams, Mass.	WMNB	1230	
N. Augusta, S.C.	WGUS	1600	
N. Battleford, Sask.	CJNB	1460	
North Bay, Ont.	CFCH	600	
North Bend, Oreg.	KFIR	1340	C
Northfield, Minn.	WCAL	770	
Northampton, Mass.	WHMP	1400	M
N. Little Rock, Ark.	KDXE	1380	
	KXLR	1150	
	KVLC	1050	
North Platte, Nebr.	KJLT	970	
	KDDY	1240	N
No. Syracuse, N.Y.	WJMK	1220	
No. Vancouver, B.C.	CKLG	730	
N. Vernon, Ind.	WDCH	1460	
No. Wilkesboro, N.C.	WKBC	810	
Norton, Va.	WNVA	1350	M
Norwalk, Conn.	WNLK	1350	
Norwich, Conn.	WICH	1310	
Norwich, N.Y.	WCHN	970	
Oakdale, La.	KREH	900	
Oakes, N.Dak.	KEYD	1220	
Oak Grove, La.	KWCL	1280	
Oak Hill, W.Va.	WDAY	860	
Oakland, Calif.	KEWB	910	
	KABL	960	
	KDIA	1310	
Oak Park, Ill.	WDPA	1490	
Oak Ridge, Tenn.	WATO	1290	
Oakville, Ont.	CHWO	1250	
Ocala, Fla.	WMOP	900	
	WTMC	1290	N
	WHYS	1370	
Oceanlake, Oreg.	KBCH	1380	
Oceanside, Calif.	KUDE	1320	
Odessa, Tex.	KECK	920	
	KOSA	1230	C
	KOYL	1310	
	KRIG	1410	M
Oelwein, Iowa	KOEL	950	
Ogallala, Nebr.	KOGA	930	
Ogden, Utah	KLO	1430	M
	KSVN	730	
	KVOG	1490	
Ogdensburg, N.Y.	WSLB	1400	M
Oil City, Pa.	WKRZ	1340	
Okla. City, Okla.	KBYE	890	A
	KLPR	1140	
	KOCY	1340	
	KOMA	1520	N
	KTOK	1000	C
	KTOW	800	
	WKY	930	
Okmulgee, Okla.	KOKL	1240	
Old Saybrook, Conn.	WLIS	1420	
Olean, N.Y.	WMNS	1360	
	WHDL	1450	A
Olney, Ill.	WVLN	740	
Olympia, Wash.	KGY	1240	M
	KITN	920	
Omaha, Nebr.	KBON	1490	
	KFAB	1110	N
	KOIL	1290	
	KOOO	1420	
	KOWH	660	
	KSWI	1560	M-A
	WOW	590	C
Omak, Wash.	KOMW	680	
Oneida, N.Y.	WONG	1600	
Oneida, Tenn.	WBNT	1310	
O'Neill, Nebr.	KBRX	1350	
Oneonta, Ala.	WCRL	1570	
Oneonta, N.Y.	WDOS	730	
Ontario, Calif.	KASK	1510	
Ontario, Oreg.	KSRV	1380	
Opelika, Ala.	WPHO	1400	M
Opelousas, La.	KSLO	1230	A
Opp, Ala.	WAMI	860	
Opportunity, Wash.	KZUN	630	
Orange, Mass.	WCAT	1390	
Orange, Tex.	KOGT	1600	
Orange, Va.	WJMA	1340	
Orangeburg, S.C.	WDIX	1150	A
	WBPD	1580	
	WTND	920	
Oregon City, Oreg.	KGON	1520	N
Orillia, Ont.	CFOR	1570	
Orlando, Fla.	WDBO	580	C
	WHOO	990	M
	WHIY	1270	
	WLOF	950	
	WKIS	740	N
Ormond Bch., Fla.	WQXQ	1380	
Orofino, Idaho	KLER	950	
Ortonville, Minn.	KDIO	1350	
Osage Bch., Mo.	KRMS	1150	
Osceola, Ark.	KOSE	860	
Oshawa, Ont.	CKLB	1350	
Oshkosh, Wis.	WOSH	1490	A
Oskaloosa, Iowa	KBOE	740	
Othello, Wash.	KRSC	1400	
Ottawa, Ill.	WCMY	1430	
Ottawa, Kans.	KOFO	1220	
Ottawa, Ont.	CBO	910	
	CFRA	560	
	CKOY	1310	
Ottumwa, Iowa	KBIZ	1240	A
	KLEE	1480	
Owatonna, Minn.	KRFO	1390	
Owego, N.Y.	WEBO	1330	
Owensboro, Ky.	WOMI	1490	M
	WVJS	1420	A
Owen Sound, Ont.	CFOS	560	
Owosso, Mich.	WOAP	1080	
Oxford, Miss.	WSUH	1420	
Oxford, N.C.	WOXF	1340	
Oxnard, Calif.	KOXR	910	
Ozark, Ala.	WOZK	900	
Paducah, Ky.	WKYB	570	N-M
	WDXR	1560	
	WPAD	1450	C
Pahokee, Fla.	WRIM	1250	
Painesville, Ohio	WPVL	1460	
Paintsville, Ky.	WSIP	1490	M
Palatka, Fla.	WWPF	1260	
	WSUZ	800	
Palestine, Tex.	KNET	1450	
Palm Bch., Fla.	WQXT	1340	A
Palm Sprgs., Calif.	KCMJ	1010	C
	KDES	920	
	KPAL	1450	
Palmdale, Calif.	KUTY	1470	
Palo Alto, Calif.	KIBE	1220	
Pampa, Tex.	KPDN	1340	M
	KHHH	1230	
Panama City, Fla.	WDLP	590	
	WPCF	1430	M
Panama City Beach, Fla.	WTHR	1480	
	WSCM	1290	
Paragould, Ark.	KDRS	1490	
Paris, Ark.	KCCL	1460	
Paris, Ill.	WPRS	1440	
Paris, Ky.	WKLX	1440	
Paris, Tenn.	WTPR	710	
Paris, Tex.	KPLT	1490	A
	KFTV	1250	
Parkersburg, W.Va.	WCEF	1050	
	WPAR	1450	C
	WTAP	1230	A
Park Falls, Wis.	WPFP	1450	
Parry Sound, Ont.	CKAR-1	1340	
Parsons, Kans.	KLKC	1540	
Pasadena, Calif.	KALI	1430	
	KPPC	1240	
	KRLA	1110	
	KWKW	1300	
Pasadena, Tex.	KLVL	1480	
Pascagoula, Miss.	WPMP	1580	A
Pasco, Wash.	KORD	910	
	KPKW	1340	
Paso Robles, Calif.	KPRL	1230	M
Patchogue, L.I., N.Y.	WALK	1370	
	WPAC	1580	
Paterson, N.J.	WPAT	930	
Pauls Valley, Okla.	KVLH	1470	
Pawtucket, R.I.	WPAW	550	A
Payette, Idaho	KEOK	1450	
Peace River, Alta.	CKYL	630	
Pecos, Tex.	KIUN	1400	M
Peekskill, N.Y.	WLNA	1420	
Pekin, Ill.	WSIV	1140	
Pell City, Ala.	WFHK	1430	
Pembroke, Ont.	CHOV	1350	
Pendleton, Oreg.	KKIO	1240	A
	KUBE	1050	
	KUMA	1290	A
Pennington Gap, Va.	WSWV	1570	
Pensacola, Fla.	WBOP	980	
	WBSR	1450	C
	WNVY	1230	A
	WCOA	1370	N
	WPFA	790	
Penticton, B.C.	CKOK	800	
Peoria, Ill.	WEEK	1350	N
	WMBD	1470	C
	WIRL	1290	M
	WPEO	1020	
Perry, Fla.	WPRY	1400	
Perry, Ga.	WBBN	980	
Perryton, Tex.	KEYE	1400	M
Peru, Ind.	WARU	1600	
Petaluma, Calif.	KAFP	1490	
Peterborough, Ont.	CHEX	980	
Petersburg, Va.	WSSV	1240	M
Petoskey, Mich.	WMBN	1340	
Phenix City, Ala.	WPNX	1460	A
Philadelphia, Miss.	WHOC	1490	
Philadelphia, Pa.	WCAU	1210	C
	WDAS	1480	
	WFIL	560	A
	WFLN	900	
	WHAT	1340	
	WIBG	990	
	WIP	610	M
	WJMJ	1540	
	WPEN	950	
	WRCV	1060	N
	WTEL	860	
Philipsburg, Pa.	WPHB	1260	
Phoenix, Ariz.	KIFN	860	
	KONI	1400	
	KHAT	1480	
	KHEP	1280	
	KOY	550	A
	KDOL	960	C
	KPHO	910	A
	KUEQ	740	
	KRIZ	1230	
	KTAR	620	N
Picayune, Miss.	WRJW	1320	
Piedmont, Ala.	WPID	1280	
Pierre, S.Dak.	KGFX	630	
	KCCR	1590	
Pikeville, Ky.	WLSI	900	
	WPKE	1240	M
Pine Bluff, Ark.	KCLA	1400	
	KOTN	1490	M
	KPBA	1590	
Pine City, Minn.	WCMP	1350	
Pineville, Ky.	WMLF	1230	
Pineville, W.Va.	WWYO	970	
Pipestone, Minn.	KLOH	1050	
Piqua, Ohio	WPTW	1570	
Pittsburg, Calif.	KKIS	990	
Pittsburg, Kans.	KOAM	860	N
	KSEK	1340	
Pittsburgh, Pa.	KDKA	1020	
	KQV	1410	C
	WCAE	1250	
	WEEP	1080	
	WAMP	1320	N
	WPIT	730	
	WWSW	970	
Pittsfield, Ill.	WBBA	1580	
Pittsfield, Mass.	WBEC	1420	A
	WBRK	1340	M
Pittston, Pa.	WPTS	1540	
Plainview, Tex.	KVDP	1400	M
Plant City, Fla.	WPLA	910	
Platteville, Wis.	WSWW	1590	
Plattsburg, N.Y.	WEAV	960	A
	WIRY	1340	M
Pleasanton, Tex.	KBOP	1380	
Pleasantville, N.J.	WDND	1400	
Plymouth, Mass.	WPLM	1390	
Plymouth, N.C.	WPNC	1470	
Plymouth, Wis.	WPLY	1420	
Pocahontas, Ark.	KPDC	1420	
Pocatello, Idaho	KSEI	930	N
	KWIK	1240	M
	KYTE	1290	
Pocomoke City, Md.	WDVM	540	
Pomona, Calif.	KWOW	1600	
Pompano Beach, Fla.			
	WLOD	980	
	WPOM	1470	
Ponca City, Okla.	WBBZ	1230	M
Ponce, P.R.	WPRP	910	
	WEUC	1420	
	WPAB	550	
	WLEO	1170	
	WISO	1260	
Pontiac, Mich.	WPON	1460	
Poplar Bluff, Mo.	KWOC	930	
Portage, Wis.	WPDR	1350	
Portage la Prairie, Man.	CFRY	1570	
Port Alberni, B.C.	CJAV	1240	
Portales, N.Mex.	KENM	1450	
Port Angeles, Wash.	KONP	1450	
Port Arthur, Ont.	CFPA	1230	
Port Arthur, Tex.	KOLE	1340	
	KPAC	1250	M
Porterville, Calif.	KTIP	1450	A
Port Hope, Ont.	CHUC	1500	
Port Hueneme, Calif.	KACY	1520	
Port Huron, Mich.	WHLS	1450	
	WTTH	1380	A
Port Jervis, N.Y.	WOLC	1490	
Portland, Ind.	WPGW	1440	
Portland, Maine	WCSH	970	N
	WGAN	560	C
	WLOB	1310	
	WPOR	1490	A-M
Portland, Oreg.	KBPS	1450	
	KLIQ	1290	
	KEX	1190	
	KGW	620	
	KOIN	970	C
	KPAM	1410	
	KPDQ	800	
	KPOJ	1330	M
	KWJJ	1080	A
	KXL	750	
Port Neches, Tex.	KPNG	1150	
Portsmouth, N.H.	WHEB	750	
Portsmouth, Ohio	WPAY	1400	C
	WNXT	1260	A
Portsmouth, Va.	WLOW	1400	A
	WAVY	1350	N
Post, Tex.	KUKO	1370	
Poteau, Okla.	KLCO	1280	
Potosi, Mo.	KYRO	1280	
Potsdam, N.Y.	WPDM	1470	
Pottstown, Pa.	WPAZ	1370	
Pottsville, Pa.	WPAM	1450	
	WPPA	1360	M
Poughkeepsie, N.Y.	WEOK	1390	
	WKIP	1450	A
Powell, Wyo.	KPOW	1260	M
Poynette, Wis.	WIBU	1240	
Prairie du Chien, Wis.	WPRE	980	
Pratt, Kans.	KWSK	1570	
Prescott, Ariz.	KYCA	1490	N
	KNOT	1450	A
	KZDK	1340	
Presque Isle, Me.	WAGM	1450	
Preston, Idaho	KPST	1340	
Prestonsburg, Ky.	WPRT	960	
	WDOC	1310	
Price, Utah	KOAL	1230	M
Prichard, Ala.	WAIP	1270	
Prince Albert, Sask.	CKBI	900	
Prince George, B.C.	CKPG	550	
Prince Rupert, B.C.	CFPR	1240	
Princeton, Ind.	WRAY	1250	
Princeton, Ky.	WPKY	1580	
Princeton, W.Va.	WLOH	1490	A
Prineville, Oreg.	KRCO	690	
Prosser, Wash.	KARY	1310	
Providence, R.I.	WEAN	790	M
	WHIM	1110	
	WICE	1290	
	WJAR	920	N
	WPRD	630	C
	WRIB	1220	
Provo, Utah	KIXX	1400	A
	KEYY	1450	
	KOVO	960	M
Pryor, Okla.	KOLS	1570	
Pueblo, Colo.	KDZA	1230	
	KAPI	690	
	KFEL	970	
	KGHF	1350	A-M
	KCSJ	590	
Pulaski, Tenn.	WKSR	1420	A
Pulaski, Va.	WPUV	1580	
Pullman, Wash.	KWSC	1250	
	KOFE	1150	
Punxsutawney, Pa.	WPME	1540	
Putnam, Conn.	WPCT	1350	
Puyallup, Wash.	KAYE	1450	
Quanah, Tex.	KOLJ	1150	
Quebec, Que.	CBV	980	
	CHRC	800	
	CJLR	1060	
	CJQC	1340	
	CKCV	1280	
Quesnel, B.C.	CKCQ	570	
Quincy, Fla.	WCNH	1230	M
Quincy, Ill.	WGEM	1440	A
	WTAD	930	C
Quincy, Mass.	WJDA	1300	
Quincy, Wash.	KPDR	1370	
Quitman, Ga.	WSFB	1490	
Racine, Wis.	WRAC	1460	
	WRJN	1400	A
Radford, Va.	WRAD	1460	
Raleigh, N.C.	WKIX	850	A

Location	C.L.	Kc.	N.A.
	WPTF	680	N
	WSHE	570	
	WRAL	1240	
Rapid City, S.Dak.	KOTA	1380	C
	KRSD	1340	
	KEZU	920	
Raton, N.Mex.	KRTN	1490	A
Ravenswood, W.Va.	WMOV	1360	
Rawlins, Wyo.	KRAL	1240	M
Raymond, Wash.	KAPA	1340	
Raymondville, Tex.	KSOX	1240	
Rayville, La.	KCLP	990	
Reading, Pa.	WEEU	850	A
	WHUM	1240	C
	WRAW	1340	N
Redding, Calif.	KROG	1230	M
	KPAP	1270	
	KSDA	1400	
	KVCV	600	C
	KVIP	540	
Red Bluff, Calif.	KBLF	1490	
Red Deer, Alta.	CKRD	850	
Redlands, Calif.	KCAL	1410	
Red Lion, Pa.	WGCB	1440	
Redmond, Oreg.	KPRB	1240	
Red Wing, Minn.	KCUE	1250	
Redwood Falls, Minn.	KLGR	1490	
Reedsburg, Wis.	WRDB	1400	
Regina, Sask.	CBK	540	
	CKCK	620	
	CKRM	980	
Reidsville, N.C.	WFRC	1600	A
	WREV	1220	
Remsen, N.Y.	WREM	1480	
Reno, Nev.	KOH	630	N
	KBET	1340	M
	KOLO	920	C
	KONE	1450	
	KDOT	1230	
Renton, Wash.	KQDE	910	
Rexburg, Idaho	KRXK	1230	
Rhinelander, Wis.	WOBT	1240	
Rice Lake, Wis.	WJMC	1240	
Richfield, Utah	KSVC	980	
Richland, Wash.	KALE	960	
Richland, Wis.	WRCO	1450	
Richlands, Va.	WRIC	540	
Richmond, Ind.	WKBV	1490	A
Richmond, Ky.	WEKY	1340	M
Richmond, Va.	WANT	990	
	WBBL	1480	
	WEZL	1590	
	WLEE	1480	N
	WEET	1320	
	WMBG	1380	A
	WRNL	910	M
	WRVA	1140	C
	WXGI	950	
Richmond Hill, Ont.	CJRH	1310	
Richwood, W.Va.	WMNF	1280	
Ridgecrest, Calif.	KRCK	1360	
	KRKS	1240	
Rimouski, Que.	CJBR	900	
Rio Piedras, P.R.	WRIO	1320	
	WWWW	1520	
Ripley, Tenn.	WTRB	1570	
Ripon, Wis.	WCWC	1600	
Riverhead, N.Y.	WRIV	1390	
Riverside, Calif.	KPRO	1440	
	KACE	1570	
Riverton, Wyo.	KWRL	1450	M
Riviera Beach, Fla.	WHEW	1600	
Riviere du Loup, Que.	CJFP	1400	
Roanoke, Ala.	WELR	1360	
Roanoke, Va.	WDBJ	960	C
	WRIS	1410	M
	WHYE	910	
	WROV	1240	A
	WSLS	610	N
Roanoke Rapids, N.C.	WCBT	1230	M
Roaring Sprgs., Pa.	WKMC	1370	
Roberval, Que.	CHRL	910	
Robinson, Ill.	WTAY	1570	
Rochester, Minn.	KROC	1340	N
	KWEB	1270	
Rochester, N.H.	WWNH	930	
Rochester, N.Y.	WBBF	950	M
	WHAM	1180	N
	WHEC	1460	C
	WRVM	680	
	WSAY	1370	
	WVET	1280	A
Rockford, Ill.	WROK	1440	A
	WRRR	1330	
Rock Hill, S.C.	WRHI	1340	M
	WTYC	1150	
Rockingham, N.C.	WAYN	900	
Rock Island, Ill.	WHBF	1270	C
Rockland, Maine	WRKD	1450	A
Rockmart, Ga.	WPLK	1220	
Rock Springs, Wyo.	KVRS	1360	M
Rockville, Md.	WINX	1600	
Rockwood, Tenn.	WRKH	580	
Rocky Ford, Colo.	KAVI	1320	
Rocky Mount, N.C.	WCEC	810	
	WEED	1390	A
	WRMT	1490	
Rocky Mount, Va.	WYTI	1570	
Rogers, Ark.	KAMD	1390	
Rogers City, Mich.	WHAK	960	
Rogersville, Tenn.	WRGS	1370	
Rolla, Mo.	KTTR	1490	
Rome, Ga.	WLAQ	1410	A
	WRGA	1470	M
	WROM	710	
Rome, N.Y.	WKAL	1450	A
Ronceverte, W.Va.	WRON	1400	
Roseburg, Oreg.	KRNR	1490	C
	KRXL	1240	A
Rosenberg, Tex.	KFRD	980	
Rossville, Ga.	WRIP	980	
Roswell, N.Mex.	KSWS	1230	
	KGFL	1400	M
	KBIM	910	
Rouyn, Que.	CKRN	1400	
Roxboro, N.C.	WRXO	1430	
Royal Oak, Mich.	WEXL	1340	
Rumford, Me.	WRUM	790	
Rupert, Idaho	KAYT	970	
Rushton, La.	KRUS	1490	
Rusk, Texas	KTLU	1580	
Russell, Kans.	KRSL	990	
Russellville, Ala.	WWWR	920	
Russellville, Ark.	KXRJ	1490	
Russellville, Ky.	WRUS	610	
Rutland, Vt.	WHWB	1000	
	WSYB	1380	M
Saanich, B.C.	CFAX	810	
Sackville, N.B.	CBA	1070	
Sacramento, Calif.	KCRA	1320	N
	KFBK	1530	A
	KGMS	1380	M
	KROY	1240	C
	KXOA	1470	
Safford, Ariz.	KGLU	1480	A
Saginaw, Mich.	WKNX	1210	
	WSAM	1400	N
	WSGW	790	M
St. Albans, Vt.	WWSR	1420	
St. Albans, W.Va.	WKLC	1300	
Ste. Anne de la Pocatiere, Que.	CHGB	1350	
St. Augustine, Fla.	WFOY	1240	C
	WSTN	1420	
St. Boniface, Man.	CKSB	1050	
St. Catherines, Ont.	CKTB	610	
St. Charles, Mo.	KADY	1460	
St. Cloud, Minn.	KFAM	1450	N
	WJON	1240	
St. George, Utah	KDXU	1450	
St. Helen, Mich.	WMIC	1590	
St. Hyacinthe, Que.	CKBS	1240	
St. Jean, Que.	CHRS	1090	
St. Jerome, Que.	CKJL	900	
Saint John, N.B.	CFBC	930	
	CHSJ	1150	
St. John's, Nfld.	CBN	640	
	CJON	930	
	VOAR	1230	
	VOCM	590	
	VOWR	800	
St. Johnsbury, Vt.	WTWN	1340	
St. Joseph, Mich.	WSJM	1400	
St. Joseph, Mo.	KFEQ	680	
	KRES	1550	M
	KUSN	1270	
St. Joseph d'Alma, Que.	CFGT	1270	
St. Louis, Mo.	KATZ	1600	
	KFUO	850	
	KMOX	1120	C
	KSD	550	N
	KSTL	690	
	KWK	1380	
	KXOK	630	
	WEW	770	M
	WIL	1430	A
St. Louis Park, Minn.	KRSI	950	
St. Mary's, Pa.	WKBI	1400	
St. Paul, Minn.	KSTP	1500	N
	KDWB	1590	M
St. Peter, Minn.	KRBI	1310	
St. Petersburg, Fla.	WPIN	680	
	WSUN	620	A
	WLCY	1380	M
St. Petersburg Beach, Fla.	WILZ	1590	
St. Thomas, Ont.	CHLO	680	
Ste. Genevieve, Mo.	KSGM	980	
Salamanca, N.Y.	WNYS	1590	
Salem, Ill.	WJBD	1350	
Salem, Ind.	WSLM	1220	
Salem, Mass.	WESX	1230	
Salem, Mo.	KSMO	1340	
Salem, Oreg.	KSLM	1390	A
	KBZY	1490	N
	KGAY	1430	
Salem, Va.	WBLU	1480	
Salida, Colo.	KVRH	1340	M
Salina, Kans.	KSAL	1150	M
Salinas, Calif.	KDON	1460	
	KSBW	1380	M
Saline, Mich.	WDIA	1290	
Salisbury, Md.	WBOC	960	
	WICO	1320	
	WJDY	1470	
Salisbury, N.C.	WSTP	1490	M
	WSAT	1280	A
Salmon, Idaho	KSRA	960	
Salt Lake City, Utah	KALL	910	M
	KCPX	1320	N
	KLUB	570	A
	KNAK	1280	
	KSL	1160	C
	KSOP	1370	
	KWHO	860	
	KWIC	1570	
San Angelo, Tex.	KTXL	1340	
	KGKL	960	A
	KPEP	1420	
	KWFR	1260	
San Antonio, Tex.	KCOR	1350	
	KENS	680	C
	KUKA	1250	
	KUBO	1310	
	KMAC	630	A
	KONO	860	
	KTSA	550	
	WOAI	1200	
San Bernardino, Calif.	KCKC	1350	
	KFXM	590	
	KRNO	1240	
	KITO	1290	M
Sandersville, Ga.	WSNT	1490	
San Diego, Calif.	KCBQ	1170	
	KFMB	540	C
	KFSD	600	N
	KGB	1360	A
	KSON	1240	
	KSDO	1130	
Sandpoint, Idaho	KSPT	1400	
Sandusky, Ohio	WLEC	1450	M
San Fernando, Calif.	KGIL	1260	
Sanford, Fla.	WTRR	1400	
	WIOD	1360	
Sanford, Me.	WSME	1220	
Sanford, N.C.	WEYE	1290	
	WWGP	1050	
San Francisco, Cal.	KFRC	610	M
	KCBS	740	C
	KJBS	1100	
	KNBC	680	N
	KOBY	1550	M
	KSAY	1010	
	KSAN	1450	
	KSFO	560	
	KYA	1260	
San Jose, Calif.	KLOK	1170	
	KSJO	1590	
	KEEN	1370	
	KXRX	1500	
San Juan, P.R.	WAPA	680	M
	WHOA	1400	
	WIPR	940	
	WKAQ	580	C
	WKVM	1230	
	WITA	1140	
San Luis Obispo, Calif.	KATY	1340	
	KVEC	920	M
San Marcos, Tex.	KCNY	1470	
San Mateo, Calif.	KOFY	1050	
San Rafael, Calif.	KTIM	1510	
San Saba, Tex.	KBAL	1410	
Santa Ana, Calif.	KWIZ	1480	
Santa Barbara, Cal.	KDB	1490	
	KIST	1340	N
	KTMS	1250	A-M
Santa Cruz, Calif.	KSCO	1080	
Santa Fe, N.Mex.	KTRC	1400	A
	KVSF	1260	C
Santa Maria, Cal.	KCOY	1400	
	KSMA	1240	
Santa Monica, Cal.	KDAY	1580	
Santa Paula, Calif.	KSPA	1400	
Santa Rosa, Calif.	KSRO	1350	
	KJAX	1150	
Santurce, P.R.	WIAC	740	
	WKAQ	580	C
Saranac Lake, N.Y.	WNBZ	1240	A
Sarasota, Fla.	WKXY	930	
	WSPB	1450	C
Saratoga Springs, N.Y.	WSPN	900	
	WRSA	1280	
Sarnia, Ont.	CHOK	1070	
Saskatoon, Sask.	CFQC	600	
	CFNS	1170	
	CKOM	1420	
Saugerties, N.Y.	WGHQ	920	
Sault Ste. Marie, Michigan	WSOO	1230	
Sault Ste. Marie, Ontario	CJIC	1050	
	CKCY	1400	
Savannah, Ga.	WCCP	1450	M
	WJIV	900	
	WSAV	630	N
	WSGA	1400	
	WTOC	1290	C
	WSOK	1230	A
Savannah, Tenn.	WORM	1010	
Sayre, Pa.	WATS	960	
Schefferville, Que.	CFKL	1230	
Schenectady, N.Y.	WGY	810	N
	WSNY	1240	
Scottsbluff, Nebr.	KNEB	960	M
	KOLT	1320	C
Scottsboro, Ala.	WCRI	1050	
	WROS	1330	
Scottsdale, Ariz.	KPOK	1440	
Scottsville, Ky.	WLCK	1250	
Scranton, Pa.	WARM	590	A
	WEJL	630	
	WGBI	910	C
	WICK	1400	
	WSCR	1320	N
Seaford, Del.	WSUX	1280	
Seattle, Wash.	KAYO	1150	
	KING	1090	A
	KIRO	710	C
	KJR	950	
	KOL	1300	
	KOMO	1000	N
	KTIX	1590	
	KTW	1250	
	KXA	770	
Searcy, Ark.	KWCB	1300	
Sebring, Fla.	WJCM	960	
Sedalia, Mo.	KDRO	1490	
	KSIS	1050	
Seguin, Tex.	KWED	1580	
Selma, Ala.	WGWC	1340	C
	WHBB	1490	
	WRWJ	1570	
Seminole, Tex.	KSML	1250	
Seneca Township, S.C.	WSNW	1150	
Sevierville, Tenn.	WSEV	930	
Seward, Alaska	KIBH	1340	C-A
Seymour, Ind.	WJCD	1390	
Seymour, Tex.	KSEY	1230	
Shamokin, Pa.	WISL	1480	
Shamrock, Tex.	KBYP	1580	
Sharon, Pa.	WPIC	790	
Shawano, Wis.	WTCH	960	
Shawinigan, Que.	CKSM	1220	
Shawnee, Okla.	KGFF	1450	M
Sheboygan, Wis.	WHBL	1330	A
	WKTL	950	
Shelby, Mont.	KSEN	1150	M
Shelby, N.C.	WOHS	730	M
	WADA	1390	
Shelbyville, Tenn.	WHAL	1400	
Shenandoah, Iowa	KFNF	920	
	KMA	960	A
Sherbrooke, Que.	CHLT	630	
	CKTS	900	
Sheridan, Wyo.	KWYO	1410	M
Sherman, Tex.	KRRV	910	M
	KTXO	1500	
Show Low, Ariz.	KVWM	1050	
Shreveport, La.	KANB	1300	
	KCIJ	1050	
	KEEL	710	
	KENT	1550	M
	KJOE	1480	
	KOKA	980	
	KRMD	1340	A
	KWKH	1130	C
Sidney, Mont.	KGCX	1480	M
Sidney, Nebr.	KSID	1340	A
Sierra Vista, Ariz.	KHFH	1420	A
Sikeston, Mo.	KSIM	1400	
Siler City, N.C.	WNCA	1570	
Siloam Sprgs., Ark.	KUOA	1290	M
Silver City, N.Mex.	KSIL	1340	C
Silver Sprgs., Md.	WGAY	1050	
Simcoe, Ont.	CFRS	1560	
Sinton, Tex.	KTOD	1590	
Sioux City, Iowa	KSCJ	1360	A
	KMNS	620	
	KTRI	1470	
Sioux Falls, S.Dak.	KISD	1230	
	KELO	1320	
	KIHO	1270	
	KSOO	1140	A
Sitka, Alaska	KIFW	1230	C-A
	KSEW	1400	
Skowhegan, Maine	WGHM	1150	
Smithfield, N.C.	WMPM	1270	
Smiths Falls, Ont.	CJET	630	
Snyder, Tex.	KSNY	1450	M
Socorro, N.Mex.	KSRC	1290	
Soda Sprgs., Idaho	KBRV	540	
Somerset, Ky.	WSFC	1240	M
	WTLO	1480	
Somerset, Pa.	WVSC	990	
Sonora, Calif.	KROG	1450	
Sorel, P.Q.	CJSO	1320	
So. Bend, Ind.	WNDU	1490	A
	WJVA	1580	M
	WSBT	960	C
Southbridge, Mass.	WESO	970	
So. Boston, Va.	WHLF	1400	A
South Daytona Beach, Florida	WELE	1590	
So. Gastonia, N.C.	WGAS	1420	
So. Paris, Me.	WKTQ	1450	
So. Pittsburg, Tenn.	WEPG	910	
So. St. Paul, Minn.	WISK	630	M
So. Williamsport, Pa.	WMPT	1450	
Sparta, Ill.	WHCO	1230	
Sparta, Tenn.	WSMT	1050	
Sparta, Wis.	WCOW	1290	
Spartanburg, S.C.	WTHE	1400	M
	WORD	910	N
	WSPA	950	C
Spencer, Iowa	KICD	1240	
Spokane, Wash.	KGA	1510	A
	KLYK	1230	
	KPEG	1380	
	KHQ	590	N
	KNEW	790	M
	KREM	970	
	KXLY	920	C
Springdale, Ark.	KBRS	1340	A
Springfield, Ill.	WCVS	1450	A-M
	WMAY	970	N
	WTAX	1240	C
Springfield, Mass.	WBZA	1030	
	WHYN	560	C
	WMAS	1450	M
	WSPR	1270	
Springfield, Mo.	KGBX	1260	N
	KICK	1340	
	KTTS	1400	C
	KWTO	560	A
Springfield, Ohio	WIZE	1340	A
	WBLY	1600	
Springfield, Oreg.	KEED	1050	
Springfield, Tenn.	WDBL	1590	
Springfield, Vt.	WCFR	1480	
Springhill, La.	KBSF	1460	
Spruce Pine, N.C.	WTOE	1470	
Stamford, Conn.	WSTC	1400	A
Stamford, Tex.	KOWT	1400	
Starke, Fla.	WRGR	1490	

