

IN THIS ISSUE—NEW!

**FM**  
Station  
List

*TONE CONT. PAGE 35*

# RADIO CRAFT

HUGO GERNSBACK, Editor



**BRUNETTI  
WRIST-WATCH  
TRANSMITTER  
SEE PAGE 28**

**APR**  
1948

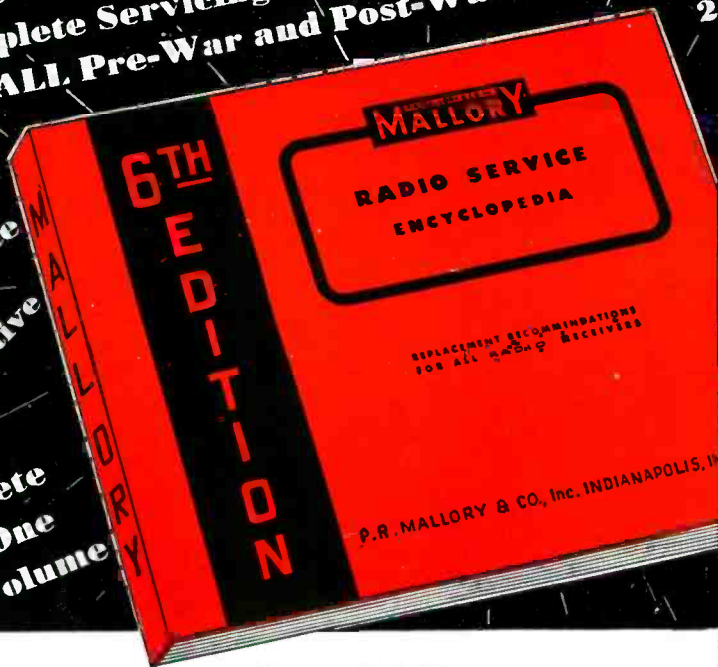
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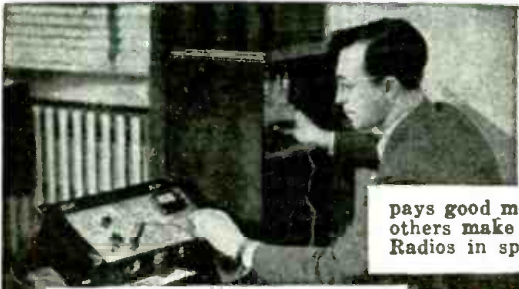
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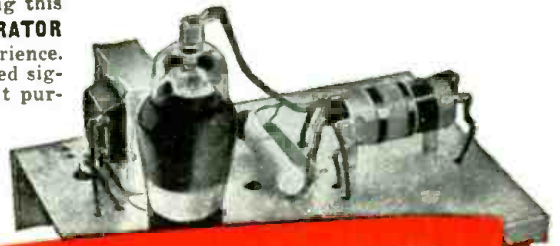
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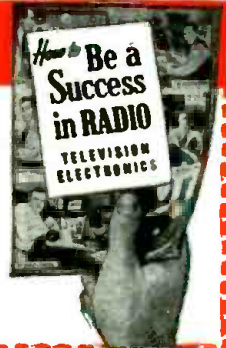
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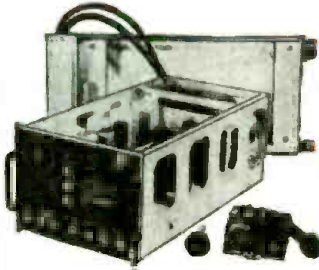
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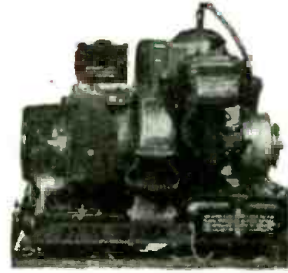


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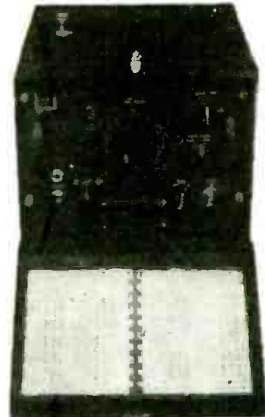
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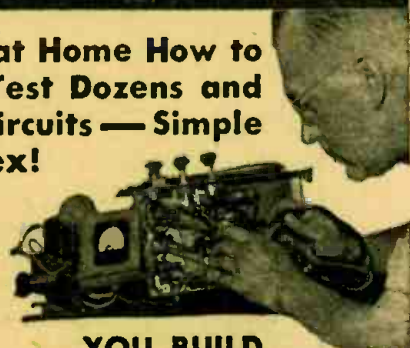
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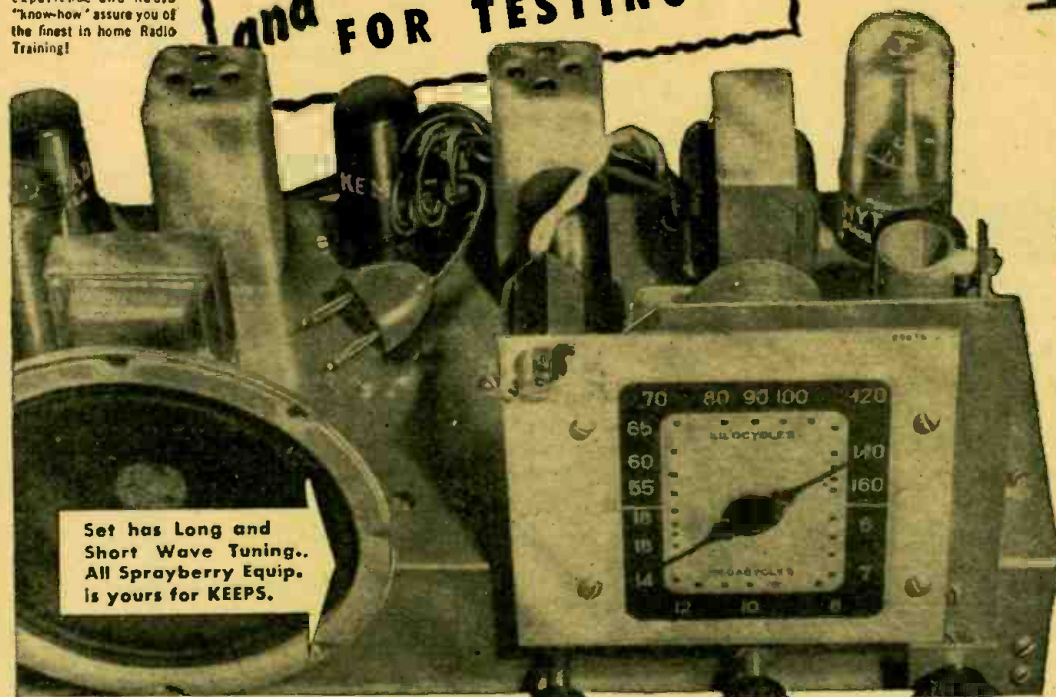
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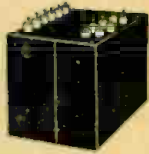
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No. 2217: Output: 24 volts @ 3 amp.....\$1.50

**SONAR SOUND DETECTION UNIT**

Ideal for detecting under water sounds, such as fish swimming in schools, within a 15 mile area. Using a Rochelle salt crystal, which is about 1000 times more sensitive than quartz. It is completely enclosed in a solid rubber sheath. This sound detector was originally used in harbor defenses. Coupled to an audio amplifier, this can be found to have many valuable applications. It's the Model JB which contains 7 microphone units.....\$12.50

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AIRCRAFT**

**"Communications"**

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**RACK FOR COMPLETE RIG**

Size 46" high, 24" wide, 22" deep. Black crackle finish, with special receiver mounting panel. Has 3 decks. 8-tube electronic control amplifier and hundreds of useful parts for that new rig. Below are a few of the items.



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- 4-AC outlets
- 2-0-3 amp. RF meters
- 1-40-0-40 ammeter
- 2-ceramic switches
- 1-ohmite pot
- 5-AC relays

- 3-fuse blocks
- 2-115v.a.c. contactors
- 1-6" AC gong
- 7-Panel controlled circuit breakers (4-15 amp, 2-35 amp, 1-50 amp)
- 3-Large push button switches
- 3-Wall type switches
- 1-Reset push button switch
- 1-Microphone jack
- 3-Meters on 5-hole meter panel
- 5-Large Jones strips
- 1-4" dpdt heavy duty knife switch

Don't miss this exceptional buy! The parts alone are worth many times this special price.....\$45.00

**MICROWAVE TUBES  
(Magnetrons)**



TUBE	FREQ. RANGE	PK. PWR	OUT PRICE
2J31	2820-2860 mc.	285 Kw.	\$10.00
2J21-A	9345-9405 mc.	50 Kw.	\$25.00
2J22	3267-3333 mc.	265 Kw.	\$15.00
2J26	2992-3019 mc.	275 Kw.	\$15.00
2J27	2955-2982 mc.	275 Kw.	\$15.00
2J32	2780-2820 mc.	285 Kw.	\$15.00
2J38	PKG. 3249-3263 mc.	5 Kw.	\$25.00
2J55	PKG. 9345-9405 mc.	50 Kw.	\$25.00
3J31	24,000 mc.	35 Kw.	\$17.50
W.E. 700-A	680.710 mc.	100 Kw.	\$35.00
W.E. 720BY	2800 mc.	1000 Kw.	\$25.00

MAGNETS for 2J21-A(725-A), 2J22, 2J26, 2J27, 2J31, 2J32 and 3J31, each.....	Price
Field Strength	
Gauss	
4850	\$ 8.00
1500	4.5-3.00
1000	Adjustable
(Electromagnet)	2 3/4" to 3" 2 1/2" \$ 12.00
2100	1 1/2" 3/4" \$ 4.00

**TRANSFORMERS**

- All Primaries—117 V 60 cycles
- # 5102: 1080 vct @ 55 ma. 6.3 v. @ 1.2 amp. \$2.35
  - # 5110: 1100 v. @ 70 ma, tapped @ 550 v. (for use with H.W. rect.).....\$2.75