Location	C.L.	Kc.	N.A.
Starkville, Miss.	WSSO	1230	
State College, Pa.	WMAJ	1450	M
Statesboro, Ga.	WWNS	1240	
Statesville, N.C.	WSIC	1400	
	WDBM	550	
Staunton, Va.	WTON	1240	A
	WAFC	900	
Stephenville, Tex.	KSTV	1510	
Sterling, Colo.	KGEK	1230	
	KOLR	1490	
Sterling, Ill.	WSDR	1240	
Steubenville, Ohio	WSTV	1340	M
Stevens Point, Wis.	WSPT	1010	
	WLBL	930	
Stillwater, Minn.	WAVN	1220	
Stillwater, Okla.	KSPI	780	
Stockton, Calif.	KJOY	1280	
	KRAK	1140	
	KSTN	1420	
	KWG	1230	A-M
Storm Lake, Iowa	KAYL	990	
Stratford, Ont.	CJCS	1240	
Streator, Ill.	WIZZ	1250	
Stroudsburg, Pa.	WVPO	840	
Stuart, Fla.	WSTU	1450	M
Sturgeon Bay, Wis.	WDOR	910	
Sturgis, Mich.	WSTR	1230	
Stuttgart, Ark.	KWAK	1240	M
Sudbury, Ont.	CKSO	790	
	CFBR	550	
	CHNO	900	
Suffolk, Va.	WLPM	1450	A
Sulphur, La.	KIKS	1310	
Sulphur Sprgs., Tex.	KSST	1230	
Summerside, P.E.I.	CJRW	1240	
Summerville, Ga.	WGTA	950	
Sumter, S.C.	WFIG	1290	M
	WSSC	1340	A
Sunbury, Pa.	WKOK	1240	C
Sunnyside, Wash.	KREW	1230	
Superior, Nebr.	KRFS	1600	
Superior, Wis.	WDSM	710	N
	WQMN	1320	
Susanville, Calif.	KSUE	1240	
Swainsboro, Ga.	WJAT	800	
Sweetwater, Tenn.	WDEH	800	
Sweetwater, Tex.	KXOX	1240	
Swift Current, Sask.	CKSW	1400	
Sydney, N.S.	CBI	1570	
	CJCB	1270	
Sylacauga, Ala.	WFEB	1340	M
	WMLS	1290	
Sylva, N.C.	WMSJ	1480	
Sylvania, Ga.	WSYL	1490	
Syracuse, N.Y.	WHEN	620	C
	WFBL	1390	A
	WNDR	1260	M
	WOLF	1490	A
	WSYR	570	N
Tabor City, N.C.	WTAB	1370	
Tacoma, Wash.	KMO	1360	
	KTAC	850	
	KTNT	1400	
	KVI	570	M
Taft, Calif.	KTKR	1310	
Tahlequah, Okla.	KTLQ	1350	
Talladega, Ala.	WJHB	1580	
	WNUZ	1230	M
Tallahassee, Fla.	WMEN	1330	
	WRFB	1580	
	WTAL	1270	
Tallassee, Ala.	WTLS	1300	
	WTNT	1450	A-M-C
Tallulah, La.	KTLD	1360	
Tampa, Fla.	WALT	1110	
	WDAE	1250	C
	WFLA	970	N
	WHBO	1050	
	WTMP	1150	
	WSOL	1300	
Tarboro, N.C.	WCPS	760	
Tarpon Sprgs., Fla.	WDCL	1470	
Tasley, Va.	WESR	1330	
Taunton, Mass.	WPEP	1570	
Tawas City, Mich.	WIOS	1480	
Taylor, Tex.	KTAE	1260	
Taylorville, Ill.	WTIM	1410	
Tell City, Ind.	WTCJ	1230	
Temple, Tex.	KTEM	1400	
Terre Haute, Ind.	WBOW	1230	N
	WMFT	1300	
	WTHI	1480	C
Terrell, Tex.	KTER	1570	
Texarkana, Ark.	KOSY	790	M
Texarkana, Tex.	KCMC	1230	A
	KTFS	1400	
Texas City, Tex.	KTLW	920	
Thayer, Mo.	KALM	1290	
The Dalles, Oreg.	KODL	1440	
	KRMW	1300	
Thermopolis, Wyo.	KRTR	1490	M
	KTHE	1240	
Thief River Falls, Minn.	KTRF	1230	
Thetford Mines, Que.	CKLD	1230	
Thibodaux, La.	KTIB	630	
Thomaston, Ga.	WSFT	1220	
Thomasville, Ala.	WJDB	630	
Thomasville, Ga.	WPAX	1240	
	WKTG	730	
Thomasville, N.C.	WTNC	790	
Thomson, Ga.	WTWA	1240	M
Three Rivers, Que.	CHLN	550	
	CKTR	1150	
Ticonderoga, N.Y.	WIPS	1250	
Tifton, Ga.	WTIF	1340	
	WWGS	1430	
Tillamook, Oreg.	KTIL	1590	
Tillsonburg, Ont.	CKOT	1510	
Timmins, Ont.	CFCL	580	
	CKGB	680	
Titusville, Fla.	WRMF	1050	
Toccoa, Ga.	WLET	1420	M
	WNEG	1320	
Toledo, Ohio	WOHO	1470	M
	WSPD	1370	N
	WTOD	1560	C
	WTOL	1230	A
Tooele, Utah	KTUT	990	
Topeka, Kans.	WIBW	580	C
	KJAY	1440	
	WREN	1250	A
	KTOP	1490	M
Toppenish, Wash.	KENE	1490	
Toronto, Ont.	CBL	740	N
	CFRB	1010	C
	CHUM	1050	
	CJBC	860	
	CKEY	580	M
	CKFH	1430	
Torrington, Conn.	WBZY	990	
	WTOR	1490	M
Torrington, Wyo.	KGOS	1490	
Towson, Md.	WAQE	1570	
Trail, B.C.	CJAT	610	
Traverse City, Mich.	WTCM	1400	
Trenton, Mo.	KTTN	1600	
Trenton, N.J.	WAAT	1300	
	WBUD	1260	
	WTTM	920	N
Trinidad, Colo.	KCRT	1240	M
Troy, Ala.	WTBF	970	M
Troy, N.Y.	WHAZ	1330	
	WTRY	980	
Truckee, Calif.	KHOE	1400	
Truro, N.S.	CKCL	600	
Truth or Consequences, New Mexico	KCHS	1400	
Tryon, N.C.	WTYN	1580	
Tucson, Ariz.	KTUC	1400	A
	KAIR	1490	
	KCEE	790	
	KTAN	580	A
	KCUB	1290	N
	KEVT	690	
	KMOP	1330	
	KTKT	990	
	KOLD	1450	C
Tucumcari, N.Mex.	KTNM	1400	M
Tulare, Calif.	KCOK	1270	M
	KGEN	1370	
Tularosa, N.M.	KMAM	1590	
Tulia, Tex.	KTUE	1260	
Tullahoma, Tenn.	WJIG	740	
Tulsa, Okla.	KAKC	970	
	KDME	1300	
	KRMG	740	
	KTUL	1430	C
	KVOO	1170	N
	KFMJ	1050	
Tupelo, Miss.	WELO	580	M
	WTUP	1490	A
Turlock, Calif.	KTUR	1390	
Tuscaloosa, Ala.	WJRD	1150	
	WACT	1420	
	WNPT	1280	A
	WTUG	790	
	WTBC	1230	M
Tuscumbia, Ala.	WVNA	1590	
Tuskegee, Ala.	WABT	580	
Twin Falls, Idaho	KTFI	1270	N
	KLIX	1310	M
	KEEP	1450	
Two Rivers, Wis.	WTRW	1590	
Tyler, Tex.	KDOK	1330	
	KGJB	1490	M
	KTBB	600	A
	KZEY	690	
Tyrone, Pa.	WTRN	1290	
Ukiah, Calif.	KUKI	1400	
Union, Mo.	KLPW	1220	
Union, S.C.	WBCU	1460	
Union City, Tenn.	WENK	1240	
Uniontown, Pa.	WMBS	590	C
Urbana, Ill.	WILL	580	
	WKID	1580	
Utica, N.Y.	WIBX	950	C
	WRUN	1150	
	WTLB	1310	A
Uvalde, Tex.	KVOU	1400	
Val D'Or, Que.	CKVD	1230	
Valdosta, Ga.	WGOV	950	M
	WGAF	910	A
	WJEM	1150	
	WVLD	1450	
Vallejo, Calif.	KNBA	1190	
Valley City, N.Dak.	KOVC	1490	M
Valparaiso-Niceville, Fla.	WNSM	1340	
Van Buren, Ark.	KFDF	1580	
Van Wert, Ohio	WERT	1220	
Vanceburg, Ky.	WKKS	1570	
Vancleve, Ky.	WMTC	730	
Vancouver, B.C.	CBU	690	
	CFUN	1410	
	CJOR	600	
	CKWX	1130	M
Vancouver, Wash.	KKEY	1150	
	KISN	910	
Ventura, Calif.	KVEN	1450	M
	KUDU	1590	
Verdun, Que.	CKVL	850	
Vermillion, S.Dak.	KUSD	690	
Vernal, Utah	KVEL	1250	
Vernon, B.C.	CJIB	940	
Vernon, Tex.	KVWC	1490	
Vero Beach, Fla.	WAXE	1370	
	WTTB	1490	A
Vicksburg, Miss.	WQBC	1420	M
	WVIM	1490	
Victoria, B.C.	CJVI	900	
	CKDA	1220	
Victoria, Tex.	KNAL	1410	
	KVIC	1340	M
Victoriaville, Que.	CFDA	1380	
Vidalia, Ga.	WVOP	970	
Vieques, P.R.	WIVV	1370	
Ville Marie, Que.	CKVM	710	
Ville Platte, La.	KVPI	1050	
Ville St. Georges, Que.	CKRB	1250	
Vincennes, Ind.	WAOV	1450	M
Vineland, N.J.	WWBZ	1360	
	WDVL	1270	
Vinita, Okla.	KVIN	1470	
Virginia, Minn.	WHLB	1400	N
Virginia Bch., Va.	WBOF	1600	
Virouqua, Wis.	WISV	1360	
Visalia, Calif.	KONG	1400	
Vivian, La.	KLVI	1600	
Waco, Tex.	WACO	1460	A
	KWTX	1230	M
Wadena, Minn.	KWAD	920	M
Wadesboro, N.C.	WADE	1210	
Wailuku, Hawaii	KMVI	550	N
Waipahu, Hawaii	KAHU	920	
	KAHU	920	
Walhalla, S.C.	WGOG	1460	
Wallace, Idaho	KWAL	620	M
Wallace, N.C.	WLSE	1400	
Walla Walla, Wash.	KHIT	1320	
	KUJ	1420	M
	KTEL	1490	A
Walnut Ridge, Ark.	KRLW	1320	
Walsenburg, Colo.	KFLJ	1380	
Walterboro, S.C.	WALD	1220	M
Waltham, Mass.	WCRB	1330	
Walton, N.Y.	WDLA	1270	
Ward Ridge, Fla.	WJOE	1570	
Ware, Mass.	WARE	1250	M
Warner Robbins, Ga.	WRPB	1350	
Warren, Ark.	KWRF	860	
Warren, Ohio	WHHH	1440	
Warren, Pa.	WNAE	1310	
Warrensburg, Mo.	KOKO	1450	
Warrenton, Mo.	KWRE	730	
Warrenton, Va.	WEER	1570	
	WKTF	1420	
Warsaw, Ind.	WRSW	1480	
Warsaw, Va.	WNNT	690	
Wasco, Calif.	KWSO	1050	
Washington, D.C.	WGMS	570	
	WMAL	630	A
	WOL	1450	M
	WOOK	1340	
	WWDC	1260	
	WRC	980	N
	WTOP	1500	C
Washington, Ga.	WKLE	1370	
Washington, Ind.	WAMW	1580	
Washington, N.J.	WCRV	1580	
Washington, N.C.	WDOW	1340	
	WRRF	930	A
Washington, Pa.	WJPA	1450	M
Washington Court House, Ohio	WCHO	1250	
Waterbury, Conn.	WATR	1320	A
	WBRY	1590	C
	WWCO	1240	M
Waterbury, Vt.	WDEV	550	M
Waterloo, Iowa	KXEL	1540	A
	KNWS	1090	
	KWWL	1330	M
Watertown, N.Y.	WATN	1240	
	WWNY	790	C
Watertown, S.Dak.	KWAT	950	M
Watertown, Wis.	WTTN	1580	
Waterville, Me.	WTVL	1490	A
Watsonville, Calif.	KOMY	1340	
Wauchula, Fla.	WAUC	1310	
Waukegan, Ill.	WKRS	1220	
Waukesha, Wis.	WAUX	1510	
Waupaca, Wis.	WDUX	800	A
Wausau, Wis.	WRIG	1400	N
	WSAU	550	A
	WHVF	1230	
Waverly, Iowa	KWVY	1470	
Waverly, Ohio	WPKO	1380	
Waxahachie, Tex.	KBEC	1390	
Waycross, Ga.	WACL	570	
	WAYX	1230	M
Waynesboro, Ga.	WBRO	1310	
Waynesboro, Miss.	WABO	990	
Waynesboro, Pa.	WAYZ	1380	
Waynesboro, Va.	WAYB	1490	M
Waynesburg, Pa.	WANB	1580	
Waynesville, N.C.	WHCC	1400	
Weatherford, Tex.	KZEE	1220	
Webster City, Iowa	KJFJ	1570	
Weirton, W.Va.	WEIR	1430	
Weiser, Idaho	KWEI	1260	
Welch, W.Va.	WELC	1150	
	WOVE	1340	M
Welland, Ontario	CHOW	1470	
Wellsboro, Pa.	WNBT	1490	M
Wellston, Ohio	WKOV	1330	
Wellsville, N.Y.	WLSV	790	
Wenatchee, Wash.	KPQ	560	A
	KUEN	900	
	KMEL	1340	M
Weslaco, Tex.	KRGV	1290	N
W. Bend, Wis.	WBKV	1470	
W. Frankfort, Ill.	WFRX	1300	
West Jefferson, N.C.	WKSK	1600	
W. Monroe, La.	KUZN	1310	
W. Palm Beach, Fla.	WEAT	850	N
	WJNO	1230	C
	WIRK	1290	M
West Plains, Mo.	KWPM	1450	
West Point, Ga.	WBMK	1310	
West Point, Miss.	WROB	1450	M
W. Springfield, Mass.	WTXL	1490	A
W. Yarmouth, Mass.	WOCB	1240	M
Westerly, R.I.	WERI	1230	M
Westfield, Mass.	WDEW	1570	
Westminster, Md.	WTTR	1470	
Weston, W.Va.	WHAW	980	M
W. Warwick, R.I.	WWRI	1450	
Wetumpka, Ala.	WETU	1250	
Wewoka-Seminole, Okla.	KWSH	1260	A
Weyburn, Sask.	CFSL	1340	
Wheaton, Md.	WDON	1540	
Wheeling, W.Va.	WHLL	1600	
	WKWK	1400	A
	WWVA	1170	C
White Castle, La.	KEVL	1590	
White Plains, N.Y.	WFAS	1230	
White River Junc., Vt.	WWRJ	910	
Whitehorse, Y.T.	CFWH	1240	
Whitesburg, Ky.	WTCW	920	
Whiteville, N.C.	WENC	1220	
Wichita, Kans.	KAKE	1240	M
	KLEO	1480	N
	KFBI	1070	
	KFH	1330	C
	KSIR	900	
	KWBB	1410	
Wichita Falls, Tex.	KSYD	990	M
	KTRN	1290	
	KWFT	620	C
Wildwood, N.J.	WCMC	1230	
Wilkes-Barre, Pa.	WBAX	1240	M
	WBRE	1340	N
	WILK	980	A
Williamsburg, Ky.	WEZJ	1440	
Williamson, W.Va.	WBTH	1400	M
Williamsport, Pa.	WLYC	1050	
	WRAK	1400	N
	WWPA	1340	C
Williamston, N.C.	WIAM	900	
Willimantic, Conn.	WILI	1400	
Williston, N.D.	KEYZ	1360	
Willmar, Minn.	KWLM	1340	A
Willow Springs, Mo.	KUKU	1330	
Wilmington, Del.	WAMS	1380	M
	WDEL	1150	N
	WILM	1450	A
	WTUX	1290	
Wilmington, N.C.	WMFD	630	A
	WKLM	980	
	WGNI	1340	M
Wilson, N.C.	WGTM	590	C
	WVOT	1420	M
Winchester, Ky.	WWKY	1380	
Winchester, Tenn.	WCDT	1340	
Winchester, Va.	WINC	1400	A
Winder, Ga.	WIMO	1300	
Windom, Minn.	KDOM	1580	
Windsor, N.S.	CFAB	1450	
Windsor, Ont.	CBE	1550	
	CKLW	800	M
Wingham, Ont.	CKNX	920	
Winnemucca, Nev.	KWNA	1400	
Winnfield, La.	KVCL	1270	
Winner, S.Dak.	KWYR	1260	
Winnipeg, Man.	CBW	990	
	CKRC	630	
	CKY	580	
	CJOB	680	
Winnsboro, La.	KMAR	1570	
Winona, Minn.	KWNO	1230	A
	KAGE	1380	
Winona, Miss.	WONA	1570	
Winslow, Ariz.	KVNC	1010	A
Winston-Salem, N.C.	WAAA	980	
	WAIR	1340	
	WSJS	600	N
	WTOB	1380	M-C
Winter Garden, Fla.	WOKB	1600	
Winter Haven, Fla.	WSIR	1490	M
	WINT	1360	
Winter Park, Fla.	WABR	1440	M
Wisconsin Rapids, Wis.	WFHR	1340	M
Wolf Pt., Mont.	KVCK	1450	M
Woodside, N.Y.	WWRL	1600	
Woodstock, N.B.	CJCJ	920	
Woodstock, Ont.	CKOX	1340	
Woodward, Okla.	KSIW	1450	
Woonsocket, R.I.	WNRI	1380	
	WWON	1240	
Wooster, Ohio	WWST	960	
Worcester, Mass.	WAAB	1440	M-N-A
	WNEB	1230	
	WORC	1310	
	WTAG	580	C
Worland, Wyo.	KWOR	1340	M
Worthington, Minn.	KWOA	730	
Worthington, Ohio	WRFD	880	
Wynne, Ark.	KWYN	1400	
Wytheville, Va.	WYVE	1280	
Yakima, Wash.	KIT	1280	
	KIMA	1460	C
	KUTI	980	
	KYAK	1390	M
Yankton, S.D.	KYNT	1450	
	WNAX	570	C
Yarmouth, N.S.	CJLS	1340	

Yazoo City Miss.	WAZF	1230	
Yellowknife, N.W.T.	CFYK	1340	
York, Nebr.	KAWL	1370	
York, Pa.	WNOW	1250	
	WORK	1350	N
	WSBA	910	A-M
York, S.C.	WYCL	1580	
Yorkton, Sask.	CJGX	940	
Youngstown, Ohio	WBBW	1240	A
	WFMJ	1390	N
	WKBN	570	O
Yreka, Calif.	KSYC	1490	
Yuba City, Calif.	KUBA	1600	
	KAGR	1450	
Yuma, Ariz.	KOFA	1240	
	KVOY	1400	A
	KYUM	560	N
Zanesville, Ohio	WHIZ	1240	N
Zarephath, N.J.	WAWZ	1380	

U. S. and Canadian AM Stations by Call Letters

C.L.	Location	Kc.
KAAA	Kingman, Ariz.	1230
KAAB	Hot Springs, Ark.	1350
KABC	Los Angeles, Calif.	790
KABL	Oakland, Calif.	960
KABQ	Albuquerque, N.M.	1350
KABR	Aberdeen, S. Dak.	1220
KABY	Albany, Oreg.	990
KACE	Riverside, Calif.	1570
KACI	The Dalles, Oreg.	1300
KACT	Andrews, Tex.	1360
KACY	Port Hueneme, Calif.	1520
KADA	Ada, Okla.	1230
KADO	Marshall, Tex.	1410
KADY	St. Charles, Mo.	1460
KAFP	Petaluma, Calif.	1490
KAFY	Bakersfield, Calif.	550
KAGE	Winona, Minn.	1380
KAGH	Crossett, Ark.	800
KAGI	Grants Pass, Oreg.	1340
KAGT	Anacortes, Wash.	1340
KAGR	Yuba City, Calif.	1450
KAHI	Auburn, Calif.	950
KAHU	Waipahu, Hawaii	920
KAIM	Kaimuki, Hawaii	870
KAIR	Tucson, Ariz.	1490
KAJI	Little Rock, Ark.	1250
KAJO	Grants Pass, Oreg.	1270
KAKC	Tulsa, Okla.	970
KAKE	Wichita, Kan.	1240
KALB	Alexandria, La.	580
KALE	Richland, Wash.	960
KALG	Alamogordo, N.Mex.	1230
KALI	Pasadena, Calif.	1430
KALL	Salt Lake City, Utah	910
KALM	Thayer, Mo.	1290
KALT	Atlanta, Tex.	900
KALV	Alva, Okla.	1430
KAMD	Camden, Ark.	910
KAML	Kenedy, Tex.	990
KAMO	Rogers, Ark.	1390
KAMP	El Centro, Calif.	1430
KANA	Anaconda, Mont.	1230
KANB	Shreveport, La.	1300
KAND	Corsicana, Tex.	1340
KANE	New Iberia, La.	1240
KANI	Kailua, Oahu, Hawaii	1240
KANO	Anoka, Minn.	1470
KANS	Independence, Mo.	1510
KAOK	Lake Charles, La.	1400
KAPA	Raymond, Wash.	1340
KAPB	Marksville, La.	1370
KAPI	Pueblo, Colo.	690
KAPR	Douglas, Ariz.	930
KARE	Atchison, Kan.	1470
KARK	Little Rock, Ark.	920
KARM	Fresno, Calif.	1430
KARS	San Antonio, Tex.	1250
KART	Jerome, Idaho	1400
KARY	Prosser, Wash.	1310
KASH	Eugene, Ore.	1600
KASI	Ames, Iowa	1430
KASK	Ontario, Calif.	1510
KASL	Newcastle, Wyo.	1240
KASM	Albany, Minn.	1150
KASO	Minden, La.	1240
KAST	Astoria, Ore.	1370
KASY	Auburn, Wash.	1220
KATE	Albert Lea, Minn.	1450
KATI	Casper, Wyo.	1400
KATL	Miles City, Mont.	1340
KATY	San Luis Obispo, Cal.	1340
KATZ	St. Louis, Mo.	1600
KAUS	Austin, Minn.	1480
KAVE	Carlsbad, N.Mex.	1240
KAVI	Rocky Ford, Colo.	1320
KAVL	Lancaster, Calif.	610
KAVR	Apple Valley, Calif.	960
KAWL	York, Neb.	1370
KAWT	Douglas, Ariz.	1450
KAYE	Puyallup, Wash.	1450
KAYL	Storm Lake, Iowa	990
KAYO	Seattle, Wash.	1150
KAYS	Hays, Kans.	1400
KAYT	Rupert, Idaho	970
KBAL	San Saba, Tex.	1410
KBAM	Longview, Wash.	1270
KBAN	Bowie, Tex.	1410
KBAR	Burley, Idaho	1230
KBBA	Benton, Ark.	690
KBBB	Borger, Tex.	1600
KBBC	Centerville, Utah	1600
KBBS	Buffalo, Wyo.	1450
KBCH	Oceanlake, Oreg.	1380
KBCL	Bossier City, La.	1220
KBEC	Waxahachie, Tex.	1390
KBEE	Modesto, Calif.	970
KBEK	Elk City, Okla.	1240
KBEL	Idabel, Okla.	1240
KBEN	Carrizo Sprgs., Tex.	1450
KBET	Reno, Nev.	1340
KBFS	Belle Fourche, S.Dak.	1450
KBHC	Nashville, Ark.	1260
KBHM	Branson, Mo.	1220
KBHS	Hot Springs, Ark.	590
KBIA	Columbia, Mo.	1580
KBIF	Fresno, Calif.	900
KBIG	Avalon, Calif.	740
KBIM	Roswell, N.Mex.	910
KBIS	Bakersfield, Calif.	970
KBIX	Muskogee, Okla.	1490
KBIZ	Ottumwa, Iowa	1240
KBJT	Fordyce, Ark.	1570
KBKC	Mission, Kans.	1480
KBKR	Baker, Oreg.	1490
KBKW	Aberdeen, Wash.	1450
KBLA	Burbank, Calif.	1490
KBLF	Red Bluff, Calif.	1490
KBLI	Blackfoot, Idaho	690
KBLO	Hot Springs, Ark.	1470
KBLR	Goodland, Kans.	730
KBLT	Big Lake, Tex.	1290
KBMI	Henderson, Nev.	1400
KBMN	Bozeman, Mont.	1230
KBMO	Benson, Minn.	1290
KBMW	Breckinrdg., Minn.	1450
KBMX	Coalinga, Calif.	1470
KBMY	Billings, Mont.	1240
KBND	Bend, Oreg.	1110
KBNZ	LaJunta, Colo.	1400
KBOA	Kennett, Mo.	830
KBOE	Oskaloosa, Iowa	740
KBOI	Boise, Idaho	950
KBOK	Malvern, Ark.	1310
KBOL	Boulder, Colo.	1490
KBOM	Mandan, N.Dak.	1270
KBON	Omaha, Nebr.	1490
KBOP	Pleasanton, Tex.	1380
KBOR	Brownsville, Tex.	1600
KBOW	Butte, Mont.	1490
KBOY	Medford, Oreg.	730
KBOX	Dallas, Tex.	1480
KBPS	Portland, Oreg.	1450
KBRC	Mt. Vernon, Wash.	1430
KBRK	Brookings, S.Dak.	1430
KBRL	McCook, Nebr.	1300
KBRO	Bremerton, Wash.	1490
KBRS	Springdale, Ark.	1340
KBRV	Soda Sprgs., Ida.	540
KBRX	O'Neill, Nebr.	1350
KBRZ	Freeport, Texas	1460
KBSF	Springhill, La.	1460
KBST	Big Spring, Tex.	1490
KBTA	Batesville, Ark.	1340
KBTM	Jonesboro, Ark.	1230
KBTN	Neosho, Mo.	1420
KBTO	El Dorado, Kans.	1360
KBUC	Corona, Calif.	1370
KBUD	Athens, Tex.	1410
KBUH	Brigham City, Utah	800
KBUN	Bemidji, Minn.	1450
KBUR	Burlington, Iowa	1490
KBUS	Mexia, Tex.	1590
KBUY	Amarillo, Tex.	1010
KBUZ	Mesa, Ariz.	1310
KBVM	Lancaster, Calif.	1380
KBWD	Brownwood, Tex.	1380
KBYE	Okla. City, Okla.	890
KBYG	Big Spring, Tex.	1400
KBYP	Shamrock, Tex.	1580
KBYR	Anchorage, Alaska	1270
KBZY	Salem, Oreg.	1490
KCAL	Redlands, Calif.	1410
KCAP	Helena, Mont.	1340
KCAR	Clarksville, Tex.	1350
KCBC	Des Moines, Iowa	1390
KCBD	Lubbock, Tex.	1590
KCBQ	San Diego, Calif.	1170
KCBS	San Fran., Calif.	740
KCCB	Corning, Ark.	1260
KCCL	Paris, Ark.	1460
KCCO	Lawton, Okla.	1050
KCCR	Pierre, S.Dak.	1590
KCCT	Corpus Christi, Tex.	1150
KCEE	Tucson, Ariz.	790
KCFA	Spokane, Wash.	1330
KCFH	Cuero, Tex.	1600
KCHA	Charles City, Iowa	1580
KCHE	Cherokee, Iowa	1440
KCHI	Chillicothe, Mo.	1010
KCHJ	Delano, Calif.	1010
KCHR	Charleston, Mo.	1350
KCHS	Truth or Consequences, New Mexico	1400
KCHV	Coachella, Calif.	970
KCHY	Cheyenne, Wyo.	1590
KCID	Caldwell, Idaho	1490
KCIJ	Shreveport, La.	1050
KCIL	Houma, La.	1490
KCIM	Carroll, Iowa	1380
KCJB	Minot, N.Dak.	910
KCKC	San Bernardino, Cal.	1350
KCKN	Kansas City, Kans.	1340
KCKY	Coolidge, Ariz.	1150
KCLA	Pine Bluff, Ark.	1400
KCLE	Cleburne, Tex.	1120
KCLF	Clifton, Ariz.	1400
KCLN	Clinton, Iowa	1390
KCLO	Leavenworth, Kans.	1410
KCLP	Rayville, La.	990
KCLS	Flagstaff, Ariz.	600
KCLV	Clovis, N.Mex.	1240
KCLW	Hamilton, Tex.	900
KVLX	Colfax, Wash.	1450
KCMC	Texarkana, Tex.	1230
KCMJ	Palm Sprgs., Calif.	1010
KCMO	Kansas City, Mo.	810
KCMR	McCamey, Tex.	1450
KCMS	Manitou Sprgs., Colo.	1490
KCNI	Broken Bow, Nebr.	1280
KCNO	Alturas, Calif.	570
KCNY	San Marcos, Tex.	1470
KCOB	Newton, Iowa	1280
KCOG	Centerville, Iowa	1400
KCOH	Houston, Tex.	1430
KCOK	Tulare, Calif.	1270
KCOL	Ft. Collins, Colo.	1410
KCON	Conway, Ark.	1230
KCOR	San Antonio, Tex.	1350
KCOW	Alliance, Nebr.	1400
KCOY	Santa Maria, Calif.	1400
KCRA	Sacramento, Calif.	1320
KCRB	Chanute, Kans.	1460
KCRC	Enid, Okla.	1390
KCRG	Cedar Rapids, Iowa	1600
KCRN	Crane, Tex.	1380
KCRS	Midland, Tex.	550
KCRT	Trinidad, Colo.	1240
KCRV	Caruthersville, Mo.	1370
KCSJ	Pueblo, Colo.	590
KCSR	Chadron, Nebr.	1450
KCTA	Corpus Christi, Tex.	1030
KCTI	Gonzales, Tex.	1450
KCTX	Childress, Tex.	1510
KCUB	Tucson, Ariz.	1290
KCUE	Red Wing, Minn.	1250
KCUL	Fort Worth, Tex.	1540
KCVL	Colville, Wash.	1270
KCVR	Lodi, Calif.	1570
KCYL	Lampasas, Tex.	1450
KDAC	Ft. Bragg, Calif.	1230
KDAL	Duluth, Minn.	610
KDAN	Eureka, Calif.	790
KDAV	Lubbock, Tex.	580
KDAY	Santa Monica, Calif.	1580
KDB	Santa Barbara, Calif.	1490
KDBC	Mansfield, La.	1360
KDBM	Dillon, Mont.	800
KDBS	Alexandria, La.	1410
KDDD	Dumas, Tex.	800
KDEC	Decorah, Iowa	1240
KDEF	Albuquerque, N.Mex.	1150
KDEN	Denver, Colo.	1340
KDEO	El Cajon, Calif.	910
KDES	Palm Sprgs., Calif.	920
KDET	Center, Tex.	930
KDEX	Dexter, Mo.	1590
KDGO	Durango, Colo.	1240
KDHL	Faribault, Minn.	920
KDIA	Oakland, Calif.	1310
KDIO	Ortonville, Minn.	1350
KDIX	Dickinson, N.Dak.	1230
KDJI	Holbrook, Ariz.	1270
KDKA	Pittsburgh, Pa.	1020
KDKD	Clinton, Mo.	1280
KDLA	DeRidder, La.	1010
KDLK	Del Rio, Tex.	1230
KDLM	Detroit Lakes, Minn.	1340
KDLR	Devils Lake, N.Dak.	1240
KDMA	Montevideo, Minn.	1450
KDMO	Carthage, Mo.	1490
KDMS	El Dorado, Ark.	1290
KDNT	Denton, Tex.	1440
KDOK	Tyler, Tex.	1330
KDOM	Windom, Minn.	1580
KDON	Salinas, Calif.	1460
KDOT	Reno, Nev.	1230
KDOV	Medford, Oreg.	1300
KDQN	DeQueen, Ark.	1390
KDRO	Sedalia, Mo.	1490
KDRS	Paragould, Ark.	1490
KDSJ	Deadwood, S.Dak.	980
KDSN	Denison, Iowa	1580
KDSX	Denison, Tex.	950
KDTA	Delta, Colo.	1400
KDTH	Dubuque, Iowa	1370
KDUB	Lubbock, Tex.	1340
KDUZ	Hutchinson, Minn.	1260
KDWB	St. Paul, Minn.	630
KDWT	Stamford, Tex.	1400
KDXE	No. Little Rock, Ark.	1380
KDXU	St. George, Utah	1450
KDYL	Salt Lake City, Utah	1320
KDZA	Pueblo, Colo.	1230
KEAN	Brownwood, Tex.	1240
KEAP	Fresno, Calif.	980
KEBE	Jacksonville, Tex.	1400
KECK	Odessa, Tex.	920
KEDO	Longview, Wash.	1400
KEED	Springfield, Oreg.	1050
KEEE	Nacogdoches, Tex.	1230
KEEL	Shreveport, La.	710
KEEN	San Jose, Calif.	1370
KEEP	Twin Falls, Idaho	1450
KELA	Centralia, Wash.	1470
KELD	El Dorado, Ark.	1400
KELK	Elko, Nev.	1240
KELO	Sioux Falls, S.Dak.	1320
KELP	El Paso, Tex.	920
KENA	Mena, Ark.	1450
KENE	Toppenish, Wash.	1490
KENI	Anchorage, Alaska	550
KENL	Arcata, Calif.	1340
KENM	Portales, N.Mex.	1450
KENN	Farmington, N.M.	1390
KENO	Las Vegas, Nev.	1460
KENS	San Antonio, Tex.	680
KENT	Shreveport, La.	1550
KENY	Bellingham, Wash.	930
KEOK	Payette, Idaho	1450
KEOS	Flagstaff, Ariz.	1290
KEPR	Kennewick, Wash.	610
KEPS	Eagle Pass, Tex.	1270
KERB	Kermit, Tex.	600
KERC	Eastland, Tex.	1590
KERG	Eugene, Oreg.	1280
KERN	Bakersfield, Calif.	1410
KERV	Kerrville, Tex.	1230
KETX	Livingston, Tex.	1440
KEUN	Eunice, La.	1490
KEVE	Minneapolis, Minn.	1440
KEVL	White Castle, La.	1590
KEVT	Tucson, Ariz.	690
KEWB	Oakland, Calif.	910
KEX	Portland, Oreg.	1190
KEXO	Grand Junc., Colo.	1230
KEYD	Oakes, N.Dak.	1220
KEYE	Perryton, Tex.	1400
KEZU	Rapid City, S.Dak.	920
KEYJ	Jamestown, N.Dak.	1400
KEYS	Corpus Christi, Tex.	1440
KEYY	Provo, Utah	1450
KEYZ	Williston, N.Dak.	1360
KFAB	Omaha, Nebr.	1110
KFAC	Los Angeles, Calif.	1330
KFAL	Fulton, Mo.	900
KFAM	St. Cloud, Minn.	1450
KFAR	Fairbanks, Alaska	660
KFAY	Fayetteville, Ark.	1250
KFBB	Great Falls, Mont.	1310
KFBC	Cheyenne, Wyo.	1240
KFBI	Wichita, Kans.	1070
KFBK	Sacramento, Calif.	1530
KFDA	Amarillo, Tex.	1440
KFDF	Van Buren, Ark.	1580
KFDM	Beaumont, Tex.	560
KFDR	Grand Coulee, Wash.	1360
KFEL	Pueblo, Colo.	970
KFEQ	St. Joseph, Mo.	680
KFFA	Helena, Ark.	1360
KFGQ	Boone, Iowa	1260
KFH	Wichita, Kans.	1330
KFHA	Lakewood, Wash.	1480
KFI	Los Angeles, Calif.	640
KFIR	North Bend, Oreg.	1340
KFIV	Modesto, Calif.	1360
KFIZ	Fond du Lac, Wis.	1450
KFJB	Marshalltown, Iowa	1230
KFJI	Klamath Falls, Oreg.	1150
KFJM	Grand Forks, N.Dak	1370
KFJZ	Ft. Worth, Tex.	1270
KFKA	Greeley, Colo.	1310
KFKF	Bellevue, Wash.	1330
KFKU	Lawrence, Kans.	1250
KFLD	Floydada, Tex.	900
KFLJ	Walsenburg, Colo.	1380
KFLW	Klamath Falls, Oreg.	1450
KFLY	Corvallis, Oreg.	1240
KFMA	Davenport, Iowa	1580
KFMB	San Diego, Calif.	540
KFMJ	Tulsa, Okla.	1050
KFML	Denver, Colo.	1390
KFMO	Flat River, Mo.	1240
KFNF	Shenandoah, Iowa	920
KFNV	Ferriday, La.	1600
KFNW	Fargo, N.Dak.	900
KFOR	Lincoln, Nebr.	1240
KFOX	Long Beach, Calif.	1280
KFPW	Ft. Smith, Ark.	1230
KFQD	Anchorage, Alaska	730
KFRB	Fairbanks, Alaska	900
KFRC	San Francisco, Calif.	610
KFRD	Rosenberg, Tex.	980
KFRE	Fresno, Calif.	940
KFRM	Kansas City, Mo.	550
KFRO	Longview, Tex.	1370
KFRU	Columbia, Mo.	1400
KFSA	Ft. Smith, Ark.	950
KFSB	Joplin, Mo.	1310
KFSC	Denver, Colo.	1220
KFSD	San Diego, Calif.	600
KFSG	Los Angeles, Calif.	1150
KFST	Ft. Stockton, Tex.	860
KFTM	Ft. Morgan, Colo.	1400
KFTV	Paris, Tex.	1250
KFUN	Las Vegas, N.Mex.	1230
KFUO	St. Louis, Mo.	850
KFVS	Cape Girardeau, Mo.	960
KFWB	Los Angeles, Calif.	980
KFXD	Nampa, Idaho	580
KFXM	San Bernardino, Calif.	590
KFYN	Bonham, Tex.	1420
KFYO	Lubbock, Tex.	790
KFYR	Bismarck, N.Dak.	550
KGA	Spokane, Wash.	1510
KGAF	Gainesville, Tex.	1580
KGAK	Gallup, N.Mex.	1330
KGAL	Lebanon, Oreg.	920
KGAN	Bastrop, La.	1340
KGAS	Carthage, Tex.	1590
KGAY	Salem, Oreg.	1430
KGB	San Diego, Calif.	1360
KGBC	Galveston, Tex.	1540
KGBT	Harlingen, Tex.	1530
KGBX	Springfield, Mo.	1260
KGCX	Sidney, Mont.	1480