**FILAMENT TRANSFORMERS**

- # 5123: 6.3 vct @ 5 amp, 6.3 vct @ 1 amp.....\$2.15
- # 5109: 27 volts @ 5.8 amp, 6.3 v. @ 2.5 amp.....\$2.75
- # 13163: 2.5 v. @ 1.75 amp, 5 v. @ 3 amp, 6.5 v. @ 5 amp, 6.5 v. @ 8 amp.....\$5.35
- Doughnut Fil. Xfmr. Two 5.1 v. windings @ 5 amp. each, 15,000 volt test.....\$7.50
- No. 5058: 6.3 VCT @ 2A. 6.3 VCT @ 2A. 6.3 VCT @ 2A.....\$2.25
- No. 5126: 5 VCT @ 3A. 5 VCT @ 3A. 5VCT @ 6A.....\$2.25
- No. 5100: 6.3 VCT @ 1.2 A. 5000 V test.....\$1.35
- No. 5080: 6.3 V NCT @ 6A. 6.3 V NCT @ 1.5 A.....\$1.40
- No. 5056: 6.3 VCT @ 9 A. 6.3 VCT @ 2.2 A. 6.3 VCT @ 2.2 A.....\$2.50
- No. 5057: 6.8 VCT @ 1 A. 5 VCT @ 3 A. 5 VCT @ 3 A.....\$2.50
- UX 6899: 5 V @ 5.5 A. 5 V @ 5.5 A. 29,000 Volts Test.....\$24.50

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- 6 Hy @ 300 ma.....\$3.25
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- Dual Choke: 7 Hy @ 75 Ma. 11 Hy @ 60 Ma.....\$1.50
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(All Nationally Advertised Brands)

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  - .03 mf @ 2000 VDC, type 551A-50.....12.75
  - .045 mf @ 2000 VDC, type G1.....12.75
  - .00015 mf @ 20 KV, type 1970-404.....25.00
  - .0001 mf @ 20 KV, type G3.....25.00
  - .0051 mf @ 15 KV, type G4.....25.00
  - .006 mf @ 16 KV, type G3.....17.50
  - .002 mf @ 15 KV.....20.00
- MPRS: Send your requirements for bathtubs. Micars. Hardware, resistors, & connectors.

**CATHODE RAY TUBES**

5BP1... \$1.20



- 3BP1—\$1.25
- 3FP7—\$1.75
- 3FP7—\$1.20
- 5FP7—\$1.75
- 6JP2—\$4.00

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Magazine for KS 12009 recorder, made by W.E. Comes with wire for 1/2-hour recording. Has elapsed time indicator, recording and erase features. Size: 1 1/4" L x 7" W x 5 1/4" H. Loss Drive Motor.....\$30.00

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# 6030	# 9293	# 6034	4.5-3 Mc.
# 6032	# 9295	# 6035	7-9.1 Mc.

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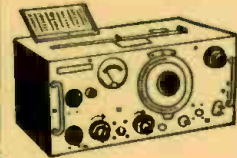
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Dynamic mike and headset combination. A high quality, efficient unit, used in B-19 tank Xmt's. Mike & phones complete, new.....\$2.75

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- 83-1AP Rt. angle.....27c



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The famous SCR 522 Radio Transmitter and Receiver, for operation on the 2 meter band (100 to 156 M.C.), is now available, complete with all 18 tubes in EXCELLENT condition at an unbelievably low price. This set is easily converted to 6 meter operation, if you prefer.

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(Shipped express charges collect)



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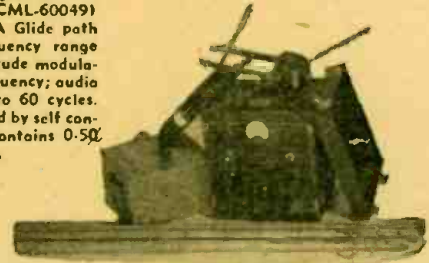
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A brand new heavily chrome plated side cowl antenna, originally used on 46 and 47 Hudsons. Telescopes to 66" long, fits most cars up to 1947. Originally sold for many times this price. (Add 40c to cover postage and handling.)

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Brand new Bowers D.C. Volt meter, 0 to 9 volts in 2" case with 2 3/4" Flange each .99c

Brand new Bowers D.C. Ammeter 0 to 100 amp scales (600 ma. movement with 100 amp shunt) same case as volt meter each .99c

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3 FP 7A -----	1.35	5 BP 1 -----	2.45
3 AP 1 -----	1.45	5 HP 1 -----	2.45
3 HP 7 -----	1.45	5 JP 1 -----	2.45
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**In An Early Issue**

MYSTERY RADIO RELAY  
DOUBLE-BRIDGE VOLTMETER  
WIND-DRIVEN GENERATORS

**On the Cover:**



Dr. Cleo Brunetti's wrist-watch-radio, as worn by Miss Dorothy S. Dowling, a Bureau of Standards employee, Washington, D.C.

Chromatone by Alex Schomburg from Harris & Ewing photo.



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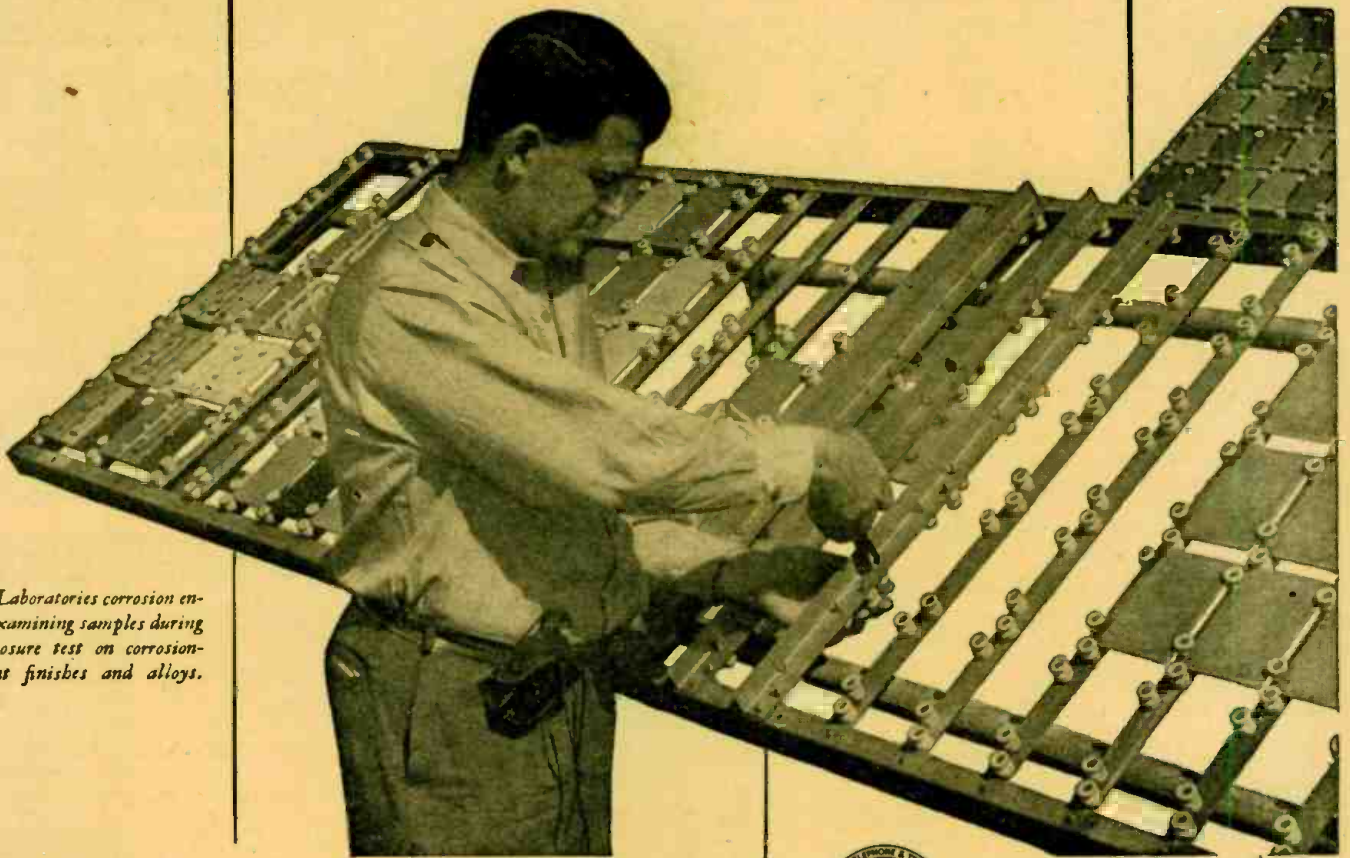
## The battle of the atoms

Telephone equipment is constantly at war against invisible forces of nature which seek to take it apart, atom by atom. On all fronts, Bell Laboratories chemists must fight corrosion — an enemy able to make a telephone circuit noisy or perhaps to sever it altogether.

An example: for years lead cable had lain protected in wooden ducts. Then in certain areas something began to eat the sheath, exposing wires to moisture. Corrosion chemists of the Laboratories were called in. The corrosion, they found, came from acetic acid generated in the wood during the preservative treatment then in use. They pumped in neutralizing ammonia. Corrosion stopped. Now telephone duct wood is controlled for acidity.

In a large city, smoke-polluted air was coating the silver surfaces of contacts with sulphide. Noisy circuits resulted. Chemists discovered minute traces of sulphur vapor in the air. They filtered incoming air with activated charcoal. Today, the latest telephone contacts are of palladium — not affected by sulphur.

Corrosion in metals is only one type of deterioration which engages Bell chemists against hostile forces. Plastics, paper, metals, rubber, textiles, coils, waxes and woods all have enemies. But knowledge, and persistence, are steadily winning out—to the benefit of the telephone user.



*A Bell Laboratories corrosion engineer examining samples during an exposure test on corrosion-resistant finishes and alloys.*

**BELL TELEPHONE LABORATORIES**



EXPLORING AND INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

RADIO-CRAFT for APRIL, 1948

# HOWARD W. SAMS WINS "OSCAR" FOR AID TO RADIO SERVICE INDUSTRY!



The handsome plaque awarded to Howard W. Sams carries the inscription: "The Federation of Radio Servicemen's Associations of Pennsylvania Award to Howard W. Sams in Recognition of His Outstanding Efforts in Behalf of the Radio Service Industry, 1947." The award is a tribute to the practical usefulness of PHOTOFACT Publications—the world's finest radio service data—indispensable to the Radio Serviceman.

## PHOTOFACT Publications Cited as Outstanding Effort in Behalf of Servicemen

"For Outstanding Efforts in Behalf of the Radio Service Industry"—reads the citation of the first annual award bestowed on Howard W. Sams by the Federation of Radio Servicemen's Associations of Pennsylvania. The "Oscar" was presented before a group of over 600 persons, including many radio industry leaders, at a banquet held on January 12, 1948, at Philadelphia's Bellevue-Stratford Hotel. The surprise ceremony was arranged as a demonstration of appreciation for the significant, practical aid made available to Radio Servicemen in PHOTOFACT Publications, and for the efforts of the SAMS' organization in behalf of the Radio Service Industry. This spontaneous demonstration marks a milestone in the Radio Service field. It is a healthy sign of growing recognition of the Serviceman's importance to the Radio Industry.



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Vol. 1. All post-war models up to Jan. 1, 1947.  
Vol. 2. Models from Jan. 1, 1947 to July 1, 1947.  
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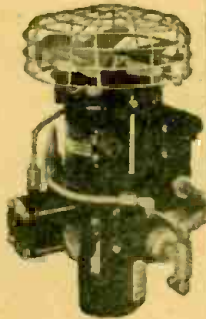
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Do not fail to closely examine this list of bargains. We believe that every item listed below is a sensational value that soon can never be repeated. All equipment advertised herein is unconditionally guaranteed to the customer's satisfaction to this extent: Return any item advertised within five days after delivery for full refund except transportation charges (both ways).

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BC 222 and BC 322 — Frequency 27.7-52.2 Mc. using 2 oscillator coils—52.8-65.8 Mc. using 1 oscillator coil. Crystal calibrator used to select amplitude modulated channels at every 400 Kc of separation. Uses one type 30 and type 33 tube.

**\$39.50**



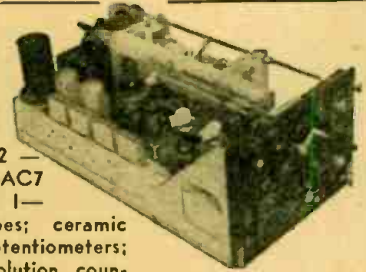
## AIR COMPRESSOR

Made by General Electric Co. Will pump pressure up to 1000 lbs. per sq. in. 2-stage type—air-cooled, powered by a 24 V. DC motor. Ideal in shop for use with airgun, small paint sprayer, and numerous other applications. Small, compact, precision built. **\$12.95**  
Only .....

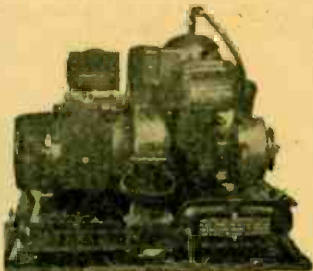
## RADAR XMTR

T-39/APQ-9

Contains 2—807's, 2—6AC7 1—931 and 1—6AG7 tubes; ceramic switch; potentiometers; gears; revolution counter; Cavity oscillator using 2—RCA 8012 tubes rated at full output to 500 Mc. (tubes are forced air-cooled by 24 V. DC motor—easily converted 110 V. AC operation); a goldmine of parts for the VHF experimenter. **\$12.50**  
Price .....



## (HRU) DC POWER SUPPLY



24-28 V. at 70 a m.p. 2000 watts gasoline engine generator with electric starter. Powers supply which can be used to operate 24-28 V. equipment, to start airplane engines, to

charge batteries, as a welding machine, lighting system, or for an amateur radio station. Height, 21½"; Width, 17½"; Length, 24¾", and weight, 115 lbs. **\$72.50**

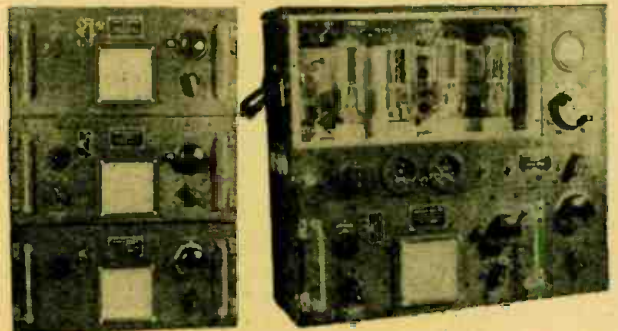


## INTERVALOMETER

Electronic timing device. Was used for releasing bombs at intervals. Ideal for darkroom timer, model train controller. (Contains relays, switches, pilot light, resistors, knobs, etc.) **\$225**

## BC-375 MOPA TRANSMITTER

*A really fine buy!*



The most famous of all surplus transmitters. Was used by the Army bombers and ground stations during the War. Frequency range is covered by means of plug-in tuning units as shown below. Each tuning unit has its own oscillator and power amplifier coils and condensers, and antenna tuning circuits all designed to operate at top efficiency within its particular frequency range. Transmitter and accessories are finished in black crackle, and the milliammeter, voltmeter, and RF ammeter are mounted on the front panel. **FREQUENCY RANGE:** 200-500 Kc. and 1500-12,500 Kc. (Will operate on 10 and 20 meter band with slight modification.) **OSCILLATOR:** self-excited, thermp-compensated, and hand calibrated. **POWER AMPLIFIER:** neutralized class "C" stage, using 211 tube, and equipped with antenna coupling circuit which matches practically any length antenna. **MODULATOR:** Class "B"—uses two 211 tubes. **POWER SUPPLY:** Dynamotor which furnishes 1000 V. at 350 Ma. **CONVERSION** instructions and diagram for 110 V. AC furnished upon request for \$1.00.

PRICES: As follows—

Transmitter only .....	<b>\$12.50</b>
Tuning units TU-5B, TU-6B, TU-7B, TU-8B, TU-9B, TU-10B, TU-26B, choice..	<b>\$2.50</b>
Dynamotor PE-73C .....	<b>\$3.95</b>
Antenna tuning unit (BC-306A) .....	<b>\$4.95</b>

## TELRAD 18-A FREQUENCY STANDARD

Checks signals in the range of 100 Kc. to 45 Mc. with a high degree of accuracy. Self-contained power supply for 110, 130, 150, 220, and 250 V. 25-60 Cy. AC. Complete with tubes, dual crystal, and instruction book. Brand new. One of the best buys on the surplus markets. **\$24.95**

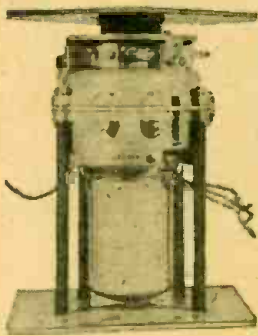


## BC-348 COMMUNICATIONS RECEIVER, \$69.50

6 bands, 200-500 Kc. and 1.5-18 Mc. 2 stages RF, 3 stages IF, BFO, crystal filter, manual or AVC. Complete with tubes and 24 V. dynamotor. These receivers have been thoroughly checked in our workshop and found in excellent condition.

BC-348, 110 V. AC power supply, including simple conversion instructions. Complete with tube.. \$8.95





**ROTATOR MOTOR FOR YOUR BEAM ANTENNA**  
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24-32 V. AC or DC operated. Reversible—only 3 wires required. Approximately 3/4 RPM. 7056 to 1 gear reduction (no free swing). Powerful motor. Rugged precision gear train, and sturdy thrust bearing—will support and turn any ham beam. Weather-proof housing. Motors are easily converted into an FB beam rotator! Conversion data included. \$9.95  
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**TRANSFORMER FOR BEAM MOTOR, 110 V. AC input, 2-12 V. Secondary windings. Rating 11 amps.....\$4.95**



**Selsyn Indicators**

For use with beam rotators for indication of direction of beam. Operate from 15-24 V. 60-cycle AC supply Wiring instructions.

Large Model 5" diameter **\$285**

Small Model 3" diameter **\$289**



**AIRCRAFT RADIO RANGE FILTER FL-8-A**

For helpful reduction of QRM on crowded CW bands. When attached to output of any communications receiver:

- 1—Will pass signal of 1020 CPS, eliminating others.
  - 2—Will pass voice frequencies and eliminate 1020 CPS code signal.
- Compact, light weight, with switch. Size 2 3/4" x 2 1/2" x 3 3/4".  
**Price ..... 2.25**



- A—Resistor kit composed of 150 or more assorted wattages. Containing various resistors of up to 10 megohms. Many with gold bands. An honest-to-goodness bargain. Box 2.65
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- C—Hardware Kit containing about 5 lbs. of radio hardware including nuts, bolts, washers, shafts, gears, grommets, lugs, screws, spacers. It is a gold-mine of invaluable parts.....1.95



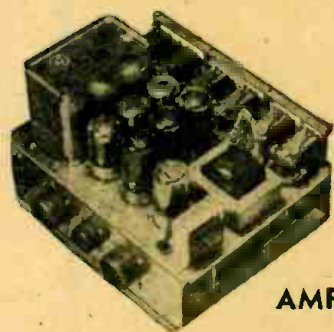
- D—Resistor mounting lugs and terminal strip kit. Assorted sizes and shapes. Many, Many, Many 1.00
- E—Tube Socket Kit. 25 or more assorted sockets having various usable sizes.....1.50
- F—Switch Kit consisting of assortment of 10 rotary and toggle switches. Price.....1.25



- A—Cond. (Solar) 10 Mfd. 1000 V. (New).....2.00
- B—Cond. (GE Pyranol) 8 Mfd. 1000 V. DC (New).....1.75
- C—Cond. (Chi. Ind. Cond. Corp.) 4 Mfd. 2000 V. (New).....2.50
- D—Cond. (Cornell-Dubilier) 1 Mfd. 4000 V. (New).....3.00
- E—Cond. (Chi. Ind. Cond. Corp.) Dual 8.5 Mfd. 1000 V. (New).....3.50



- F—Cond., .25 Mfd. 400 V. (New).....10
- G—Cond., .125 Mfd. 400 V. (metal cased) (dual condenser) (New).....15
- H—Cond., 1.75 Mfd. 50 V. (New).....15
- J—Cond. (GE Pyranol) 2 Mfd. 600 V. (New).....50
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Were used to control operation of Servo-units, causing them to move the control surface of airplane in one direction or the other in response to signals received. The complete amplifier includes one rect. 7Y4, 3-7F7's for amplification and control, 3-7N7's for signal discrimination, 1 power transformer, 6 relays, 4 control pots, chokes, condensers, etc. Convert for use on radio controlled models, doors, etc. Operates from 24 V. DC. Size 9 1/4 x 6 1/4 x 7 3/8". **\$6.95 Complete**

**APN-1 RADIO ALTIMETER**



A complete 460 Mc. radio receiver and transmitter which can be converted for ham or commercial use. Tubes used and included: 4-12SH7, 3-12SJ7, 2-6H6, 1-VR150, 2-955, 2-9004. Other components such as relays, 24 V. dynamotor, transformers, pots, condensers, etc., make this a buy on which you cannot go wrong. Complete as shown in aluminum case **\$8.95** 18" x 7" x 7 1/4".

**BC-645 Ultra Hi-Frequency Transmitter-Receiver**



You read about it recently in QST! Originally operated in the frequency band from 450 to 500 Mc. Can be converted to 420 Mc. amateur band. Consists of complete transmitter and modulator system, and receiver. Instructions for conversion to AC supply. Complete with 15 tubes..... **\$11.95**  
**BRAND NEW**



- 6 V. (New) (Dry-charged).....\$3.00
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SPRAGUE PRODUCTS COMPANY, North Adams, Mass.