C.L.	Location	Kc.
KGDN	Edmonds, Wash.	630
KGEE	Bakersfield, Calif.	1230
KGEK	Sterling, Colo.	1230
KGEM	Boise, Idaho	1140
KGEN	Tulare, Calif.	1370
KGER	Long Beach, Calif.	1390
KGEZ	Kalispell, Mont.	600
KGFF	Shawnee, Okla.	1450
KGFJ	Los Angeles, Calif.	1230
KGFL	Roswell, N.Mex.	1400
KGFW	Kearney, Nebr.	1340
KGFX	Pierre, S.Dak.	630
KGGF	Coffeyville, Kans.	690
KGGM	Albuquerque, N.Mex.	610
KGHF	Pueblo, Colo.	1350
KGHL	Billings, Mont.	790
KGHM	Brookfield, Mo.	1470
KGIL	San Fernando, Calif.	1260
KGIW	Alamosa, Colo.	1450
KGKB	Tyler, Tex.	1490
KGKL	San Angelo, Tex.	960
KGLC	Miami, Okla.	910
KGLN	Glenwood Sprgs., Colo.	980
KGLO	Mason City, Iowa	1300
KGLU	Safford, Ariz.	1480
KGMB	Honolulu, Hawaii	590
KGMC	Englewood, Colo.	1150
KGMO	Cape Girardeau, Mo.	1220
KGMS	Sacramento, Calif.	1380
KGNB	New Braunfels, Tex.	1420
KGNC	Amarillo, Tex.	710
KGNO	Dodge City, Kans.	1370
KGO	San Francisco, Calif.	810
KGON	Oregon City, Oreg.	1520
KGOS	Torrington, Wyo.	1490
KGPC	Grafton, N.Dak.	1340
KGRN	Grinnell, Iowa	1410
KGRO	Gresham, Oreg.	1230
KGRT	Las Cruces, N.Mex.	570
KGST	Fresno, Calif.	1600
KGU	Honolulu, Hawaii	760
KGVL	Greenville, Tex.	1400
KGVO	Missoula, Mont.	1290
KGVW	Belgrade, Mont.	630
KGW	Portland, Oreg.	620
KGWA	Enid, Okla.	960
KGY	Olympia, Wash.	1240
KGYN	Guymon, Okla.	1220
KHAM	Albuquerque, N.Mex.	1580
KHAS	Hastings, Nebr.	1230
KHAT	Phoenix, Ariz.	1480
KHBC	Hilo, Hawaii	970
KHBM	Monticello, Ark.	1430
KHBR	Hillsboro, Tex.	1560
KHEM	Big Springs, Tex.	1270
KHEN	Henryetta, Okla.	1590
KHEP	Phoenix, Ariz.	1280
KHEY	El Paso, Tex.	690
KHFH	Sierra Vista, Ariz.	1420
KHHH	Pampa, Tex.	1230
KHIL	Brighton-Fort Lupton, Colorado	800
KHIT	Walla Walla, Wash.	1320
KHJ	Los Angeles, Calif.	930
KHMO	Hannibal, Mo.	1070
KHOB	Hobbs, N.Mex.	1280
KHOG	Fayetteville, Ark.	1450
KHOT	Madera, Calif.	1250
KHOW	Denver, Colo.	630
KHOZ	Harrison, Ark.	900
KHQ	Spokane, Wash.	590
KHSJ	Hemet, Calif.	1320
KHSL	Chico, Calif.	1290
KHUB	Fremont, Nebr.	1340
KHUZ	Borger, Tex.	1490
KHVH	Honolulu, Hawaii	1040
KIBE	Palo Alto, Calif.	1220
KIBH	Seward, Alaska	1340
KIBL	Beeville, Tex.	1490
KIBS	Bishop, Calif.	1230
KICA	Clovis, N.Mex.	980
KICD	Spencer, Iowa	1240
KICK	Springfield, Mo.	1340
KICN	Denver, Colo.	710
KICO	Calexico, Calif.	1490
KID	Idaho Falls, Idaho	590
KIDD	Monterey, Calif.	630
KIDO	Boise, Idaho	630
KIEM	Eureka, Calif.	1480
KIEV	Glendale, Calif.	870
KIFI	Idaho Falls, Idaho	1260
KIFN	Phoenix, Ariz.	860
KIFW	Sitka, Alaska	1230
KIHN	Hugo, Okla.	1340
KIHO	Sioux Falls, S.Dak.	1270
KIHR	Hood River, Oreg.	1340
KIJV	Huron, S.Dak.	1340
KIKK	Bakersfield, Calif.	800
KIKI	Honolulu, Hawaii	830
KIKO	Miami, Ariz.	1340
KIKS	Sulphur, La.	1310
KILE	Galveston, Tex.	1400
KILO	Grand Forks, S.Dak.	1440
KILT	Houston, Tex.	610
KIMA	Yakima, Wash.	1460
KIMB	Kimball, Nebr.	1260
KIML	Gillette, Wyo.	1490
KIMO	Hilo, Hawaii	850
KIMN	Denver, Colo.	950
KIMP	Mt. Pleasant, Tex.	960
KIND	Independence, Kans.	1010
KINE	Kingsville, Tex.	1330
KING	Seattle, Wash.	1090
KINS	Eureka, Calif.	980
KINT	El Paso, Tex.	1590
KINY	Juneau, Alaska	800
KIOA	Des Moines, Iowa	940
KIOX	Bay City, Tex.	1270
KIPA	Hilo, Hawaii	1110
KIRO	Seattle, Wash.	710
KIRT	Mission, Tex.	1580
KIRX	Kirksville, Mo.	1450
KISD	Sioux Falls, S.Dak.	1230
KISN	Vancouver, Wash.	910
KIST	Santa Barbara, Calif.	1340
KIT	Yakima, Wash.	1280
KITI	Chehalis, Wash.	1420
KITN	Olympia, Wash.	920
KITO	San Bernardino, Calif.	1290
KIUL	Garden City, Kans.	1240
KIUN	Pecos, Tex.	1400
KIUP	Durango, Colo.	930
KIVY	Crockett, Tex.	1290
KIXL	Dallas, Tex.	1040
KIXX	Provo, Utah	1400
KIXZ	Amarillo, Tex.	940
KJAN	Atlantic, Iowa	1220
KJAT	Henderson, Tex.	1000
KJAX	Santa Rosa, Calif.	1150
KJAY	Topeka, Kans.	1440
KJBC	Midland, Tex.	1150
KJBS	San Francisco, Calif.	1100
KJCK	Junction City, Kans.	1420
KJEF	Jennings, La.	1290
KJET	Beaumont, Tex.	1380
KJFJ	Webster City, Iowa	1570
KJIM	Ft. Worth, Tex.	870
KJLT	North Platte, Nebr.	970
KJNO	Juneau, Alaska	630
KJOE	Shreveport, La.	1480
KJOY	Stockton, Calif.	1280
KJR	Seattle, Wash.	950
KJRG	Newton, Kans.	950
KJSK	Columbus, Nebr.	900
KKEY	Vancouver, Wash.	1150
KKID	Pendleton, Oreg.	1240
KKIS	Pittsburg, Calif.	990
KKOG	Ogden, Utah	730
KKSN	Grand Prairie, Tex.	730
KLAC	Los Angeles, Calif.	570
KLAD	Klamath Falls, Oreg.	960
KLAK	Lakewood, Colo.	1600
KLAM	Cordova, Alaska	1450
KLAS	Las Vegas, Nev.	1230
KLBM	La Grande, Oreg.	1450
KLBS	Livingston, Tex.	1220
KLCN	Blytheville, Ark.	910
KLCO	Poteau, Okla.	1280
KLEA	Lovington, N.Mex.	630
KLEE	Ottumwa, Iowa	1480
KLEM	LeMars, Iowa	1410
KLEN	Killeen, Tex.	1050
KLEO	Wichita, Kans.	1480
KLER	Orofino, Idaho	950
KLEX	Lexington, Mo.	1570
KLFD	Litchfield, Minn.	1410
KLFT	Golden Meadow, La.	1600
KLGA	Algona, Iowa	1600
KLGN	Logan, Utah	1390
KLGR	Redwood Falls, Minn.	1490
KLIC	Monroe, La.	1230
KLIF	Dallas, Tex.	1190
KLIK	Jefferson City, Mo.	950
KLIL	Estherville, Iowa	1340
KLIN	Lincoln, Nebr.	1400
KLIQ	Portland, Oreg.	1290
KLIR	Denver, Colo.	990
KLIX	Twin Falls, Idaho	1310
KLIZ	Brainerd, Minn.	1380
KLKC	Parsons, Kans.	1540
KLLA	Leesville, La.	1570
KLLL	Lubbock, Tex.	1460
KLMO	Longmont, Colo.	1050
KLMR	Lamar, Colo.	920
KLMS	Lincoln, Nebr.	1480
KLMX	Clayton, N.Mex.	1450
KLO	Ogden, Utah	1430
KLOG	Kelso, Wash.	1490
KLOH	Pipestone, Minn.	1050
KLOK	San Jose, Calif.	1170
KLOO	Corvallis, Oreg.	1340
KLOS	Albuquerque, N.Mex.	1450
KLOU	Lake Charles, La.	1580
KLOV	Loveland, Colo.	1570
KLPL	Lake Providence, La.	1050
KLPM	Minot, N.Dak.	1390
KLPR	Okla. City, Okla.	1140
KLPW	Union, Mo.	1220
KLRA	Little Rock, Ark.	1010
KLRS	Mountain Grove, Mo.	1360
KLTF	Little Falls, Minn.	960
KLTR	Blackwell, Okla.	1580
KLTZ	Glasgow, Mont.	1240
KLUB	Salt Lake City, Utah	570
KLUE	Longview, Tex.	1280
KLUK	Evanston, Wyo.	1240
KLUV	Haynesville, La.	1580
KLVC	Leadville, Colo.	1230
KLVI	Vivian, La.	1600
KLVL	Pasadena, Tex.	1480
KLVT	Levelland, Tex.	1230
KLWN	Lawrence, Kans.	1320
KLWT	Lebanon, Mo.	1230
KLYD	Bakersfield, Calif.	1350
KLYK	Spokane, Wash.	1230
KLYR	Clarksville, Ark.	1360
KLZ	Denver, Colo.	560
KMA	Shenandoah, Iowa	960
KMAC	San Antonio, Tex.	630
KMAE	McKinney, Tex.	1600
KMAK	Fresno, Calif.	1340
KMAM	Tularosa, N.Mex.	1590
KMAN	Manhattan, Kans.	1350
KMAP	Bakersfield, Calif.	1490
KMAQ	Maquoketa, Iowa	1320
KMAR	Winnsboro, La.	1570
KMBC	Kansas City, Mo.	980
KMBL	Junction, Tex.	1450
KMBY	Monterey, Calif.	1240
KMCD	Fairfield, Iowa	1570
KMCM	McMinnville, Oreg.	1260
KMCO	Conroe, Tex.	900
KMDO	Ft. Scott, Kans.	1600
KMED	Medford, Oreg.	1440
KMEL	Wenatchee, Wash.	1340
KMHL	Marshall, Minn.	1400
KMHT	Marshall, Tex.	1450
KMIL	Cameron, Tex.	1330
KMIN	Grants, N.M.	980
KMJ	Fresno, Calif.	580
KMLB	Monroe, La.	1440
KMLW	Marlin, Tex.	1010
KMMJ	Grand Island, Nebr.	750
KMMO	Marshall, Mo.	1300
KMNS	Sioux City, Iowa	620
KMO	Tacoma, Wash.	1360
KMON	Great Falls, Mont.	560
KMOP	Tucson, Ariz.	1330
KMOX	St. Louis, Mo.	1120
KMPC	Los Angeles, Calif.	710
KMRC	Morgan City, La.	1430
KMRS	Morris, Minn.	1570
KMUL	Muleshoe, Tex.	1380
KMUR	Murray, Utah	1230
KMUS	Muskogee, Okla.	1380
KMVI	Wailuku, T. H.	550
KMYC	Marysville, Calif.	1410
KNAF	Fredericksburg, Tex.	1340
KNAK	Salt Lake City, Utah	1280
KNAL	Victoria, Tex.	1410
KNBA	Vallejo, Calif.	1190
KNBC	San Francisco, Calif.	680
KNBX	Kirkland, Wash.	1050
KNBY	Newport, Ark.	1280
KNCK	Concordia, Kans.	1390
KNCM	Moberly, Mo.	1230
KNCO	Garden City, Kans.	1050
KNDC	Hettinger, N.Dak.	1490
KNDE	Aztec, N.Mex.	1340
KNDY	Marysville, Kans.	1570
KNEA	Jonesboro, Ark.	970
KNEB	Scottsbluff, Nebr.	960
KNED	McAlester, Okla.	1150
KNEL	Brady, Tex.	1490
KNEM	Nevada, Mo.	1240
KNET	Palestine, Tex.	1450
KNEU	Provo, Utah	1450
KNEW	Spokane, Wash.	790
KNEX	McPherson, Kans.	1540
KNEZ	Lompoc, Calif.	960
KNGS	Hanford, Calif.	620
KNIM	Maryville, Mo.	1580
KNIT	Abilene, Tex.	1280
KNOC	Natchitoches, La.	1450
KNOE	Monroe, La.	1390
KNOG	Nogales, Ariz.	1340
KNOK	Ft. Worth, Tex.	970
KNOR	Norman, Okla.	1400
KNOT	Prescott, Ariz.	1450
KNOW	Austin, Tex.	1490
KNOX	Grand Forks, N.Dak.	1310
KNPT	Newport, Ore.	1310
KNUJ	New Ulm, Minn.	860
KNUZ	Houston, Tex.	1230
KNWS	Waterloo, Iowa	1090
KNX	Los Angeles, Calif.	1070
KOA	Denver, Colo.	850
KOAC	Corvallis, Oreg.	550
KOAL	Price, Utah	1230
KOAM	Pittsburg, Kans.	860
KOB	Albuquerque, N.Mex.	1030
KOBE	Las Cruces, N.Mex.	1450
KOBY	San Francisco, Calif.	1550
KOCA	Kilgore, Tex.	1240
KOCY	Oklahoma City, Okla.	1340
KODE	Joplin, Mo.	1230
KODI	Cody, Wyo.	1400
KODL	The Dalles, Oreg.	1440
KODY	North Platte, Nebr.	1240
KOEL	Oelwein, Iowa	950
KOFA	Yuma, Ariz.	1240
KOFE	Pullman, Wash.	1150
KOFI	Kalispell, Mont.	930
KOFO	Ottawa, Kans.	1220
KOFY	San Mateo, Calif.	1050
KOGA	Ogallala, Nebr.	930
KOGT	Orange, Tex.	1600
KOH	Reno, Nev.	630
KOHU	Hermiston, Oreg.	1570
KOIL	Omaha, Nebr.	1290
KOIN	Portland, Oreg.	970
KOJM	Havre, Mont.	610
KOKA	Shreveport, La.	980
KOKE	Austin, Tex.	1370
KOKL	Okmulgee, Okla.	1240
KOKO	Warrensburg, Mo.	1450
KOKX	Keokuk, Iowa	1310
KOKY	Little Rock, Ark.	1440
KOL	Seattle, Wash.	1300
KOLD	Tucson, Ariz.	1450
KOLE	Port Arthur, Tex.	1340
KOLJ	Quanah, Tex.	1150
KOLL	Libby, Mont.	1230
KOLO	Reno, Nev.	920
KOLR	Sterling, Colo.	1490
KOLS	Pryor, Okla.	1570
KOLT	Scottsbluff, Nebr.	1320
KOLY	Mobridge, S.Dak.	1300
KOMA	Okla. City, Okla.	1520
KOMB	Cottage Grove, Oreg.	1400
KOME	Tulsa, Okla.	1300
KOMO	Seattle, Wash.	1000
KOMW	Omak, Wash.	680
KOMY	Watsonville, Calif.	1340
KONE	Reno, Nev.	1450
KONG	Visalia, Calif.	1400
KONI	Phoenix, Ariz.	1400
KONO	San Antonio, Tex.	860
KONP	Port Angeles, Wash.	1450
KOOK	Billings, Mont.	970
KOOL	Phoenix, Ariz.	960
KOOO	Omaha, Nebr.	1420
KOOS	Coos Bay, Oreg.	1230
KOPR	Butte, Mont.	550
KOPY	Alice, Tex.	1070
KORA	Bryan, Tex.	1240
KORC	Mineral Wells, Tex.	1140
KORD	Pasco, Wash.	910
KORE	Eugene, Oreg.	1450
KORK	Las Vegas, Nev.	1340
KORN	Mitchell, S.Dak.	1490
KORT	Grangeville, Idaho	1230
KOSA	Odessa, Tex.	1230
KOSE	Osceola, Ark.	860
KOSI	Aurora, Colo.	1430
KOSY	Texarkana, Ark.	790
KOTA	Rapid City, S.Dak.	1380
KOTE	Fergus Falls, Minn.	1250
KOTN	Pine Bluff, Ark.	1490
KOTS	Deming, N.M.	1230
KOVC	Valley City, N.Dak.	1490
KOVE	Lander, Wyo.	1330
KOVO	Provo, Utah	960
KOWB	Laramie, Wyo.	1340
KOWH	Omaha, Nebr.	660
KOWL	Lake Tahoe, Calif.	1490
KOWN	Escondido, Calif.	1450
KOXR	Oxnard, Calif.	910
KOY	Phoenix, Ariz.	550
KOYE	El Paso, Tex.	1150
KOYL	Odessa, Tex.	1310
KOYN	Billings, Mont.	910
KOZE	Lewiston, Idaho	1300
KOZI	Chelan, Wash.	1220
KOZY	Grand Rapids, Minn.	1490
KPAC	Port Arthur, Tex.	1250
KPAL	Palm Springs, Calif.	1450
KPAM	Portland, Oreg.	1410
KPAN	Hereford, Tex.	860
KPAP	Redding, Calif.	1270
KPAS	Banning, Calif.	1490
KPAY	Chico, Calif.	1060
KPBA	Pine Bluff, Ark.	1590
KPBM	Carlsbad, N.Mex.	740
KPCA	Marked Tree, Ark.	1580
KPDN	Pampa, Tex.	1340
KPDQ	Portland, Oreg.	800
KPEG	Spokane, Wash.	1380
KPEL	Lafayette, La.	1420
KPEP	San Angelo, Tex.	1420
KPER	Gilroy, Calif.	1290
KPET	Lamesa, Tex.	690
KPHO	Phoenix, Ariz.	910
KPIG	Cedar Rapids, Iowa	1450
KPIK	Colorado Sprgs., Colo.	1580
KPIN	Casa Grande, Ariz.	1260
KPKW	Pasco, Wash.	1340
KPLC	Lake Charles, La.	1470
KPLK	Dallas, Oreg.	1460
KPLY	Crescent City, Calif.	1240
KPMC	Bakersfield, Calif.	1560
KPNG	Port Neches, Tex.	1150
KPOA	Honolulu, T.H.	630
KPOC	Pocahontas, Ark.	1420
KPOF	Denver, Colo.	910
KPOI	Honolulu, Hawaii	1380
KPOJ	Portland, Oreg.	1330
KPOK	Scottsdale, Ariz.	1440
KPOL	Los Angeles, Calif.	1540
KPOP	Los Angeles, Calif.	1020
KPOR	Quincy, Wash.	1370
KPOW	Powell, Wyo.	1260
KPPC	Pasadena, Calif.	1240
KPQ	Wenatchee, Wash.	560
KPRB	Redmond, Oreg.	1240
KPRC	Houston, Tex.	950
KPRK	Livingston, Mont.	1340
KPRL	Paso Robles, Calif.	1230
KPRO	Riverside, Calif.	1440
KPRS	Kansas City, Mo.	1590
KPSO	Falfurrias, Tex.	1260
KPST	Preston, Idaho	1340
KPTL	Carson City, Nev.	1300
KPUG	Bellingham, Wash.	1170
KPVA	Camas, Wash.	1480
KQDE	Renton, Wash.	910
KQDI	Bismarck, N.D.	1350
KQDY	Minot, N.Dak.	1320
KQEO	Albuquerque, N.Mex.	920
KQIK	Lakeview, Oreg.	1230
KQTE	Missoula, Mont.	1340
KQTY	Everett, Wash.	1230
KQV	Pittsburgh, Pa.	1410
KRAC	Alamogordo, N.M.	1270
KRAI	Craig, Colo.	550
KRAK	Stockton, Calif.	1140
KRAL	Rawlins, Wyo.	1240
KRAM	Las Vegas, Nev.	920
KRAY	Amarillo, Tex.	1360
KRBA	Lufkin, Tex.	1340
KRBC	Abilene, Tex.	1470
KRBI	St. Peter, Minn.	1310
KRBO	Las Vegas, Nev.	1050
KRCK	Ridgecrest, Calif.	1360
KRCO	Prineville, Oreg.	690
KRCT	Baytown, Tex.	650
KRDG	Redding, Calif.	1230
KRDO	Colo. Springs, Colo.	1240
KRDU	Dinuba, Calif.	1240

C.L.	Location	Kc.
KRE	Berkeley, Calif.	1400
KREH	Oakdale, La.	900
KREI	Farmington, Mo.	800
KREM	Spokane, Wash.	970
KREO	Indio, Calif.	1400
KRES	St. Joseph, Mo.	1550
KREW	Sunnyside, Wash.	1230
KREX	Grand Junc., Colo.	920
KRFO	Owatonna, Minn.	1390
KRFS	Superior, Nebr.	1600
KRGI	Grand Island, Neb.	1430
KRGV	Weslasco, Tex.	1290
KRHD	Duncan, Okla.	1350
KRIB	Mason City, Iowa	1490
KRIC	Beaumont, Tex.	1450
KRIG	Odessa, Tex.	1410
KRIO	McAllen, Tex.	910
KRIZ	Phoenix, Ariz.	1230
KRKC	King City, Calif.	1570
KRKD	Los Angeles, Calif.	1150
KRKO	Everett, Wash.	1380
KRKS	Ridgecrest, Calif.	1240
KRLA	Pasadena, Calif.	1110
KRLC	Lewiston, Idaho	1350
KRLD	Dallas, Tex.	1080
KRLN	Canon City, Colo.	1400
KRLW	Walnut Ridge, Ark.	1320
KRMD	Shreveport, La.	1340
KRMG	Tulsa, Okla.	740
KRMO	Monett, Mo.	990
KRMS	Osage Beach, Mo.	1150
KRNO	San Bernardino, Calif.	1240
KRNR	Roseburg, Oreg.	1490
KRNS	Burns, Oreg.	1230
KRNT	Des Moines, Iowa	1350
KRNY	Kearney, Nebr.	1460
KROC	Rochester, Minn.	1340
KROD	El Paso, Tex.	600
KROF	Abbeville, La.	960
KROG	Sonora, Calif.	1450
KROP	Brawley, Calif.	1300
KROS	Clinton, Iowa	1340
KROX	Crookston, Minn.	1260
KROY	Sacramento, Calif.	1240
KRPL	Moscow, Idaho	1400
KRRV	Sherman, Tex.	910
KRSC	Othello, Wash.	1400
KRSD	Rapid City, S.Dak.	1340
KRSI	St. Louis Park, Minn.	950
KRSL	Russell, Kans.	990
KRSN	Los Alamos, N.Mex.	1490
KRTN	Raton, N.Mex.	1490
KRTR	Thermopolis, Wyo.	1490
KRUN	Ballinger, Tex.	1400
KRUS	Ruston, La.	1490
KRUX	Glendale, Ariz.	1360
KRVN	Lexington, Nebr.	1010
KRWC	Forest Grove, Oreg.	1570
KRXK	Rexburg, Idaho	1230
KRXL	Roseburg, Oreg.	1240
KRYS	Corpus Christi, Tex.	1360
KSAC	Manhattan, Kans.	580
KSAL	Salina, Kans.	1150
KSAM	Huntsville, Tex.	1490
KSAN	San Francisco, Calif.	1450
KSAY	San Francisco, Calif.	1010
KSBW	Salinas, Calif.	1380
KSCB	Liberal, Kans.	1270
KSCJ	Sioux City, Iowa	1360
KSCO	Santa Cruz, Calif.	1080
KSD	St. Louis, Mo.	550
KSDA	Redding, Calif.	1400
KSDN	Aberdeen, S.Dak.	930
KSDO	San Diego, Calif.	1130
KSEI	Pocatello, Idaho	930
KSEK	Pittsburg, Kans.	1340
KSEL	Lubbock, Tex.	950
KSEM	Moses Lake, Wash.	1470
KSEN	Shelby, Mont.	1150
KSEO	Durant, Okla.	750
KSET	El Paso, Tex.	1340
KSEW	Sitka, Alaska	1400
KSEY	Seymour, Tex.	1230
KSFA	Nacogdoches, Tex.	860
KSFE	Needles, Calif.	1340
KSFO	San Francisco, Calif.	560
KSGM	Ste. Genevieve, Mo.	980
KSIB	Creston, Iowa	1520
KSID	Sidney, Nebr.	1340
KSIG	Crowley, La.	1450
KSIJ	Gladewater, Tex.	1430
KSIL	Silver City, N.Mex.	1340
KSIM	Sikeston, Mo.	1400
KSIR	Wichita, Kans.	900
KSIS	Sedalia, Mo.	1050
KSIW	Woodward, Okla.	1450
KSIX	Corpus Christi, Tex.	1230
KSJB	Jamestown, N.Dak.	600
KSJO	San Jose, Calif.	1590
KSKY	Dallas, Tex.	660
KSL	Salt Lake City, Utah	1160
KSLM	Salem, Oreg.	1390
KSLO	Opelousas, La.	1230
KSLV	Monte Vista, Colo.	1240
KSMA	Santa Maria, Calif.	1240
KSML	Seminole, Tex.	1250
KSMN	Mason City, Iowa	1010
KSMO	Salem, Mo.	1340
KSNY	Snyder, Tex.	1450
KSO	Des Moines, Iowa	1460
KSOK	Arkansas City, Kans.	1280
KSON	San Diego, Calif.	1240
KSOO	Sioux Falls, S.Dak.	1140
KSOP	Salt Lake City, Utah	1370
KSOX	Raymondville, Tex.	1240
KSPA	Santa Paula, Calif.	1400
KSPI	Stillwater, Okla.	780
KSPL	Diboll, Tex.	1260
KSPT	Sandpoint, Idaho	1400
KSRA	Salmon, Idaho	960
KSRC	Socorro, N.Mex.	1290
KSRO	Santa Rosa, Calif.	1350
KSRV	Ontario, Oreg.	1380
KSSS	Colorado Springs, Colo.	740
KSST	Sulphur Springs, Tex.	1230
KSTA	Coleman, Tex.	1000
KSTB	Breckenridge, Tex.	1430
KSTL	St. Louis, Mo.	690
KSTN	Stockton, Calif.	1420
KSTP	St. Paul, Minn.	1500
KSTR	Grand Junction, Colo.	620
KSTT	Davenport, Iowa	1170
KSTV	Stephenville, Tex.	1510
KSUB	Cedar City, Utah	590
KSUE	Susanville, Calif.	1240
KSUM	Fairmont, Minn.	1370
KSUN	Bisbee, Ariz.	1230
KSVC	Richfield, Utah	980
KSVP	Artesia, N.Mex.	990
KSWA	Graham, Tex.	1330
KSWI	Council Bluffs, Iowa	1560
KSWO	Lawton, Okla.	1380
KSWS	Roswell, N.Mex.	1230
KSYC	Yreka, Calif.	1490
KSYD	Wichita Falls, Tex.	990
KSYL	Alexandria, La.	970
KTAC	Tacoma, Wash.	850
KTAE	Taylor, Tex.	1260
KTAN	Tucson, Ariz.	580
KTAR	Phoenix, Ariz.	620
KTAT	Frederick, Okla.	1570
KTBB	Tyler, Tex.	600
KTBC	Austin, Tex.	590
KTCB	Malden, Mo.	1470
KTCN	Berryville, Ark.	1480
KTCS	Fort Smith, Ark.	1410
KTEE	Carmel, Calif.	1410
KTEL	Walla Walla, Wash.	1490
KTEM	Temple, Tex.	1400
KTER	Terrell, Tex.	1570
KTFI	Twin Falls, Idaho	1270
KTFS	Texarkana, Tex.	1400
KTFY	Bronwfield, Tex.	1300
KTHE	Thermopolis, Wyo.	1240
KTHS	Little Rock, Ark.	1090
KTHT	Houston, Tex.	790
KTIB	Thibodaux, La.	630
KTIL	Tillamook, Oreg.	1590
KTIM	San Rafael, Calif.	1510
KTIP	Porterville, Calif.	1450
KTIS	Minneapolis, Minn.	900
KTIX	Seattle, Wash.	1590
KTJS	Hobart, Okla.	1420
KTKN	Ketchikan, Alaska	930
KTKR	Taft, Calif.	1310
KTKT	Tucson, Ariz.	990
KTLD	Tullulah, La.	1360
KTLN	Denver, Colo.	1280
KTLO	Mtn. Home, Ark.	1490
KTLQ	Tahlequah, Okla.	1350
KTLU	Rusk, Tex.	1580
KTLW	Texas City, Tex.	920
KTMC	McAlester, Okla.	1400
KTMS	Santa Barbara, Calif.	1250
KTNC	Falls City, Nebr.	1230
KTNM	Tucumcari, N.Mex.	1400
KTNT	Tacoma, Wash.	1400
KTOC	Jonesboro, La.	920
KTOD	Sinton, Tex.	1590
KTOE	Mankato, Minn.	1420
KTOH	Lihue, Hawaii	1490
KTOK	Oklahoma City, Okla.	1000
KTOO	Henderson, Nev.	1280
KTOP	Topeka, Kans.	1490
KTOW	Oklahoma City, Okla.	800
KTRB	Modesto, Calif.	860
KTRC	Santa Fe, N.Mex.	1400
KTRE	Lufkin, Tex.	1420
KTRF	Thief River Falls, Minn.	1230
KTRH	Houston, Tex.	740
KTRI	Sioux City, Iowa	1470
KTRM	Beaumont, Tex.	990
KTRN	Wichita Falls, Tex.	1290
KTRY	Bastrop, La.	730
KTSA	San Antonio, Tex.	550
KTSM	El Paso, Tex.	1380
KTTN	Trenton, Mo.	1600
KTTR	Rolla, Mo.	1490
KTTS	Springfield, Mo.	1400
KTUC	Tucson, Ariz.	1400
KTUE	Tulia, Tex.	1260
KTUL	Tulsa, Okla.	1430
KTUR	Turlock, Calif.	1390
KTUT	Tooele, Utah	990
KTW	Seattle, Wash.	1250
KTWO	Casper, Wyo.	1470
KTXJ	Jasper, Tex.	1350
KTXL	San Angelo, Tex.	1340
KTXO	Sherman, Tex.	1500
KTYM	Inglewood, Calif.	1460
KUBA	Yuba City, Calif.	1600
KUBC	Montrose, Colo.	580
KUBE	Pendleton, Oreg.	1050
KUBO	San Antonio, Tex.	1310
KUDE	Oceanside, Calif.	1320
KUDI	Great Falls, Mont.	1450
KUDL	Kansas City, Mo.	1380
KUDU	Ventura, Calif.	1590
KUDY	Littleton, Colo.	1510
KUEN	Wenatchee, Wash.	900
KUEQ	Phoenix, Ariz.	740
KUGN	Eugene, Oreg.	590
KUIK	Hillsboro, Oreg.	1360
KUJ	Walla Walla, Wash.	1420
KUKI	Ukiah, Calif.	1400
KUKO	Post, Tex.	1370
KUKU	Willow Springs, Mo.	1330
KULA	Honolulu, Hawaii	690
KULE	Ephrata, Wash.	730
KULP	El Campo, Tex.	1390
KUMA	Pendleton, Oreg.	1290
KUNO	Corpus Christi, Tex.	1400
KUOA	Siloam Springs, Ark.	1290
KUOM	Minneapolis, Minn.	770
KUPI	Idaho Falls, Idaho	980
KURA	Moab, Utah	1450
KURL	Billings, Mont.	730
KURV	Edinburg, Tex.	710
KURY	Brookings, Oreg.	910
KUSD	Vermillion, S.Dak.	690
KUSH	Cushing, Okla.	1600
KUSN	St. Joseph, Mo.	1270
KUTI	Yakima, Wash.	980
KUTY	Palmdale, Calif.	1470
KUVR	Holdredge, Nebr.	1380
KUZN	W. Monroe, La.	1310
KVCK	Wolf Point, Nebr.	1450
KVCL	Winnfield, La.	1270
KVCV	Redding, Calif.	600
KVEC	San Luis Obispo, Calif.	920
KVEL	Vernal, Utah	1250
KVEN	Ventura, Calif.	1450
KVET	Austin, Tex.	1300
KVFC	Cortez, Colo.	740
KVFD	Ft. Dodge, Iowa	1400
KVGB	Great Bend, Kans.	1590
KVHL	Homer, La.	1320
KVI	Seattle, Wash.	570
KVIC	Victoria, Tex.	1340
KVIM	New Iberia, La.	1360
KVIN	Vinita, Okla.	1470
KVIP	Redding, Calif.	540
KVKM	Monahans, Tex.	1340
KVLB	Cleveland, Tex.	1410
KVLC	Little Rock, Ark.	1050
KVLF	Alpine, Tex.	1240
KVLG	LaGrange, Tex.	1570
KVLH	Pauls Valley, Okla.	1470
KVLV	Fallon, Nev.	1250
KVMA	Magnolia, Ark.	630
KVMC	Colorado City, Tex.	1320
KVNA	Flagstaff, Ariz.	690
KVNC	Winslow, Ariz.	1010
KVNI	Coeur d'Alene, Idaho	1240
KVNU	Logan, Utah	610
KVOC	Casper, Wyo.	1230
KVOE	Emporia, Kans.	1400
KVOG	Ogden, Utah	1490
KVOL	Lafayette, La.	1330
KVOM	Morrilton, Ark.	800
KVON	Napa, Calif.	1440
KVOO	Tulsa, Okla.	1170
KVOP	Plainview, Tex.	1400
KVOR	Colo. Springs, Colo.	1300
KVOS	Bellingham, Wash.	790
KVOU	Uvalde, Tex.	1400
KVOW	Littlefield, Tex.	1490
KVOX	Moorhead, Minn.	1280
KVOY	Yuma, Ariz.	1400
KVOZ	Laredo, Tex.	1490
KVPI	Ville Platte, La.	1050
KVRC	Arkadelphia, Ark.	1240
KVRH	Salida, Colo.	1340
KVRS	Rock Springs, Wyo.	1360
KVSA	McGehee, Ark.	1220
KVSF	Santa Fe, N.Mex.	1260
KVSO	Ardmore, Okla.	1240
KVWC	Vernon, Tex.	1490
KVWM	Show Low, Ariz.	1050
KVWO	Cheyenne, Wyo.	1370
KWAD	Wadena, Minn.	920
KWAK	Stuttgart, Ark.	1240
KWAL	Wallace, Idaho	620
KWAM	Memphis, Tenn.	990
KWAT	Watertown, S.Dak.	950
KWBA	Baytown, Tex.	1360
KWBB	Wichita, Kans.	1410
KWBE	Beatrice, Nebr.	1450
KWBG	Boone, Iowa	1590
KWBW	Hutchinson, Kans.	1450
KWCB	Searcy, Ark.	1300
KWCL	Oak Grove, La.	1280
KWCO	Chickasha, Okla.	1560
KWEB	Rochester, Minn.	1270
KWED	Seguin, Tex.	1580
KWEI	Weiser, Idaho	1260
KWEL	Midland, Tex.	1600
KWEW	Hobbs, N.Mex.	1480
KWFR	San Angelo, Tex.	1260
KWFT	Wichita Falls, Tex.	620
KWG	Stockton, Calif.	1230
KWHI	Brenham, Tex.	1280
KWHK	Hutchinson, Kans.	1260
KWHN	Fort Smith, Ark.	1320
KWHO	Salt Lake City, Utah	860
KWHW	Altus, Okla.	1450
KWIC	Salt Lake City, Utah	1570
KWIK	Pocatello, Idaho	1240
KWIL	Albany, Oreg.	790
KWIN	Ashland, Oreg.	1400
KWIV	Douglas, Wyo.	1050
KWIZ	Santa Ana, Calif.	1480
KWJB	Globe, Ariz.	1240
KWJC	Natchitoches, La.	1450
KWJJ	Portland, Oreg.	1080
KWIP	Merced, Calif.	1580
KWIQ	Moses Lake, Wash.	1260
KWK	St. Louis, Mo.	1380
KWKC	Abilene, Tex.	1340
KWKH	Shreveport, La.	1130
KWKW	Pasadena, Calif.	1300
KWKY	Des Moines, Iowa	1150
KWLC	Decorah, Iowa	1240
KWLM	Willmar, Minn.	1340
KWMT	Ft. Dodge, Iowa	540
KWNA	Winnemucca, Nev.	1400
KWNO	Winona, Minn.	1230
KWOA	Worthington, Minn.	730
KWOC	Poplar Bluff, Mo.	930
KWOE	Clinton, Okla.	1320
KWON	Bartlesville, Okla.	1400
KWOR	Worland, Wyo.	1340
KWOS	Jefferson City, Mo.	1240
KWOW	Pomona, Calif.	1600
KWPC	Muscatine, Iowa	860
KWPM	West Plains, Mo.	1450
KWPR	Claremore, Okla.	1270
KWRD	Henderson, Tex.	1470
KWRE	Warrenton, Mo.	730
KWRF	Warren, Ark.	860
KWRL	Riverton, Wyo.	1450
KWRO	Coquille, Oreg.	1450
KWRT	Boonville, Mo.	1370
KWRW	Guthrie, Okla.	1490
KWSC	Pullman, Wash.	1250
KWSD	Mt. Shasta, Calif.	620
KWSH	Wewoka-Seminole, Oklahoma	1260
KWSK	Pratt, Kans.	1570
KWSO	Wasco, Calif.	1050
KWTC	Barstow, Calif.	1230
KWTO	Springfield, Mo.	560
KWTX	Waco, Tex.	1230
KWVY	Waverly, Iowa	1470
KWWL	Waterloo, Iowa	1330
KWYK	Farmington, N.Mex.	960
KWYN	Wynne, Ark.	1400
KWYO	Sheridan, Wyo.	1410
KWYR	Winner, S.Dak.	1260
KXA	Seattle, Wash.	770
KXAR	Hope, Ark.	1490
KXEL	Waterloo, Iowa	1540
KXEN	Festus, Mo.	1010
KXEO	Mexico, Mo.	1340
KXGI	Ft. Madison, Iowa	1360
KXGN	Glendive, Mont.	1400
KXGO	Fargo, N.D.	790
KXIC	Iowa City, Iowa	800
KXIT	Dalhart, Tex.	1410
KXJK	Forrest City, Ark.	950
KXL	Portland, Oreg.	750
KXLE	Ellensburg, Wash.	1240
KXLF	Butte, Mont.	1370
KXLJ	Helena, Mont.	1240
KXLK	Great Falls, Mont.	1400
KXLL	Missoula, Mont.	1450
KXLO	Lewiston, Mont.	1230
KXLR	No. Little Rock, Ark.	1150
KXLW	Clayton, Mo.	1320
KXLY	Spokane, Wash.	920
KXO	El Centro, Calif.	1230
KXOA	Sacramento, Calif.	1470
KXOK	St. Louis, Mo.	630
KXOL	Ft. Worth, Tex.	1360
KXOX	Sweetwater, Tex.	1240
KXRA	Alexandria, Minn.	1490
KXRJ	Russellville, Ark.	1490
KXRO	Aberdeen, Wash.	1320
KXRX	San Jose, Calif.	1500
KXXI	Golden, Colo.	1250
KXXL	Bozeman, Mont.	1450
KXXX	Colby, Kans.	790
KXYZ	Houston, Tex.	1320
KYA	San Francisco, Calif.	1260
KYCA	Prescott, Ariz.	1490
KYJC	Medford, Oreg.	1230
KYME	Boise, Idaho	740
KYNO	Fresno, Calif.	1300
KYNG	Coos Bay, Oreg.	1420
KYNT	Yankton, S.Dak.	1450
KYOK	Houston, Tex.	1590
KYOR	Blythe, Calif.	1450
KYOS	Merced, Calif.	1480
KYOU	Greeley, Colo.	1450
KYRO	Potosi, Mo.	1280
KYSM	Mankato, Minn.	1230
KYSN	Colorado Sprgs., Colo.	1460
KYSS	Missoula, Mont.	910
KYTE	Pocatello, Idaho	1290
KYUM	Yuma, Ariz.	560
KYVA	Gallup, N.Mex.	1230
KYW	Cleveland, Ohio	1100
KZEE	Weatherford, Tex.	1220
KZEY	Tyler, Tex.	690
KZIN	Coeur d'Alene, Idaho	1050
KZIP	Amarillo, Tex.	1310
KZOK	Prescott, Ariz.	1340
KZOL	Muleshoe, Tex.	1570
KZUM	Farmington, N.Mex.	1280
KZUN	Opportunity, Wash.	630
WAAA	Winston-Salem, N.C.	980
WAAB	Worcester, Mass.	1440
WAAF	Chicago, Ill.	950
WAAG	Adel, Ga.	1470
WAAT	Trenton, N.J.	1300
WAAY	Huntsville, Ala.	1550
WABA	Aguadilla, P.Rico	850
WABB	Mobile, Ala.	1480
WABC	New York, N.Y.	770
WABG	Greenwood, Miss.	960
WABI	Bangor, Maine	910
WABJ	Adrian, Mich.	1490
WABL	Amite, La.	1570
WABO	Waynesboro, Miss.	990
WABQ	Cleveland, Ohio	1540
WABR	Winter Park, Fla.	1440
WABT	Tuskegee, Ala.	580