JOBGING DISTRIBUTING ORGANIZATION FOR PRODUCTS OF SPRAGUE ELECTRIC CO.

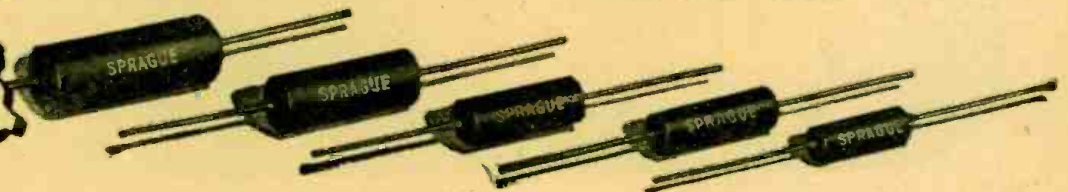
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**UNCONDITIONALLY GUARANTEED!**

You can stake your reputation on Sprague replacement parts. If used at rated capacitance and voltage, they are **UNCONDITIONALLY GUARANTEED** to give satisfactory performance. Insist on Sprague and get the best!



# RADIO AS A VOCATION\*

*The radio-electronic field is more lucrative than ever.*

By HUGO GERNSBACH

IT IS estimated from best available sources that the radio industry as a whole today employs no less than one hundred and fifty thousand\*\* men in all its branches.

This includes everybody, from the lowest-paid radio assembler girl up to the highest-paid radio executive. In between, we run the entire gamut of all classes of radio men and *the classification of all of them would take more space than this printed page!*

The young man eager to enter the radio field today has a tremendous field before him with numerous branches of the industry from which to choose. Each succeeding year, new subdivisions of the various branches are being added and the field constantly expands and keeps enlarging. The major branches of radio today may be roughly summarized as follows:

Radio set manufacturing, radio tube manufacturing, radio parts manufacturing, television, general electronics, radio broadcasting, radio servicing; and a great many minor branches.

I constantly receive letters from young men who write to me that they "wish to get into the radio game." As a rule, the writers do not state their qualifications or their educational background, and it is almost impossible without closely questioning the subject, to determine just where he will fit in best. It is useless to speak in generalities to these people without having made a careful survey of their mental equipment. One man might fit in well as a serviceman and might make a success of it, while the same man as a research engineer or broadcasting engineer would be totally unfit. For this reason, it is impossible to give hard and fast rules, it being impracticable for the outsider to arrive at any definite conclusion.

We cannot all be radio executives or research engineers of high order. We may not have the right mental equipment for this. In many ways, the college graduate who has taken up electrical engineering is fitted for an entirely different capacity than the man who has only a high school education; but, of course, there are exceptions. Some of our best radio executives have had no college education. Here then, again, the mental equipment and other educational background play a big role.

No two cases are ever alike for two men. No two men will react exactly alike; neither will their likes be exactly the same; nor will they fit into the same positions equally well.

There is, however, a general rule—that may be summarized in *one word*—which the young man who wishes to enter the radio industry should be told about. In the first place, what are his personal likes in the matter?

What are the goals he is striving for? Some men who wish to reach the top do not care how low they start; anything that comes along will be taken as the first rung of the ladder to be climbed. Others have fixed ideas as to what they wish to tackle. My own recommendation to would-be aspirants to a position of importance in the radio industry has always been expressed in one word—"Specialization."

What the radio industry of today needs more than anything else is specialists in the various branches. There are too many half-baked, irresponsible young men who just hold down jobs and never get anywhere. These form by far the largest percentage of the total manpower of the radio industry. *It is the minority who specialize, and who, as a rule, get somewhere.*

And it makes little difference in this respect whether they are college graduates or not. Of course, if you can afford to go through college and take the various courses (always provided that you know how to take advantage of the teaching offered at college), you will emerge from college with a first-class background which will enable you to "go places" in the radio industry. By far, the greater majority of young men, however, are not so fortunate. They find it necessary to earn a living after they leave high school. A large proportion of these either take a good radio correspondence course or visit a resident school for a number of months. Others, who cannot afford this, get their entire knowledge from practical work in the field and from radio books and publications. In the end, it all amounts to the same thing. If they have the correct mental make-up, it will get them just as far with one type of education as with another—and often the self-taught man has been able to go as far as the college graduate. Edison, for instance, never had better than a high school education,

*(Continued on page 81)*

**R**ADIO-CRAFT continues to receive many letters from young men eager to make radio-electronics their profession. For them and untold thousands we reprint on this page an editorial first published in the November, 1935, issue of RADIO-CRAFT.

What was written then applies even more truly today. Since World War II the radio-electronics field has grown to undreamed-of proportions. The estimate of 265,000 radio-electronic technicians in all the various branches today is a conservative one. The number still grows by leaps and bounds year after year.

\*Reprinted from November 1935 RADIO-CRAFT.

\*\*Corrected estimate, as of 1948, 265,000.

## BROAD-BAND METAL LENS

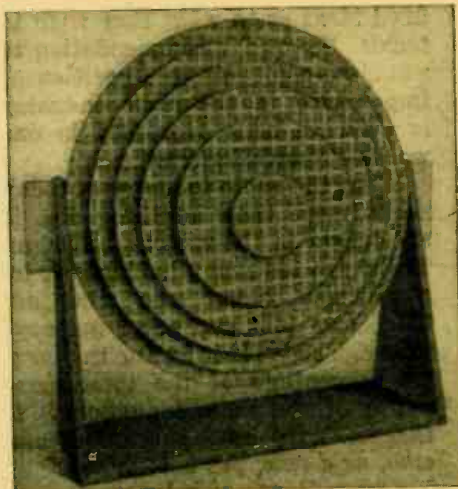
which can theoretically handle from 50 to 100 television channels or tens of thousands of simultaneous telephone messages was announced last month by Dr. Winston E. Kock of Bell Laboratories.

The new lenses are based on the theories of light transmission through atomic and molecular structures; in fact, one type of the new lens looks somewhat like a model of a crystalline molecule shown in almost any physics textbook.

One such lens consists of an array of metallic spheres. The radio waves, in passing through the lens, set up electric currents in the spheres and thereby produce the same effect on the radio waves that the molecular lattices of a glass or crystalline lens produce on light waves.

Thus the new lenses are built by scaling up (increasing the size of) the molecular lattice structure of a dielectric or non-conductor, such as glass, and then substituting electrically conductive elements for the molecules. These elements need not be spheres but can be small strips of conducting material, such as aluminum or copper foil.

The earlier metallic lenses were constructed of rows of conducting plates



This "printed circuit" metal lens is made of tin squares sprayed onto polystyrene sheets.

and operate on wave-guide principles which speed up the radio waves as they pass through the lens. In the new type lens, the wave is slowed down as in an ordinary glass lens. Dr. Kock and his associates have demonstrated that lenses constructed on this principle can be used over a much wider band of wave lengths.

One lens, for example, could be effective at all microwave lengths between a half-inch and four inches. Such a lens could theoretically handle 50 to 100 television channels. Available techniques limit present lenses to only eight such programs in the relatively narrow wave length band between three and three and one-half inches.

It had been known for some time that glass lenses could focus microwaves just as they focus light waves. But such lenses would have to be so big and so heavy that they are completely impossible for radio relay applications. Such a lens might be 10 feet in diameter and weigh several tons.

# RADIO-ELECTRONICS

Then the thought occurred to Dr. Kock that if the lattice structures which are believed to constitute atoms and molecules could focus light waves, a scaled-up or magnified model of such a lattice structure would also focus electro-magnetic or radio waves of correspondingly scaled-up wave length.

Since even the very short radio waves known as microwaves are 100,000 times longer than light waves, a scaling-up of the molecular model by that ratio produces a lens which can focus microwaves.

**TELEVISION** interference must continue with the prospect of blotted-out and disrupted picture reception if present-day television-receiver standards and frequency assignments are not changed, the engineering staff of the American Radio Relay League testified at a special hearing of the Federal Communications Commission last month.

At the hearing, which was held mainly to consider rearrangement of the present television frequency channels, ARRL representatives cautioned against continuation of frequency assignments that invite technically unavoidable interference, not only from amateurs but also from police and fire-department radio, mobile telephone circuits, industrial users, and diathermy installations in hospitals and doctors' offices.

**LARGEST TELEVISION** studios in the world are being constructed in New York City by the Columbia Broadcasting System, Frank Stanton, president of the network, announced last month.

Mr. Stanton said that the studios will occupy more than 700,000 square feet of space and will be in operation by April.

**A RADAR-PROOF** container for air shipment of photoflash bulbs was announced last month by Sylvania Electric Products, Inc.

The new development is aimed at protecting air shipments of the bulbs from ignition by radar. It has been found that under certain conditions radar may set off the flash bulbs.

The radar-proof canister resembles containers used to hold perishable food.

**MOVIEGOERS** in 1975 will be able to watch events as they happen anywhere throughout the world with the aid of guided missiles and television, Eric Johnston, president of the Motion Picture Association, predicted last month.

He envisaged planetarium-type theaters in which "the audience will sit around a circle and watch the action being produced on a giant dome . . . instead of on a flat screen."

Mr. Johnston explained that guided missiles travelling at a speed which could take them around the earth in two and a half hours would carry pickup equipment to transmit these images in full color.

**TELEVISION** set owners in New York, Philadelphia, and Chicago are only lukewarm toward the television programs they now receive, but eager for a pay-as-you-see system that will telecast first run movies, Broadway plays, and other costly entertainment features unavailable on free television.

These facts were determined by a survey just completed by William Bethke, educational director of LaSalle Extension University in Chicago.

The survey, he reports, covered 9,341 television set owners in New York, Philadelphia, Chicago, and adjacent areas. Letters were sent to television set owners with return postcards for answering two questions: First: Was the set owner satisfied with the television programs he now receives. Second: In addition to free programs would he be willing to pay a reasonable fee for home viewing of first-run movies, Broadway plays, newsreels, and championship sport events not available on free television. The return figures show that 76% of the set owners in Connecticut, 64% in New York, 52% in New Jersey, 70% in Chicago, and 49% in Philadelphia would be willing to pay for programs.

**FACSIMILE BROADCASTING** on a large scale by FM broadcasters has its first indication in a letter filed with the Federal Communications Commission by the FM Association last month.

Filed in protest against proposed rates for 15,000-kc circuits for FM networks, as submitted by the American Telephone and Telegraph Co., the FMA letter claimed that the transmission of programs and facsimile simultaneously over the same circuit is possible, but that restrictions by AT&T would preclude duplexing of programs and facsimile.

Rates proposed for FM network facilities are approximately double those for ordinary radio networks, according to the FM Association.

**REVISION OF RULES** governing the operation of low-power oscillators is being considered, the Federal Communications Commission announced last month. This low-power equipment includes devices ranging from phonograph oscillators to carrier-current transmitters.

This announcement was made because of the apparently increasing general interest in such apparatus. It is intended to "sound a note of caution" to present and prospective users and manufacturers of devices which operate within such rules.

**FACSIMILE EDITIONS** of the *New York Times* were transmitted last month in a large-scale demonstration of this service. The material was written by the staff of the newspaper and transmitted over WQXR-FM. The editions had four pages 11½ inches long and 8 inches wide.

# MONTHLY REVIEW

**RADAR SIGNALLING** for the Chicago elevated transit lines was proposed in a report submitted to the Chicago Transit Authority committee by Captain William C. Eddy last month.

In operation, a transmitter on the front of the train sends out a signal which is reflected back to a receiver by a special reflector on the rear end of the train ahead. If there is a safe distance



How the proposed radar system will operate.

between the two trains, an automatic computer lights a green lamp on the engineer's control panel. An unsafe distance between the trains causes a red lamp to glow. If the distance between the trains becomes dangerously short, the train brakes lock automatically to prevent a crash.

**COMPLAINTS** by customers against radio repairmen have been greatly exaggerated in radio and newspaper reports, the newly-organized Association of Radio Servicemen of New York City discovered last month.

Aroused by widespread accounts of malpractice by radio repairmen, the Association offered to handle complaints from any radio owner who had suffered at the hands of any unscrupulous radio servicemen. The offer was publicized widely in the city newspapers.

Two weeks after the notice was issued only 20 complaints had been received, 17 of which were settled immediately. During the same period—unexpectedly—more than 30 requests for service were made. These were referred to the Association member nearest each job. Thus favorable reactions outweighed unfavorable ones by 50%. A further 16 requests for advice were also classed as favorable.

**GOVERNMENT CONTROL** of broadcasting in Argentina was protested in a letter from the Inter-American Association of Broadcasters to the president of the Argentine Congress last month. The letter is the result of a study made by the IAAB on the Argentine Congress' proposal to turn over the control of broadcasting stations to the government.

A report filed with the letter states that during 1947 many stations were closed and licenses cancelled. It also protested against the government practice of ordering stations to drop regular schedules for a broadcast in the political interest of the government.

RADIO-CRAFT for APRIL, 1948

**SHORTWAVE HEATING** and blasts of dry air are now being used to kill the larva inside silkworm cocoons. This new method, the Japanese silk industry claims, produces a silk as tough and durable as synthetic fibers.

Silkworms were formerly killed by plunging the cocoons into boiling water and drying them with hot air. The new electronic process avoids the intense heat which it is believed to reduce the tensile strength of the old product.

**DR. W. R. G. BAKER** of the General Electric Company was elected vice-chairman of the Electrical Standards Committee of the American Standards Association at a meeting in New York City last month. He will serve as chairman of the communications and electronic section.

Dr. Baker's appointment by the ASA is expected to give the radio and electronic industry greater representation in the national standardization work.

**A 5,280-MILE** conversation on microwaves was made last month at an alumni meeting at the Massachusetts Institute of Technology. This call set a record for long-distance microwave transmissions. In the call, the voice of Paul M. Byle, engineer for the Bell Telephone Laboratories, made 12 round trips on the microwave circuit between Boston and New York.

This transmission climaxed a demonstration by engineers of the Bell Laboratories and the American Telephone and Telegraph Company. The demonstration also included calls to an automobile, a trawler at sea, to Nantucket Island and Hawaii.



Dr. McKay of Bell Labs with diamond amplifier equipment. Insert: diamond in its holder.

**AMPLIFICATION** with a diamond rather than the conventional vacuum tube was announced by Bell Laboratories last month. The method is based on the discovery that when beams of electrons are shot at an insulator—in this case a diamond chip—electric currents are produced in the insulator which may be several hundred times as large as the current in the original electron beam.

The process itself is somewhat similar to the technique of translating the energy of a beam of light into electricity which underlies the operation of the well-known photoelectric cell.

One of the major difficulties encountered came when the Bell physicists found that as the current started to flow in the diamond chip, the electrons became trapped in the tiny imperfections which are present in all crystals. Thus, after the first fraction of a second, the induced current wasted away under the opposition of the trapped electrons.

To overcome this, the investigators applied an alternating voltage to the diamond chip so that current flowed through the diamond one way for a fraction of a second and then in the other direction, reversing itself 120 times a second. Alternately negative and positive charges are drawn through the crystal and some of each kind are trapped. The trapped positive charges cancel out the effect of the trapped electrons, or negative charges, and the induced current is allowed to flow freely.

The experiments stemmed directly from previous pioneer research in which current was induced in diamonds by bombarding them with alpha particles. This earlier investigation promises development of a new laboratory tool for counting alpha particles. It would do essentially the same thing as the familiar "Geiger counter." The new device, however, would have smaller size, lower operating voltage and a faster counting rate.

Texoma Radio's new auto radio section.

By C. J. WHITTON



Interior view of the new auto radio repair department and part of main radio repair section.

*The Radioman*

# Expands His Business

**S**HOULD we expand? Do we actually need more floor space and facilities? Will our business continue to warrant an expansion that is apparently needed at this time? This is a problem that many a radioman has to meet at one time or another in his career. We at Texoma were recently confronted with these perplexing questions and our answer was an emphatic Yes.

In arriving at this conclusion we did not consider our past success nor did

we rely upon our own judgment as to what the future might bring. The answer to these first two questions were found, in our own business records. For the first, many valuable outside sources of information were called upon to give us a definite answer. These sources of information are available to any business, whether it be large or small, and the data that may be had for the asking in all probability took months to compile and represents several million dollars spent on research. These silent partners of your business are glad to help you and you can be sure that

the information they give you will be to your advantage because they stand to lose or gain with you.

At the head of our list of information sources is our banker. A word here in regard to the part your banker should play in your business will not be amiss. Handle all of your transactions by check. By depositing your entire shop income and making all payments by check, you have created two assets to your business. You have secured an indisputable receipt for

payments made, and you have placed at the disposal of your banker a complete financial record of your firm. He can study this record and tell you more about your financial condition than you can. Remember, too, that if your decision is to expand your business, in all probability you will have to call upon this banker for that little financial boost that will be needed in most cases. The advice you receive from him will be based on the outlook for several years to come, for it would be foolish for him to invest money in your business on the prospects of a few months.

Our next source of advice is our jobbers and suppliers. They too stand to lose or gain by your decision. Business done with your main suppliers should be handled on an open account basis when possible. This again accomplishes two things. It gives you an established credit rating which, if properly handled, is another valuable asset. Second, your jobber can at a glance determine from your ledger sheet the direction of your buying trend. This when coupled with the trend of his area will help him in advising you. Remember that the business trends of localities are often misleading, so rely upon someone who already has this cross-sectional information. It will save you lots of time and trouble.

Our final questions were placed with our local business associates: our hotels, garages, theaters, and managers of large chain concerns. Here again we receive an unbiased opinion because each fellow's business is dependent upon another's success.

Our answers: From the banker, (Continued on page 74)

## A New Year and New Links In Our Chain of Improvements!



Interior View of Texoma Radio Co., Featuring the Recently Completed Car Radio Service Department

### To a Greater Growing Denison!

As the old saying goes, "A chain is no stronger than its weakest link"—we believe that business must be founded on the satisfaction of customers who are the links that make progress in business possible.

In less than two years we have undergone two major expansion programs, adding new installations, space and equipment to better serve our customers, who have made our anticipated growth a reality.

Our friends and customers and their splendid reception of the services that we have to offer are wholly responsible for the expansion programs we have been able to complete.

We want to sincerely thank every citizen of this community and promise them a guaranteed service on all repair work that we are privileged to do for them.

**Texoma Radio Co.**

"COMPLETE RADIO AND APPLIANCE REPAIR SERVICE"  
124 West Chestnut Phone 2430

An excellent example of how the radio technician can use advertising.

# Standard Television Sets Become Projectors

**L**ARGE-SCREEN television is a treat for which we will have to wait for some years, say the engineers of some of the biggest radio and television companies. Serviceman and engineer William Spellman refuses to look at the problem so patiently and philosophically, and has produced his own large-screen television here and now. He has custom-engineered a large number of ordinary television receivers to work with a large screen, and is now—in co-operation with Colonial Television Co. of the Bronx, New York—selling such sets to points as far away as Los Angeles.

Mr. Spellman's system is simple. He installs a high-voltage, projection-type tube in place of the regular viewing tube of a standard televiser, provides a 30-kilovolt r.f. power supply for it, and mounts a projection lens ahead of the tube. The lens is adjustable to focus on a screen, which can vary in size up to 6 x 8 feet with excellent definition, and may be as large as 12 x 16 feet where especially large pictures are required.

The high-voltage power supply, shown in Photo 1, is a standard r.f. job with a pair of 6Y6's as oscillators and three 8016/1B3 rectifiers in a voltage-tripling circuit. The high-voltage portions of the circuit are all mounted on Lucite, as may be seen from the photograph.

An ordinary low-voltage power pack supplies power to the oscillator tubes. The 2 sections of the new pack are mounted in the lower half of a wheeled cabinet, in the top half of which the televiser is installed.

Photo 2 shows a top view of this top compartment as seen through a removable center panel in the top of the cabinet. The high-voltage, projection-type

television tube has ample room in the space occupied by the original 10- or 12-inch viewing tube, even with part of the lens assembly ahead of it. The lens itself, together with the viewing tube, is shown in Photo 3. It is manufactured especially for television projection by Bausch and Lomb.

Mr. Spellman has found that, though a standard televiser will produce satisfactory projection images, it is advisable to modify the video amplifiers if very large screens are to be used. Improved contrast and definition result, he claims.

Not a large number of sets have been produced up to the present, and the demand has been such that Mr. Spellman has found it expedient to accelerate his operations through combining with the Colonial Television Co. to turn out a larger number. Most of his sets are being used by theaters or exhibitors, and of course in bars and grills. The largest audience recorded was at the Shriners' Auditorium in Los Angeles, where 4,800 people viewed a program projected on a 12 x 16-foot screen. Reception, according to *Billboard* magazine, was quite satisfactory.

Operation of the projection televisers is as simple as that of any other type of television receiver, the only additional adjustment being that of the optical lens, which must be focused on the screen like a home movie projector.