C.L.	Location	Kc.
WABV	Abbeville, S.C.	1590
WABW	Annapolis, Md.	810
WABY	Albany, N.Y.	1400
WABZ	Albemarle, N.C.	1010
WACA	Camden, S.C.	1590
WACB	Kittanning, Pa.	1380
WACE	Chicopee, Mass.	730
WACK	Newark, N.Y.	1420
WACL	Waycross, Ga.	570
WACO	Waco, Tex.	1460
WACR	Columbus, Miss.	1050
WACT	Tuscaloosa, Ala.	1420
WADA	Shelby, N.C.	1390
WADC	Akron, Ohio	1350
WADE	Wadesboro, N.C.	1210
WADK	Newport, R.I.	1540
WADO	New York, N.Y.	1280
WADP	Kane, Pa.	960
WADS	Ansonia, Conn.	690
WAEB	Allentown, Pa.	790
WAEL	Mayaguez, P.Rico	600
WAEW	Crossville, Tenn.	1330
WAFC	Staunton, Va.	900
WAGC	Chattanooga, Tenn.	1450
WAGE	Leesburg, Va.	1290
WAGF	Dothan, Ala.	1320
WAGG	Franklin, Tenn.	950
WAGM	Presque Isle, Maine	1450
WAGN	Menominee, Mich.	1340
WAGR	Lumberton, N.C.	580
WAGS	Bishopville, S.C.	1380
WAGY	Forest City, N.C.	1320
WAIK	Galesburg, Ill.	1590
WAIL	Baton Rouge, La.	1460
WAIM	Anderson, S.C.	1230
WAIN	Columbia, Ky.	1270
WAIP	Prichard, Ala.	1270
WAIR	Winston-Salem, N.C.	1340
WAIT	Chicago, Ill.	820
WAJF	Decatur, Ala.	1490
WAJR	Morgantown, W.Va.	1440
WAKE	Atlanta, Ga.	1340
WAKN	Aiken, S.C.	990
WAKO	Lawrenceville, Ill.	910
WAKR	Akron, Ohio	1590
WAKU	Latrobe, Pa.	1570
WAKY	Louisville, Ky.	790
WALA	Mobile, Ala.	1410
WALB	Albany, Ga.	1590
WALD	Walterboro, S.C.	1220
WALE	Fall River, Mass.	1400
WALK	Patchogue, N.Y.	1370
WALL	Middletown, N.Y.	1340
WALM	Albion, Mich.	1260
WALO	Humacao, P.R.	1240
WALT	Tampa, Fla.	1110
WALY	Herkimer, N.Y.	1420
WAMD	Aberdeen, Md.	970
WAME	Miami, Fla.	1260
WAMI	Opp, Ala.	860
WAML	Laurel, Miss.	1340
WAMM	Flint, Mich.	1420
WAMO	Homestead, Pa.	860
WAMP	Pittsburgh, Pa.	1320
WAMS	Wilmington, Del.	1380
WAMV	E. St. Louis, Ill.	1490
WAMW	Washington, Ind.	1580
WAMY	Amory, Miss.	1580
WANA	Anniston, Ala.	1490
WANB	Waynesburg, Pa.	1580
WAND	Canton, Ohio	900
WANE	Ft. Wayne, Ind.	1450
WANN	Annapolis, Md.	1190
WANS	Anderson, S.C.	1280
WANT	Richmond, Va.	990
WANY	Albany, Ky.	1390
WAOK	Atlanta, Ga.	1380
WAOV	Vincennes, Ind.	1450
WAPA	San Juan, P.R.	680
WAPE	Jacksonville, Fla.	690
WAPF	McComb, Miss.	980
WAPG	Arcadia, Fla.	1480
WAPI	Birmingham, Ala.	1070
WAPL	Appleton, Wis.	1570
WAPO	Chattanooga, Tenn.	1150
WAPX	Montgomery, Ala.	1600
WAQE	Towson, Md.	1570
WARA	Attleboro, Mass.	1320
WARB	Covington, La.	730
WARD	Johnstown, Pa.	1490
WARE	Ware, Mass.	1250
WARF	Jasper, Ala.	1240
WARK	Hagerstown, Md.	1490
WARL	Arlington, Va.	780
WARM	Scranton, Pa.	590
WARN	Ft. Pierce, Fla.	1330
WARU	Peru, Ind.	1600
WASA	Havre de Grace, Md.	1330
WASK	Lafayette, Ind.	1450
WATA	Boone, N.C.	1450
WATC	Gaylord, Mich.	900
WATE	Knoxville, Tenn.	620
WATH	Athens, Ohio	970
WATK	Antigo, Wis.	900
WATM	Atmore, Ala.	1590
WATN	Watertown, N.Y.	1240
WATO	Oak Ridge, Tenn.	1290
WATP	Marion, S.C.	1430
WATR	Waterbury, Conn.	1320
WATS	Sayre, Pa.	960
WATT	Cadillac, Mich.	1240
WATV	Birmingham, Ala.	900
WATW	Ashland, Wis.	1400
WATZ	Alpena, Mich.	1450
WAUC	Wauchula, Fla.	1310
WAUD	Auburn, Ala.	1230
WAUG	Augusta, Ga.	1050
WAUX	Waukesha, Wis.	1510
WAVE	Louisville, Ky.	970
WAVI	Dayton, Ohio	1210
WAVL	Apollo, Pa.	910
WAVN	Stillwater, Minn.	1220
WAVO	Avondale Estates, Ga.	1420
WAVP	Avon Park, Fla.	1390
WAVU	Albertville, Ala.	630
WAVY	Portsmouth, Va.	1350
WAVZ	New Haven, Conn.	1300
WAWK	Kendallville, Ind.	1570
WAWZ	Zarephath, N.J.	1380
WAXE	Vero Beach, Fla.	1370
WAXX	Chippewa Falls, Wis.	1150
WAYB	Waynesboro, Va.	1490
WAYE	Dundalk, Md.	860
WAYN	Rockingham, N.C.	900
WAYS	Charlotte, N.C.	610
WAYX	Waycross, Ga.	1230
WAYZ	Waynesboro, Pa.	1380
WAZA	Bainbridge, Ga.	1360
WAZF	Yazoo City, Miss.	1230
WAZL	Hazelton, Pa.	1490
WBAA	West Lafayette, Ind.	920
WBAB	Babylon, N.Y.	1440
WBAC	Cleveland, Tenn.	1340
WBAL	Baltimore, Md.	1090
WBAM	Montgomery, Ala.	740
WBAP	Ft. Worth, Tex.	570, 820
WBAR	Bartow, Fla.	1460
WBAT	Marion, Ind.	1400
WBAX	Wilkes-Barre, Pa.	1240
WBAW	Barnwell, S.C.	740
WBAY	Green Bay, Wis.	1360
WBBA	Pittsfield, Ill.	1580
WBBB	Burlington, N.C,	920
WBBF	Rochester, N.Y.	950
WBBI	Abingdon, Va.	1230
WBBL	Richmond, Va.	1480
WBBM	Chicago, Ill.	780
WBBN	Perry, Ga.	980
WBBO	Forest City, N.C.	780
WBBQ	Augusta, Ga.	1340
WBBT	Lyons, Ga.	1340
WBBW	Youngstown, Ohio	1240
WBBZ	Ponca City, Okla.	1230
WBCA	Bay Minette, Ala.	1150
WBCB	Levittown, Pa.	1490
WBCH	Hastings, Mich.	1220
WBCK	Battle Creek, Mich.	930
WBCM	Bay City, Mich.	1440
WBCR	Christiansburg, Va.	1260
WBCU	Union, S.C.	1460
WBEC	Pittsfield, Mass.	1420
WBEE	Harvey, Ill.	1570
WBEJ	Elizabethton, Tenn.	1240
WBEL	Beloit, Wis.	1380
WBEN	Buffalo, N.Y.	930
WBET	Brockton, Mass.	1460
WBEU	Beaufort, S.C.	960
WBEV	Beaver Dam, Wis.	1430
WBEX	Chillicothe, Ohio	1490
WBFD	Bedford, Pa.	1310
WBGC	Chipley, Fla.	1240
WBGR	Jesup, Ga.	1370
WBHB	Fitzgerald, Ga.	1240
WBHC	Hampton, S.C.	1270
WBHF	Cartersville, Ga.	1450
WBHP	Huntsville, Ala.	1230
WBIA	Augusta, Ga.	1230
WBIE	Marietta, Ga.	1050
WBIG	Greensboro, N.C.	1470
WBIL	Leesburg, Fla.	1410
WBIP	Booneville, Miss.	1400
WBIR	Knoxville, Tenn.	1240
WBIS	Bristol, Conn.	1440
WBIW	Bedford, Ind.	1340
WBIZ	Eau Claire, Wis.	1400
WBKH	Hattiesburg, Miss.	950
WBKN	Newton, Miss.	1410
WBKV	West Bend, Wis.	1470
WBLA	Elizabethtown, N.C.	1450
WBLE	Batesville, Miss.	1290
WBLF	Bellefonte, Pa.	1330
WBLG	Lexington, Ky.	1300
WBLJ	Dalton, Ga.	1230
WBLO	Evergreen, Ala.	1470
WBLR	Batesburg, S.C.	1430
WBLT	Bedford, Va.	1350
WBLU	Salem, Va.	1480
WBLY	Springfield, Ohio	1600
WBMA	Beaufort, N.C.	1400
WBMC	McMinnville, Tenn.	960
WBMD	Baltimore, Md.	750
WBMK	West Point, Ga.	1310
WBML	Macon, Ga.	1240
WBNC	Conway, N.H.	1050
WBNL	Boonville, Ind.	1540
WBNS	Columbus, Ohio	1460
WBNT	Oneida, Tenn.	1310
WBNX	New York, N.Y.	1380
WBNY	Buffalo, N.Y.	1400
WBOB	Galax, Va.	1360
WBOC	Salisbury, Md.	960
WBOF	Virginia Beach, Va.	1600
WBOK	New Orleans, La.	800
WBOP	Pensacola, Fla.	980
WBOS	Brookline, Mass.	1600
WBOW	Terre Haute, Ind.	1230
WBOX	Bogalusa, La.	920
WBOY	Clarksburg, W.Va.	1400
WBPD	Orangeburg, S.C.	1580
WBPZ	Lock Haven, Pa.	1230
WBRB	Mt. Clemens, Mich.	1430
WBRC	Birmingham, Ala.	960
WBRD	Bradenton, Fla.	1420
WBRE	Wilkes-Barre, Pa.	1340
WBRG	Lynchburg, Va.	1050
WBRK	Pittsfield, Mass.	1340
WBRM	Marion, N.C.	1250
WBRN	Big Rapids, Mich.	1460
WBRO	Waynesboro, Ga.	1310
WBRT	Bardstown, Ky.	1320
WBRV	Boonville, N.Y.	900
WBRX	Berwick, Pa.	1280
WBRY	Waterbury, Conn.	1590
WBSC	Bennetsville, S.C.	1550
WBSM	New Bedford, Mass.	1420
WBSR	Pensacola, Fla.	1450
WBT	Charlotte, N.C.	1110
WBTA	Batavia, N.Y.	1490
WBTH	Williamson, W.Va.	1400
WBTL	Farmville, N.C.	1050
WBTM	Danville, Va.	1330
WBTN	Bennington, Vt.	1370
WBTO	Linton, Ind.	1600
WBUD	Trenton, N.J.	1260
WBUT	Butler, Pa.	1050
WBUX	Doylestown, Pa.	1570
WBUY	Lexington, N.C.	1440
WBUZ	Fredonia, N.Y.	1570
WBVL	Barboursville, Ky.	950
WBVP	Beaver Falls, Pa.	1230
WBYE	Calera, Ala.	1370
WBYS	Canton, Ill.	1560
WBZ	Boston, Mass.	1030
WBZA	Springfield, Mass.	1030
WBZY	Torrington, Conn.	990
WCAE	Pittsburgh, Pa.	1250
WCAL	Northfield, Minn.	770
WCAM	Camden, N.J.	1310
WCAO	Baltimore, Md.	600
WCAP	Lowell, Mass.	980
WCAR	Detroit, Mich.	1130
WCAS	Gadsden, Ala.	570
WCAT	Orange, Mass.	1390
WCAU	Philadelphia, Pa.	1210
WCAW	Charleston, W.Va.	1300
WCAX	Burlington, Vt.	620
WCAY	Cayce, S.C.	620
WCAZ	Carthage, Ill.	990
WCBA	Corning, N.Y.	1350
WCBC	Anderson, Ind.	1470
WCBG	Chambersburg, Pa.	1590
WCBI	Columbus, Miss.	550
WCBL	Benton, Ky.	1290
WCBM	Baltimore, Md.	680
WCBQ	Fremont, Mich.	1490
WCBS	New York, N.Y.	880
WCBT	Roanoke Rapids, N.C.	1230
WCBY	Cheboygan, Mich.	1240
WCCC	Hartford, Conn.	1290
WCCM	Lawrence, Mass.	800
WCCN	Neillsville, Wis.	1370
WCCO	Minneapolis, Minn.	830
WCCP	Savannah, Ga.	1450
WCDL	Carbondale, Pa.	1440
WCDJ	Edenton, N.C.	1260
WCDT	Winchester, Tenn.	1340
WCEC	Rocky Mount, N.C.	810
WCED	DuBois, Pa.	1420
WCEH	Hawkinsville, Ga.	610
WCEM	Cambridge, Md.	1240
WCEN	Mt. Pleasant, Mich.	1150
WCER	Charlotte, Mich.	1390
WCFL	Chicago, Ill.	1000
WCFR	Springfield, Vt.	1480
WCFV	Clifton Forge, Va.	1230
WCGA	Calhoun, Ga.	900
WCGC	Belmont, N.C.	1270
WCHA	Chambersburg, Pa.	800
WCHB	Inkster, Mich.	1440
WCHI	Chillicothe, Ohio	1350
WCHJ	Brookhaven, Miss.	1470
WCHK	Canton, Ga.	1290
WCHO	Washington Court House, Ohio	1250
WCHL	Chapel Hill, N.C.	1360
WCHN	Norwich, N.Y.	970
WCHS	Charleston, W.Va.	580
WCHV	Charlottesville, Va.	1260
WCIL	Carbondale, Ill.	1020
WCIN	Cincinnati, Ohio	1480
WCJU	Columbia, Miss.	1450
WCKB	Dunn, N.C.	780
WCKI	Greer, S.C.	1300
WCKR	Miami, Fla.	610
WCKY	Cincinnati, Ohio	1530
WCLA	Claxton, Ga.	1470
WCLB	Camilla, Ga.	1220
WCLC	Jamestown, Tenn.	1260
WCLD	Cleveland, Miss.	1490
WCLE	Cleveland, Tenn.	1570
WCLG	Morgantown, W.Va.	1300
WCLI	Corning, N.Y.	1450
WCLO	Janesville, Wis.	1230
WCLS	Columbus, Ga.	1580
WCLT	Newark, Ohio	1430
WCLW	Mansfield, Ohio	1570
WCMA	Corinth, Miss.	1230
WCMB	Harrisburg, Pa.	1460
WCMC	Wildwood, N.J.	1230
WCME	Brunswick, Maine	900
WCMI	Ashland, Ky.	1340
WCMN	Arecibo, P.R.	1280
WCMP	Pine City, Minn.	1350
WCMR	Elkhart, Ind.	1270
WCMS	Norfolk, Va.	1050
WCMT	Martin, Tenn.	1410
WCMW	Canton, Ohio	1060
WCMY	Ottawa, Ill.	1430
WCNB	Connersville, Ind.	1580
WCNC	Elizabeth City, N.C.	1240
WCNG	Canonsburg, Pa.	540
WCNH	Quincy, Fla.	1230
WCNL	Newport, N. H.	1010
WCNR	Bloomsburg, Pa.	930
WCNT	Centralia, Ill.	1210
WCNU	Crestview, Fla.	1010
WCNX	Middletown, Conn.	1150
WCOA	Pensacola, Fla.	1370
WCOC	Meridian, Miss.	910
WCOG	Greensboro, N.C.	1320
WCOH	Newnan, Ga.	1400
WCOJ	Coatesville, Pa.	1420
WCOL	Columbus, Ohio	1230
WCON	Cornelia, Ga.	1450
WCOP	Boston, Mass.	1150
WCOR	Lebanon, Tenn.	900
WCOS	Alma, Ga.	1400
WCOU	Lewiston, Maine	1240
WCOV	Montgomery, Ala.	1170
WCOW	Sparta, Wis.	1290
WCOY	Columbia, Pa.	1580
WCPA	Clearfield, Pa.	900
WCPC	Houston, Miss.	1320
WCPH	Etowah, Tenn.	1220
WCPK	College Park, Ga.	1570
WCPM	Cumberland, Ky.	1280
WCPO	Cincinnati, Ohio	1230
WCPS	Tarboro, N.C.	760
WCRA	Effingham, Ill.	1090
WCRB	Waltham, Mass.	1330
WCRE	Cheraw, S.C.	1420
WCRI	Scottsboro, Ala.	1050
WCRK	Morristown, Tenn.	1150
WCRL	Oneonta, Ala.	1570
WCRO	Johnstown, Pa.	1230
WCRR	Corinth, Miss.	1330
WCRS	Greenwood, S.C.	1450
WCRT	Birmingham, Ala.	1260
WCRV	Washington, N.J.	1580
WCRW	Chicago, Ill.	1240
WCRY	Macon, Ga.	900
WCSC	Charleston, S.C.	1390
WCSH	Portland, Maine	970
WCSI	Columbus, Ind.	1010
WCSR	Hillsdale, Mich.	1340
WCSS	Amsterdam, N.Y.	1490
WCST	Berkeley Springs, W.Va.	1010
WCTA	Andalusia, Ala.	920
WCTC	New Brunswick, N.J.	1450
WCTT	Corbin, Ky.	680
WCUB	Manitowoc, Wis.	980
WCUE	Akron, Ohio	1150
WCUM	Cumberland, Md.	1230
WCVA	Culpeper, Va.	1490
WCVI	Connellsville, Pa.	1340
WCVP	Murphy, N.C.	600
WCVS	Springfield, Ill.	1450
WCWC	Ripon, Wis.	1600
WCYB	Bristol, Va.	690
WCYN	Cynthiana, Ky.	1400
WDAD	Indiana, Pa.	1450
WDAE	Tampa, Fla.	1250
WDAF	Kansas City, Mo.	610
WDAK	Columbus, Ga.	540
WDAL	Meridian, Miss.	1330
WDAN	Danville, Ill.	1490
WDAR	Darlington, S.C.	1350
WDAS	Philadelphia, Pa.	1480
WDAX	McRae, Ga.	1410
WDAY	Fargo, N. Dak.	970
WDBC	Escanaba, Mich.	680
WDBF	Delray Beach, Fla.	1420
WDBJ	Roanoke, Va.	960
WDBL	Springfield, Tenn.	1590
WDBM	Statesville, N.C.	550
WDBO	Orlando, Fla.	580
WDBQ	Dubuque, Iowa	1490
WDCF	Dade City, Fla.	1350
WDCL	Tarpon Sprgs., Fla.	1470
WDCR	Hanover, N.H.	1340
WDDT	Greenville, Miss.	900
WDDY	Gloucester, Va.	1420
WDEA	Ellsworth, Me.	1350
WDEC	Americus, Ga.	1290
WDEF	Chattanooga, Tenn.	1370
WDEH	Sweetwater, Tenn.	800
WDEL	Wilmington, Del.	1150
WDEV	Waterbury, Vt.	550
WDEW	Westfield, Mass.	1570
WDGY	Minneapolis, Minn.	1130
WDIA	Memphis, Tenn.	1070
WDIG	Dothan, Ala.	1450
WDIX	Orangeburg, S.C.	1150
WDKD	Kingstree, S.C.	1310
WDKN	Dickson, Tenn.	1260
WDLA	Walton, N.Y.	1270
WDLB	Marshfield, Wis.	1450
WDLC	Port Jervis, N.Y.	1490
WDLT	Indianola, Miss.	1380
WDLP	Panama City, Fla.	590
WDMF	Buford, Ga.	1460
WDMG	Douglas, Ga.	860
WDMJ	Marquette, Mich.	1320
WDNC	Durham, N.C.	620
WDNE	Elkins, W.Va.	1240
WDNG	Anniston, Ala.	1450
WDNT	Dayton, Tenn.	1280
WDOB	Canton, Miss.	1370
WDOC	Prestonsburg, Ky.	1310
WDOD	Chattanooga, Tenn.	1310
WDOE	Dunkirk, N.Y.	1410
WDOG	Marine City, Mich.	1590
WDOK	Cleveland, Ohio	1260
WDOL	Athens, Ga.	1470
WDON	Wheaton, Md.	1540
WDOR	Sturgeon Bay, Wis.	910
WDOS	Oneonta, N.Y.	730
WDOT	Burlington, Va.	1400

C.L.	Location	Kc.
WDOV	Dover, Del.	1410
WDQN	DuQuoin, Ill.	1580
WDRC	Hartford, Conn.	1360
WDRF	Chester, Pa.	1590
WDSC	Dillon, S.C.	800
WDSG	Dyersburg, Tenn.	1450
WDSK	Cleveland, Miss.	1410
WDSM	Superior, Wis.	710
WDSP	DeFuniak Springs, Florida	1280
WDSR	Lake City, Fla.	1340
WDSU	New Orleans, La.	1280
WDTV	St. John, V.I.	1190
WDUN	Gainesville, Ga.	1240
WDUX	Waupaca, Wis.	800
WDUZ	Green Bay, Wis.	1400
WDVA	Danville, Va.	1250
WDVH	Gainesville, Fla.	980
WDVL	Vineland, N.J.	1270
WDVM	Pocomoke City, Md.	540
WDWD	Dawson, Ga.	990
WDWS	Champaign, Ill.	1400
WDXB	Chattanooga, Tenn.	1490
WDXE	Lawrenceburg, Tenn.	1370
WDXI	Jackson, Tenn.	1310
WDXL	Lexington, Tenn.	1490
WDXN	Clarksville, Tenn.	540
WDXR	Paducah, Ky.	1560
WDZ	Decatur, Ill.	1050
WEAB	Greer, S.C.	800
WEAG	Alcoa, Tenn.	1470
WEAM	Arlington, Va.	1390
WEAN	Providence, R.I.	790
WEAQ	Eau Claire, Wis.	790
WEAT	W. Palm Beach, Fla.	850
WEAV	Plattsburg, N.Y.	960
WEAW	Evanston, Ill.	1330
WEBB	Baltimore, Md.	1360
WEBC	Duluth, Minn.	560
WEBJ	Brewton, Ala.	1240
WEBO	Owego, N.Y.	1330
WEBQ	Harrisburg, Ill.	1240
WEBR	Buffalo, N.Y.	970
WEBY	Milton, Fla.	1330
WECL	Eau Claire, Wis.	1050
WEDC	Chicago, Ill.	1240
WEDO	McKeesport, Pa.	810
WEDR	Birmingham, Ala.	1220
WEEB	Southern Pines, N.C.	990
WEED	Rocky Mount, N.C.	1390
WEEI	Boston, Mass.	590
WEEK	Peoria, Ill.	1350
WEEL	Fairfax, Va.	1310
WEEN	Lafayette, Tenn.	1460
WEEP	Pittsburgh, Pa.	1080
WEER	Warrenton, Va.	1570
WEEU	Reading, Pa.	850
WEEX	Easton, Pa.	1230
WEGO	Concord, N.C.	1410
WEHH	Elmira Heights, Horseheads, N. Y.	1590
WEIC	Charleston, Ill.	1270
WEIM	Fitchburg, Mass.	1280
WEIR	Weirton, W.Va.	1430
WEJL	Scranton, Pa.	630
WEKR	Fayetteville, Tenn.	1240
WEKY	Richmond, Ky.	1340
WEKZ	Monroe, Wis.	1260
WELB	Elba, Ala.	1350
WELC	Welch, W.Va.	1150
WELD	Fisher, W.Va.	690
WELE	S. Daytona, Fla.	1590
WELI	New Haven, Conn.	960
WELK	Charlottesville, Va.	1010
WELL	Battle Creek, Mich.	1400
WELM	Elmira, N.Y.	1400
WELO	Tupelo, Miss.	580
WELP	Easley, S.C.	1360
WELR	Roanoke, Ala.	1360
WELS	Kinston, N.C.	1010
WELY	Ely, Minn.	1450
WELZ	Belzoni, Miss.	1460
WEMB	Erwin, Tenn.	1420
WEMP	Milwaukee, Wis.	1250
WENA	Bayamon, P.R.	1560
WENC	Whiteville, N.C.	1220
WEND	Baton Rouge, La.	1380
WENE	Endicott, N.Y.	1430
WENK	Union City, Tenn.	1240
WENN	Homewood, Ala.	1320
WENO	Madison, Tenn.	1430
WENT	Gloversville, N.Y.	1340
WENY	Elmira, N.Y.	1230
WEOA	Evansville, Ind.	1400
WEOK	Poughkeepsie, N.Y.	1390
WEOL	Elyria, Ohio	930
WEPG	S. Pittsburgh, Tenn.	910
WEPM	Martinsburg, W.Va.	1340
WERC	Erie, Pa.	1260
WERD	Atlanta, Ga.	860
WERE	Cleveland, Ohio	1300
WERH	Hamilton, Ala.	970
WERI	Westerly, R.I.	1230
WERT	Van Wert, Ohio	1220
WESA	Charleroi, Pa.	940
WESB	Bradford, Pa.	1490
WESC	Greenville, S.C.	660
WESD	Southbridge, Mass.	970
WESR	Tasley, Va.	1330
WEST	Easton, Pa.	1400
WESX	Salem, Mass.	1230
WESY	Leland, Miss.	1580
WETB	Johnson City, Tenn.	790
WETD	Gadsden, Ala.	930
WETU	Wetumpka, Ala.	1250
WETZ	New Martinsville, West Virginia	1330
WEUC	Ponce, P.R.	1420
WEUP	Huntsville, Ala.	1600
WEVA	Emporia, Va.	860
WEVD	New York, N.Y.	1330
WEVE	Eveleth, Minn.	1340
WEW	St. Louis, Mo.	770
WEWO	Laurinburg, N.C.	1080
WEXL	Royal Oak, Mich.	1340
WEYE	Sanford, N.C.	1290
WEZB	Bessemer, Ala.	1450
WEZE	Boston, Mass.	1260
WEZJ	Williamsburg, Ky.	1440
WEZL	Richmond, Va.	1590
WEZN	Elizabethtown, Pa.	1600
WEZY	Cocoa, Fla.	1480
WFAA	Dallas, Tex.	570, 820
WFAH	Alliance, Ohio	1310
WFAR	Farrell, Pa.	1470
WFAS	White Plains, N.Y.	1230
WFAU	Augusta, Me.	1340
WFAX	Falls Church, Va.	1220
WFBC	Greenville, S.C.	1330
WFBG	Altoona, Pa.	1340
WFBL	Syracuse, N.Y.	1390
WFBM	Indianapolis, Ind.	1260
WFBR	Baltimore, Md.	1300
WFBS	Ft. Walton Bch., Fla.	950
WFDF	Flint, Mich.	910
WFDR	Manchester, Ga.	1370
WFDT	St. Helen, Mich.	1590
WFEA	Manchester, N.Y.	1370
WFEB	Sylacauga, Ala.	1340
WFEC	Miami, Fla.	1220
WFGM	Fitchburg, Mass.	960
WFGN	Gaffney, S.C.	1570
WFHG	Bristol, Va.	980
WFHK	Pell City, Ala.	1430
WFHR	Wis. Rapids, Wis.	1340
WFIG	Sumter, S.C.	1290
WFIL	Philadelphia, Pa.	560
WFIN	Findlay, Ohio	1330
WFIS	Fountain Inn, S.C.	1600
WFIW	Fairfield, Ill.	1390
WFKN	Franklin, Ky.	1220
WFKY	Frankfort, Ky.	1490
WFLA	Tampa, Fla.	970
WFLB	Fayetteville, N.C.	1490
WFLN	Philadelphia, Pa.	900
WFLO	Farmville, Va.	870
WFLR	Dundee, N.Y.	1570
WFLW	Monticello, Ky.	1360
WFMC	Goldsboro, N.C.	730
WFMD	Frederick, Md.	930
WFMH	Cullman, Ala.	1460
WFMJ	Youngstown, Ohio	1390
WFMO	Fairmont, N.C.	860
WFMW	Madisonville, Ky.	730
WFNC	Fayetteville, N.C.	1390
WFNS	Burlington, N.C.	1150
WFOB	Fostoria, Ohio	1430
WFOM	Marietta, Ga.	1230
WFOR	Hattiesburg, Miss.	1400
WFOX	Milwaukee, Wis.	860
WFOY	St. Augustine, Fla.	1240
WFPA	Fort Payne, Ala.	1400
WFPG	Atlantic City, N.J.	1450
WFPM	Fort Valley, Ga.	1150
WFPR	Hammond, La.	1400
WFRA	Franklin, Pa.	1430
WFRB	Frostburg, Md.	740
WFRC	Reidsville, N.C.	1600
WFRL	Freeport, Ill.	1570
WFRM	Coudersport, Pa.	600
WFRO	Fremont, Ohio	900
WFRX	West Frankfort, Ill.	1300
WFSC	Franklin, N.C.	1050
WFST	Caribou, Maine	600
WFTC	Kinston, N.C.	960
WFTG	London, Ky.	1400
WFTL	Ft. Lauderdale, Fla.	1400
WFTM	Maysville, Ky.	1240
WFTR	Front Royal, Va.	1450
WFTW	Ft. Walton Beach, Florida	1260
WFUL	Fulton, Ky.	1270
WFUN	Huntsville, Ala.	1450
WFUR	Grand Rapids, Mich.	1570
WFVA	Fredericksburg, Va.	1230
WFVG	Fuquay Sprgs., N.C.	1460
WFWL	Camden, Tenn.	1220
WFYC	Alma, Mich.	1280
WFYI	Mineola, N.Y.	1520
WGAA	Cedartown, Ga.	1340
WGAC	Augusta, Ga.	580
WGAD	Gadsden, Ala.	1350
WGAF	Valdosta, Ga.	910
WGAI	Elizabeth City, N.C.	560
WGAL	Lancaster, Pa.	1490
WGAN	Portland, Maine	560
WGAP	Maryville, Tenn.	1400
WGAR	Cleveland, Ohio	1220
WGAS	S. Gastonia, N.C.	1420
WGAT	Gate City, Va.	1050
WGAU	Athens, Ga.	1340
WGAW	Gardner, Mass.	1340
WGAY	Silver Spring, Md.	1050
WGBA	Columbus, Ga.	1270
WGBB	Freeport, N.Y.	1240
WGBF	Evansville, Ind.	1280
WGBG	Greensboro, N.C.	1400
WGBI	Scranton, Pa.	910
WGBR	Goldsboro, N. C.	1150
WGBS	Miami, Fla.	710
WGCB	Red Lion, Pa.	1440
WGCD	Chester, S.C.	1490
WGCM	Gulfport, Miss.	1240
WGEA	Geneva, Ala.	1150
WGEE	Indianapolis, Ind.	1590
WGEM	Quincy, Ill.	1440
WGES	Chicago, Ill.	1390
WGET	Gettysburg, Pa.	1450
WGEZ	Beloit, Wis.	1490
WGFS	Covington, Ga.	1430
WGGA	Gainesville, Ga.	550
WGGG	Gainesville, Fla.	1230
WGGH	Marion, Ill.	1150
WGGO	Salamanca, N.Y.	1590
WGH	Newport News, Va.	1310
WGHM	Skowegan, Maine	1150
WGHN	Grd. Haven, Mich.	1370
WGHQ	Saugerties, N.Y.	920
WGIG	Brunswick, Ga.	1440
WGIL	Galesburg, Ill.	1400
WGIR	Manchester, N.H.	610
WGIV	Charlotte, N.C.	1600
WGKA	Atlanta, Ga.	1600
WGKV	Charleston, W.Va.	1300
WGL	Fort Wayne, Ind.	1250
WGLC	Centreville, Miss.	1580
WGLI	Babylon, N.Y.	1290
WGMA	Hollywood, Fla.	1320
WGMS	Washington, D.C.	570
WGN	Chicago, Ill.	720
WGNI	Wilmington, N.C.	1450
WGNS	Murfreesboro, Tenn.	1450
WGNY	Newburgh, N.Y.	1220
WGOG	Walhalla, S.C.	1460
WGOH	Grayson, Ky.	1370
WGOK	Mobile, Ala.	900
WGOL	Goldsboro, N.C.	1300
WGOR	Georgetown, Ky.	1580
WGOV	Valdosta, Ga.	950
WGPA	Bethlehem, Pa.	1100
WGPC	Albany, Ga.	1450
WGR	Buffalo, N.Y.	550
WGRA	Cairo, Ga.	790
WGRC	Green Cove Springs, Florida	1580
WGRD	Grand Rapids, Mich.	1410
WGRF	Aguadella, P.R.	1340
WGRM	Greenwood, Miss.	1240
WGRO	Lake City, Fla.	960
WGRV	Greeneville, Tenn.	1340
WGRY	Gary, Ind.	1370
WGSA	Savannah, Ga.	1400
WGSM	Huntington, N.Y.	740
WGSR	Millen, Ga.	1570
WGST	Atlanta, Ga.	920
WGSV	Guntersville, Ala.	1270
WGSW	Greenwood, S.C.	1350
WGTA	Summerville, Ga.	950
WGTC	Greenville, N.C.	1590
WGTL	Kannapolis, N.C.	870
WGTM	Wilson, N.C.	590
WGTN	Georgetown, S.C.	1400
WGTO	Cypress Gardens, Fla.	540
WGUN	Decatur, Ga.	1010
WGUS	North Augusta, S.C.	1600
WGUY	Bangor, Maine	1250
WGVA	Geneva, N.Y.	1240
WGVM	Greenville, Miss.	1260
WGWC	Selma, Ala.	1340
WGWR	Asheboro, N.C.	1260
WGY	Schenectady, N.Y.	810
WGYV	Greenville, Ala.	1380
WHA	Madison, Wis.	970
WHAB	Baxley, Ga.	1260
WHAI	Greenfield, Mass.	1240
WHAK	Rogers City, Mich.	960
WHAL	Shelbyville, Tenn.	1400
WHAM	Rochester, N.Y.	1180
WHAP	Hopewell, Va.	1340
WHAR	Clarksburg, W.Va.	1340
WHAS	Louisville, Ky.	840
WHAT	Philadelphia, Pa.	1340
WHAV	Haverhill, Mass.	1490
WHAW	Weston, W.Va.	980
WHAY	New Britain, Conn.	910
WHAZ	Troy, N.Y.	1330
WHB	Kansas City, Mo.	710
WHBB	Selma, Ala.	1490
WHBC	Canton, Ohio	1480
WHBF	Rock Island, Ill.	1270
WHBG	Harrisonburg, Va.	1360
WHBI	Newark, N.J.	1280
WHBL	Sheboygan, Wis.	1330
WHBN	Harrodsburg, Ky.	1420
WHBO	Tampa, Fla.	1050
WHBQ	Memphis, Tenn.	560
WHBT	Harriman, Tenn.	1600
WHBU	Anderson, Ind.	1240
WHBY	Appleton, Wis.	1230
WHCC	Waynesville, N.C.	1400
WHCO	Sparta, Ill.	1230
WHCU	Ithaca, N.Y.	870
WHDF	Houghton, Mich.	1400
WHDH	Boston, Mass.	850
WHDL	Olean, N.Y.	1450
WHDM	McKenzie, Tenn.	1440
WHEB	Portsmouth, N.H.	750
WHEC	Rochester, N.Y.	1460
WHEE	Martinsville, Va.	1370
WHEN	Syracuse, N.Y.	620
WHER	Memphis, Tenn.	1430
WHEW	Riveria Beach, Fla.	1600
WHEY	Millington, Tenn.	1220
WHFB	Benton Harbor, Mich.	1060
WHFC	Cicero, Ill.	1450
WHGB	Harrisburg, Pa.	1400
WHGR	Houghton L., Mich.	1290
WHHH	Warren, Ohio	1440
WHHY	Montgomery, Ala.	1440
WHHM	Memphis, Tenn.	1340
WHIE	Griffin, Ga.	1320
WHIL	Medford, Mass.	1430
WHIM	E. Providence, R.I.	1110
WHIN	Gallatin, Tenn.	1010
WHIO	Dayton, Ohio	1290
WHIP	Mooresville, N.C.	1350
WHIR	Danville, Ky.	1230
WHIS	Bluefield, W.Va.	1440
WHIT	New Bern, N.C.	1450
WHIY	Orlando, Fla.	1270
WHIZ	Zanesville, Ohio	1240
WHJB	Greensburg, Pa.	620
WHJC	Matawan, W.Va.	1360
WHK	Cleveland, Ohio	1420
WHKK	Akron, Ohio	640
WHKP	Hendersonville, N.C.	1450
WHKY	Hickory, N.C.	1290
WHLB	Virginia, Minn.	1400
WHLD	Niagara Falls, N.Y.	1270
WHLF	South Boston, Va.	1400
WHLI	Hempstead, N.Y.	1100
WHLL	Wheeling, W.Va.	1600
WHLM	Bloomsburg, Pa.	550
WHLN	Harlan, Ky.	1410
WHLP	Centerville, Tenn.	1570
WHLS	Port Huron, Mich.	1450
WHLT	Huntington, Ind.	1300
WHMA	Anniston, Ala.	1390
WHMI	Howell, Mich.	1350
WHMP	Northampton, Mass.	1400
WHMS	Charleston, W.Va.	1490
WHNC	Henderson, N.C.	890
WHNY	McComb, Miss.	1250
WHO	Des Moines, Iowa	1040
WHOA	San Juan, P.R.	1400
WHOC	Philadelphia, Miss.	1490
WHOK	Lancaster, Ohio	1320
WHOL	Allentown, Pa.	600
WHOM	New York, N.Y.	1480
WHOO	Orlando, Fla.	990
WHOP	Hopkinsville, Ky.	1230
WHOS	Decatur, Ala.	800
WHDT	Campbell, Ohio	1570
WHOU	Houlton, Maine	1340
WHOW	Clinton, Ill.	1520
WHP	Harrisburg, Pa.	580
WHPB	Belton, S.C.	1390
WHPE	High Point, N.C.	1070
WHRT	Hartselle, Ala.	860
WHRV	Ann Arbor, Mich.	1600
WHRW	Bowling Green, Ohio	730
WHSC	Hartsville, S.C.	1450
WHSM	Hayward, Wis.	910
WHSY	Hattiesburg, Miss.	1230
WHTC	Holland, Mich.	1450
WHTG	Eatontown, N.J.	1410
WHUB	Cookeville, Tenn.	1400
WHUC	Hudson, N.Y.	1230
WHUM	Reading, Pa.	1240
WHUN	Huntington, Pa.	1150
WHVF	Wausau, Wis.	1230
WHVH	Henderson, N.C.	1450
WHVR	Hanover, Pa.	1280
WHWB	Rutland, Vt.	1000
WHYE	Roanoke, Va.	910
WHYL	Carlisle, Pa.	960
WHYN	Springfield, Mass.	560
WHYS	Ocala, Fla.	1370
WIAC	San Juan, P.R.	580
WIAM	Williamston, N.C.	900
WIBA	Madison, Wis.	1310
WIBB	Macon, Ga.	1280
WIBC	Indianapolis, Ind.	1070
WIBG	Philadelphia, Pa.	990
WIBM	Jackson, Mich.	1450
WIBR	Baton Rouge, La.	1300
WIBU	Poynette, Wis.	1240
WIBV	Belleville, Ill.	1260
WIBW	Topeka, Kans.	580
WIBX	Utica, N.Y.	950
WICA	Ashtabula, Ohio	970
WICC	Bridgeport, Conn.	600
WICE	Providence, R.I.	1290
WICH	Norwich, Conn.	1310
WICK	Scranton, Pa.	1400
WICO	Salisbury, Md.	1320
WICU	Erie, Pa.	1330
WICY	Malone, N.Y.	1490
WIDE	Biddeford, Maine	1400
WIDU	Fayetteville, N.C.	1600
WIEL	Elizabethtown, Ky.	1400
WIFM	Elkin, N.C.	1540
WIGM	Medford, Wis.	1490
WIIN	Atlanta, Ga.	970
WIKB	Iron River, Mich.	1230
WIKC	Bogalusa, La.	1490
WIKE	Newport, Vt.	1490
WIKY	Evansville, Ind.	820
WIL	St. Louis, Mo.	1430
WILA	Danville, Va.	1580
WILD	Boston, Mass.	1090
WILE	Cambridge, Ohio	1270
WILI	Willimantic, Conn.	1400
WILK	Wilkes-Barre, Pa.	980
WILL	Urbana, Ill.	580
WILM	Wilmington, Del.	1450
WILO	Frankfort, Ind.	1570
WILS	Lansing, Mich.	1320
WILZ	St. Petersburg Beach, Florida	1590
WIMA	Lima, Ohio	1150
WIMO	Winder, Ga.	1300
WIMS	Michigan City, Ind.	1420
WINA	Charlottesville, Va.	1400
WINC	Winchester, Va.	1400
WIND	Chicago, Ill.	560
WINE	Kenmore, N.Y.	1080
WINF	Manchester, Conn.	1230
WING	Dayton, Ohio	1410
WINI	Murphysboro, Ill.	1420