It is expected that kits for converting ordinary televisers to large-screen machines will be made available to experimenters. The cost will not be low—totaling something over \$300. This would make the conversion more attractive for commercial than home use, though no doubt many experimenters would be interested.



Colonial President Emerson adjusts the lens.



Photo 3—The projection lens and 30-kv tube.

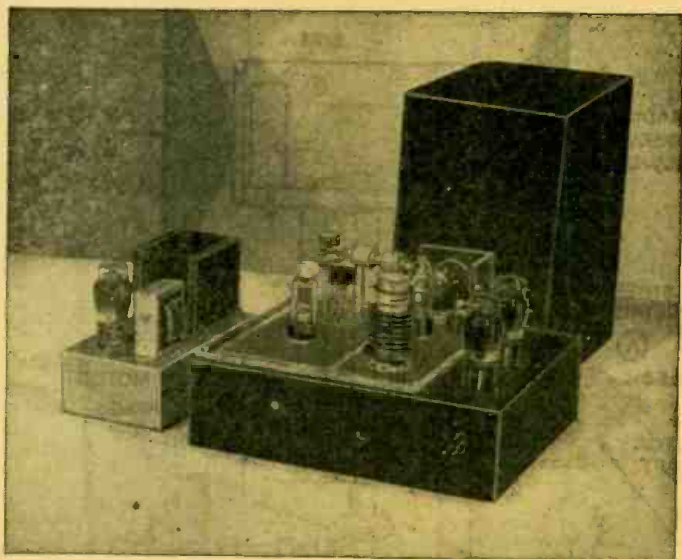
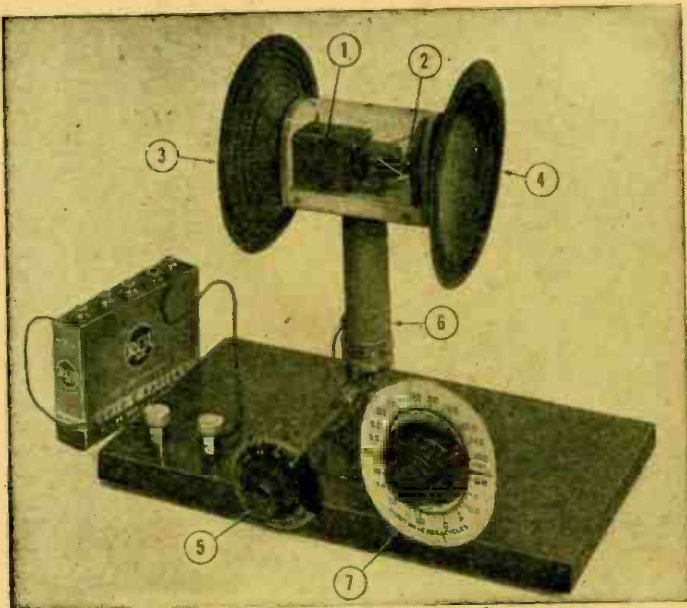


Photo 1, above—The 30-kv r.f. unit and the low-voltage power pack which supplies it. Fig. 2, right—Top view of a standard televiser showing how the high-voltage projection tube and lens are installed.



# Tubeless Homo- Heteradio

By MOHAMMED ULYSSES FIPS, I.R.E.I.R.E.\*



A recent model of the tubeless Homo-Heteradio which contains neither tubes nor radio parts, except a rheostat. 1. Special high-speed motor. 2. Supersonic siren. 3. Intake of radio waves. 4. Loudspeaker. 5. Dial to rotate Heteradio mounted on shaft 6. 7. Rheostat, which controls motor speed, tuning the radio.

A completely revolutionary type of radio is described here. It bears not even a remote resemblance to present-day radios. It is so new that readers will have to reorient their thinking completely from present-day radio technique.

**E**VER since the advent of the vacuum-tube and our modern radio receiver, we have read from time to time that a tubeless radio had been invented.

Despite many press notices, up to very recently no radio which did not depend on the electron tube existed to the best of my knowledge. I exclude from this the typical old crystal receiver which worked beautifully with excellent reproduction. It, too had no tubes.

The question, therefore, arises: How could a tubeless, crystalless radio set come about? In my opinion—which goes back for many years—it should not be impossible to build a *purely mechanical* radio, completely disregarding our present radio ideas. Some time ago I set out to prove just that. The present article is the result of my exhaustive investigations and studies on this fascinating subject.

To begin with, speaking broadly, the waves which broadcast our present radio signals from our radio broadcast stations are no different than any other vibrations in space. I refer you to the schedule on the next page entitled: "Table of Vibrations," whose effects are recognized today. You will observe that the entire known spectrum of vibrations starts with the first octave and goes up to the 62nd octave at present. In this spectrum will be found sound-waves, supersonic sound waves, electrical waves (which include radio waves) heat waves, light rays, chemical rays, and X-rays. *These waves are all related to each other, but vary in frequency, or rate of vibration.*

The first octave, be it noted, encompasses waves vibrating at two vibrations per second. At the other end we find the 62nd octave where the waves vibrate at

the enormous frequency of 4,611,686,-618,427,389,904 vibrations per second.

Electrical and radio waves, known as electromagnetic waves not only vibrate much faster than sound waves, but in an unknown manner. Sound waves are vibrations of physical substances, such as air, water, the metal of bells, etc. If we enclose an electric bell in a bell-jar and pump the air gradually out of it, the sound dies away. Radio waves move better when there is no air in their path than through it, or any other medium. We know that radio waves are of a vibratory nature but neither Drs. Alexander, Armstrong, and de Forest together can tell us *what* it is that vibrates.

Radio waves as we have seen, are related to sound waves *except that they vibrate infinitely faster.* The human ear cannot hear these radio waves for the

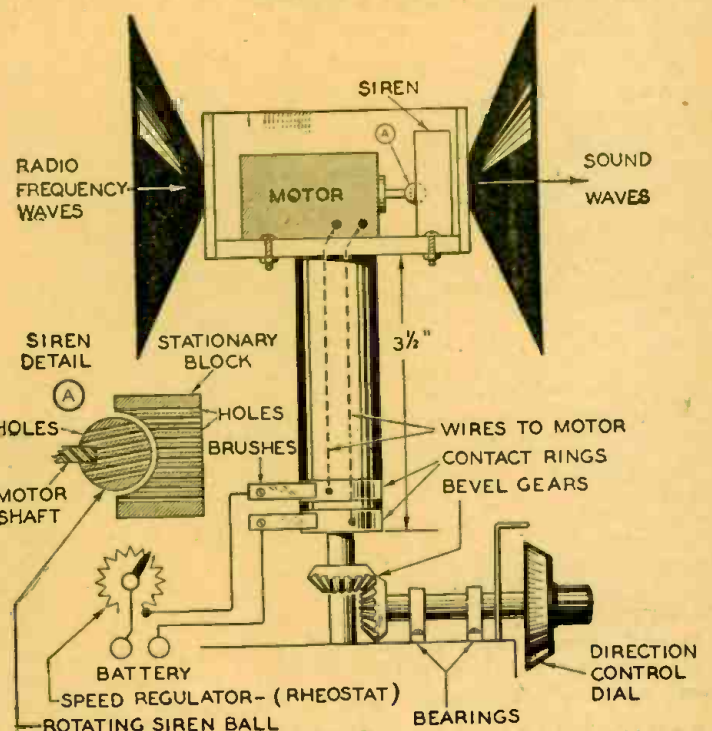
simple reason that somewhere above 18,000 vibrations a second the human ear can no longer detect the waves directly.

Scientists think that there may be some living entities that can hear radio waves, but so far this has not been proved.

Thus we know that canary birds can hear supersonic waves around a frequency of 30,000. Presumably there may be insects or other organisms that can hear much higher up the scale, but this today remains merely an assumption.

We do know, however, that the radio waves are all around us. Indeed, while you are reading this, radio waves of thousands of radio stations pass right

Elements of the new heteradio. The heart of the new radio is the supersonic siren shown also in detail "A". The siren gives from 500,000 cycles upward taking in the entire broadcast frequency range. By means of a special heterodyne effect, audible sounds are converted from radio frequency waves. Heteradio motor runs by means of small 6-volt battery. Direction control moves Heteradio into optimum position to receive radio frequency waves.



\*Islamic Royal Euclidean Intransigent Radio Engineers



through you, through your head, through your body, and through the building in which you sit (except where steel or other metallic masses cut off the waves.) Because the human ear cannot directly hear radio waves we must make them heard by means of crystal detectors, or radio tubes in various ways well known to every radioman.

Using radio tubes, we first detect the wave in our detector tube; then after detection we step it up by means of high amplification after which it is fed into the loudspeaker. The latter then gives off sound waves which we hear at the lower frequencies between 8 and 18,000 vibrations a second.

This method is a most circuitous one and it is easy to see that there should be something much less complicated than our complex radio sets.

At this point I must digress and show that in principle the tubeless radio is really not revolutionarily new, because in the past radio waves have been made audible to the human ear without radio crystals or radio tubes.

If you wish to read more about this I refer you to H. Gernsback's editorial "Superadio" printed in the April 1947 issue. In December 1946, Johns Hopkins University scientists accidentally discovered that a strip of Columbium nitride about the size of a pin, when cooled to minus 444.4 degrees Fahrenheit detects radio waves without any radio tubes. Radio programs could be heard distinctly, however, it was necessary to have the Columbium nitride strip connected to an amplifier.

Going back even further, as you will read in the same editorial—ever since radio broadcasting started in the early 20's, newspapers from all over the world have reported a number of most unusual and unorthodox radio reception cases. For example a cold-water faucet a block away from a Boston radio broadcast transmitter emitted music or speech when the water was turned on. A few blocks away a housewife almost fainted when a frying pan on a gas stove gave out music and lectures that could be heard throughout the flat.

But nothing much was ever done about these effects in reducing them to a workable radio receiver without using orthodox radio tubes and other radio components. Here matters rested.

Many of these instances were probably special cases of ordinary electrical detection. The celebrated case of John Moscovitz, the Newark cutlery worker, who at all times heard station WOR, is a case in point. Engineers discovered that carborundum particles from his grinding wheel had lodged in the metallic bridgework of his teeth, making him a living crystal receiver.

How the currents thus detected were turned into sound has never been satisfactorily explained, but it is supposed that part of his auditory nerve when stimulated by the modulated currents from his bridgework passed the sensation of sound to the brain.

No such explanation will serve in the case of the cold-water faucets, or frying pans, which picked up and reproduced broadcast signals. Here the radio waves

acting directly on physical matter produced sound. It was these instances I studied, and from them I learned how sound was produced directly from radio waves—learned, indeed, to duplicate such effects.