C.L.	Location	Kc.
WINK	Fort Myers, Fla.	1240
WINN	Louisville, Ky.	1240
WINQ	Tampa, Fla.	1010
WINR	Binghamton, N.Y.	680
WINS	New York, N.Y.	1010
WINT	Winter Haven, Fla.	1360
WINX	Rockville, Md.	1600
WINZ	Miami, Fla.	940
WIOD	Sanford, Fla.	1360
WION	Ionia, Mich.	1430
WIDS	Tawas City, Mich.	1480
WIOU	Kokomo, Ind.	1350
WIP	Philadelphia, Pa.	610
WIPC	Lake Wales, Fla.	1280
WIPR	San Juan, P.R.	940
WIPS	Ticonderoga, N.Y.	1250
WIRA	Fort Pierce, Fla.	1400
WIRB	Enterprise, Ala.	600
WIRC	Hickory, N.C.	630
WIRE	Indianapolis, Ind.	1430
WIRJ	Humboldt, Tenn.	740
WIRK	W. Palm Beach, Fla.	1290
WIRL	Peoria, Ill.	1290
WIRO	Ironton, Ohio	1230
WIRY	Plattsburg, N.Y.	1340
WIS	Columbia, S.C.	560
WISE	Asheville, N.C.	1310
WISH	Indianapolis, Ind.	1310
WISL	Shamokin, Pa.	1480
WISM	Madison, Wis.	1480
WISN	Milwaukee, Wis.	1150
WISO	Ponce, P.R.	1260
WISP	Kinston, N.C.	1230
WISR	Butler, Pa.	680
WIST	Charlotte, N.C.	930
WISV	Virouqua, Wis.	1360
WITA	San Juan, P.R.	1140
WITH	Baltimore, Md.	1230
WITT	Lewisburg, Pa.	1010
WITY	Danville, Ill.	980
WITZ	Jasper, Ind.	990
WIVI	Christiansted, V.I.	1040
WIVK	Knoxville, Tenn.	860
WIVV	Vieques, P.R.	1370
WIVY	Jacksonville, Fla.	1050
WIZE	Springfield, Ohio	1340
WIZZ	Streator, Ill.	1250
WJAC	Johnstown, Pa.	1400
WJAG	Norfolk, Nebr.	780
WJAK	Jackson, Tenn.	1460
WJAM	Marion, Ala.	1310
WJAN	Ishpeming, Mich.	970
WJAR	Providence, R.I.	920
WJAS	Pittsburgh, Pa.	1320
WJAT	Swainsboro, Ga.	800
WJAX	Jacksonville, Fla.	930
WJAY	Mullins, S.C.	1280
WJAZ	Albany, Ga.	1050
WJBB	Haleyville, Ala.	1230
WJBC	Bloomington, Ill.	1230
WJBD	Salem, Ill.	1350
WJBK	Detroit, Mich.	1500
WJBL	Holland, Mich.	1260
WJBO	Baton Rouge, La.	1150
WJBS	DeLand, Fla.	1490
WJBW	New Orleans, La.	1230
WJCD	Seymour, Ind.	1390
WJCM	Sebring, Fla.	960
WJOA	Quincy, Mass.	1300
WJDB	Thomasville, Ala.	630
WJOX	Jackson, Miss.	620
WJDY	Salisbury, Md.	1470
WJEF	Grand Rapids, Mich.	1230
WJEH	Gallipolis, Ohio	990
WJEJ	Hagerstown, Md.	1240
WJEM	Valdosta, Ga.	1150
WJER	Dover, Ohio	1450
WJET	Erie, Pa.	1400
WJGD	Columbia, Tenn.	1280
WJHB	Talladega, Ala.	1580
WJHL	Johnson City, Tenn.	910
WJHO	Opelika, Ala.	1400
WJIG	Tullahoma, Tenn.	740
WJIM	Lansing, Mich.	1240
WJIV	Savannah, Ga.	900
WJJC	Commerce, Ga.	1270
WJJD	Chicago, Ill.	1160
WJJL	Niagara Falls, N.Y.	1440
WJJM	Lewisburg, Tenn.	1490
WJKO	Springfield, Mass.	1600
WJLB	Detroit, Mich.	1400
WJLD	Homewood, Ala.	1400
WJLK	Asbury Park, N.J.	1310
WJLS	Beckley, W.Va.	560
WJMA	Orange, Va.	1340
WJMB	Brookhaven, Miss.	1340
WJMC	Rice Lake, Wis.	1240
WJMJ	Philadelphia, Pa.	1540
WJMO	Cleveland Hgts., Ohio	1490
WJMR	New Orleans, La.	990
WJMS	Ironwood, Mich.	630
WJMX	Athens, Ala.	730
WJMX	Florence, S.C.	970
WJNC	Jacksonville, N.C.	1240
WJNO	W. Palm Beach, Fla.	1230
WJOB	Hammond, Ind.	1230
WJOC	Jamestown, N.Y.	1340
WJOE	Ward Ridge, Fla.	1570
WJOI	Florence, Ala.	1340
WJOL	Joliet, Ill.	1340
WJON	St. Cloud, Minn.	1240
WJOT	Lake City, S.C.	1260
WJOY	Burlington, Vt.	1230
WJPA	Washington, Pa.	1450
WJPD	Ishpeming, Mich.	1240
WJPF	Herrin, Ill.	1340
WJPG	Green Bay, Wis.	1440
WJPR	Greenville, Miss.	1330
WJPS	Evansville, Ind.	1330
WJQS	Jackson, Miss.	1400
WJR	Detroit, Mich.	760
WJRD	Tuscaloosa, Ala.	1150
WJRI	Lenoir, N.C.	1340
WJSB	Crestview, Fla.	1050
WJSD	Jonesboro, Tenn.	1590
WJTN	Jamestown, N.Y.	1240
WJUN	Mexico, Pa.	1220
WJVA	South Bend, Ind.	1580
WJW	Cleveland, Ohio	850
WJWL	Georgetown, Del.	900
WJWS	South Hill, Va.	1370
WJXN	Jackson, Miss.	1450
WJZM	Clarksville, Tenn.	1400
WKAB	Mobile, Ala.	840
WKAI	Macomb, Ill.	1510
WKAL	Rome, N.Y.	1450
WKAM	Goshen, Ind.	1460
WKAN	Kankakee, Ill.	1320
WKAP	Allentown, Pa.	1320
WKAQ	San Juan, P.R.	580
WKAR	East Lansing, Mich.	870
WKAT	Miami Beach, Fla.	1360
WKAY	Glasgow, Ky.	1490
WKAZ	Charleston, W.Va.	950
WKBC	N. Wilkesboro, N.C.	810
WKBH	La Crosse, Wis.	1410
WKBI	St. Mary's, Pa.	1400
WKBJ	Milan, Tenn.	1600
WKBK	Keene, N.H.	1220
WKBL	Covington, Tenn.	1250
WKBN	Youngstown, Ohio	570
WKBO	Harrisburg, Pa.	1230
WKBR	Manchester, N.H.	1240
WKBV	Richmond, Ind.	1490
WKBW	Buffalo, N. Y.	1520
WKBX	Kissimmee, Fla.	1220
WKBZ	Muskegon, Mich.	850
WKCB	Berlin, N.H.	1230
WKCT	Bowling Green, Ky.	930
WKOA	Nashville, Tenn.	1240
WKOK	Newberry, S.C.	1240
WKOL	Clarksdale, Miss.	1600
WKON	Camden, N.J.	800
WKOX	Hamlet, N.C.	1400
WKEE	Huntington, W. Va.	800
WKEI	Kewanee, Ill.	1450
WKEN	Oover, Del.	1600
WKEU	Griffin, Ga.	1450
WKEY	Covington, Va.	1340
WKGN	Knoxville, Tenn.	1340
WKHM	Jackson, Mich.	970
WKIC	Hazard, Ky.	1390
WKID	Urbana, Ill.	1580
WKIK	Leonardtown, Md.	1370
WKIN	Kingsport, Tenn.	1320
WKIP	Poughkeepsie, N.Y.	1450
WKIS	Orlando, Fla.	740
WKIX	Raleigh, N.C.	850
WKIZ	Key West, Fla.	1500
WKJB	Mayaguez, P.R.	710
WKJG	Fort Wayne, Ind.	1380
WKKO	Cocoa, Fla.	860
WKKS	Vanceburg, Ky.	1570
WKLA	Ludington, Mich.	1450
WKLC	St. Albans, W.Va.	1300
WKLE	Washington, Ga.	1370
WKLF	Clanton, Ala.	980
WKLK	Cloquet, Minn.	1230
WKLM	Wilmington, N.C.	980
WKLO	Louisville, Ky.	1080
WKLV	Blackstone, Va.	1440
WKLX	Paris, Ky.	1440
WKLY	Hartwell, Ga.	980
WKLZ	Kalamazoo, Mich.	1470
WKMC	Roaring Sprgs., Pa.	1370
WKMF	Flint, Mich.	1470
WKMH	Dearborn, Mich.	1310
WKMI	Kalamazoo, Mich.	1360
WKMT	Kings Mtn., N.C.	1220
WKNB	New Britain, Conn.	840
WKNE	Keene, N.H.	1290
WKNX	Saginaw, Mich.	1210
WKNY	Kingston, N.Y.	1490
WKOA	Hopkinsville, Ky.	1480
WKOK	Sunbury, Pa.	1240
WKOP	Binghamton, N.Y.	1360
WKOV	Wellston, Ohio	1330
WKOW	Madison, Wis.	1070
WKOX	Framingham, Mass.	1190
WKOY	Bluefield, W.Va.	1240
WKOZ	Kosciusko, Miss.	1350
WKPA	New Kensington, Pa.	1150
WKPT	Kingsport, Tenn.	1400
WKRC	Cincinnati, Ohio	550
WKRK	Murphy, N.C.	1390
WKRG	Mobile, Ala.	710
WKRM	Columbia, Tenn.	1340
WKRO	Cairo, Ill.	1490
WKRS	Waukegan, Ill.	1220
WKRT	Cortland, N.Y.	920
WKRZ	Oil City, Pa.	1340
WKSB	Milford, Del.	930
WKSK	W. Jefferson, N.C.	1600
WKSR	Pulaski, Tenn.	1420
WKST	New Castle, Pa.	1280
WKTC	Charlotte, N.C.	1310
WKTF	Warrenton, Va.	1420
WKTG	Thomasville, Ga.	730
WKTL	Sheboygan, Wis.	950
WKTM	Mayfield, Ky.	1050
WKTQ	South Paris, Maine	1450
WKTX	Atlantic Beach, Fla.	1600
WKTY	LaCrosse, Wis.	580
WKUL	Cullman, Ala.	1340
WKVA	Lewistown, Pa.	920
WKVM	San Juan, P.R.	810
WKWF	Key West, Fla.	1600
WKWK	Wheeling, W.Va.	1400
WKXL	Concord, N.H.	1450
WKXV	Knoxville, Tenn.	900
WKXY	Sarasota, Fla.	930
WKY	Oklahoma City, Okla.	930
WKYB	Paducah, Ky.	570
WKYR	Keyser, W.Va.	1270
WKYW	Louisville, Ky.	900
WKZD	Kalamazoo, Mich.	590
WLAC	Nashville, Tenn.	1510
WLAD	Danbury, Conn.	800
WLAF	LaFollette, Tenn.	1450
WLAG	La Grange, Ga.	1240
WLAK	Lakeland, Fla.	1430
WLAM	Lewiston, Maine	1470
WLAN	Lancaster, Pa.	1390
WLAP	Lexington, Ky.	630
WLAQ	Rome, Ga.	1410
WLAR	Athens, Tenn.	1450
WLAT	Conway, S.C.	1330
WLAU	Laurel, Miss.	1600
WLAV	Grand Rapids, Mich.	1340
WLAW	Lawrenceville, Ga.	1360
WLAY	Muscle Shoals, Ala.	1450
WLBA	Gainesville, Ga.	1580
WLBB	Carrollton, Ga.	1100
WLBC	Muncie, Ind.	1340
WLBE	Leesburg, Fla.	790
WLBG	Laurens, S.C.	860
WLBH	Mattoon, Ill.	1170
WLBI	Denham Springs, La.	1220
WLBJ	Bowling Green, Ky.	1410
WLBK	DeKalb, Ill.	1360
WLBL	Auburndale, Wis.	930
WLBN	Lebanon, Ky.	1590
WLBR	Lebanon, Pa.	1270
WLBZ	Bangor, Maine	620
WLCK	Scottsville, Ky.	1250
WLCM	Lancaster, S.C.	1360
WLCO	Eustis, Fla.	1240
WLCS	Baton Rouge, La.	910
WLCX	LaCrosse, Wis.	1490
WLCY	St. Petersburg, Fla.	1380
WLOB	Atlantic City, N.J.	1490
WLOS	Jacksonville, Ill.	1180
WLOY	Ladysmith, Wis.	1340
WLEA	Hornell, N.Y.	1480
WLEC	Sandusky, Ohio	1450
WLEE	Richmond, Va.	1480
WLEM	Emporium, Pa.	1250
WLEO	Ponce, P.R.	1170
WLET	Toccoa, Ga.	1420
WLEU	Erie, Pa.	1450
WLEW	Bad Axe, Mich.	1340
WLFA	Lafayette, Ga.	1590
WLFH	Little Falls, N.Y.	1230
WLIB	New York, N.Y.	1190
WLIK	Newport, Tenn.	1270
WLIL	Lenoir, Tenn.	730
WLIP	Kenosha, Wis.	1050
WLIS	Old Saybrook, Conn.	1420
WLIV	Livingston, Tenn.	920
WLIZ	Lake Worth, Fla.	1380
WLLH	Lowell, Mass.	1400
WLLY	Richmond, Va.	1320
WLMJ	Jackson, Ohio	1280
WLNA	Peekskill, N.Y.	1420
WLNH	Laconia, N.H.	1350
WLOA	Braddock, Pa.	1550
WLOB	Portland, Maine	1310
WLOO	Pompano Beach, Fla.	980
WLOE	Leaksville, N.C.	1490
WLOF	Orlando, Fla.	950
WLOG	Logan, W.Va.	1230
WLOH	Princeton, W.Va.	1490
WLOI	LaPorte, Ind.	1540
WLOK	Memphis, Tenn.	1480
WLOL	Minneapolis, Minn.	1330
WLON	Lincolnton, N.C.	1050
WLOS	Asheville, N.C.	1380
WLOU	Louisville, Ky.	1350
WLOW	Portsmouth, Va.	1400
WLOX	Biloxi, Miss.	1490
WLPM	Suffolk, Va.	1450
WLPO	LaSalle, Ill.	1220
WLS	Chicago, Ill.	890
WLSB	Copper Hill, Tenn.	1400
WLSC	Loris, S.C.	1570
WLSD	Big Stone Gap, Va.	1220
WLSE	Wallace, N.C.	1400
WLSH	Lansford, Pa.	1410
WLSI	Pikeville, Ky.	900
WLSM	Louisville, Miss.	1270
WLST	Escanaba, Mich.	600
WLSV	Wellsville, N.Y.	790
WLTC	Gastonia, N.C.	1370
WLVA	Lynchburg, Va.	590
WLW	Cincinnati, Ohio	700
WLYC	Williamsport, Pa.	1050
WLYN	Lynn, Mass.	1360
WMAB	Munising, Mich.	1400
WMAF	Madison, Fla.	1230
WMAG	Forest, Miss.	860
WMAJ	State College, Pa.	1450
WMAK	Nashville, Tenn.	1300
WMAL	Washington, D.C.	630
WMAM	Marinette, Wis.	570
WMAN	Mansfield, Ohio	1400
WMAP	Monroe, N.C.	1060
WMAQ	Chicago, Ill.	670
WMAS	Springfield, Mass.	1450
WMAX	Grand Rapids, Mich.	1480
WMAY	Springfield, Ill.	970
WMAZ	Macon, Ga.	940
WMBA	Ambridge, Pa.	1460
WMBC	Macon, Miss.	1400
WMBO	Peoria, Ill.	1470
WMBG	Richmond, Va.	1380
WMBH	Joplin, Mo.	1450
WMBI	Chicago, Ill.	1110
WMBL	Morehead City, N.C.	740
WMBM	Miami Beach, Fla.	800
WMBN	Petoskey, Mich.	1340
WMBD	Auburn, N.Y.	1340
WMBR	Jacksonville, Fla.	1460
WMBS	Uniontown, Pa.	590
WMC	Memphis, Tenn.	790
WMCA	New York, N.Y.	570
WMCH	Church Hill, Tenn.	1260
WMCK	McKeesport, Pa.	1360
WMCW	Harvard, Ill.	1600
WMDC	Hazlehurst, Miss.	1220
WMOD	Fajardo, P.R.	1490
WMDF	Mount Dora, Fla.	1580
WMDN	Midland, Mich.	1490
WMEG	Eau Gallie, Fla.	920
WMEK	Chase City, Va.	980
WMEN	Tallahassee, Fla.	1330
WMET	Miami Beach, Fla.	1490
WMEV	Marion, Va.	1010
WMEX	Boston, Mass.	1510
WMFC	Monroeville, Ala.	1360
WMFD	Wilmington, N.C.	630
WMFG	Hibbing, Minn.	1240
WMFJ	Daytona Beach, Fla.	1450
WMFR	High Point, N.C.	1230
WMFS	Chattanooga, Tenn.	1260
WMFT	Terre Haute, Ind.	1300
WMGA	Moultrie, Ga.	1400
WMGM	New York, N.Y.	1050
WMGR	Bainbridge, Ga.	930
WMGW	Meadville, Pa.	1490
WMGY	Montgomery, Ala.	800
WMIC	St. Helen, Mich.	1590
WMID	Atlantic City, N.J.	1340
WMIE	Miami, Fla.	1140
WMIK	Middlesboro, Ky.	560
WMIL	Milwaukee, Wis.	1290
WMIN	Mpls.-St. Paul, Minn.	1400
WMIQ	Iron Mountain, Mich.	1450
WMIS	Natchez, Miss.	1240
WMIX	Mt. Vernon, Ill.	940
WMJM	Cordele, Ga.	1490
WMLF	Pineville, Ky.	1230
WMLP	Milton, Pa.	1570
WMLS	Sylacauga, Ala.	1290
WMLT	Oublin, Ga.	1330
WMLY	Millville, N.J.	1440
WMMB	Melbourne, Fla.	1240
WMMH	Marshall, N.C.	1460
WMMN	Fairmont, W.Va.	920
WMMS	Bath, Maine	730
WMMT	McMinnville, Tenn.	1230
WMMW	Meriden, Conn.	1470
WMNA	Gretna, Va.	730
WMNB	No. Adams, Mass.	1230
WMNC	Morganton, N.C.	1430
WMNE	Menomonie, Wis.	1360
WMNF	Richwood, W.Va.	1280
WMNI	Columbus, Ohio	920
WMNS	Olean, N.Y.	1360
WMOA	Marietta, Ohio	1490
WMOD	Moundsville, W.Va.	1370
WMOG	Brunswick, Ga.	1490
WMOH	Hamilton, Ohio	1450
WMOK	Metropolis, Ill.	920
WMON	Montgomery, W.Va.	1340
WMOP	Ocala, Fla.	900
WMOR	Morehead, Ky.	1330
WMOV	Ravenswood, W.Va.	1360
WMOX	Meridian, Miss.	1240
WMOZ	Mobile, Ala.	960
WMPA	Aberdeen, Miss.	1240
WMPC	Lapeer, Mich.	1230
WMPL	Hancock, Mich.	920
WMPM	Smithfield, N.C.	1270
WMPS	Memphis, Tenn.	680
WMPT	So. Williamsport, Pa.	1450
WMRB	Greenville, S.C.	1490
WMRC	Milford, Mass.	1490
WMRE	Monroe, Ga.	1490
WMRF	Lewistown, Pa.	1490
WMRI	Marion, Ind.	860
WMRN	Marion, Ohio	1490
WMRO	Aurora, Ill.	1280
WMRP	Flint, Mich.	1570
WMSA	Massena, N.Y.	1340
WMSC	Columbia, S.C.	1320
WMSJ	Sylva, N.C.	1480
WMSL	Decatur, Ala.	1400
WMSR	Manchester, Tenn.	1320
WMST	Mt. Sterling, Ky.	1150
WMT	Cedar Rapids, Iowa	600
WMTA	Central City, Ky.	1380
WMTC	Vancleve, Ky.	730
WMTE	Manistee, Mich.	1340
WMTL	Leitchfield, Ky.	1580
WMTM	Moultrie, Ga.	1300
WMTN	Morristown, Tenn.	1300
WMTR	Morristown, N.J.	1250
WMTS	Murfreesboro, Tenn.	860
WMUS	Muskegon, Mich.	1090
WMUU	Greenville, S.C.	1260
WMVA	Martinsville, Va.	1450
WMVB	Millville, N.J.	1440
WMVG	Milledgeville, Ga.	1450
WMVO	Mt. Vernon, Ohio	1300
WMYB	Myrtle Beach, S.C.	1450
WMYN	Mayodan, N.C.	1420
WMYR	Ft. Myers, Fla.	1410
WNAB	Bridgeport, Conn.	1450
WNAC	Boston, Mass.	680

C.L.	Location	Kc.
WNAD	Norman, Okla.	640
WNAE	Warren, Pa.	1310
WNAG	Grenada, Miss.	1400
WNAH	Nashville, Tenn.	1360
WNAK	Nanticoke, Pa.	730
WNAM	Neenah, Wis.	1280
WNAR	Norristown, Pa.	1110
WNAT	Natchez, Miss.	1450
WNAU	New Albany, Miss.	1470
WNAV	Annapolis, Md.	1430
WNAX	Yankton, S.Dak.	570
WNBF	Binghamton, N.Y.	1290
WNBH	New Bedford, Mass.	1340
WNBP	Newburyport, Mass.	1470
WNBS	Murray, Ky.	1340
WNBT	Wellsboro, Pa.	1490
WNBZ	Saranac Lake, N.Y.	1240
WNCA	Siler City, N.C.	1570
WNCC	Barnesboro, Pa.	950
WNCO	Ashland, Ohio	1340
WNDB	Daytona Beach, Fla.	1150
WNDR	Syracuse, N.Y.	1260
WNDU	South Bend, Ind.	1490
WNEB	Worcester, Mass.	1230
WNEG	Taccoa, Ga.	1320
WNER	Live Oak, Fla.	1250
WNES	Central City, Ky.	1600
WNEW	New York, N.Y.	1130
WNEX	Macon, Ga.	1400
WNGO	Mayfield, Ky.	1320
WNHC	New Haven, Conn.	1340
WNIA	Cheektowaga, N.Y.	1230
WNIK	Arecibo, P.R.	1230
WNIL	Niles, Mich.	1290
WNJR	Newark, N.J.	1430
WNKY	Neon, Ky.	1480
WNLC	New London, Conn.	1490
WNLK	Norwalk, Conn.	1350
WNMP	Evanston, Ill.	1590
WNNC	Newton, N.C.	1230
WNNJ	Newton, N.J.	1360
WNNT	Warsaw, Va.	690
WNOE	New Orleans, La.	1060
WNOG	Naples, Fla.	1270
WNOK	Columbia, S.C.	1230
WNOP	Newport, Ky.	740
WNOR	Norfolk, Va.	1230
WNOS	High Point, N.C.	1590
WNOW	York, Pa.	1250
WNOX	Knoxville, Tenn.	990
WNPS	New Orleans, La.	1450
WNPT	Tuscaloosa, Ala.	1280
WNRG	Grundy, Va.	1250
WNRI	Woonsocket, R.I.	1380
WNRV	Narrows, Va.	990
WNSL	Laurel, Miss.	1260
WNSM	Valparaiso-Niceville, Florida	1340
WNTA	Newark, N.J.	970
WNUZ	Talladega, Ala.	1230
WNVA	Norton, Va.	1350
WNVY	Pensacola, Fla.	1230
WNYC	New York, N.Y.	830
WNYS	Salamanca, N.Y.	1590
WNXT	Portsmouth, Ohio	1260
WOAI	San Antonio, Tex.	1200
WOAP	Owosso, Mich.	1080
WOAY	Oak Hill, W.Va.	860
WOBS	Jacksonville, Fla.	1360
WOBT	Rhinelander, Wis.	1240
WOC	Davenport, Iowa	1420
WOCB	W. Yarmouth, Mass.	1240
WOCH	North Vernon, Ind.	1460
WOHI	E. Liverpool, Ohio	1490
WOHO	Toledo, Ohio	1470
WOHP	Bellefontaine, Ohio	1390
WOHS	Shelby, N.C.	730
WOI	Ames, Iowa	640
WOIA	Saline, Mich.	1290
WOIC	Columbia, S.C.	1470
WOKB	Winter Garden, Fla	1600
WOKE	Charleston, S.C.	1340
WOKK	Meridian, Miss.	1450
WOKJ	Jackson, Miss.	1590
WOKO	Albany, N.Y.	1460
WOKS	Columbus, Ga.	1340
WOKY	Milwaukee, Wis.	920
WOKZ	Alton, Ill.	1570
WOL	Washington, D.C.	1450
WOLF	Syracuse, N.Y.	1490
WOLS	Florence, S.C.	1230
WOMI	Owensboro, Ky.	1490
WOMP	Bellaire, Ohio	1290
WOMT	Manitowoc, Wis.	1240
WONA	Winona, Miss.	1570
WOND	Pleasantville, N.J.	1400
WONE	Dayton, Ohio	980
WONG	Oneida, N.Y.	1600
WONN	Lakeland, Fla.	1230
WONW	Defiance, Ohio	1280
WOOD	Grand Rapids, Mich.	1300
WOOF	Dothan, Ala.	560
WOOK	Washington, D.C.	1340
WOOO	Deland, Fla.	1310
WOOW	Washington, N.C.	1340
WOPA	Oak Park, Ill.	1490
WOPI	Bristol, Tenn.	1490
WOR	New York, N.Y.	710
WORA	Mayaguez, P.R.	1150
WORC	Worcester, Mass.	1310
WORD	Spartanburg, S.C.	910
WORK	York, Pa.	1350
WORL	Boston, Mass.	950
WORM	Savannah, Tenn.	1010
WORX	Madison, Ind.	1270
WOSC	Fulton, N.Y.	1300
WOSH	Oshkosh, Wis.	1490
WOSU	Columbus, Ohio	820
WOTR	Corry, Pa.	1370
WOTW	Nashua, N.H.	900
WOUB	Athens, Ohio	1340
WOVE	Welch, W.Va.	1340
WOW	Omaha, Nebr.	590
WOWE	Allegan, Mich.	1580
WOWI	New Albany, Ind.	1570
WOWL	Florence, Ala.	1240
WOWO	Ft. Wayne, Ind.	1190
WOXF	Oxford, N.C.	1340
WOZK	Ozark, Ala.	900
WPAB	Ponce, P.R.	550
WPAC	Patchogue, N.Y.	1580
WPAD	Paducah, Ky.	1450
WPAG	Ann Arbor, Mich.	1050
WPAL	Charleston, S.C.	730
WPAM	Pottsville, Pa.	1450
WPAP	Fernandina Beach, Florida	1570
WPAQ	Mount Airy, N.C.	740
WPAR	Parkersburg, W.Va.	1450
WPAT	Paterson, N.J.	930
WPAW	Pawtucket, R.I.	550
WPAX	Thomasville, Ga.	1240
WPAY	Portsmouth, Ohio	1400
WPAZ	Pottstown, Pa.	1370
WPBC	Minneapolis, Minn.	980
WPCC	Clinton, S.C.	1400
WPCF	Panama City, Fla.	1430
WPCO	Mt. Vernon, Ind.	1590
WPCT	Putnam, Conn.	1350
WPDM	Potsdam, N.Y.	1470
WPDQ	Jacksonville, Fla.	600
WPDR	Portage, Wis.	1350
WPDX	Clarksburg, W.Va.	750
WPEL	Montrose, Pa.	1250
WPEN	Philadelphia, Pa.	950
WPEO	Peoria, Ill.	1020
WPEP	Taunton, Mass.	1570
WPET	Greensboro, N.C.	950
WPFA	Pensacola, Fla.	790
WPFB	Middletown, Ohio	910
WPFP	Park Falls, Wis.	1450
WPGC	Bradbury Hghts., Md.	1580
WPGW	Portland, Ind.	1440
WPHB	Philipsburg, Pa.	1260
WPIC	Sharon, Pa.	790
WPID	Piedmont, Ala.	1280
WPIK	Alexandria, Va.	730
WPIN	St. Petersburg, Fla.	680
WPIT	Pittsburgh, Pa.	730
WPKE	Pikeville, Ky.	1240
WPKO	Waverly, Ohio	1380
WPKY	Princeton, Ky.	1580
WPLA	Plant City, Fla.	910
WPLH	Huntington, W.Va.	1470
WPLK	Rockmart, Ga.	1220
WPLM	Plymouth, Mass.	1390
WPLO	Atlanta, Ga.	590
WPLY	Plymouth, Wis.	1420
WPME	Punxsutawney, Pa.	1540
WPMP	Pascagoula, Miss.	1580
WPNC	Plymouth, N.C.	1470
WPNF	Brevard, N.C.	1240
WPNX	Phenix City, Ala.	1460
WPOM	Pompano Beach, Fla.	1470
WPON	Pontiac, Mich.	1460
WPOP	Hartford, Conn.	1410
WPOR	Portland, Maine	1490
WPOW	New York, N.Y.	1330
WPPA	Pottsville, Pa.	1360
WPRA	Mayaguez, P.R.	990
WPRC	Lincoln, Ill.	1370
WPRE	Prairie Du Chien, Wis.	980
WPRN	Butler, Ala.	1220
WPRT	Prestonsburg, Ky.	960
WPRO	Providence, R.I.	630
WPRP	Ponce, P.R.	910
WPRS	Paris, Ill.	1440
WPRW	Manassas, Va.	1460
WPRY	Perry, Fla.	1400
WPTF	Raleigh, N.C.	680
WPTR	Albany, N.Y.	1540
WPTS	Pittston, Pa.	1540
WPTW	Piqua, Ohio	1570
WPTX	Lexington Pk., Md.	920
WPUV	Pulaski, Va.	1580
WPVA	Colonial Hghts., Va.	1290
WPVL	Painesville, Ohio	1460
WQAM	Miami, Fla.	560
WQBC	Vicksburg, Miss.	1420
WQDY	Calais, Maine	1230
WQIC	Meridian, Miss.	1390
WQIK	Jacksonville, Fla.	1280
WQMN	Superior, Wis.	1320
WQOK	Greenville, S.C.	1440
WQSN	Charleston, S.C.	1450
WQTE	Monroe, Mich.	560
WQUA	Moline, Ill.	1230
WQXI	Atlanta, Ga.	790
WQXQ	Ormond Bch., Fla.	1380
WQXR	New York, N.Y.	1560
WQXT	Palm Beach, Fla.	1340
WRAC	Racine, Wis.	1460
WRAD	Radford, Va.	1460
WRAG	Carrollton, Ala.	590
WRAJ	Anna, Ill.	1440
WRAK	Williamsport, Pa.	1400
WRAL	Raleigh, N.C.	1240
WRAM	Monmouth, Ill.	1330
WRAP	Norfolk, Va.	850
WRAW	Reading, Pa.	1340
WRAY	Princeton, Ind.	1250
WRBC	Jackson, Miss.	1300
WRBL	Columbus, Ga.	1420
WRC	Washington, D.C.	980
WRCA	New York, N.Y.	660
WRCD	Dalton, Ga.	1430
WRCO	Richland, Wis.	1450
WRCS	Ahoskie, N.C.	970
WRCV	Philadelphia, Pa.	1060
WRDB	Reedsburg, Wis.	1400
WRDO	Augusta, Maine	1400
WRDW	Augusta, Ga.	1480
WREB	Holyoke, Mass.	930
WREC	Memphis, Tenn.	600
WREL	Lexington, Va.	1450
WREM	Remsen, N.Y.	1480
WREN	Topeka, Kans.	1250
WREV	Reidsville, N.C.	1220
WRFB	Tallahassee, Fla.	1580
WRFC	Athens, Ga.	960
WRFD	Worthington, Ohio	880
WRFS	Alexander City, Ala.	1050
WRGA	Rome, Ga.	1470
WRGR	Starke, Fla.	1490
WRGS	Rogersville, Tenn.	1370
WRHC	Jacksonville, Fla.	1400
WRHI	Rock Hill, S.C.	1340
WRIB	Providence, R.I.	1220
WRIC	Richlands, Va.	540
WRIG	Wausau, Wis.	1400
WRIM	Pahokee, Fla.	1250
WRIO	Rio Piedras, P.R.	1320
WRIP	Rossville, Ga.	980
WRIS	Roanoke, Va.	1410
WRIT	Milwaukee, Wis.	1340
WRIV	Riverhead, N.Y.	1390
WRJN	Racine, Wis.	1400
WRJW	Picayune, Miss.	1320
WRKD	Rockland, Maine	1450
WRKH	Rockwood, Tenn.	580
WRKM	Carthage, Tenn.	1350
WRKT	Cocoa Beach, Fla.	1300
WRLD	Lanitt, Ala.	1490
WRMA	Montgomery, Ala.	950
WRMF	Titusville, Fla.	1050
WRMN	Elgin, Ill.	1410
WRMT	Rocky Mount, N.C.	1490
WRNB	New Bern, N.C.	1490
WRNL	Richmond, Va.	910
WROA	Gulfport, Miss.	1390
WROB	West Point, Miss.	1450
WROD	Daytona Beach, Fla.	1340
WROK	Rockford, Ill.	1440
WROM	Rome, Ga.	710
WRON	Ronceverte, W.Va.	1400
WROS	Scottsboro, Ala.	1330
WROV	Roanoke, Va.	1240
WROW	Albany, N.Y.	590
WROX	Clarksdale, Miss.	1450
WROY	Carmi, Ill.	1460
WRPB	Warner Robbins, Ga.	1350
WRR	Dallas, Tex.	1310
WRRF	Washington, N.C.	930
WRRR	Rockford, Ill.	1330
WRRZ	Clinton, N.C.	880
WRSA	Saratoga Sprgs., N.Y.	1280
WRSW	Warsaw, Ind.	1480
WRTA	Altoona, Pa.	1240
WRUF	Gainesville, Fla.	850
WRUM	Rumford, Maine	790
WRUN	Utica, N.Y.	1150
WRUS	Russellville, Ky.	610
WRVA	Richmond, Va.	1140
WRVK	Mt. Vernon, Ky.	1460
WRVM	Rochester, N.Y.	680
WRWH	Cleveland, Ga.	1380
WRWJ	Selma, Ala.	1570
WRXO	Roxboro, N.C.	1430
WSAC	Fort Knox, Ky.	1470
WSAI	Cincinnati, Ohio	1360
WSAJ	Grove City, Pa.	1340
WSAL	Logansport, Ind.	1230
WSAM	Saginaw, Mich.	1400
WSAN	Allentown, Pa.	1470
WSAR	Fall River, Mass.	1480
WSAT	nr. Salisbury, N.C.	1280
WSAU	Wausau, Wis.	550
WSAV	Savannah, Ga.	630
WSAY	Rochester, N.Y.	1370
WSAZ	Huntington, W.Va.	930
WSB	Atlanta, Ga.	750
WSBA	York, Pa.	910
WSBB	New Smyrna Beach, Florida	1230
WSBC	Chicago, Ill.	1240
WSBS	Gt. Barrington, Mass.	860
WSBT	South Bend, Ind.	960
WSCM	Panama City Beach, Florida	1290
WSCR	Scranton, Pa.	1320
WSDB	Homestead, Fla.	1430
WSDR	Sterling, Ill.	1240
WSEN	Baldwinsville, N.Y.	1050
WSEV	Sevierville, Tenn.	930
WSFB	Quitman, Ga.	1490
WSFC	Somerset, Ky.	1240
WSFT	Thomaston, Ga.	1220
WSGA	Savannah, Ga.	1400
WSGC	Elberton, Ga.	1400
WSGN	Birmingham, Ala.	610
WSGW	Saginaw, Mich.	790
WSHE	Raleigh, N.C.	570
WSIC	Statesville, N.C.	1400
WSID	Baltimore, Md.	1010
WSIG	Mount Jackson, Va.	790
WSIP	Paintsville, Ky.	1490
WSIR	Winter Haven, Fla.	1490
WSIV	Pekin, Ill.	1140
WSIX	Nashville, Tenn.	980
WSJC	Magee, Miss.	1280
WSJM	St. Joseph, Mich.	1400
WSJS	Winston-Salem, N.C.	600
WSKI	Montpelier-Barre, Vt.	1240
WSKP	Miami, Fla.	1450
WSKY	Asheville, N.C.	1230
WSLB	Ogdensburg, N.Y.	1400
WSLI	Jackson, Miss.	930
WSLM	Salem, Ind.	1220
WSLS	Roanoke, Va.	610
WSM	Nashville, Tenn.	650
WSMB	New Orleans, La.	1350
WSME	Sanford, Maine	1220
WSMI	Litchfield, Ill.	1540
WSMN	Nashua, N.H.	1590
WSMT	Sparta, Tenn.	1050
WSNJ	nr. Bridgeton, N.J.	1240
WSNT	Sandersville, Ga.	1490
WSNW	Seneca Twnshp., S.C.	1150
WSNY	Schenectady, N.Y.	1240
WSOC	Charlotte, N.C.	1240
WSOK	Savannah, Ga.	1230
WSOL	Tampa, Fla.	1300
WSON	Henderson, Ky.	860
WSOO	Sit. Ste. Marie, Mich.	1230
WSOY	Decatur, Ill.	1340
WSPA	Spartanburg, S.C.	950
WSPB	Sarasota, Fla.	1450
WSPD	Toledo, Ohio	1370
WSPN	Saratoga Sprgs., N.Y.	900
WSPR	Springfield, Mass.	1270
WSPT	Stevens Pt., Wis.	1010
WSRA	Milton, Fla.	1490
WSRC	Durham, N.C.	1410
WSRO	Marlborough, Mass.	1470
WSRW	Hillsboro, Ohio	1590
WSSB	Durham, N.C.	1490
WSSC	Sumter, S.C.	1340
WSSO	Starkville, Miss.	1230
WSSV	Petersburg, Va.	1240
WSTA	Charlotte Amalie, V.I.	1340
WSTC	Stamford, Conn.	1400
WSTK	Woodstock, Va.	1230
WSTL	Eminence, Ky.	1600
WSTN	St. Augustine, Fla.	1420
WSTP	Salisbury, N.C.	1490
WSTR	Sturgis, Mich.	1230
WSTS	Massena, N.Y.	1050
WSTU	Suart, Fla.	1450
WSTV	Steubenville, Ohio	1340
WSUB	Groton, Conn.	980
WSUH	Oxford, Miss.	1420
WSUI	Iowa City, Iowa	910
WSUN	St. Petersburg, Fla.	620
WSUX	Seaford, Del.	1280
WSUZ	Palatka, Fla.	800
WSVA	Harrisonburg, Va.	550
WSVS	Crewe, Va.	800
WSWN	Belle Glade, Fla.	900
WSWV	Pennington Gap, Va.	1570
WSWW	Platteville, Wis.	1590
WSYB	Rutland, Vt.	1380
WSYD	Mt. Airy, N.C.	1300
WSYL	Sylvania, Ga.	1490
WSYR	Syracuse, N.Y.	570
WTAB	Tabor City, N.C.	1370
WTAC	Flint, Mich.	600
WTAD	Quincy, Ill.	930
WTAG	Worcester, Mass.	580
WTAL	Tallahassee, Fla.	1270
WTAN	Clearwater, Fla.	1340
WTAO	Cambridge, Mass.	740
WTAP	Parkersburg, W.Va.	1230
WTAQ	LaGrange, Ill.	1300
WTAR	Norfolk, Va.	790
WTAW	Bryan, Tex.	1150
WTAX	Springfield, Ill.	1240
WTAY	Robinson, Ill.	1570
WTBC	Tuscaloosa, Ala.	1230
WTBF	Troy, Ala.	970
WTBO	Cumberland, Md.	1450
WTCB	Flomaton, Ala.	990
WTCH	Shawano, Wis.	960
WTCJ	Tell City, Ind.	1230
WTCM	Traverse City, Mich.	1400
WTCN	Minneapolis, Minn.	1280
WTCO	Campbellsville, Ky.	1450
WTCR	Ashland, Ky.	1420
WTCS	Fairmont, W.Va.	1490
WTCW	Whitesburg, Ky.	920
WTEL	Philadelphia, Pa.	860
WTHE	Spartanburg, S.C.	1400
WTHG	Jackson, Ala.	1290
WTHI	Terre Haute, Ind.	1480
WTHR	Panama City, Fla.	1480
WTIC	Hartford, Conn.	1080
WTIF	Tifton, Ga.	1340
WTIG	Massillon, Ohio	900
WTIK	Durham, N.C.	1310
WTIL	Mayaguez, P.R.	1300
WTIM	Taylorville, Ill.	1410
WTIP	Charleston, W.Va.	1240
WTIX	New Orleans, La.	690
WTJH	East Point, Ga.	1260
WTJS	Jackson, Tenn.	1390
WTKM	Hartford, Wis.	1540
WTKO	Ithaca, N.Y.	1470
WTLB	Utica, N.Y.	1310
WTLO	Somerset, Ky.	1480
WTLS	Tallasee, Ala.	1300
WTMA	Charleston, S.C.	1250
WTMC	Ocala, Fla.	1290
WTMJ	Milwaukee, Wis.	620
WTMP	Tampa, Fla.	1150
WTMT	Louisville, Ky.	620
WTNC	Thomasville, N.C.	790
WTNO	Orangeburg, S.C.	920
WTNS	Coshocton, Ohio	1560
WTNT	Tallahassee, Fla.	1450
WTOB	Winston-Salem, N.C.	1380
WTOC	Savannah, Ga.	1290
WTOD	Toledo, Ohio	1560
WTOE	Spruce Pine, N.C.	1470
WTOL	Toledo, Ohio	1230