The secret of the mystery lies in the statement a few paragraphs back "radio waves travel better when there is no air or other medium in their way." It has long been known that radio waves are absorbed in air, and to a much greater

source of local power—like de Forest's B-battery—which could be modulated or controlled by the incoming signal.

I imagined a purely mechanical wave converter which would make radio waves audible. Here is the way I finally worked it out in building my revolutionary receiver.

Suppose we wish to detect and listen directly to radio waves having a frequency of 570,000 cycles (570 kc), which is equal to 526.3 meters.

For this we build a supersonic siren which can go beyond 570 kc. To drive the siren we use a powerful extra-high speed electric motor. We put an ordinary rheostat in series with the motor so we can control its speed accurately. We now connect the motor and the rheostat to the battery and drive the motor at the correct speed.

I found out that in order to do so the motor would have to run at the rate of 300,000 revolutions per minute, or 5,000 revolutions per second. That is pretty high speed and at present hard to obtain.

But, suppose we take the fifth harmonic or 100,000 cycles. The speed of the motor can, therefore, be made much lower, or 1,000 revolutions per second—60,000 revolutions per minute. This today is not impossible of obtaining.

Now we must have a siren. No standard siren could operate at this speed without flying to pieces. So I designed a Ball-Siren. This comprises a steel ball which has bored through it a number of small holes at an angle. Around this small ball, which is only about 3/16 inch in diameter, a shell was built exceedingly close to the siren ball. This made a tiny siren giving off high-frequency supersonic sound. As the weight of the ball rotor is less than 2 grams, at the high centrifugal speeds to which the ball is subject it will not undergo destructive strains. I found it was necessary to use an especially high-grade steel so it would not fly apart under the stresses at the tremendous speed.

Now, when the siren is turned on at full speed I can readily obtain sufficiently high supersonic vibrations at radio frequencies from 500,000 cycles upward, through the entire broadcast band.

How can we now hear the radio waves? This is done by simply creating interference between the siren waves and the radio waves. In other words, a heterodyne effect.

Incidentally, the heterodyne effect, first demonstrated by Fessenden, operates as follows:

A local generator of radio-frequency waves is made to generate signals a few hundreds or thousands of cycles away from the frequency of the incoming signal wave. The two sets of waves, being

(Continued on page 62)

## TABLE OF VIBRATIONS

Whose Effects Are Recognized and Studied  
Number of Vibrations per Second

1st Octave.....	2	
2nd "	4	
3rd "	8	
4th "	16	
5th "	32	
6th "	64	
7th "	128	SOUND
8th "	256	
9th "	512	
10th "	1,024	
15th "	32,768	SUPERSONIC
20th "	1,047,576	
25th "	33,554,432	
30th "	1,073,741,824	RADIO
35th "	34,359,738,368	
40th "	1,099,511,627,776	LITTLE-KNOWN RADIO & INFRA-RED
45th "	35,184,372,088,832	
46th "	70,368,744,177,644	
47th "	140,737,468,355,328	HEAT
48th "	281,474,976,710,656	
49th "	562,949,953,421,312	LIGHT
50th "	1,125,899,906,842,624	
51st "	2,251,799,813,685,248	ULTRA-VIOLET
57th "	144,115,118,075,855,872	
58th "	288,230,376,151,711,744	UNKNOWN
59th "	576,460,752,303,423,488	
60th "	1,152,921,504,606,846,976	X-RAYS
61st "	2,305,843,009,213,693,952	
62nd "	4,611,686,618,427,387,904	COSMIC & UNKNOWN

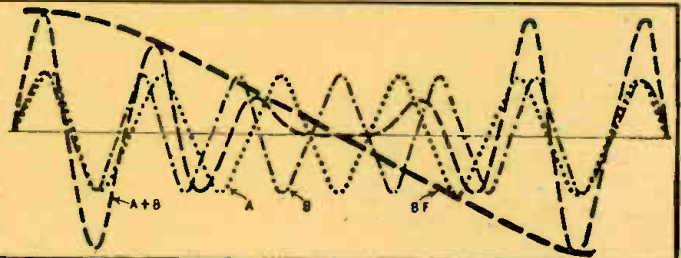
The above table gives vibrations from the 1st to the 62nd octave, to better understand the operation of the Tubeless Heteradio receiver.

extent in better conductors. But absorption merely means that the radio wave does work in the medium—transfers some of its unknown electrical energy into mechanical energy—actual motion of the molecules of the substance through which it passes. This is of course the secret of the examples just given. Water or iron set in motion by the waves, usually assisted by some rectifying action which reduced the effect of radio frequency vibrations and allowed their audio modulation to stand out, is probably the explanation of all these effects.

I was soon able to produce speech and music with a variety of such devices. Only trouble was that, like the old crystal receiver, they were dependent on power received from the broadcast station. Loud signals were obtainable for only a mile or so from high-powered broadcasters. What was needed was a

FIG. 1

Heterodyne action. If frequency A is (for example) 1,000 kc and B 1,001 kc, a wave of the form A + B will be produced. This produces a 1,000-cycle note (BF) in following circuits.



# British Radio Design

By MAJOR RALPH W. HALLOWS\*

European conditions produce some very interesting circuit features

THE path of the British broadcast radio designer is not easy. Except for a few who specialize in fine-quality receivers, all manufacturing firms regard the low-priced set as their main source of sales and profit. Our idea of low prices in radio are very different from those which prevail in America. For reasons into which I cannot enter into here, it is scarcely possible in Britain to produce a domestic receiver selling at a basic price of less than the equivalent of about \$60, on top of which there is a 21.5% purchase tax, bringing the minimum price close to \$73. Our tube manufacturers sell competitively

For this reason and certain others, such as the prevailing shortages of manpower, components, and raw materials, the designer of low and medium-priced radio sets is limited to the use of not more than 4 tubes, in addition to the rectifier. We don't as a rule include the rectifier, which after all need not be a tube, in the number of tubes stated in receiver specifications.

For the \$70 to \$100 which he pays for the small radio receiver, the British buyer expects these things:

1. Besides ranges from 5-20 mc and 500-1,500 kc, the tuning bands must cover 150-300 kc, for much important

European broadcasting is done on the low frequencies;

2. Selectivity must be good enough to separate stations on channels 9 kc apart, for that is the basis of the present frequency allocation on this side of the Atlantic;

3. Arrangements for the use of a pickup must generally be provided;

4. The set must be adjustable to work on any line voltage between 200 and 250 volts.

The designer, then has at his disposal a maximum of 4 tubes with which to produce a set meeting all these requirements. Clearly, if he is to produce a best seller—or even a good seller—he must get the utmost possible performance from his quartet of tubes. At first sight it doesn't seem possible to ring many changes on 4 tubes. The set must be a superheterodyne. That seems to indicate a triode-heptode as mixer; a variable-mu pentode as i.f. amplifier; a duo-diode-triode as detector, supplier of a.v.c. voltage, and first a.f. amplifier; and a pentode as output tube. That is just about all that you can do with 4 tubes—or is it? Let's see. It would be an advantage if you could cut the tubes down to 3 and still produce a superheterodyne with the required performance. A 3-tube superhet, with ample output from its loudspeaker? We have several! The Mullard MAS 305, for example, is shown in Fig. 1.

In this receiver we have the curious and ingenious combination of 2 variable-mu triode-heptodes and a duo-diode-pentode. The first triode-heptode V1 functions quite normally as a converter, with injector-grid coupling between the 2 sections of the tube. V2 is used in an

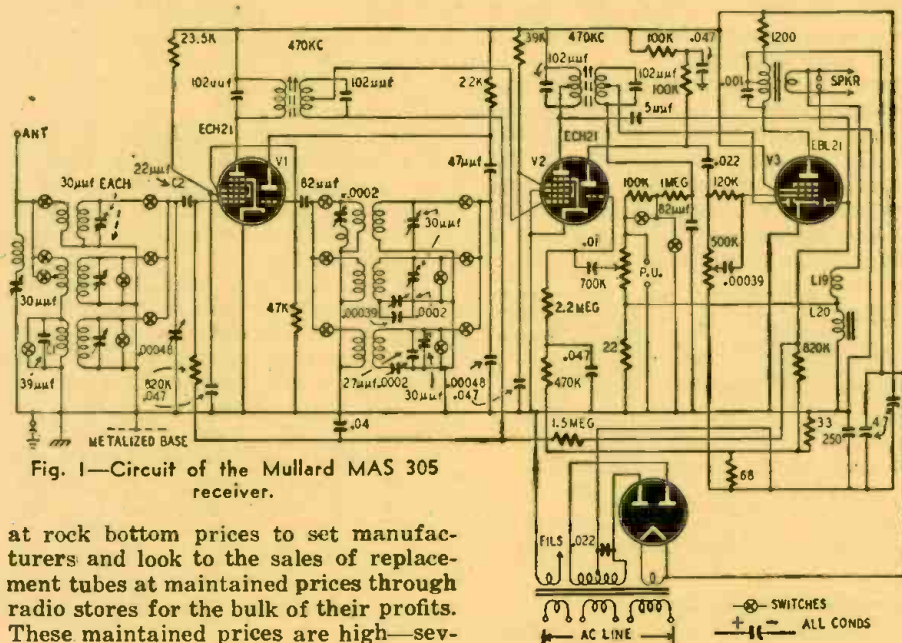


Fig. 1—Circuit of the Mullard MAS 305 receiver.

at rock bottom prices to set manufacturers and look to the sales of replacement tubes at maintained prices through radio stores for the bulk of their profits. These maintained prices are high—sev-

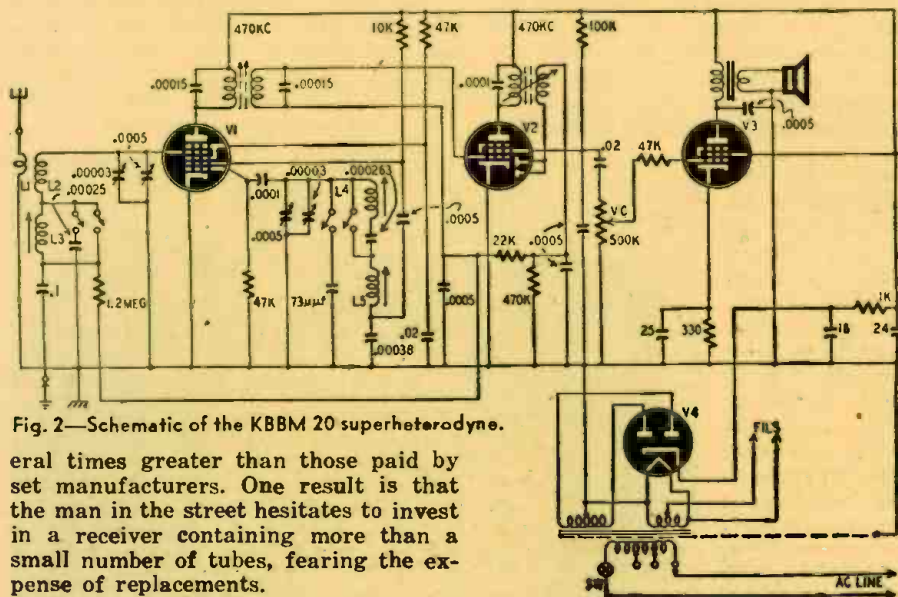


Fig. 2—Schematic of the KBBM 20 superheterodyne.

eral times greater than those paid by set manufacturers. One result is that the man in the street hesitates to invest in a receiver containing more than a small number of tubes, fearing the expense of replacements.