C.L.	Location	Kc.
WTON	Staunton, Va.	1240
WTOP	Washington, D.C.	1500
WTOR	Torrington, Conn.	1490
WTOT	Marianna, Fla.	980
WTPR	Paris, Tenn.	710
WTRA	Latrobe, Pa.	1480
WTRB	Ripley, Tenn.	1570
WTRC	Elkhart, Ind.	1340
WTRL	Bradenton, Fla.	1490
WTRN	Tyrone, Pa.	1290
WTRO	Dyersburg, Tenn.	1330
WTRP	LaGrange, Ga.	620
WTRR	Sanford, Fla.	1400
WTRU	Muskegon, Mich.	1600
WTRW	Two Rivers, Wis.	1590
WTRX	Flint, Mich.	1330
WTRY	Troy, N.Y.	980
WTSA	Brattleboro, Vt.	1450
WTSB	Lumberton, N.C.	1340
WTSL	Hanover-Lebanon, New Hampshire	1400
WTSN	Dover, N.H.	1270
WTSV	Claremont, N.H.	1230
WTTB	Vero Beach, Fla.	1490
WTTH	Port Huron, Mich.	1380
WTTL	Madisonville, Ky.	1310
WTTM	Trenton, N.J.	920
WTTN	Watertown, Wis.	1580
WTTR	Westminster, Md.	1470
WTTS	Bloomington, Ind.	1370
WTTT	Arlington, Fla.	1220
WTUG	Tuscaloosa, Ala.	790
WTUP	Tupelo, Miss.	1490
WTUX	Wilmington, Del.	1290
WTVB	Coldwater, Mich.	1590
WTVL	Waterville, Maine	1490
WTVN	Columbus, Ohio	610
WTWA	Thomson, Ga.	1240
WTWB	Auburndale, Fla.	1570
WTWN	St. Johnsbury, Vt.	1340
WTXL	W. Spgfd., Mass.	1490
WTYC	Rock Hill, S.C.	1150
WTYM	East Longmeadow, Mass.	1600
WTYN	Tryon, N.C.	1580
WTYS	Marianna, Fla.	1340
WULA	Eufaula, Ala.	1240
WUSJ	Lockport, N.Y.	1340
WUST	Bethesda, Md.	1120
WVAM	Altoona, Pa.	1430
WVCG	Coral Gables, Fla.	1070
WVCH	Chester, Pa.	740
WVEC	Hampton, Va.	1490
WVET	Rochester, N.Y.	1280
WVIM	Vicksburg, Miss.	1490
WVIP	Mt. Kisco, N.Y.	1310
WVJP	Caguas, P.R.	1110
WVJS	Owensboro, Ky.	1420
WVKO	Columbus, Ohio	1580
WVLD	Valdosta, Ga.	1450
WVLK	Lexington, Ky.	590
WVLN	Olney, Ill.	740
WVMC	Mt. Carmel, Ill.	1360
WVMI	Biloxi, Miss.	570
WVNA	Tuscumbia, Ala.	1590
WVNJ	Newark, N.J.	620
WVOK	Birmingham, Ala.	690
WVOL	Nashville, Tenn.	1470
WVDP	Vidalia, Ga.	970
WVOS	Liberty, N.Y.	1240
WVOT	Wilson, N.C.	1420
WVOW	Logan, W.Va.	1290
WVOX	New Rochelle, N.Y.	1460
WVPO	Stroudsburg, Pa.	840
WVSC	Somerset, Pa.	990
WVVW	Grafton, W.Va.	1260
WWBC	Bay City, Mich.	1250
WWBD	Bamberg, S.C.	790
WWBZ	Vineland, N.J.	1360
WWCA	Gary, Ind.	1270
WWCC	Bremen, Ga.	1440
WWCO	Waterbury, Conn.	1240
WWDC	Washington, D.C.	1260
WWGP	Sanford, N.C.	1050
WWGS	Tifton, Ga.	1430
WWHG	Hornell, N.Y.	1320
WWIL	Ft. Lauderdale, Fla.	1580
WWIN	Baltimore, Md.	1400
WWIS	Black River Falls, Wis.	1260
WWIT	Canton, N.C.	970
WWIZ	Lorain, Ohio	1380
WWJ	Detroit, Mich.	950
WWJB	Brooksville, Fla.	1450
WWKY	Winchester, Ky.	1380
WWL	New Orleans, La.	870
WWNC	Asheville, N.C.	570
WWNH	Rochester, N.H.	930
WWNR	Beckley, W.Va.	620
WWNS	Statesboro, Ga.	1240
WWNY	Watertown, N.Y.	790
WWOD	Lynchburg, Va.	1390
WWOK	Charlotte, N.C.	1480
WWOL	Buffalo, N.Y.	1120
WWON	Woonsocket, R.I.	1240
WWPA	Williamsport, Pa.	1340
WWPF	Palatka, Fla.	1260
WWRI	W. Warwick, R.I.	1450
WWRJ	White River Junc., Vt.	910
WWRL	Woodside, N.Y.	1600
WWSC	Glens Falls, N.Y.	1450
WWSR	St. Albans, Vt.	1420
WWST	Wooster, Ohio	960
WWSW	Pittsburgh, Pa.	970
WWVA	Wheeling, W.Va.	1170
WWWB	Jasper, Ala.	1360
WWWF	Fayette, Ala.	990
WWWR	Russellville, Ala.	920
WWWW	Rio Piedras, P.R.	1520
WWXL	Manchester, Ky.	1450
WWYO	Pineville, W.Va.	970
WXAL	Demopolis, Ala.	1400
WXGI	Richmond, Va.	950
WXLI	Dublin, Ga.	1440
WXLW	Indianapolis, Ind.	950
WXOK	Baton Rouge, La.	1260
WXRF	Guayama, P.R.	1590
WXXX	Hattiesburg, Miss.	1310
WXYZ	Detroit, Mich.	1270
WYCL	York, S.C.	1580
WYDE	Birmingham, Ala.	850
WYFE	New Orleans, La.	600
WYLD	New Orleans, La.	940
WYMB	Manning, S.C.	1410
WYNG	Warwick-East Greenwich, R.I.	1590
WYRN	Louisburg, N.C.	1480
WYSE	Lakeland, Fla.	1330
WYSR	Franklin, Va.	1250
WYTH	Madison, Ga.	1250
WYTI	Rocky Mount, Va.	1570
WYUO	Newport News, Va.	1270
WYVE	Wytheville, Va.	1280
WYZE	Atlanta, Ga.	1480
WZEP	DeFuniak Sprgs., Fla.	1460
WZIP	Covington, Ky.	1050
WZKY	Albemarle, N.Dak.	1580
WZOB	Ft. Payne, Ala.	1250
WZOK	Jacksonville, Fla.	1320
WZRO	Jacksonville Beach, Florida	1010
WZYX	Cowan, Tenn.	1440

Canada

C.L.	Location	Kc.
CBA	Sackville, N.B.	1070
CBAF	Moncton, N.B.	1300
CBE	Windsor, Ont.	1550
CBF	Montreal, Que.	690
CBG	Gander, Nfld.	1450
CBH	Halifax, N.S.	1330
CBI	Sydney, N.S.	1140
CBJ	Chicoutimi, Que.	1580
CBK	Regina, Sask.	540
CBL	Toronto, Ont.	740
CBM	Montreal, Que.	940
CBN	St. John's, Nfld.	640
CBO	Ottawa, Ont.	910
CBT	Grand Falls, Nfld.	990
CBU	Vancouver, B.C.	690
CBV	Quebec, Que.	980
CBW	Winnipeg, Man.	990
CBX	Edmonton, Alta.	1010
CBXA	Edmonton, Alta.	740
CBY	Corner Brook, Nfld.	790
CFAB	Windsor, N.S.	1450
CFAC	Calgary, Alta.	960
CFAM	Altona, Man.	1290
CFAR	Flin Flon, Man.	590
CFAX	Saanich, B.C.	810
CFBC	Saint John, N.B.	930
CFBR	Sudbury, Ont.	550
CFCF	Montreal, Que.	600
CFCH	North Bay, Ont.	600
CFCL	Timmins, Ont.	580
CFCN	Calgary, Alta.	1060
CFCO	Chatham, Ont.	630
CFCP	Courtenay, B.C.	1440
CFCW	Camrose, Alta.	1230
CFCY	Charlottetown, P.E.I.	630
CFDA	Victoriaville, Que.	1380
CFGB	Goose Bay, Nfld.	1340
CFGP	Grande Prairie, Alta.	1050
CFGR	Gravelbourg, Sask.	1230
CFGT	St. Joseph d'Alma, Que.	1270
CFJC	Kamloops, B.C.	910
CFJR	Brockville, Ont.	1450
CFKL	Schefferville, Que.	1230
CFLM	LaTuque, Que.	1240
CFML	Cornwall, Ont.	1110
CFNB	Fredericton, N.B.	550
CFNS	Saskatoon, Sask.	1170
CFOB	Fort Frances, Ont.	800
CFOR	Orillia, Ont.	1570
CFOS	Owen Sound, Ont.	560
CFPA	Port Arthur, Ont.	1230
CFPL	London, Ont.	980
CFPR	Prince Rupert, B.C.	1240
CFQC	Saskatoon, Sask.	600
CFRA	Ottawa, Ont.	560
CFRB	Toronto, Ont.	1010
CFRC	Kingston, Ont.	1490
CFRG	Gravelbourg, Sask.	710
CFRN	Edmonton, Alta.	1260
CFRS	Simcoe, Ont.	1560
CFRY	Portage la Prairie, Man.	1570
CFSL	Weyburn, Sask.	1340
CFUN	Vancouver, B.C.	1410
CFWH	Whitehorse, Yukon T.	1240
CFYK	Yellowknife, N.W.T.	1340
CFYT	Dawson, Yukon T.	1230
CHAB	Moose Jaw, Sask.	800
CHAD	Amos, Que.	1340
CHAT	Medicine Hat, Alta.	1270
CHEC	Lethbridge, Alta.	1090
CHED	Edmonton, Alta.	1080
CHEF	Granby, Que.	1450
CHEX	Peterborough, Ont.	980
CHFA	Edmonton, Alta.	680
CHFC	Churchill, Man.	1230
CHGB	St. Anne de la Pocatiere, Que.	1350
CHIC	Brampton, Ont.	1090
CHLN	Three Rivers, Que.	550
CHLO	St. Thomas, Ont.	680
CHLT	Sherbrooke, Que.	630
CHML	Hamilton, Ont.	900
CHNC	New Carlisle, Que.	610
CHNO	Sudbury, Ont.	900
CHNS	Halifax, N.S.	960
CHOK	Sarnia, Ont.	1070
CHOV	Pembroke, Ont.	1350
CHOW	Welland, Ontario	1470
CHRC	Quebec, Que.	800
CHRD	Drummondville, Que.	1340
CHRL	Roberval, Que.	910
CHRS	St. Jean, Que.	1090
CHSJ	Saint John, N.B.	1150
CHUB	Nanaimo, B.C.	1570
CHUC	Port Hope, Ont.	1500
CHUM	Toronto, Ont.	1050
CHVC	Niagara Falls, Ont.	1600
CHWK	Chilliwack, B.C.	1270
CHWO	Oakville, Ont.	1250
CJAD	Montreal, Que.	800
CJAT	Trail, B.C.	610
CJAV	Port Alberni, B.C.	1240
CJBC	Toronto, Ont.	860
CJBQ	Belleville, Ont.	800
CJBR	Rimouski, Que.	900
CJCA	Edmonton, Alta.	930
CJCB	Sydney, N.S.	1270
CJCH	Halifax, N.S.	920
CJCJ	Woodstock, N.B.	920
CJCS	Stratford, Ont.	1240
CJDC	Dawson Creek, B.C.	1350
CJEM	Edmundston, N.B.	570
CJET	Smiths Falls, Ont.	630
CJFP	Riviere du Loup, Que.	1400
CJFX	Antigonish, N.S.	580
CJGX	Yorkton, Sask.	940
CJIB	Vernon, B.C.	940
CJIC	Sault Ste. Marie, Ont.	1050
CJKL	Kirkland Lake, Ont.	560
CJLR	Quebec, Que.	1060
CJLS	Yarmouth, N. S.	1340
CJMS	Montreal, Que.	1280
CJMT	Chicoutimi, Que.	1420
CJNB	N. Battleford, Sask.	1460
CJNR	Blind River, Ont.	730
CJOB	Winnipeg, Man.	680
CJOC	Lethbridge, Alta.	1220
CJON	St. John's, Nfld.	930
CJOR	Vancouver, B.C.	600
CJOY	Guelph, Ont.	1450
CJQC	Quebec, Que.	1340
CJRH	Richmond Hill, Ont.	1310
CJRL	Kenora, Ont.	1220
CJRW	Summerside, P.E.I.	1240
CJSO	Sorel, Que.	1320
CJSP	Leamington, Ont.	710
CJSS	Cornwall, Ont.	1220
CJVI	Victoria, B.C.	900
CKAC	Montreal, Que.	730
CKAR	Huntsville, Ont.	590
CKAR-I	Parry Sound, Ont.	1340
CKBB	Barrie, Ont.	950
CKBC	Bathurst, N.B.	1400
CKBI	Prince Albert, Sask.	900
CKBL	Matane, Que.	1250
CKBM	Montmagny, Que.	1490
CKBS	St. Hyacinthe, Que.	1240
CKBW	Bridgewater, N.S.	1000
CKCH	Hull, Que.	970
CKCK	Regina, Sask.	620
CKCL	Truro, N.S.	600
CKCQ	Quesnel, B.C.	570
CKCR	Kitchener, Ont.	1490
CKCV	Quebec, Que.	1280
CKCW	Moncton, N.B.	1220
CKCY	Sault Ste. Marie, Ont.	1400
CKDA	Victoria, B.C.	1220
CKDH	Amherst, N.S.	1400
CKDM	Dauphin, Man.	730
CKEC	New Glasgow, N.S.	1230
CKEK	Cranbrook, B.C.	570
CKEN	Kentville, N.S.	1350
CKEY	Toronto, Ont.	580
CKFH	Toronto, Ont.	1430
CKGB	Timmins, Ont.	680
CKGR	Galt, Ont.	1110
CKJL	St. Jerome, Que.	900
CKKW	Kitchener, Ont.	1320
CKLB	Oshawa, Ont.	1350
CKLC	Kingston, Ont.	1380
CKLD	Thetford Mines, Que.	1230
CKLG	N. Vancouver, B.C.	730
CKLN	Nelson, B.C.	1390
CKLS	LaSarre, Que.	1240
CKLW	Windsor, Ont.	800
CKLY	Lindsay, Ont.	910
CKMP	Midland, Ont.	1230
CKMR	Newcastle, N.B.	790
CKNB	Campbellton, N.B.	950
CKNW	New Westminster, British Columbia	980
CKNX	Wingham, Ont.	920
CKOC	Hamilton, Ont.	1150
CKOK	Penticton, B.C.	800
CKOM	Saskatoon, Sask.	1420
CKOT	Tillsonburg, Ont.	1510
CKOV	Kelowna, B.C.	630
CKOX	Woodstock, Ont.	1340
CKOY	Ottawa, Ont.	1310
CKPC	Brantford, Ont.	1380
CKPG	Prince George, B.C.	550
CKPR	Fort William, Ont.	580
CKRB	Ville St. Georges, Que.	1250
CKRC	Winnipeg, Man.	630
CKRD	Red Deer, Alta.	850
CKRM	Regina, Sask.	980
CKRN	Rouyn, Que.	1400
CKRS	Jonquiere, Que.	590
CKSA	Lloydminster, Alta.	1150
CKSB	St. Boniface, Man.	1050
CKSL	London, Ont.	1290
CKSM	Shawinigan, Quebec	1220
CKSO	Sudbury, Ont.	790
CKSW	Swift Current, Sask.	1400
CKTB	St. Catharines, Ont.	610
CKTR	Three Rivers, Que.	1150
CKTS	Sherbrooke, Que.	900
CKUA	Edmonton, Alta.	580
CKVD	Val d'Or, Que.	1230
CKVL	Verdun, Que.	850
CKVM	Ville Marie, Que.	710
CKWS	Kingston, Ont.	960
CKWX	Vancouver, B.C.	1130
CKX	Brandon, Man.	1150
CKXL	Calgary, Alta.	1140
CKY	Winnipeg, Man.	580
CKYL	Peace River, Alta.	630
VOAR	St. John's, Nfld.	1230
VOCM	St. John's, Nfld.	590
VOWR	St. John's, Nfld.	800

Canadian Short-Wave—Domestic and International

Abbreviations: Kc., frequency in kilocycles (to change to megacycles, divide by 1000); C.L., call letters

*Transmitter at Sackville, New Brunswick

Kc.	C.L.	Location
5970	CBNX	St. John's, Nfld.
5970	CKNA	Montreal, Que.*
5990	CHAY	Montreal, Que.*
6005	CFCX	Montreal, Que.
6010	CJCX	Sydney, N.S.
6030	CFVP	Calgary, Alta.
6060	CKRZ	Montreal, Que.*
6070	CFRX	Toronto, Ont.
6080	CKFX	Vancouver, B.C.
6090	CBFW	Montreal, Que.
6090	CKOB	Montreal, Que.*
6130	CHNX	Halifax, N.S.
6160	CBUX	Vancouver, B.C.
6160	CHAC	Montreal, Que.*
9520	CBFR	Montreal, Que.
9585	CKLP	Montreal, Que.*
9610	CBFX	Montreal, Que.
9610	CHLS	Montreal, Que.*
9630	CBFO	Montreal, Que.
9630	CKLO	Montreal, Que.*
9710	CHLR	Montreal, Que.*
9740	CHFO	Montreal, Que.*
11705	CBFY	Montreal, Que.
11705	CKXA	Montreal, Que.*
11720	CBFL	Montreal, Que.
11720	CHOL	Montreal, Que.*
11760	CBFA	Montreal, Que.
11760	CKRA	Montreal, Que.*
11900	CKEX	Montreal, Que.*
11945	CKEX	Montreal, Que.*
15090	CKLX	Montreal, Que.*
15105	CKUS	Montreal, Que.*
15190	CBFZ	Montreal, Que.
15190	CKCX	Montreal, Que.*
15255	CKSR	Montreal, Que.*
15275	CKBR	Montreal, Que.*
15320	CKCS	Montreal, Que.*
17710	CHSB	Montreal, Que.*
17735	CHRX	Montreal, Que.*
17820	CKNC	Montreal, Que.*
17865	CHYS	Montreal, Que.*
21600	CKRP	Montreal, Que.*
21710	CHLA	Montreal, Que.*

World-Wide Short-Wave Stations

Most international broadcasting is done within frequency limits agreed upon at international conventions. These frequency ranges are listed here, at the right, expressed both in frequency and by meter bands (wave-length).

Not all of the bands are employed at once. In fact, only one or two are usable at any one time. The time of the day and the season (or seasons, since the season is opposite in the southern hemisphere) are the two chief determining factors. Broadcasters beaming programs to the U.S. use the best band for the time. Broadcasts not beamed to the U.S., if heard here at all, will be scattered over the bands. Low frequencies are better heard at night than by day. High frequencies are better heard in summer than in winter.

5950 to 6200 kc/s (49 meter band)
7100 to 7300 kc/s (41 meter band)
9500 to 9775 kc/s (31 meter band)
11700 to 11975 kc/s (25 meter band)
15100 to 15450 kc/s (19 meter band)
17700 to 17900 kc/s (16 meter band)
21450 to 21750 kc/s (13 meter band)

The symbol ● denotes stations beaming regular evening broadcasts to the United States.

Kc.	C.L.	Location
4768	HJEF	Cali, Colombia
4775	HJGB	Bucaramanga, Col.
4783	HJAB	Barranquilla, Col.
4790	YVQC	Ciudad Bolivar, Vz.
4797	HJFU	Armenia, Colombia
4800	YVME	Maracaibo, Venez.
4805	ZYS8	Manaos, Brazil
4810	YVMG	Maracaibo, Venez.
4815	HJBB	Cucuta, Col.
4820	XEJG	Guadalajara, Mex.
4820	YVNB	Coro, Venez.
4830	YVOA	San Cristobal, Vez.
4835	HJKE	Bogota, Colombia
4840	YVOI	Valera, Venez.
4845	CSA93	Ponta Delgada, Az.
4848	HJGF	Bucaramanga, Col.
4850	YVMS	Barquisimeto, Vz.
4855	HJFN	Neiva, Colombia
4860	JKL	Tokyo, Japan
4860	YVPA	San Filipe, Venez.
4865	PRC5	Belem, Para, Brazil
4865	HJFA	Pereira, Colombia
4871	HJBG	Cucuta, Colombia
4880	YVKF	Caracas, Venez.
4892	YVKB	Caracas, Venez.
4895	HJCH	Bogota, Col.
4895	PRF6	Manaos, Brazil
4897	VLX4	Perth, Aust.
4900	YVQE	Ciudad Bolivar, Vz.
4903	HJAG	Barranquilla, Col.
4907	YVMM	Coro, Venez.
4910	JKI	Nazaki, Japan
4910	YDB2	Djakarta, Indon.
4915		Accra, Ghana
4915	YVKR	Caracas, Venez.
4917	HI9B	Santiago, Dom. Rep.
4917	VLM4	Brisbane, Aus.
4930	HJAP	Cartagena, Col.
4940	JKM	Kawachi, Japan
4940	YVMQ	Barquisimeto, Vz.
4945	HJCW	Bogota, Col.
4950	ZQI	Kingston, Jamaica
4951		Dakar, Senegal
4960	YVQA	Cumana, Venez.
4967	HJAE	Cartagena, Col.
4970	YVLK	Caracas, Venez.
4985	YVMO	Barquisimeto, Vz.
4993	HI1A	Santiago, D.Rep.
5010		Grenada, Windward Is.
5014	PJC3	Willimstad, Curac.
5020	HJFW	Manizales, Col.
5023	HI8Z	Santiago, D.Rep.
5030	YVKM	Caracas, Venez.
5045	ZYP23	Petropolis, Brazil
5050	YVKD	Caracas, Venez.
5053	HI2L	Ciudad Trujillo, D.R.
5055	HJDW	Medellin, Col.
5075	HJKH	Sutatenza, Colom.
5758	PZH5	Paramaribo, Surinam
5880	HRN	Tegucigalpa, Hond.
5920	HRA	Tegucigalpa, Hond.
5940		Khabarovsk, U.S.S.R.
5940		Moscow, U.S.S.R.
5952	TGNA	Guatemala, Guat.
5960	HJCF	Bogota, Colombia
5965		Shanghai, China
5969	HVJ	Vatican City
5970	HI4T	Ciudad Trujillo, D.R.
5981	ZFY	Georgetown, Br. Gui.
5985		Radio Free Europe, Munich, Germany
5990	TGJA	Guatemala, Guat.
5995	HO50	Panama, Panama
6005		Berlin, Germany
6005	HP5K	Colon, Panama
6009	HJFC	Armenia, Colombia
6010	GRB	London, England
6010	OLR2A	Prague, Czecho.
6010	XEOI	Mexico, Mex.
6015	PRA8	Recife, Brazil
6018	HJCX	Bogota, Col.
6020		Kiev, U.S.S.R.
6020		Radio Free Europe, Munich, Germany
6020	KNBH(VOA)	Dixon, Calif.
6020	XEUW	Vera Cruz, Mex.
6024		Brazzaville, Fr. Eq. Africa
6025		Radio Nederland
6025	HI1J	San Pedro, D.R.
6030		Stuttgart, Germany
6030	DZH6	Manila, P.I.
6030	XEKW	Morelia, Mex.
6030	HP5B	Panama, Pan.
6035	GWS	London, England
6035		Monte Carlo, Monaco
6035	XYZ	Rangoon, Burma
6037		San Jose, Costa Rica
6040	GSY	London, England
6040	KCBR	Delano, Calif.
6040		Tangier, Tangier
6040	WLWO	Cincinnati, U.S.A.
6045	YDF	Djakarta, Indonesia
6050	HI1N	Ciudad Trujillo, D.R.
6050	GSA	London, England
6054	HJEX	Cali, Colombia
6055	HER2	Bern, Switzerland
6060	GSX	London, England
6060	KNBH(VOA)	Dixon, Calif.
6060		Tangier I, Tangier
6060	WDSI	New York, U.S.A.
6065	SBO	Motala, Sweden
6065	XEXE	Mexico City, Mex.
6069	JOB	Tokyo, Japan
6070	GRR	London, England
6075	KGEI	San Fran., U.S.A.
6080		Munich III, Germany
6081	OAX4Z	Lima, Peru
6085	ORU	Brussels, Belgium
6085	VP4RD	Port-of-Spain, Trinidad
6085	ZYK2	Recife, Brazil
6090	GWM	London, England
6090	VLI6	Sydney, Australia
6092		Radio Luxemburg
6095		Horby, Sweden
6095		Radio Free Europe, Munich, Germany
6095	ZYB7	Sao Paulo, Brazil
6095	HJFK	Pereira, Colombia
6100		Belgrade, Yugoslavia
6100	WRCA	New York, U.S.A.
6110	GSL	London, England
6112	HI1Z	Ciudad Trujillo, D.R.
6115		Berlin, Germany
6120	HC2FB	Guayaquil, Ecua.
6120	ZJI4	Limassol, Cyprus
6120		Tangier, Tangier
6120	WRCA	New York, U.S.A,
6122	HP5H	Panama, Pan.
6124	HRQ	San Pedro Sula, Hond.
6125	GWA	London, England
6130	XEUZ	Mexico, Mex.
6130		Radio Spain ●
6130	COCD	Havana, Cuba
6130		Port Moresby, New Guinea
6135	HJED	Cali, Colombia
6140		Munich, Germany
6145	HJDE	Medellin, Col.
6147	PRL9	Rio de Janeiro, Br.
6150	GRW	London, England
6150	TGAZ	Guatemala, Guat.
6160	HJKJ	Bogota, Colombia
6160		Honolulu, Hawaii
6160		Munich, Germany
6165	GWK	London, England
6165	HER3	Bern, Switzerland ●
6167	4VCM	Port-au-Prince, H.
6170		Munich, Germany
6170	GSZ	London, England
6170	KCBR	Delano, Cal., U.S.A.
6170	YVKO	Caracas, Venez.
6172	ZJM5	Limassol, Cyprus
6175	XEXA	Mexico, Mex.
6180	LRM	Mendoza, Argentina
6180		Ashkabad, U.S.S.R.
6180	GRO	London, England
6182	TGWB	Guatemala, Guat.
6185	KCBR(VOA)	Delano, Calif.
6185	HJCT	Bogota, Colombia
6190		Frankfurt, Germany
6190	HI9T	Puerto Plata, D.R.
6190	WLWO	Cincinnati, U.S.A.
6190	WRCA	New York, U.S.A.
6195	GRN	London, England
6195		Honolulu, Hawaii
6200		Paris, France
6215	SP13	Warsaw, Poland
6235	HRO2	La Ceiba, Hond.
6235		Karachi, Pakistan
6248		Budapest, Hungary
6285	TGTQ	Guatemala, Guat.
6295	OTM1	Leopoldville, Belgian Congo
6295	TGLA	Guatemala, Guat.
6320		Baden.Baden, Germany
6322	COCW	Havana, Cuba
6335	TGTA	Guatemala, Guat.
6351	HRP1	San Pedro Sula, Hond.
6374	CSA21	Lisbon, Port.
6405	TGQA	Quezaltenango, Guat.
6450	COCY	Santa Clara, Cuba
6632	HC2RL	Guayaquil, Ecu.
6660	HROW	Tegucigalpa, Hond.
6758	YNVP	Managua, Nic.
6790	ZJM6	Limassol, Cyprus
6830	4XB21	Tel Aviv, Israel
6870	HC4EB	Manta, Ecuador
7105		Paris, France
7112	CR4AA	Praia, Cape V. Isls.
7120	GRM	London, England
7135	BED7	Taipei, Formosa
7135	MCM	London, England
7145		Radio Free Europe Lisbon, Portugal
7150	GRT	London, England
7165		Moscow, U.S.S.R.
7175	VUD	Delhi, India
7180	JOA	Tokyo, Japan
7185	GRK	London, England
7200	GWZ	London, England
7205		Warsaw, Poland
7210	GWL	London, England
7210	HEI3	Bern, Switzerland
7222		Budapest, Hungary ●
7230	GSW	London, England
7240		Moscow, U.S.S.R.
7240		Paris, France
7250	GWI	London, England
7255		Prague.Czechoslovakia ●
7257	JKH	Tokyo, Japan
7260	GSU	London, England
7260		Moscow, U.S.S.R.
7280	GWN	London, England
7285	JKJ	Tokyo, Japan
7285	TAS	Ankara, Turkey
7290		Hamburg, Germany
7290	VUD	Delhi, India
7295		Moscow, U.S.S.R.
7300		Radio Free Europe, Munich, Germany
7300	SVD2	Athens, Greece
7315	YSO	San Salvador, Salv.
7320	GRJ	London, England
7335	BEC36	Taipei, Formosa
7360		Moscow, U.S.S.R.
7670		Sofia, Bulgaria
7850	ZAA	Tirana, Albania
7863	SUX	Cairo, Egypt
7933	HLKA	Pusan, S. Korea
7951		Alicante, Spain
8036	FXE	Beirut, Lebanon
8664	COJK	Camaguey, Cuba
8825	COCQ	Havana, Cuba
8955	COKG	Santiago, Cuba
9007		Voice of Zion, Tel Aviv, Israel
9026	COBZ	Havana, Cuba
9236	COBQ	Havana, Cuba
9252		Bucharest, Rumania
9290	PRN9	Rio de Janeiro, Brazil
9316	LRS	Buenos Aires, Arg.
9340	OAX4J	Lima, Peru
9363	COBC	Havana, Cuba
9369		Madrid, Spain
9380		Khabarovsk, U.S.S.R.
9400	OTM2	Leopoldville, Belgian Congo
9410	GRI	London, England
9440		Brazzaville, Fr. Eq. Africa
9452	LRY1	Buenos Aires, Arg.
9463	TAP	Ankara, Turkey
9480		Moscow, U.S.S.R.
9490	KUJ39	Agana, Guam.
9500	XEWW	Mexico, Mex.
9504	OLR3B	Prague, Czecho.
9505	HOLA	Colon, Panama
9505	JBD	Kawachi, Japan
9510	YVHJ	Barquisimeto, Ven.
9510	GSB	London, England
9515	KNBH(VOA)	Dixon, Calif.
9515	TAT	Ankara, Turkey
9520		Colombo, Ceylon
9520	HJKF	Bogota, Colombia
9520	OZF	Skamlebak, Denmark ●
9520	VLT9	Port Moresby, British New Guinea
9520	WLWO	Cincinnati, U.S.A.
9525	GWJ	London, England
9525	ZBW3	Victoria, Hong Kong
9527		Warsaw, Poland
9530		Honolulu, Hawaii
9530		Manila, Philippines
9530	KCBR	Delano, Cal., U.S.A.
9530	WABC	New York, U.S.A.
9531	COCO	Havana, Cuba
9535	HER4	Bern, Switzerland ●
9535	SBU	Stockholm, Sweden
9540		Munich, Germany
9540	VLG9	Melbourne, Aus.
9540	ZL2	Wellington, N. Zeal.
9543	XYZ	Rangoon, Burma
9548	XEFT	Vera Cruz, Mex.
9550	HVJ	Vatican City
9550		Paris, France
9550	OLR3A	Prague, Czecho. ●
9550		Grenada, Windward Is.
9555	OIX2	Pori, Finland
9555	XETT	Mexico, Mex.
9560	JBD2	Kawachi, Japan
9560		London, England
9560		Paris, France
9560	WLWO	Cincinnati, U.S.A.
9560	WRCA	New York, U.S.A.
9565		Komsomolsk, U.S.S.R.
9565	ZYK3	Recife, Brazil
9570		Algiers, Algeria
9570	GWX	London, England
9570	KCBR(VOA)	Delano, Calif.
9570		Warsaw, Poland
9570		Bucharest, Rumania ●
9570		Rome, Italy ●
9580	GSC	London, England
9580	VLB9	Shepparton, Aus.
9585		Madrid, Spain ●
9590		Hilversum, Neth. ●
9590	WABC	New York, U.S.A.
9600	GRY	London, England
9600	KCBR	Delano, Cal., U.S.A.
9600	KRCA	San Fran., U.S.A.
9600		Leningrad, U.S.S.R.
9605	HP5J	Panama, Pan.
9605	JKL2	Toyko, Japan
9605		Radio Free Europe, Lisbon, Portugal
9607		Athens, Greece
9610	VLX9	Perth, Australia
9610	ZYC8	Rio de Janeiro, Brazil
9610	LLG	Oslo, Norway
9610	XERQ	Mexico, Mex.
9615		Voice of Amer., Tangier
9615	VLB9	Shepparton, Aus.
9615	WRCA	New York, U.S.A.
9618	TIDCR	San Jose, C.Rica
9620		Horby, Sweden ● (Nov. to Febr. only)
9620		Paris, France
9620	ZL8	Wellington, N.Z.
9625	XEBT	Mexico, Mex.
9625	GWO	London, England
9625	VP4RD	Port-au-Spain, Trinidad
9630	HJKC	Bogota, Colombia
9630	VUD4/10	Delhi, India
9630		Rome, Italy
9635		Munich, Germany
9635		Voice of Amer., Tangier
9640		Accra, Ghana
9640		West Germany Radio, Cologne ●
9640	DZH2	Manila, P.I.
9640	GVZ	London, England
9645		Karachi, Pakistan
9645	LLH	Oslo, Norway
9645	TIFC	San Jose, C.Rica
9646	HVJ9	Vatican City
9650		Honolulu, Hawaii
9650		Moscow, U.S.S.R.
9650		Tangier, Tangier
9650	WDSI(VOA)	Brentwood, N. Y.
9652	ZJM8	Limassol, Cyprus
9654	OTC2	Leopoldville, Belgian Congo
9655	JKI2	Nazaki, Japan
9656	4VEH	Cap-Haitien, Haiti
9660	EQC	Teheran, Iran
9660	GWP	London, England
9660	VLQ9	Brisbane, Aus.
9665	HEU3	Bern, Switzerland
9668	TGNB	Guatemala, Guat.
9670		Munich, Germany
9670		Voice of Amer., Tangier
9670		Moscow, U.S.S.R.
9675	GWT	London, England
9675	JOB3	Tokyo, Japan
9680		Paris, France
9680	XEQQ	Mexico, Mex.
9680	VUD	Delhi, India
9680		Moscow, U.S.S.R.
9680		Voice of America, Tangier

Kc.	C.L.	Location
9680	VLR9/VLH9	Melbourne, Australia
9685		Paris, France
9685	WLWO	Cincinnati, U.S.A.
9690	LRA	Buenos Aires, Arg. ●
9690	GRX	London, England
9690		Moscow, U.S.S.R. ●
9690		Singapore, Malaya
9695	JKM2	Kawachi, Japan
9700	GWY	London, England
9700	WDSI	New York, U.S.A.
9700		Sofia, Bulgaria ●
9700		Voice of America, Tangier
9700	WLWO	Cincinnati, U.S.A.
9700	KCBR	Delano, Cal., U.S.A.
9700	FZF6	Ft. de France, Mart.
9710		Moscow, U.S.S.R. ●
9710		Dakar, Fr. W. Africa
9710	YDF6	Djakarta, Indonesia
9710		Rome, Italy
9715		Cairo, Egypt
9716		Moscow, U.S.S.R. ●
9717		Radio Free Europe, Ger.
9720	PRL7	Rio de Janeiro, Brazil
9730		French Equatorial Africa ●
9730		Nanking, China
9730	DZH7	Manila, P.I.
9730		Leipzig, Germany
9735	HI2T	Ciudad,Trujillo, D.R.
9741	CSA27	Lisbon, Portugal
9745	HCJB	(Missionary Station), Quito, Ecuador ●
9745	ORU	Brussels, Belgium
9760	CR7BE	Lourence Marques, Moz.
9765	TGWA	Guatemala, Guat.
9770		London, England
9770	ORU	Brussels, Belgium
9770	PRL4	Rio de Jan., Brazil
9780		Rome, Italy
9785		Monte Carlo, Monaco
9825	GRH	London, England ●
9833		Budapest, Hungary ●
9833	COBL	Havana, Cuba
9865	YDF8	Djakarta, Indonesia
9915	GRU	London, England
9966		Brazzaville, Fr. Eq. Africa
10058	SUV	Cairo, Egypt
10195		Paris, France
10220	PSH	Rio de Janeiro, Brazil
10258	XRRA	Peiping, China
10780	SDB2	Motala, Sweden
11027	CSA29	Lisbon, Portugal
11090	CSA92	PontaDelgada,Azores
11455		Peking, China
11475	ZNX52	Barbadoes, B.W.I.
11513		Tangier, Morocco
11515		Peking, China
11630		Leningrad, U.S.S.R.
11640		All India Radio, Delhi
11650		Peking, China
11670		Bangkok, Thailand
11680	HJCQ	Bogota, Colombia
11680	GRG	London, England
11685		Peking, China
11695	HP5A	Panama, Panama
11700	GVW	London, England
11702		Paris, France
11705	JOA4	Tokyo, Japan
11705	SBP	Motala, Sweden
11710		Moscow, U.S.S.R.
11710		Voice of America, Tangier
11710	VUD5/7	Delhi, India
11710	WLWO	Cincinnati, U.S.A.
11714	ZJM7	Limassol, Cyprus
11715	HEI5	Bern, Switzerland
11718		Athens, Greece
11720	PRL8	Rio de Janeiro, Brazil
11720		Radio Portugal ●
11720	DTM4	Leopoldville, Belgian Congo
11720	ORY2	Brussels, Belgium
11724	HNG	Baghdad, Iraq
11725	COCY	Havana, Cuba
11730	GVV	London, England
11730	KGEI	San Fran., U.S.A.
11730		Hilversum, Nether. ●
11730	CE1173	Santiago, Chile
11735	BED6	Taipei, Formosa
11735	LKQ	Frederikstad, Nor.
11735		Radio Free Europe, Ger.
11740		Moscow, U.S.S.R.
11740		Warsaw, Poland ●
11740	WRUL	Boston, U.S.A.
11742	CE1174	Santiago, Chilo
11750	GSD	London, England
11755		Radio Portugal ●
11740		Moscow, U.S.S.R.
11760	DLR4B	Prague, Czecho.
11760		Voice of America, Tangier
11760	VLA11/VLB11	Shepparton, Aus.
11760	VUD7/11	Delhi, India
11764	CR7BH	Lourenco Marques, Mozambique
11770	GVU	London, England
11770	YDE/YDF7	Djakarta, Indonesia
11775		Radio Poland ●
11780	BBC	London, England ●
11780		Moscow, U.S.S.R.
11780	XEQH	Mexico, D.F.
11780	ZL3	Wellington, N.Z.
11790	WDSI(VOA)	New York
11790	GWV	London, England
11790	VUD	Delhi, India
11790	WRUL	Boston, U.S.A.
11790		Voice of America, Tangier
11795		West Germany Radio, Cologne ●
11795	YDF3	Djakarta, Indonesia
11795	WRUL	Boston, U.S.A.
11795		Radio Pakistan, Karachi
11795	ELWA	Monrovia, Liberia
11800	JKI4	Tokyo, Japan
11800	GWH	London, England
11800		Brussels, Belgium
11810		Moscow, U.S.S.R. ●
11810		Radio Sweden ● (except—Nov. to Febr.)
11810		Rome, Italy
11810	VLA11	Shepparton, Aus. ● (Morning program)
11815		Warsaw, Poland
11820	GSN	London, England
11820	XEBR	Hermosillo, Mex.
11825	JKI6	Tokyo, Japan
11825		Moscow, U.S.S.R.
11825	ZYK3	Recife, Brazil
11830	FZS4	Saigon, Fr.Indo-C.
11830		Moscow, U.S.S.R. ●
11830		Voice of America, Tangier
11830	WBOU(VOA)	New York, U.S.A.
11830	WDSI(VOA)	New York, U.S.A.
11835	CXA19	Montevideo, Uru.
11835		Prague, Czechoslovakia ●
11840	VLW11	Perth, Australia
11840	OLR4A	Prague, Czecho.
11840	LRT	Tucuman, Argentina
11845		Karachi, Pakistan
11847		Paris, France
11850	VLB11	Shepparton, Aus.
11850	ORU	Brussels, Belgium
11850	TGNC	Guatemala, Guat.
11850	VUD11	Delhi, India
11850	LLK	Oslo, Norway
11855	DZH9	Manila, Philippines
11855		Radio Free Europe, Lisbon, Portugal
11860	GSE	London, England
11860	KWID	San Fran., U.S.A.
11865	CR6RA	Luanda, Angola
11865	HER5	Bern, Switzerland ●
11870		Munich, Germany
11870	KNBH	San Fran., U.S.A.
11870		Voice of America, Tangier
11870	WRUL	Boston, U.S.A.
11875	OLR4C	Prague, Czecho.
11875		Radio Portugal ●
11880		Moscow, U.S.S.R.
11880	LRS	Buenos Aires, Arg.
11880	VLG11/VLH11	Melbourne, Aus.
11880		Horby, Sweden
11880	XEHH	Mexico, Mex.
11880	GRE	London, England
11880	SBP	Stockholm, Sweden
11885	APK3	Karachi, Pakistan
11890		Moscow, U.S.S.R.
11890	GWW	London, England
11890	KZFJ	Manila, P.I.
11890	WBOU	New York, U.S.A.
11895	FHE3	Dakar, Fr.W.Af.
11895		Radio Portugal ●
11895		Manila, Philippines
11900	CE1190	Valparaiso, Chilo
11900	CXA10	Montevideo, Uru.
11900	HCJB	Calvary Radio Ministry
11900	XEXE	Mexico City, Mex.
11900		Rome, Italy ●
11910		Budapest, Hungary ●
11910		Karachi, Pakistan
11915		Radio Netherlands ●
11915		Damascus, Syria
11915	HCJB	Quito, Ecuador ●
11915		Radio Portugal ●
11918	BED4	Taipei, Formosa
11924	FZS4	Saigon, Vietnam
11930	GVX	London, England
11935		Warsaw, Poland
11937		Bucharest, Rumania ●
11950		Radio Netherlands ●
11950	YSAX	San Salvador, Salv.
11955	GVY	London, England
11960		Moscow, U.S.S.R.
11964		Lisbon, Portugal ●
11970		Brazzaville, Fr.Eq.Africa ●
11972	TIHH	San Jose, C.Rica
11975		Colombo, Ceylon
11980		Moscow, U.S.S.R.
11995	CSA32	Lisbon, Portugal ●
11998	CE1180	Santiago, Chilo
12040	GRV	London, England
12095	GRF	London, England
12175	TFJ	Reykjavik, Iceland
14492		Radio Moscow
14690	PSF	Rio de Janeiro, Brazil
15050	ETAA	Addis Ababa, Eth.
15050	V3USE	Forest Side, Mauritius
15060		Peking, China
15070	GWC	London, England
15095	HVJ	Vatican City
15100	CSA39	Lisbon, Portugal
15100		Moscow, U.S.S.R.
15100	EPB	Teheran, Iran
15105	KGEI	San Fran., U.S.A.
15105	DAX4X	Lima, Peru
15110	GWG	London, England
15110		Moscow, U.S.S.R.
15115	HCJB	Quito, Ecuador ●
15120		Colombo, Ceylon
15120		Moscow, U.S.S.R.
15120		Rome, Italy
15120		Warsaw, Poland ●
15125	CSA36	Lisbon, Portugal
15130		Voice of America, Tangier
15130	WABC	New York, U.S.A.
15130	WLWO	Cincinnati, U.S.A.
15130	KCBR(VOA)	Delano, Calif.
15130	WBOU	Bound Brook, N. J., U.S.A.
15135		Radio Japan, Tokyo ●
15135	PRB23	Sao Paulo, Brazil
15140	GSF	London, England
15150	YDC	Djakarta, Indonesia
15145	ZYK2	Recife, Brazil
15150	OAX4R	Lima, Peru
15150	CE1515	Santiago, Chilo
15155	SBT	Motala, Sweden
15156	ZYB9	Sao Paulo, Brazil
15160	VUD5/7	Delhi, India
15160	VLB15	Shepparton, Aus.
15160	TAU	Ankara, Turkey
15165	WLWO	Cincinnati, U.S.A.
15165	ZYN7	Fortaleza, Brazil
15170	LKV	Oslo, Norway
15170	TGWA	Guatemala, Guat.
15170		Moscow,U.S.S.R.
15175	LLM	Oslo, Norway
15180	GSO	London, England
15180		Moscow, U.S.S.R.
15180	OZH2	Shamlebak, Den.
15190	VUD5/11	Delhi, India
15190	OIX4	Pori, Finland ●
15195	TAQ	Ankara, Turkey
15200		Moscow, U.S.S.R.
15200	VLA15/VLC15	Shepparton, Aus.
15205	XESC	Mexico, Mexico
15205		Voice of America, Tangier
15210		Munich, Germany
15210	GWU	London, England
15210	WBOU(VOA)	New York, U.S.A.
15210	VLG15	Melbourne, Aus.
15220		Hilversum, Neth. ●
15220	ZL10	Wellington, N.Z.
15225	JBD3	Kawachi, Japan
15228		Komsomolsk, U.S.S.R.
15230	GWD	London, England
15230		Moscow, U.S.S.R.
15230	OLR5A	Prague, Czecho.
15230	VLH15	Melbourne, Aus.
15230	WRUL	Boston, U.S.A.
15235	BED3	Taipei, Formosa
15235	JOB5	Tokyo, Japan
15240		Radio China (Canton) ●
15240		Belgrade, Yugoslavia
15240	KRCA	San Fran., U.S.A.
15240		Paris, France
15240	VLH15	Melbourne, Aus.
15240	WLWD	Cincinnati, U.S.A.
15250		Bucharest, Rumania ●
15250		Voice of Amer., Manila, P.I.
15250	WLWO	Cincinnati, U.S.A.
15250		Voice of Amer., Tangier
15260	GSI	London, England
15260		Karachi, Pakistan
15270	KCBR	Delano, Cal., U.S.A.
15270		Munich, Germany
15270	WBDU(VOA)	New York, U.S.A.
15270		Sverdlovsk, U.S.S.R.
15280		Munich, Germany
15280	ZL4	Wellington, N.Z.
15280		Moscow, U.S.S.R.
15280		Voice of Amer., Tangier
15285	CR7BG	Lourenco Marques, Mozambique
15285	WBOU(VOA)	New York, U.S.A.
15285	WRUL	Boston, U.S.A.
15290	LRU	Buenos Aires, Arg.
15290	VUD5/9	Delhi, India
15295		Voice of Amer., Tangier
15300	DZH8	Manila, P.I.
15300	GWR	London, England
15300		Singapore, Malaya
15305	HER6	Bern, Switzerland ●
15305	RV97	Novosibirsk, U.S.S.R.
15310	KCBR	Delano, Calif.
15310	GSP	London, England ●
15320	VLG15	Melbourne, Aus.
15320		Moscow, U.S.S.R.
15320	OLR5B	Praguo, Czech.
15325		Rome, Italy
15330	KGEI	San Fran., U.S.A.
15330		Sofia, Bulgaria
15330	WLWO	Cincinnati, U.S.A.
15335		Brussels, Belgium
15335		Karachi, Pakistan
15340		Moscow, U.S.S.R.
15340	KCBR	Delano, Cal., U.S.A.
15340		Voice of Amer., Tangier
15345		Athens, Greece
15345		Formosa Radio ●
15347	LRA	Buenos Aires, Arg.
15350		Paris, France
15350	WRUL	Boston, U.S.A.
15350	WLWD	Cincinnati, U.S.A.
15350	VUD8	Delhi, India
15352		Radio Luxemburg
15360		London, England
15360		Moscow, U.S.S.R.
15364	ZYC9	Rio de Jan., Brazil
15365		Radio Netherlands ●
15390		Moscow, U.S.S.R.
15390		Radio China (Canton) ●
15400		Paris, France
15400		Rome, Italy ●
15405	DMQ15	Cologne, W. Germany
15405	PZC	Paramaribo, Surinam
15410		Moscow, U.S.S.R.
15420		Paris, France
15420		Brazzaville, Fr.Equat.Africa
15425		Radio Netherlands ●
15435	GWE	London, England
15440		Moscow, U.S.S.R.
15445		Radio Netherlands ●
15450	GRD	London, England
15595		Brazzaville, Fr.Eq.Africa
15620		Madrid, Spain
15880		Peking, China
17700	GVP	London, England
17710	WRUL	Boston, U.S.A.
17715	GRA	London, England ●
17720	LRA5	Buenos Aires, Arg.
17730	GVQ	London, England
17750	WRUL	Boston, U.S.A.
17750		Rome, Italy
17760	WGEO	Schenectady, U.S.A.
17760	VUD	Delhi, India
17770	KCBR	Delano, Cal., U.S.A.
17770		Rome, Italy
17770		Voice of America, Tangier
17770		Radio Sweden, Stockholm
17775		Hilversum, Netherlands
17780	VUD/10/11	Delhi, India
17780	WBOU	New York, U.S.A.
17780		Voice of Amer., Manila, P.I.
17784	HER7	Bern, Switzerland
17785	JOA	Tokyo, Japan
17790	GSG	London, England
17795	WLWO	Cincinnati, U.S.A.
17800	KNBH	San Fran., U.S.A.
17800	WLWO	Cincinnati, U.S.A.
17800		Radio Australia, Melbourne
17800		Radio Poland ●
17800	KRHO	Honolulu, Hawaii
17800		Stockholm, Sweden
17800	OIX5	Pori, Finland ●
17804		Rome, Italy
17805	DZI6	Manila, P.I.
17810		Formosa Radio ●
17810	GSV	London, England
17810		Moscow, U.S.S.R.
17815	WRUL	Boston, U.S.A.
17820		Colombo, Ceylon
17825	LLN	Oslo, Norway
17825	TAV	Ankara, Turkey
17825		Radio Japan, Tokyo ●
17830		Moscow, U.S.S.R.
17830	WDSI(VOA)	New York, U.S.A.
17835		Karachi, Pakistan
17840		Radio Sweden ●
17840		Brazzaville, Fr.Eq.Africa
17840		Moscow, U.S.S.R.
17840	VLC17	Shepparton, Aus.
17840	HVJ	Vatican City
17850		Paris, France
17860	ORU3	Brussels, Belgium
17865		Damascus, Syria
17870	CSA44	Lisbon, Portugal
17890	HCJB	(Missionary Station) Quito, Ecuador
17910		Grenada, Windward Is.
18250	TFTO	Paris, France
18450		United Nations Radio, Geneva, Switzerland
20088		Moscow, U.S.S.R.
21460	KNBH (VDA)	Dixon, Calif.
21470	GSH	London, England
21480		Hilversum, Netherlands
21490		Paris, France
21500	WRCA	New York, U.S.A.
21510	VUD5	Delhi, India
21520	HER8	Bern, Switzerland
21520	WLWO	Cincinnati, U.S.A.
21530	GSJ	London, England
21540	VLB2	Shepparton, Aus.
21550	GST	London, England
21560		Moscow, U.S.S.R.
21560		Rome, Italy
21570	WDSI(VDA)	New York, U.S.A.
21580		Horby, Sweden
21590	WGED	Schenectady, N.Y.
21610	WLWO(VOA)	Cincinnati, U.S.A.
21620		Colombo, Ceylon
21640	GRZ	London, England
21650	WLWO	Cincinnati, U.S.A.
21660		Lisbon, Portugal
21670	LLP	Oslo, Norway
21675	GVR	London, England
21680	VLC21	Shepparton, Aus.
21690		Voice of America, Tangier
21700	VUD10	Delhi, India
21710	GVS	London, England
21730	WBOU(VOA)	New York, U.S.A.
21740	KCBR	Delano, Cal., U.S.A.
21740	KGEI	San Fran., U.S.A.
21740		Paris, France
21750	GVT	London, England
25615	DEI38	Linz, Austria
25640	HER9	Berne, Switzerland
25650	DMQ25	Cologne, West Germany
25670		Sweden Radio, Stockholm
25675		Radio Australia, Melbourne
25750	GSQ	London, England
26080	GSK	London, England

United States FM Stations

Abbreviations: Mc., megacycles, asterisk (*) indicates educational station

ALABAMA

Location	C.L.	Mc.
Albertville	WAVU-FM	105.1
Alexander City	WRFS-FM	106.1
Andalusia	WCTA-FM	98.1
Anniston	WHMA-FM	100.5
Athens	WJOF	104.3
Birmingham	WAPI-FM	99.5
	WBRC-FM	106.9
	WSFM	93.7
Clanton	WKLF-FM	100.9
Cullman	WFMH-FM	101.1
Decatur	WHOS-FM	102.1
Homewood	WJLN	104.7
Lanett	WRLD-FM	102.9
Mobile	WKRG-FM	99.9
Tuscaloosa	WTBC-FM	95.7
	WUOA	*91.7

ARIZONA

Location	C.L.	Mc.
Globe	KWJB-FM	100.3
Mesa	KBUZ-FM	104.7
Phoenix	KELE	95.5
	KFCA	*88.5
Tucson	KFMM	99.5

ARKANSAS

Location	C.L.	Mc.
Blytheville	KLCN-FM	96.1
Ft. Smith	KFPW-FM	94.9
Jonesboro	KBTM-FM	101.9
	KASU	91.9
Mammoth Springs	KAMS	103.9
Pine Bluff	KOTN-FM	92.3
Siloam Springs	KUOA-FM	105.7

CALIFORNIA

Location	C.L.	Mc.
Atherton	KPEN	101.3
Bakersfield	KERN-FM	94.1
	KQXR	101.5
Berkeley	KPFA	94.1
	KPFB	*89.3
	KRE-FM	102.9
Claremont	KSPC	*88.9
Eureka	KRED-FM	96.3
Fresno	KARM-FM	101.9
	KMJ-FM	97.9
	KRFM	93.7
Glendale	KFMU	97.1
	KUTE	101.9
Long Beach	KFOX-FM	102.3
	KLON	*88.1
	KNOB	97.9
Los Angeles	KABC-FM	95.5
	KBCA	105.1
	KBMS	105.9
	KCBH	98.7
	KFAC-FM	92.3
	KGLA	*103.5
	KHJ	101.1
	KMLA	100.3
	KNX-FM	93.1
	KBIQ	104.3
	KPOL-FM	93.9
	KRHM	94.7
	KRKD-FM	96.3
	KUSC	*91.5
	KXLU	*88.7
	KHOF	99.5
Marysville	KMYC-FM	99.9
Modesto	KBEE-FM	103.3
	KTRB-FM	104.1
Oakland	KAFE	98.1
Ontario	KASK-FM	93.5
Oxnard	KAAR	104.7
Pasadena	KPCS	89.3
Riverside	KPLI	99.1
	KDUO	97.5
Sacramento	KCRA-FM	96.1
	KFBK-FM	96.9
	KGMS-FM	100.5
	KJML	95.3
	KXOA-FM	107.9
San Bernardino	KVCR	*91.9
San Diego	KFSD-FM	94.1
	KGB-FM	101.5
	KITT	105.3
	KSDS	*88.3
San Francisco	KALW	*91.7
	KCBS-FM	98.9
	KDFC	102.1
	KEAR	97.3
	KGD	103.7
	KNBC-FM	99.7
	KRON-FM	96.5
	KSFR	94.9
San Jose	KSJD-FM	92.3
San Mateo	KCSM	*90.9
Santa Ana	KWIZ-FM	96.7
Santa Barbara	KRCW	97.5
Santa Clara	KSCU	*90.1
Santa Maria	KEYM	99.1
	KSMA-FM	102.5
Santa Monica	KCRW	*89.9
Stockton	KCVN	*91.3
West Covina	KOWC	98.3

COLORADO

Location	C.L.	Mc.
Boulder	KRNW	97.3
Colorado Springs	KRCC	*91.3
	KFMH	96.5
	KSHS	*90.5
Denver	KFML-FM	98.5
	KDEN-FM	99.5
	KLIR-FM	100.3
	KTGM	105.1
Manitou Springs	KCMS-FM	102.7

CONNECTICUT

Location	C.L.	Mc.
Brookfield	WGHF	95.1
Danbury	WLAD-FM	98.3
Hartford	WHCN	105.9
	WRTC-FM	*89.3
	WTIC-FM	96.5
Meriden	WMMW-FM	95.7
New Haven	WNHC-FM	99.1
Stamford	WSTC-FM	96.7
Storrs	WHUS	*90.5

DELAWARE

Location	C.L.	Mc.
Dover	WDDV-FM	94.7
Wilmington	WDEL-FM	93.7
	WJBR	99.5

D. C.

Location	C.L.	Mc.
Washington	WASH-FM	97.1
	WFAN	100.3
	WGMS-FM	103.5
	WMAL-FM	107.3
	WOL-FM	98.7
	WRC-FM	93.9
	WTOP-FM	96.3
	WWDC-FM	101.1

FLORIDA

Location	C.L.	Mc.
Coral Gables	WVCG-FM	105.1
Daytona Beach	WNDB-FM	94.5
Gainesville	WRUF-FM	*104.1
Jacksonville	WJAX-FM	95.1
	WZFM	96.9
	WMBR-FM	96.1
Miami	WCKR-FM	97.3
	WGBS-FM	96.3
	WTHS	*91.7
	WWPB-FM	101.5
Miami Beach	WKAT-FM	93.1
	WMET-FM	93.9
Orlando	WDBO-FM	92.3
	WHOO-FM	96.5
	WKIS-FM	100.3
Palm Beach	WQXT-FM	97.9
Tallahassee	WFSU-FM	*91.5
Tampa	WDAE-FM	100.7
	WFLA-FM	93.3
	WPKM	104.7
	WTUN	*88.9
Winter Park	WPRK	*91.5

GEORGIA

Location	C.L.	Mc.
Athens	WGAU-FM	102.5
Atlanta	WABE	*90.1
	WPLO-FM	103.3
	WGKA-FM	92.9
	WSB-FM	98.5
Augusta	WAUG-FM	105.7
	WBBQ-FM	103.7
Columbus	WRBL-FM	93.3
Gainesville	WDUN-FM	103.9
Lagrange	WLAG-FM	104.1
Macon	WMAZ-FM	99.1
Newnan	WCOH-FM	96.7
Savannah	WTOC-FM	97.3
Swainsboro	WJAT-FM	101.7
Toccoa	WLET-FM	106.1

HAWAII

Location	C.L.	Mc.
Honolulu	KAIM-FM	95.5
	KUOH	*90.5
	KVOK	*88.1

ILLINOIS

Location	C.L.	Mc.
Anna	WRAJ-FM	92.7
Bloomington	WJBC-FM	101.5
Carmi	WROY-FM	97.3
Champaign	WDWS-FM	97.5
Chicago	WBBM-FM	96.3
	WBEZ	*91.5
	WCLM	101.9
	WDHF	95.5
	WEBH	93.9
	WEFM	99.5
	WEHS	97.9
	WENR-FM	94.7
	WFMF	100.3
	WFMQ	107.5
	WFMT	98.7
	WKFM	103.5
	WMAQ-FM	101.1
	WNIB	97.1
	WSEL	104.3
Decatur	WSOY-FM	102.1
DeKalb	WNIC	*91.1
Effingham	WSEI	95.7
Elgin	WEPS	*88.1
Elmwood Park	WXFM	105.9
Evanston	WEAW	105.1
	WNUR	*89.3
Harrisburg	WEBQ-FM	99.9
Jacksonville	WLDS-FM	100.5
Macomb	WWKS	*91.3
Mattoon	WLBH-FM	96.9
Mt. Vernon	WMIX-FM	94.1
Oak Park	WOPA-FM	102.3
Olney	WVLN-FM	92.9
Paris	WPRS-FM	98.3
Peoria	WMBD-FM	92.5
Quincy	WGEM-FM	105.1
	WTAD-FM	99.5
Rockford	WROK-FM	97.5
Rock Island	WHBF-FM	98.9
Springfield	WTAX-FM	103.7
Urbana	WILL-FM	*90.9

INDIANA

Location	C.L.	Mc.
Bloomington	WFIU	*103.7
Columbus	WCSI-FM	98.3
Connersville	WCNB-FM	100.3
Crawfordsville	WBBS-FM	106.3
Elkhart	WCMR-FM	95.1
	WTRC-FM	100.7
Evansville	WIKY-FM	104.1
	WEVC	*91.5
	WPSR	90.7
Gary	WGVE	*88.1
Goshen	WGCS	91.1
Greencastle	WGRE	*91.7
Hammond	WJOB-FM	92.3
Hartford City	WHCI	*91.9
Huntington	WVSH	*91.9
Indianapolis	WAJC	*104.5
	WFMS	95.5
	WIAN	*90.1
Jasper	WITZ-FM	104.7
Madison	WORX-FM	96.7
Marion	WMRI-FM	106.9
Muncie	WMUN	104.1
	WWHI	*91.5
New Albany	WNAS	*88.1
New Castle	WCTW	102.5
	WYSN	*91.1
South Bend	WETL	*91.9
Terre Haute	WTHI-FM	99.9
Wabash	WSKS	*91.3
Warsaw	WRSW-FM	107.3
Washington	WFML	106.5

IOWA

Location	C.L.	Mc.
Ames	WOI-FM	*90.1
Boone	KFGQ	*99.3
Clinton	KROS-FM	96.1
Davenport	WOC-FM	103.7
Des Moines	KOPS	*88.1
	WHO-FM	100.3
Dubuque	WOBQ	103.3
Iowa City	KSUI	*91.7
Mason City	KGLD-FM	101.1
Muscatine	KWPC-FM	99.7
Storm Lake	KAYL-FM	101.5
Waverly	KWAR	89.1

KANSAS

Location	C.L.	Mc.
Emporia	KSTE	*88.7
Lawrence	KANU	*91.5
Manhattan	KSDB-FM	*88.1
Newton	KJRG-FM	92.1
Ottawa	KTJO-FM	*88.1
Wichita	KFH-FM	100.3
	KMUW	*89.1

KENTUCKY

Location	C.L.	Mc.
Ashland	WCMI-FM	93.7
Central City	WNES-FM	101.9
Fulton	WFUL-FM	104.9
Hazard	WKIC-FM	96.5
Henderson	WSDN-FM	99.5
Hopkinsville	WHDP-FM	98.7
Lexington	WBKY	*91.3
	WLAP-FM	94.5
Louisville	WFPK	*91.9
	WFPL	*89.3
	WLVL	97.5
Madisonville	WFMW-FM	93.9
	WNGD-FM	94.7
Owensboro	WOMI-FM	92.5
	WVJS-FM	96.1
Paducah	WPAD-FM	96.9
	WKYB-FM	93.3

LOUISIANA

Location	C.L.	Mc.
Alexandria	KALB-FM	96.9
Baton Rouge	WJBO-FM	98.1
Monroe	KMBL-FM	104.1
New Orleans	WBEH	89.3
	WDSU-FM	105.3
	WRCM	97.1
	WMMT	95.7
Shreveport	KRMD-FM	101.1
	KBCL-FM	96.5
	KWKH-FM	94.5

MAINE

Location	C.L.	Mc.
Brunswick	WBOR	*91.1
Caribou	WFST-FM	97.7
Lewiston	WCOU-FM	93.9

MARYLAND

Location	C.L.	Mc.
Annapolis	WNAV-FM	99.1
Baltimore	WBJC	*88.1
	WCAO-FM	102.7
	WFDS-FM	97.9
	WITH-FM	104.3
Bethesda	WUST-FM	106.3
Bradbury Heights	WPGC	95.5
Cumberland	WCUM-FM	102.9
Hagerstown	WJEJ-FM	104.7
	WARK-FM	106.9
Oakland	WBUZ	95.5

MASSACHUSETTS

Location	C.L.	Mc.
Amherst	WAMF	*88.1
	WMUA	*91.1
Boston	WBUR	*90.9
	WBCN	104.1
	WBZ-FM	106.7
	WCOP-FM	100.7
	WEEI-FM	103.3
	WERS	*88.9
	WHDH-FM	94.5
	WRKO-FM	98.5
	WXHR	96.9
Brockton	WBET-FM	97.7
Brookline	WBOS-FM	92.9
Cambridge	WGBH-FM	*89.7
	WHRB-FM	107.1
Greenfield	WHAI-FM	98.3
Lowell	WLLH-FM	99.5
New Bedford	WBSM-FM	97.3
	WNBH-FM	98.1
S. Hadley	WMHC	88.5
Springfield	WHYN-FM	93.1
	WEDK	91.7
	WMAS-FM	94.7
Waltham	WCRB-FM	102.5
W. Yarmouth	WOCB-FM	94.3
Williamstown	WCFM	*90.1
Winchester	WHSR-FM	*91.9
Worcester	WTAG-FM	96.1

MICHIGAN

Location	C.L.	Mc.
Ann Arbor	WUOM	*91.7
Benton Hrbr.	WHFB-FM	99.9
Coldwater	WTVB-FM	98.3
Dearborn	WKMH-FM	100.3
Detroit	WDET-FM	*101.9
	WDTR	*90.9
	WHFI	94.7
	WJBK-FM	93.1
	WMUZ	103.5
	WMZK	97.9
	WJR-FM	96.3
	WWJ-FM	97.1
	WXYZ-FM	101.1
E. Lansing	WKAR-FM	*90.5
	WSWM	99.1
Flint	WFBE	*95.1
Grand Rapids	WFRS	92.5
	WJEF-FM	93.7
	WLAV-FM	96.9
Highland Pk.	WHPR	*88.1
Jackson	WMKZ	94.1
Kalamazoo	WMCR	*102.1
Oak Park	WLDM	95.5
Royal Oak	WOAK	*89.3
	WOMC	104.3
Saginaw	WSAM-FM	98.1
Sturgis	WSTR-FM	103.1

MINNESOTA

Location	C.L.	Mc.
Mankato	KYSM-FM	103.5
Minneapolis	KTIS-FM	*98.5
	KWFM	97.1
	WLOL-FM	99.5
St. Cloud	KFAM-FM	104.7

MISSISSIPPI

Location	C.L.	Mc.
Jackson	WJDX-FM	102.9
Meridian	WMMI	*88.1

MISSOURI

Location	C.L.	Mc.
Clayton	KFUO-FM	99.1
Joplin	WMBH-FM	96.1
Kansas City	KCMO-FM	94.9
	KCMK	93.3
	KCUR-FM	89.3

Location	C.L.	Mc.
Kennett	KBOA-FM	98.9
Poplar Bluff	KWOC-FM	94.5
St. Louis	KCFM	93.7
	KSLH	*91.5
Springfield	KTTS-FM	94.7
West Plains	KWPM-FM	93.9

NEBRASKA

Location	C.L.	Mc.
Lincoln	KFMQ	95.3
Omaha	KQAL-FM	94.3

NEVADA

Location	C.L.	Mc.
Reno	KNEV	95.5

NEW HAMPSHIRE

Location	C.L.	Mc.
Berlin	WKCQ	103.7
Claremont	WTSV-FM	106.1
Manchester	WKBR-FM	95.7
Mt. Washington	WMTW-FM	94.9
Nashua	WOTW-FM	106.3

NEW JERSEY

Location	C.L.	Mc.
Asbury Park	WJLK-FM	94.3
Bridgeton	WSNJ-FM	98.9
E. Orange	WFMU	*91.1
Hackettstown	WNTI	*91.9
Newark	WNTA-FM	94.7
	WBGO	*88.3
New Brunswk.	WCTC-FM	98.3
Paterson	WPAT-FM	93.1
Princeton	WPRB	103.9
South Orange	WSOU	*89.5
Trenton	WTOA	97.5
Zarephath	WAWZ-FM	99.1

NEW MEXICO

Location	C.L.	Mc.
Albuquerque	KANW	*89.1
	KHFM	96.3
Los Alamos	KRSN-FM	98.5
Mountain Park	KMFM	97.9
Roswell	KBIM-FM	97.1

NEW YORK

Location	C.L.	Mc.
Albany	WAMC	*90.7
Auburn	WMBO-FM	96.1
Babylon	WTFM	103.5
Binghamton	WNBF-FM	98.1
	WKOP-FM	95.3
Brooklyn	WNYE	*91.5
Buffalo	WBEN-FM	106.5
	WBNY-FM	92.9
	KWOL-FM	104.1
Cherry Valley	WRRC	101.9
Corning	WCLI-FM	106.1
Cortland	WKRT-FM	99.9
DeRuyter	WRRD	105.1
Elmira	WECW	*88.1
Floral Park	WSHS	*90.3
Hempstead	WHLI-FM	98.3
Hornell	WWHG-FM	105.3
Ithaca	WHCU-FM	97.3
	WICB	*91.7
	WRRA-FM	103.7
	WVBR-FM	101.7
Jamestown	WJTN-FM	93.3
Kenmore	WINE-FM	103.3
Massena	WMSA-FM	105.3
New Rochelle	WVOX-FM	93.5
New York	WABC-FM	95.5
	WBAI	99.5
	WBFM	101.9
	WCBS-FM	101.1
	WEVD-FM	97.9
	WFUV	*90.7
	WHOM-FM	92.3
	WKCR-FM	*89.9
	WNCN	104.3
	WNEW-FM	102.7
	WNYC-FM	93.9
	WNYE	91.5
	WOR-FM	98.7
	WQXR-FM	96.3
	WRCA-FM	97.1
	WRFM	105.1
Niagara Falls	WHLD-FM	98.5
Olean	WHDL-FM	95.7
Patchogue	WALK-FM	97.5
	WPAC-FM	106.1
Peekskill	WLNA-FM	100.7
Poughkeepsie	WKIP-FM	104.7
Rochester	WHFM	98.9
Schenectady	WGFM	99.5
South Bristol	WRRE	95.1
Springville	WSPE	*88.1
Syracuse	WAER	*88.1
	WDOS-FM	93.1
	WOND	100.9
	WSYR-FM	94.5
Troy	WFLY	92.3
	WRPI	91.5
Utica	WRUN-FM	105.7
Wethersfield	WRRL	107.7
White Plains	WFAS-FM	103.9

NORTH CAROLINA

Location	C.L.	Mc.
Albemarle	WABZ-FM	100.9
Asheboro	WGWR-FM	92.3
Asheville	WLOS-FM	104.3
Burlington	WBBB-FM	101.1
	WFNS-FM	93.9
Chapel Hill	WUNC	*91.5
Charlotte	WSOC-FM	103.5
Clingman's Pk.	WMIT	106.9
Durham	WDNC-FM	105.1
Elkin	WIFM-FM	100.9
Fayetteville	WFNC-FM	98.1
Forest City	WBBO-FM	93.3
Gastonia	WGNC-FM	101.9
Goldsboro	WEQR	96.9
Greensboro	WGPS	*89.9
	WMDE	98.7
Greenville	WWWS	*91.3
Henderson	WHNC-FM	92.5
	WHKP-FM	102.5
Hendersonville	WHKP-FM	102.5
Hickory	WHKY-FM	102.9
High Point	WHPE-FM	95.5
	WHPS	*89.3
	WMFR-FM	99.5
	WNOS-FM	100.3
Laurinburg	WEWO-FM	96.5
Leaksville	WLOE-FM	94.5
Lexington	WBUY-FM	94.3
Raleigh	WKIX-FM	96.1
	WPTF-FM	94.7
	WRAL-FM	101.5
Reidsville	WREV-FM	102.1
Rocky Mount	WEED-FM	92.1
	WFMA	100.7
Roxboro	WRXO-FM	96.7
Salisbury	WSTP-FM	106.5
Sanford	WWGP-FM	105.5
Shelby	WOHS-FM	96.1
Statesville	WFMX	105.7
Tarboro	WCPS-FM	104.3
Thomasville	WTNC-FM	98.3
Winston-Salem	WAIR-FM	93.1
	WSJS-FM	104.1

OHIO

Location	C.L.	Mc.
Akron	WAKR-FM	97.5
	WAPS	*89.1
Alliance	WFAH-FM	101.7
Ashland	WNCO-FM	101.3
Ashtabula	WICA-FM	103.7
Athens	WOUB-FM	*91.5
Bellaire	WOMP-FM	100.5
Berea	WBWC	*88.3
Bowling Green	WBGU	*88.1
Canton	WHBC-FM	94.1
Cincinnati	WCPO-FM	105.1
	WAEF-FM	104.3
	WKRC-FM	101.9
	WSAI-FM	102.7
Cleveland	KYW-FM	105.7
	WBOE	*90.3
	WDOK-FM	102.1
	WERE-FM	98.5
	WGAR-FM	99.5
	WHK-FM	100.7
	WJW-FM	104.1
Cleveland Hts.	WSRS-FM	95.3
Columbus	WCBE	*90.5
	WBNS-FM	97.1
	WCOL-FM	92.3
	WOSU-FM	*89.7
	WVKO	94.7
Dayton	WHIO-FM	99.1
Delaware	WSLN	*91.1
Elyria	WEOL-FM	107.3
Findlay	WFIN-FM	100.5
Fostoria	WFOB	96.7
Fremont	WFRO-FM	99.3
Hamilton	WQMS	96.7
	WHOH	103.5
Kent	WKSU-FM	*88.1
Lancaster	WHOK-FM	95.5
Lima	WIMA-FM	102.1
Marion	WMRN-FM	106.9
Middletown	WPFB-FM	105.9
Mt. Vernon	WMVO-FM	93.7
Newark	WCLT-FM	100.3
Oxford	WMUB	*88.5
Portsmouth	WPAY-FM	104.1
Salem	WSOM-FM	105.1
Sandusky	WLEC-FM	102.7
Springfield	WBLY-FM	103.9
Steubenville	WSTV-FM	103.5
Toledo	WSPD-FM	101.5
	WMHE	92.5
	WTDS	*91.3
	WTOL-FM	104.7
	WTRT	99.9
Wooster	WWST-FM	104.5
Youngstown	WKBN-FM	98.9
	WBBW-FM	93.3

OKLAHOMA

Location	C.L.	Mc.
Durant	KSEO-FM	107.3
Norman	WNAD-FM	*90.9
Oklahoma City	KOKH	*88.9
	KEFM	94.7
	KYFM	98.9
Shawnee	KBGC	*89.9
Stillwater	KAMC-FM	*91.7
	KSPI-FM	93.9
Tulsa	KWGS	*90.5

OREGON

Location	C.L.	Mc.
Eugene	KRVM	*91.9
	KEED-FM	93.1
	KUGN-FM	99.1
	KWAX	*91.1
Grants Pass	KGPO	96.9
Medford	KBOY-FM	95.3
Oretech	KTEC	*88.1
Portland	KEX-FM	92.3
	KOIN-FM	101.1
	KPFM	97.1
	KPOJ-FM	98.7
	KQFM	100.3
	KRRC	*89.3

PENNSYLVANIA

Location	C.L.	Mc.
Allentown	WFMZ	100.7
Altoona	WVAM-FM	100.1
Bethlehem	WGPA-FM	95.1
Bloomsburg	WHLM-FM	106.5
Braddock	WLOA-FM	96.9
Butler	WBUT-FM	97.7
Carlisle	WHYL-FM	102.3
Chambersburg	WCHA-FM	95.9
Dubois	WCED-FM	102.1
Easton	WEST-FM	107.9
	WEEX-FM	99.9
Erie	WERC-FM	99.9
Glenside	WIFI	92.5
Harrisburg	WHP-FM	97.3
Havertown	WHHS	*89.3
Hazleton	WAZL-FM	97.9
Johnstown	WARD-FM	92.1
	WJAC-FM	95.5
Lancaster	WGAL-FM	101.3
	WLAN-FM	96.9
Lebanon	WLBR-FM	100.1
Meadville	WMGW-FM	100.3
Oil City	WOJR	98.5
Philadelphia	WCAU-FM	98.1
	WDAS-FM	105.3
	WFIL-FM	102.1
	WFLN	95.7
	WHAT-FM	96.5
	WHYY	*90.9
	WIBG-FM	94.1
	WIP-FM	93.3
	WPEN-FM	102.9
	WPWT	*91.7
	WRTI-FM	*90.1
	WXPN	*88.9
Pittsburgh	KDKA-FM	92.9
	WDUQ	*91.5
	WFMP	99.7
	WKJF	93.7
	WWSW-FM	94.5
Pottsville	WPPA-FM	101.9
Scranton	WGBI-FM	101.3
	WUSV	*88.9
Sharon	WPIC-FM	102.9
State College	WDFM	*91.1
Sunbury	WKOK-FM	94.1
Warren	WRRN	92.3
Washington	WJPA-FM	104.3
Waynesboro	WAYZ-FM	101.5
Wilkes-Barre	WBRE-FM	98.5
	WYZZ	103.3
Williamsport	WLYC-FM	105.1
	WRAK-FM	100.3
York	WNOW-FM	105.7

RHODE ISLAND

Location	C.L.	Mc.
Providence	WPJB-FM	105.1
	WPFM	95.5
	WPRO-FM	92.3
	WXCN	101.5
Woonsocket	WWON-FM	106.3

SOUTH CAROLINA

Location	C.L.	Mc.
Anderson	WCAC	101.1
Charleston	WCSC-FM	96.9
	WTMA-FM	95.1
Columbia	WCOS-FM	97.9
	WNOK-FM	104.7
	WUSC-FM	*89.9
Dillon	WDSC-FM	92.9
Greenville	WESC-FM	92.5
	WFBC-FM	93.7
Rock Hill	WRHI-FM	98.3
Seneca	WSNW-FM	98.1
Spartanburg	WSPA-FM	98.9

TENNESSEE

Location	C.L.	Mc.
Bristol	WOPI-FM	96.9
Greeneville	WGRV-FM	94.9
Jackson	WTJS-FM	104.1
Johnson City	WJHL-FM	100.7
Kingsport	WKPT-FM	98.5
Knoxville	WBIR-FM	93.3
	WKCS	*91.1
	WUOT	*91.9
Memphis	WMCF	99.7
Nashville	WFMB	105.9

TEXAS

Location	C.L.	Mc.
Abilene	KACC-FM	*91.1
Amarillo	KGNC-FM	93.1
Austin	KHFI	98.3
	KAZZ	95.5
Beaumont	KRIC-FM	97.5
Brownwood	KHPC	88.1
Cleburne	KCLE-FM	94.9
Corpus Christi	KOMC	95.5
Dallas	KIXL-FM	104.5
	KNER	*88.1
	KRLD-FM	92.5
	WRR-FM	101.1
	KVTT	*91.7
Denton	KDNT-FM	106.3
El Paso	KVOF-FM	*88.5
	KHMS	94.7
Ft. Worth	WBAP-FM	96.3
	KFJZ-FM	97.1
Gainesville	KGAF-FM	94.5
Houston	KHGM	102.9
	KFMK	97.9
	KTRH-FM	101.1
	KUHF	*91.3
Lubbock	KRKH-FM	93.7
	KBFM	96.3
Plainview	KHBL	*88.1
Port Arthur	KFMP	93.3
San Antonio	KISS	99.5
	KEEZ	97.3
	KONO-FM	92.9
Texarkana	KCMC-FM	98.1

UTAH

Location	C.L.	Mc.
Ephraim	KEPH	*88.9
Logan	KVSC	*88.1
Salt Lake City	KDYL-FM	98.7
	KSL-FM	100.3

VIRGINIA

Location	C.L.	Mc.
Arlington	WARL-FM	105.1
Charlottesville	WINA-FM	95.3
	WTJU	91.3
Crewe	WSVS-FM	104.7
Harrisonburg	WEMC	*91.7
	WSVA-FM	100.7
Lynchburg	WWOD-FM	100.1
Martinsville	WMVA-FM	96.3
Newport News	WGH-FM	97.3
Norfolk	WMTI	*91.5
	WRVC	102.5
	WYFI-FM	99.7
Richmond	WCOD	98.1
	WRFK	91.1
	WRVA-FM	94.5
	WRNL-FM	102.1
Roanoke	WDBJ-FM	94.9
	WROV-FM	103.7
	WSLS-FM	99.1
South Norfolk	WFOS	*90.5
Staunton	WAFC-FM	93.3
Williamsburg	WCWM	89.1
Winchester	WRFL	92.5
Woodbridge	WBVA	105.9

WASHINGTON

Location	C.L.	Mc.
Cheney	KEWC-FM	*89.9
Seattle	KING-FM	98.1
	KIRO-FM	100.7
	KISW	99.9
	KMCS	98.9
	KUOW	94.9
Spokane	KREM-FM	92.9
Tacoma	KCPS	90.9
	KTNT-FM	97.3
	KTOY	*91.7
	KTWR	103.9

WEST VIRGINIA

Location	C.L.	Mc.
Beckley	WBKW	99.5
Charleston	WKAZ-FM	97.5
Huntington	WHTN-FM	100.5
Martinsburg	WEPM-FM	94.3
Morgantown	WAJR-FM	99.3
Oak Hill	WOAY-FM	94.1
Parkersburg	WAAM-FM	106.5
Wheeling	WKWK-FM	97.3
	WWVA-FM	98.7

WISCONSIN

Location	C.L.	Mc.
Appleton	WLFM	*91.1
Chilton	WHKW	*89.3
Colfax	WHWC	*88.3
Delafield	WHAD	*90.7
Eau Claire	WEAU-FM	94.1
Greenfield Twp.	WWCF	94.9
Highland	WHHI	91.3
Highland Twp.	WHSA	*89.9
Janesville	WCLO-FM	99.9
La Crosse	WHLA	*90.3
Madison	WHA-FM	*88.7
	WISC-FM	98.1
	WMFM	104.1
	WRVB-FM	102.5
Merrill	WLIN	100.7
Milwaukee	WFMR	96.5
	WQFM	93.3
	WTMJ-FM	94.1
Monroe	WEKZ-FM	93.7
Racine	WRJN-FM	100.7
Rice Lake	WJMC-FM	96.3
Wausau	WHRM	*91.9
West Bend	WBKV-FM	92.5
Wisc. Rapids	WFHR-FM	103.3

Canadian FM Stations

Location	C.L.	Mc.
Brantford, Ont.	CKPC-FM	92.1
Cornwall, Ont.	CJSS-FM	104.5
Edmonton, Alta.	CFRN-FM	100.3
	CJCA-FM	99.5
	CKUA-FM	98.1
Ft. William, Ont.	CKPR-FM	94.3
Halifax, N.S.	CHNS-FM	96.1
Kingston, Ont.	CFRC-FM	91.9
	CKLC-FM	99.5
	CKWS-FM	96.3
Kitchener, Ont.	CKCR-FM	96.7
Lethbridge, Alta.	CHEC-FM	100.9
London, Ont.	CFPL-FM	95.9
Montreal, Que.	CBF-FM	95.1
	CBM-FM	100.7
	CFCF-FM	106.5
Oshawa, Ont.	CKLB-FM	93.5
Ottawa, Ont.	CBO-FM	103.3
	CFRA-FM	93.9
Quebec, Que.	CHRC-FM	98.1
Rimouski, Que.	CJBR-FM	101.5
St. Catharines, Ont.	CKTB-FM	97.7
Sydney, N.S.	CJCB-FM	94.9
Timmins, Ont.	CKGB-FM	94.5
Toronto, Ont.	CBC-FM	99.1
	CFRB-FM	99.9
	CHFI-FM	98.1
	CJRT-FM	91.1
Vancouver, B.C.	CBU-FM	105.7
Verdun, Que.	CKVL-FM	96.9
Victoria, B.C.	CKOA-FM	98.5
Windsor, Ont.	CKLW-FM	93.9
Winnipeg, Man.	CJOB-FM	103.1

United States Television Stations

(Territories and possessions follow states). Chan., channel number; asterisk (*) indicates educational station.

ALABAMA

Location	C.L.	Chan.
Andalusia	WAIQ	*2
Birmingham	WAPI-TV	13
	WBIQ	*10
	WBRC-TV	6
Decatur	WMSL-TV	23
Dothan	WTVY	9
Florence	WOWL	15
Huntsville	WAFG-TV	31
Mobile	WALA-TV	10
	WKRG-TV	5
Montgomery	WCOV-TV	20
	WSFA-TV	12
Munford	WCIQ	*7

ALASKA

Location	C.L.	Chan.
Anchorage	KENI-TV	2
	KTVA	11
Fairbanks	KFAR-TV	2
	KTVF	11
Juneau	KINY.TV	8

ARIZONA

Location	C.L.	Chan.
Phoenix	KOOL-TV	10
	KPHO-TV	5
	KTVK	3
	KVAR	12
Tucson	KGUN-TV	9
	KOLD-TV	13
	KVOA-TV	4
	KUAT	*6
Yuma	KIVA	11

ARKANSAS

Location	C.L.	Chan.
El Dorado	KTVE	10
Ft. Smith	KFSA-TV	5
Little Rock	KARK-TV	4
	KTHV	11
	KATV	7
Texarkana	KCMC-TV	6

CALIFORNIA

Location	C.L.	Chan.
Bakersfield	KBAK-TV	29
	KERO-TV	10
	KLYD-TV	17
Chico	KHSL-TV	12
El Centro	XEM-TV	3
Eureka	KIEM-TV	3
	KVIQ-TV	6
Fresno	KFRE-TV	12
	KJEO	47
	KMJ-TV	24
Los Angeles	KABC-TV	7
	KCOP	13
	KHJ-TV	9
	KNXT	2
	KRCA	4
	KTLA	5
	KTTV	11
Oakland	KTVU	2
Redding	KVIP-TV	7
Sacramento	KXTV	10
	KCRA-TV	3
	KVIE	*6
	KVUE	40
Salinas	KSBW-TV	8
San Diego	KFMB-TV	8
	KFSD.TV	10
(Tijuana, Mex.)	XETV	6
San Francisco	KGO-TV	7
	KPIX	5
	KQED	*9
	KRON-TV	4
San Jose	KNTV	11
San Luis Obispo	KSBY-TV	6
Santa Barbara	KEY-T	3
Stockton	KOVR	13

COLORADO

Location	C.L.	Chan.
Colorado Springs	KKTV	11
	KRDO-TV	13
Denver	KBTV	9
	KLZ-TV	7
	KOA-TV	4
	KRMA-TV	*6
	KTVR	2
Grand Junction	KREX-TV	5
Montrose	KREY-TV	10
Pueblo	KCSJ-TV	5

CONNECTICUT

Location	C.L.	Chan.
Bridgeport	WICC-TV	43
Hartford	WTIC-TV	3
	WHCT	18
New Britain	WNBC	30
New Haven	WNHC-TV	8
Waterbury	WATR-TV	53

DIST. OF COLUMBIA

Location	C.L.	Chan.
Washington	WMAL-TV	7
	WRC-TV	4
	WTOP-TV	9
	WTTG	5

FLORIDA

Location	C.L.	Chan.
Daytona Beach	WESH-TV	2
Fort Myers	WINK.TV	11
Gainesville	WUFT	*5
Jacksonville	WFGA-TV	12
	WJCT	*7
	WJXT	4
Miami	WCKT	7
	WPST-TV	10
	WTHS-TV	*2
	WTVJ	4
Orlando	WDBO-TV	6
	WLOF-TV	9
Palm Beach	WPTV	5
Panama City	WJDM.TV	7
Pensacola	WEAR-TV	3
St. Petersburg	WSUN-TV	38
Tampa	WFLA-TV	8
	WEDU	3
	WTVT	13
W. Palm Beach	WEAT-TV	12

GEORGIA

Location	C.L.	Chan.
Albany	WALB-TV	10
Atlanta	WAGA-TV	5
	WSB-TV	2
	WETV	*30
	WLW-A	11
Augusta	WJBF	6
	WRDW-TV	12
Columbus	WRBL-TV	4
	WTVM	28
Macon	WMAZ-TV	13
Savannah	WSAV-TV	3
	WTOC-TV	11
Thomasville	WCTV	6

HAWAII

Location	C.L.	Chan.
Hilo	KHBC-TV	9
Honolulu	KGMB-TV	9
	KONA	2
	KULA-TV	4
Wailuku	KMAU	3
	KALA	7
	KMVI-TV	12

IDAHO

Location	C.L.	Chan.
Boise	KBOI	2
	KTVB	7
Idaho Falls	KID-TV	3
Lewiston	KLEW-TV	3
Nampa	KCIX-TV	6
Pocatello	KTLE	6
Twin Falls	KLIX-TV	11

ILLINOIS

Location	C.L.	Chan.
Champaign	WCIA	3
	WCHU	33
Chicago	WBBM-TV	2
	WBKB	7
	WGN-TV	9
	WNBQ	5
	WTTW	*11
Danville	WDAN-TV	24
Decatur	WTVP	17
Harrisburg	WSIL-TV	3
La Salle	WEEQ-TV	35
Peoria	WEEK-TV	43
	WMBD	31
	WTVH	19
Quincy	WGEM-TV	10
Rockford	WREX-TV	13
	WTVO	39
Rock Island	WHBF-TV	4
Springfield	WICS	20
Urbana	WILL-TV	*12

INDIANA

Location	C.L.	Chan.
Bloomington	WTTV	4
Elkhart	WSJV-TV	28
Evansville	WFIE-TV	14
	WEHT	50
	WTVW	7
Ft. Wayne	WANE-TV	15
	WKJG-TV	33
	WPTA	21
Indianapolis	WFBM-TV	6
	WLWI	13
	WISH-TV	8
	WFAM-TV	18
Muncie	WLBC.TV	49
South Bend	WNDU-TV	16
	WSBT-TV	22
Terre Haute	WTHI-TV	10

IOWA

Location	C.L.	Chan.
Ames	WOI-TV	5
Cedar Rapids	KCRG-TV	9
	WMT-TV	2
Davenport	WOC-TV	6
Des Moines	KRNT-TV	8
	KDPS-TV	*11
	WHO-TV	13
Fort Dodge	KQTV	21
Mason City	KGLO-TV	3
Ottumwa	KTVO	3
Sioux City	KTIV	4
	KVTV	9
Waterloo	KWWL-TV	7

KANSAS

Location	C.L.	Chan.
Ensign	KTVC	6
Garden City	KGLD	11
Goodland	KBLR-TV	10
Great Bend	KCKT	2
Hays	KAYS-TV	7
Hutchinson	KTVH	12
Pittsburg	KOAM-TV	7
Topeka	WIBW-TV	13
Wichita	KAKE-TV	10
	KARD-TV	3

KENTUCKY

Location	C.L.	Chan.
Lexington	WLEX-TV	18
	WKYT	27
Louisville	WAVE.TV	3
	WFPK-TV	*15
	WHAS-TV	11
	WQXL-TV	41
Paducah	WPSD-TV	6

LOUISIANA

Location	C.L.	Chan.
Alexandria	KALB-TV	5
Baton Rouge	WAFB-TV	28
	WBRZ	2
Lafayette	KLFY-TV	10
Lake Charles	KPLC-TV	7
	KTAG-TV	25
Monroe	KNOE-TV	8
	KLSE	*13
New Orleans	WDSU-TV	6
	WJMR-TV	20
	WWL-TV	4
	WYES	*8
Shreveport	KSLA-TV	12
	KTBS-TV	3

MAINE

Location	C.L.	Chan.
Bangor	WABI-TV	5
	WLBZ-TV	2
Poland Spring	WMTW-TV	8
Portland	WCSH-TV	6
	WGAN-TV	13
Presque Isle	WAGM-TV	8

MARYLAND

Location	C.L.	Chan.
Baltimore	WJZ-TV	13
	WBAL-TV	11
	WMAR-TV	2
Salisbury	WBOC-TV	16

MASSACHUSETTS

Location	C.L.	Chan.
Adams	WCDC	19
Boston	WBZ-TV	4
	WGBH-TV	*2
	WHDH-TV	5
	WNAC-TV	7
Greenfield	WRLP	32
Springfield	WHYN-TV	40
	WWLP	22
Worcester	WWOR-TV	14

MICHIGAN

Location	C.L.	Chan.
Bay City	WNEM-TV	5
Cadillac	WWTV	13
Cheboygan	WTOM-TV	4
Detroit	WJBK.TV	2
	WTVS	*56
	WWJ-TV	4
	WXYZ-TV	7
(Windsor, Ont.)	CKLW-TV	9
Flint	WJRT	12
Grand Rapids	WOOD-TV	8
Kalamazoo	WKZO-TV	3
Lansing	WJIM-TV	6
Marquette	WLUC-TV	6
Onondaga	WIIX-TV/WMSB	10
Saginaw	WKNX-TV	57
Traverse City	WPBN-TV	7

MINNESOTA

Location	C.L.	Chan.
Alexandria	KCMT	7
Austin	KMMT	6
Duluth	KDAL-TV	3
	WDSM-TV	6
Minneapolis	KMSP	9
	WCCO-TV	4
	WTCN-TV	11
Rochester	KROC-TV	10
St. Paul	KSTP-TV	5
	KTCA-TV	*2

MISSISSIPPI

Location	C.L.	Chan.
Columbus	WCBI-TV	4
Greenwood	WABG-TV	6
Jackson	WJTV	12
	WLBT	3
Laurel	WDAM-TV	7
Meridian	WTOK-TV	11
	WCOC-TV	30
Tupelo	WTWV	9

MISSOURI

Location	C.L.	Chan.
Cape Girardeau	KFVS-TV	12
Columbia	KOMU-TV	8
Hannibal	KHQA-TV	7
Jefferson City	KRCG.TV	13
Joplin	KODE-TV	12
Kansas City	KCMO-TV	5
	KMBC-TV	9
	WDAF-TV	4
Kirksville	KTVO	3
St. Joseph	KFEQ-TV	2
St. Louis	KETC	*9
	KMOX-TV	4
	KSD-TV	5
	KTVI	2
	KPLR-TV	11
Sedalia	KMOS-TV	6
Springfield	KTTS-TV	10
	KYTV	3

MONTANA

Location	C.L.	Chan.
Billings	KOOK-TV	2
	KGHL-TV	8
Butte	KXLF-TV	4
Glendive	KXGN-TV	5
Great Falls	KFBB-TV	5
	KRTV	3
Helena	KXLJ-TV	12
Kalispell	KULR	9
Missoula	KMSO-TV	13

NEBRASKA

Location	C.L.	Chan.
Hastings	KHAS-TV	5
Hay Springs	KDUH-TV	4
Hayes Center	KHPL-TV	6
Kearney	KHOL-TV	13
Lincoln	KOLN-TV	10
	KUON-TV	*12
McCook	KOMC	8
North Platte	KNOP	2
Omaha	KMTV	3
	KETV	7
	WOW-TV	6
Scottsbluff	KSTF	10

NEVADA

Location	C.L.	Chan.
Henderson	KLRJ-TV	2
Las Vegas	KLAS-TV	8
	KSHO-TV	13
Reno	KOLO-TV	8

NEW HAMPSHIRE

Location	C.L.	Chan.
Durham	WENH	*11
Manchester	WMUR-TV	9

NEW JERSEY

Location	C.L.	Chan.
Newark	WNTA-TV	13

Location	C.L.	Chan.
EW MEXICO		
ue	KGGM-TV	13
	KNME-TV	*5
	KOAT-TV	7
	KOB-TV	4
Carlsbad	KAVE-TV	6
Clovis	KVER-TV	12
Roswell	KSWS-TV	8
NEW YORK		
Albany	WTEN	10
	WTRI	35
Binghamton	WINR-TV	40
	WNBF-TV	12
Buffalo	WBEN-TV	4
	WBUF	17
	WGR-TV	2
	WKBW	7
Carthage	WCNY-TV	7
Elmira	WSYE-TV	18
New York	WABC-TV	7
	WNEW-TV	5
	WCBS-TV	2
	WOR-TV	9
	WPIX	11
	WRCA-TV	4
Plattsburg	WPTZ-TV	5
Rochester	WHEC-TV	10
	WROC-TV	5
	WVET-TV	10
Schenectady	WRGB	6
Syracuse	WHEN-TV	8
	WSYR-TV	3
Utica	WKTV	13
NORTH CAROLINA		
Asheville	WISE-TV	62
	WLOS-TV	13
Chapel Hill	WUNC-TV	*4
Charlotte	WBTV	3
	WSOC-TV	9
Durham	WTVD	11
Greensboro	WFMY-TV	2
Greenville	WNCT	9
Raleigh	WRAL-TV	5
Washington	WITN	7
Wilmington	WECT	6
Winston-Salem	WSJS-TV	12
NORTH DAKOTA		
Bismarck	KBMB-TV	12
	KFYR-TV	5
Dickinson	KDIX-TV	2
Fargo	WDAY-TV	6
	KXGO-TV	11
Grand Forks	KNOX-TV	10
Minot	KXMC-TV	13
	KMOT	10
Valley City	KXJB-TV	4
Williston	KUMV-TV	8
OHIO		
Akron	WAKR-TV	49
Cincinnati	WCET	*48
	WCPO-TV	9
	WKRC-TV	12
	WLW-T	5
	WCIN-TV	54
Cleveland	KYW-TV	3
	WEWS	5
	WJW-TV	8
Columbus	WBNS-TV	10
	WLW-C	4
	WOSU-TV	*34
	WTVN-TV	6
Dayton	WHIO-TV	7
	WLW-D	2
Lima	WIMA-TV	35
Oxford	WMUB-TV	14
Steubenville	WSTV-TV	9
Toledo	WSPD-TV	13

Location	C.L.	Chan.
	WTOL-TV	11
Youngstown	WFMJ-TV	21
	WKBN-TV	27
	WKST-TV	45
Zanesville	WHIZ-TV	18
OKLAHOMA		
Ada	KTEN	10
Ardmore	KXII	12
Enid	KOCO-TV	5
Lawton	KSWO-TV	7
Oklahoma City	KETA	*13
	KOKH-TV	25
	KWTV	9
	WKY-TV	4
Tulsa	KOTV	6
	KOED-TV	*11
	KTUL-TV	8
	KVOO-TV	2
OREGON		
Corvallis	KOAC-TV	*7
Eugene	KVAL-TV	13
Klamath	KOTI	2
Medford	KBES-TV	5
Portland	KGW-TV	8
	KHTV	27
	KOIN-TV	6
	KPTV	12
Roseburg	KPIC	4
PENNSYLVANIA		
Altoona	WFBG-TV	10
Erie	WICU	12
	WSEE-TV	35
Harrisburg	WHP-TV	55
	WTPA	27
Johnstown	WARD-TV	56
	WJAC-TV	6
Lancaster	WGAL-TV	8
Lebanon	WLVH-TV	15
Lockhaven	WBPZ-TV	32
New Castle	WKST-TV	45
Philadelphia	WCAU-TV	10
	WFIL-TV	6
	WHYY-TV	*35
	WRCV-TV	3
Pittsburgh	KDKA-TV	2
	WIIC	11
	WQED	*13
	WQEX	*16
	WTAE	4
Scranton	WNEP-TV	16
	WDAU-TV	22
Wilkes-Barre	WBRE-TV	28
York	WSBA-TV	43
RHODE ISLAND		
Providence	WJAR-TV	10
	WPRO-TV	12
SOUTH CAROLINA		
Anderson	WAIM-TV	40
Charleston	WCSC-TV	5
	WUSN-TV	2
Columbia	WIS-TV	10
	WNOK-TV	67
Florence	WBTW	8
Greenville	WFBC-TV	4
Spartanburg	WSPA-TV	7
SOUTH DAKOTA		
Aberdeen	KXAB-TV	9
Florence	KDLO-TV	3
Rapid City	KOTA-TV	3
	KRSD-TV	7
Reliance	KPLO-TV	6
Sioux Falls	KELO-TV	11

Location	C.L.	Chan.
TENNESSEE		
Chattanooga	WDEF-TV	12
	WRGP-TV	3
	WTVC	9
Jackson	WDXI-TV	7
Johnson City	WJHL-TV	11
Knoxville	WATE-TV	6
	WBIR-TV	10
	WTVK	26
Memphis	WHBQ-TV	13
	WKNO	*10
	WMCT	5
	WREC-TV	3
Nashville	WLAC-TV	5
	WSIX-TV	8
	WSM-TV	4
TEXAS		
Abilene	KRBC-TV	9
Amarillo	KFDA-TV	10
	KGNC-TV	4
	KVII	7
Austin	KTBC-TV	7
Beaumont	KFDM-TV	6
Big Spring	KEDY-TV	4
Bryan	KBTX-TV	3
Corpus Christi	KRIS-TV	6
	KZTV	10
Dallas	KRLD-TV	4
	WFAA-TV	8
El Paso	KELP-TV	13
	KROD-TV	4
	KTSM-TV	9
(Ciudad Juarez, Mex.)	XEJ-TV	5
Ft. Worth	KFJZ-TV	11
	WBAP-TV	5
Harlingen	KGBT-TV	4
Houston	KPRC-TV	2
	KHOU-TV	11
	KTRK-TV	13
	KUHT	*8
Laredo	KGNS-TV	8
Lubbock	KCBD-TV	11
	KDUB-TV	13
Lufkin	KTRE-TV	9
Midland	KMID-TV	2
Monahans	KVKM-TV	9
Odessa	KOSA-TV	7
Port Arthur-Beaumont	KPAC-TV	4
San Angelo	KCTV	8
San Antonio	KCOR-TV	41
	KENS-TV	5
	KONO-TV	12
	WOAI-TV	4
Sweetwater	KPAR-TV	12
Temple	KCEN-TV	6
Texarkana	KCMC-TV	6
Tyler	KLTV	7
Waco	KWTX-TV	10
Weslaco	KRGV-TV	5
Wichita Falls	KFDX-TV	3
	KSYD-TV	6
UTAH		
Provo	KLOR-TV	11
Salt Lake City	KSL-TV	5
	KTVT	4
	KUED	*7
	KUTV	2
VERMONT		
Burlington	WCAX-TV	3
VIRGINIA		
Bristol	WCYB-TV	5

Location	C.L.	Chan.
Hampton	WVEC-TV	13
Harrisonburg	WSVA-TV	3
Lynchburg	WLVA-TV	13
Norfolk	WTAR-TV	3
Petersburg	WXEX-TV	8
Portsmouth	WAVY-TV	10
Richmond	WRVA-TV	12
	WTVR	6
Roanoke	WDBJ-TV	7
	WSLS-TV	10
WASHINGTON		
Bellingham	KVOS-TV	12
Ephrata	KBAS-TV	16
Pasco	KEPR-TV	19
Seattle	KCTS-TV	*9
	KING-TV	5
	KIRO-TV	7
	KOMO-TV	4
Spokane	KHQ-TV	6
	KREM-TV	2
	KXLY-TV	4
Tacoma	KTNT-TV	11
	KTVW	13
Yakima	KIMA-TV	29
	KNDO-TV	23
WEST VIRGINIA		
Bluefield	WHIS-TV	6
Charleston	WCHS-TV	8
Clarksburg	WBOY-TV	12
Huntington	WHTN-TV	13
	WSAZ-TV	3
Oak Hill	WOAY-TV	4
Parkersburg	WTAP-TV	15
Wheeling	WTRF-TV	7
WISCONSIN		
Eau Claire	WEAU-TV	13
Green Bay	WBAY-TV	2
	WFRV	5
La Crosse	WKBT	8
Madison	WHA-TV	*21
	WISC-TV	3
	WKOW-TV	27
	WMTV	33
Marinette	WMBV-TV	11
Milwaukee	WISN-TV	12
	WMVS-TV	*10
	WTMJ-TV	4
	WXIX	18
Wausau	WSAU-TV	7
Whitefish Bay	WITI-TV	6
WYOMING		
Casper	KTWO-TV	2
Cheyenne	KFBC-TV	5
Riverton	KWRB-TV	10
GUAM		
Agana	KUAM-TV	8
PUERTO RICO		
Mayaguez	WORA-TV	5
Ponce	WRIK-TV	7
	WSUR-TV	9
San Juan	WAPA-TV	4
	WIPR-TV	*6
	WKAQ-TV	2

Canadian Television Stations

Location	C.L.	Chan.
ALBERTA		
Calgary	CHCT-TV	2
Edmonton	CFRN-TV	3
Lethbridge	CJLH-TV	7
Medicine Hat	CHAT-TV	6
Red Deer	CHCA-TV	6
BRITISH COLUMBIA		
Dawson Creek	CJDC-TV	5
Kamloops	CFCR-TV	4
Kelowna	CHBC-TV	2
Penticton	CHBC-TV	13
Vancouver	CBUT	2
Vernon	CHBC-TV	7
Victoria	CHEK-TV	6
LABRADOR		
Goose Bay	CFLA-TV	8
MANITOBA		
Brandon	CKX-TV	5

Location	C.L.	Chan.
Winnipeg	CBWT	3
NEW BRUNSWICK		
Moncton	CKCW-TV	2
Saint John	CHSJ-TV	4
NEWFOUNDLAND		
Argentia	CJOX-TV	10
Corner Brook	CBYT	5
St. John's	CJON-TV	6
Stephenville	CFSN-TV	8
NOVA SCOTIA		
Halifax	CBHT	3
Inverness	CJCB-TV-1	6
Liverpool	CBHT-1	12
Shelburne	CBHT-2	8
Sydney	CJCB-TV	4
Yarmouth	CBHT-3	11
ONTARIO		
Barrie	CKVR-TV	3
Elk Lake	CFCL-TV-2	2

Location	C.L.	Chan.
Elliot Lake	CKSO-TV-1	3
Hamilton	CHCH-TV	11
Kapuskasing	CFCL-TV-1	3
Kingston	CKWS-TV	11
Kitchener	CKCO-TV	13
London	CFPL-TV	10
North Bay	CKGN-TV	10
Peterborough	CHEX-TV	12
Ottawa	CBOFT	9
	CBOT	4
Port Arthur	CFCJ-TV	2
Sault Ste. Marie	CJIC-TV	2
Sudbury	CKSO-TV	5
Timmins	CFCL-TV	6
Toronto	CBLT	6
Windsor	CKLW-TV	9
Wingham	CKNX-TV	8
PRINCE EDWARD ISLAND		
Charlottetown	CFCY-TV	13

Location	C.L.	Chan.
QUEBEC		
Clermont	CFCV-TV-1	75
Estcourt	CJES-TV-1	70
Jonquiere	CKRS-TV	12
Matane	CKBL-TV	9
Montreal	CBFT	2
	CBMT	6
New Carlisle	CHAU-TV	5
Quebec	CFCM-TV	4
	CKMI-TV	5
Rimouski	CJBR-TV	3
Rouyn	CKRN-TV	4
Sherbrooke	CHLT-TV	7
Three Rivers	CKTM-TV	13
SASKATCHEWAN		
Moose Jaw	CHAB-TV	4
Prince Albert	CKBI-TV	5
Regina	CKCK-TV	2
Saskatoon	CFQC-TV	8
Swift Current	CFJB-TV	5
Yorkton	CKOS-TV	3

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- ☐ Arch. Drawing and Designing
- ☐ Building Contractor
- ☐ Building Estimator
- ☐ Carpenter Builder
- ☐ Carpentry and Millwork
- ☐ Carpenter Foreman
- ☐ Heating
- ☐ Painting Contractor
- ☐ Plumbing
- ☐ Reading Arch. Blueprints

ART
- ☐ Commercial Art
- ☐ Magazine Illus.
- ☐ Show Card and Sign Lettering
- ☐ Sketching and Painting

AUTOMOTIVE
- ☐ Automobile
- ☐ Auto Body Rebuilding and Refinishing
- ☐ Auto Engine Tuneup
- ☐ Auto Technician

AVIATION
- ☐ Aero-Engineering Technology
- ☐ Aircraft & Engine Mechanic

BUSINESS
- ☐ Accounting
- ☐ Advertising
- ☐ Business Administration
- ☐ Business Management
- ☐ Cost Accounting
- ☐ Creative Salesmanship
- ☐ Managing a Small Business
- ☐ Professional Secretary
- ☐ Public Accounting
- ☐ Purchasing Agent
- ☐ Salesmanship
- ☐ Salesmanship and Management
- ☐ Traffic Management

CHEMICAL
- ☐ Analytical Chemistry
- ☐ Chemical Engineering
- ☐ Chem. Lab. Technician
- ☐ Elements of Nuclear Energy
- ☐ General Chemistry
- ☐ Natural Gas Prod. and Trans.
- ☐ Petroleum Prod. and Engr.
- ☐ Professional Engineer (Chem)
- ☐ Pulp and Paper Making

CIVIL ENGINEERING
- ☐ Civil Engineering
- ☐ Construction Engineering
- ☐ Highway Engineering
- ☐ Professional Engineer (Civil)
- ☐ Reading Struc. Blueprints
- ☐ Sanitary Engineer
- ☐ Structural Engineering
- ☐ Surveying and Mapping

DRAFTING
- ☐ Aircraft Drafting
- ☐ Architectural Drafting
- ☐ Drafting & Machine Design
- ☐ Electrical Drafting
- ☐ Mechanical Drafting
- ☐ Sheet Metal Drafting
- ☐ Structural Drafting

ELECTRICAL
- ☐ Electrical Engineering
- ☐ Elec. Engr. Technician
- ☐ Elec. Light and Power
- ☐ Practical Electrician
- ☐ Practical Lineman
- ☐ Professional Engineer (Elec)

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- ☐ High School Diploma
- ☐ Good English
- ☐ High School Mathematics
- ☐ High School Science
- ☐ Short Story Writing

LEADERSHIP
- ☐ Industrial Foremanship
- ☐ Industrial Supervision
- ☐ Personnel-Labor Relations
- ☐ Supervision

MECHANICAL and SHOP
- ☐ Diesel Engines
- ☐ Gas-Elec. Welding
- ☐ Industrial Engineering
- ☐ Industrial Instrumentation
- ☐ Industrial Metallurgy
- ☐ Industrial Safety
- ☐ Machine Shop Practice
- ☐ Mechanical Engineering
- ☐ Professional Engineer (Mech)
- ☐ Quality Control
- ☐ Reading Shop Blueprints
- ☐ Refrigeration and Air Conditioning
- ☐ Tool Design ☐ Tool Making

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- ☐ General Electronics Tech.
- ☐ Industrial Electronics
- ☐ Practical Radio-TV Eng'r'g
- ☐ Practical Telephony
- ☐ Radio-TV Servicing

RAILROAD
- ☐ Car Inspector and Air Brake
- ☐ Diesel Electrician
- ☐ Diesel Engr. and Fireman
- ☐ Diesel Locomotive

STEAM and DIESEL POWER
- ☐ Combustion Engineering
- ☐ Power Plant Engineer
- ☐ Stationary Diesel Engr.
- ☐ Stationary Fireman

TEXTILE
- ☐ Carding and Spinning
- ☐ Cotton Manufacture
- ☐ Cotton Warping and Weaving
- ☐ Loom Fixing Technician
- ☐ Textile Designing
- ☐ Textile Finishing & Dyeing
- ☐ Throwing
- ☐ Warping and Weaving
- ☐ Worsted Manufacturing

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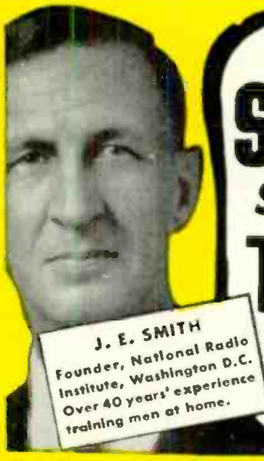

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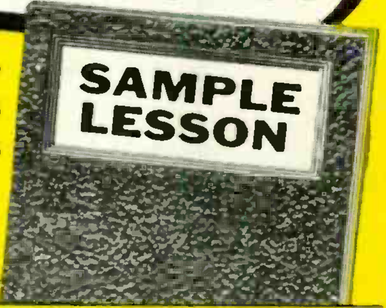

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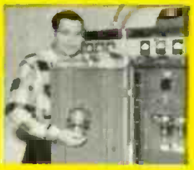

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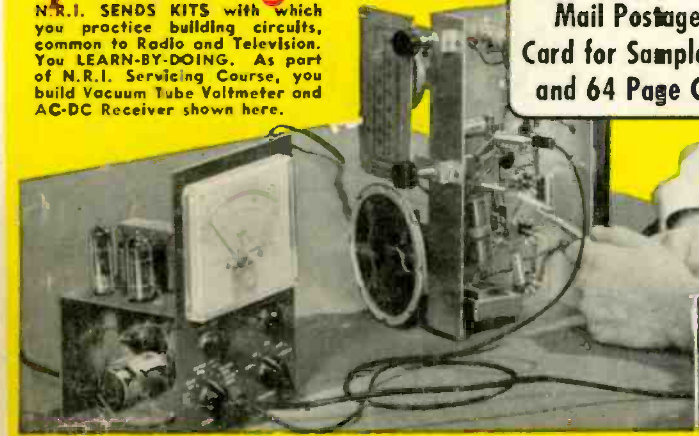

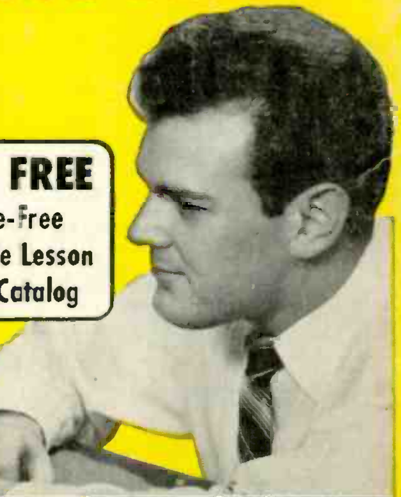

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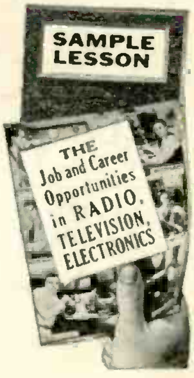

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