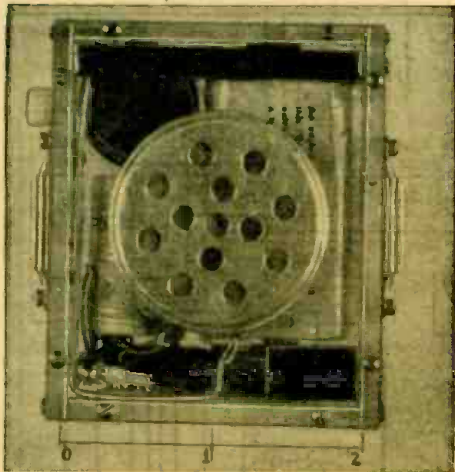
\*RADIO-CRAFT'S European Correspondent.



Typical British console is the Murphy A-104.



## COVER FEATURE



Close up view of transmitter.

# Brunetti Wrist-Watch Transmitter

By HUGO GERNSBACK

**Even smaller radios than this 2-x 3-inch transmitter may be made when smaller and better batteries are built.**

**P**ERHAPS the most revolutionary advance in radio set building methods was developed during World War II. This is known as the printed circuit technique.\* The man chiefly responsible for most of the new ideas in this branch of radio is Dr. Cleo Brunetti and his co-workers of the National Bureau of Standards.

When it became necessary, during World War II, to design extraordinarily small radio sets which, however, had to be extremely efficient at the same time, it was Dr. Brunetti who solved the host of problems which made these tiny radios possible.

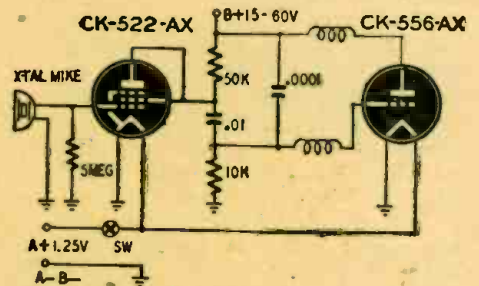
In the proximity fuse, for instance, a tiny radio transmitter with combined radar was required. This entire transmitter (complete with batteries, tubes, etc.) is so small that it fits in the head of the small projectile. In use the shell

is set to explode at a predetermined height from the ground, or from any object it may pass in flight. When the shell reaches this point, a radar impulse bouncing back from the ground (or object) to the shell, activates the proximity fuse, which now bursts.

Actually millions of these were manufactured during World War II and did much in helping to win the war. Many similar radio weapons were designed by Dr. Brunetti and his associates.

Dr. Brunetti, who is the Chief of the Engineering Electronic Section of the National Bureau of Standards, is a physicist of the first order. He and his associates had to overcome tremendous difficulties in compressing a standard radio transmitter into a space that measures less than the fist of a small child. Extraordinary problems had to be solved in carrying out this work, which included much pioneering in many different directions.

So important has this new technique become, that the Bureau of Standards felt it necessary to bring out a 44-page book entitled: "Printed Circuit Techniques" by Cleo Brunetti and Roger W. Curtis. This is a National Bureau of Standards circular No. 468, for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., for 25c. In this book will be found all the various complex techniques that have enabled Dr. Brunetti and his



The wrist-watch radio transmitter schematic. The wrist-watch radio transmitters actually staff to build radio transmitters actually down to the size of a lipstick case (minus batteries and microphone).

One of the most recent Brunetti developments is his wrist-watch radio transmitter featured on this month's cover. It is so small that it can be worn like a wrist watch. The entire transmitter (including crystal microphone, A and B batteries) is all housed in the plastic case. The size of the case is  $2\frac{1}{4} \times 2\frac{11}{16}$  inches. From the diagram it will be noted that there are two tubes, a CK522AX and a CK556AX.

These are well-known miniature battery types. The A-battery is a small Mallory dry cell which measures about 1 inch in diameter and  $\frac{5}{8}$  inch in height. The B-battery is a small hearing-aid type manufactured by several battery manufacturers.

The wrist-watch radio is a transmitter only and has no receiver. There is no aerial, yet the transmission is reliable over a range of about 100 ft. Any receiver tuned to the correct wavelength (in the 6-mc region) can receive the signals.

In a demonstration, which the writer witnessed, Dr. Brunetti was walking



Dr. Brunetti's smallest and latest transmitter compared with a box of ordinary book matches.

about the floor whispering into the wristwatch radio, yet his voice came out clear and strong from the table radio receiver at a considerable distance away from the transmitter. As a matter of fact it is necessary to be some little distance away, otherwise there will be an audio feedback howl.

Dr. Brunetti built a similar miniature pocket-radio for President Truman, which was presented to him on Christmas Day. In the White House there are a number of receivers attuned to the President's transmitter. The President can now walk about the entire White House, including grounds, and talk to the personnel wherever he is located. It is not possible to "talk back" to the President as there are no radio transmitters for the White House staff.

There are many practical uses for wristwatch transmitters of this type, only a few which are listed here:

During building construction when the architect or the foreman wishes to talk to a temporary office, contact can easily be established.

Such a walking transmitter is a great boon in commercial departments between stock clerks and main office.

For mines, quarries, etc., foremen—if equipped with a wristwatch radio—can keep in touch with the distant office at all times. It would be particularly effective during mine disasters. These are only a few uses. There are of course thousands of others.

Dr. Brunetti has not stopped at the small wristwatch radio, but has since developed even smaller units. A number of these are reproduced here for the first time in any publication.

There is, for instance, an astonishing new two-stage audio amplifier, illustrated in these pages, which is incredibly small. This amplifier (complete with tubes) is a cylindrical plug-in unit and weighs 17 grams (a little over half an

ounce). It is  $1\frac{1}{4}$  inches long and  $11/16$  inch in diameter. The prongs are  $7/16$  inches long. The entire amplifier is cast in solid transparent plastic. Therefore, it cannot be taken apart or opened. The only way this could be done would be by dissolving the plastic in a solvent. It could not be taken apart mechanically because in the process all the parts would be ruined. The circuit diagram of this transmitter is also reproduced here. It is probably at the moment the smallest two-stage audio amplifier ever made.

Since Dr. Brunetti constructed his wristwatch radio—shown on the cover of RADIO-CRAFT this month—he has developed an even smaller one. It is the smallest ever built up to now. The small flat two-tube transmitter is shown in our illustrations. The entire circuit is printed on a  $1/16$  inch lucite plate; the transmitter (tubes, resistors, circuits, base plate, etc.) weighs exactly 8 grams ( $2/7$  oz.). The tiny set, smaller than a book match, measures 1 inch by  $1\frac{15}{16}$  inch and is  $5/16$  inch in maximum height.

As we go to press Dr. Brunetti has come up with some even more astonishing versions of his miniature radios. During the first part of last February he demonstrated his "Half-Dollar Radio Station" before the local section of the Institute of Radio Engineers in Washington.

He exhibited a whole "network" of radio broadcast transmitters which he carried in his pockets. Among others he demonstrated a tiny transmitter which fits in an empty lipstick container. He also had a "Calling Card Radio," the size of a calling card.

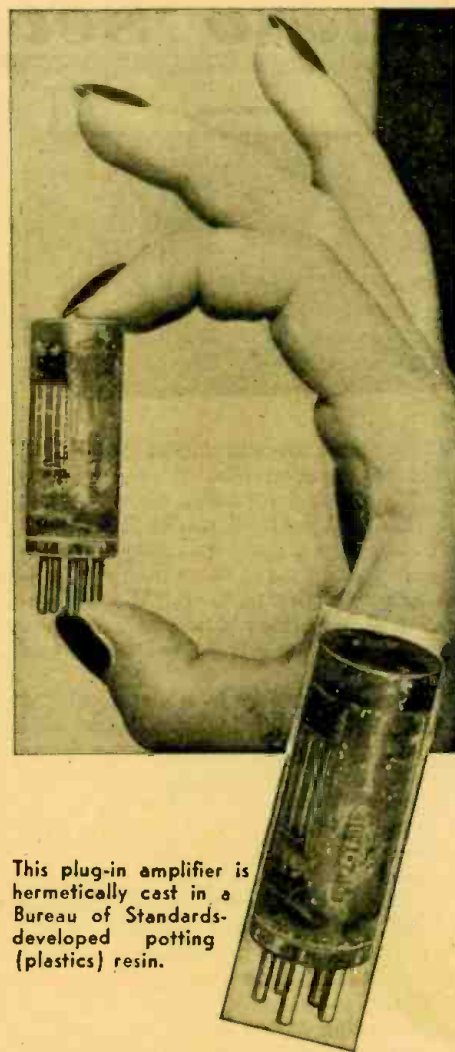
His "Half-Dollar Broadcasting Unit" is built on a square which barely covers a 50c piece. The thin plastic square measures  $1\frac{1}{4}$  inches each way. Flat painted lines, which are the radio circuits, are used instead of wires. The tiny tubes are soldered to the flat surface. Small hearing-aid batteries supply the power for this sub-miniature radio station.

Dr. Brunetti also presented a duplicate vestpocket transmitter and receiver of the type presented to President Truman, as above mentioned.

These small radio transmitters and receivers are no longer in the theoretical stage nor are they "stunt" exhibition pieces. The National Bureau of Standards, in a recent survey revealed that more than 65 radio manufacturers have begun to use printed circuit techniques in various of their products.

There is already in use at present a hearing aid manufactured with the printed circuit. Plans are under way for two-way personal radios at present.

Dr. Brunetti illustrated to the assembled engineers at Washington how large stores can use the midget transmitters in routine inventory taking. The idea for this use of miniature radios came from an executive of a large chain store. One clerk would count the stock, broadcasting by radio the resulting stock figures to the main office where they would be recorded and tabulated. This would be quicker than having the clerk write down the results himself, because



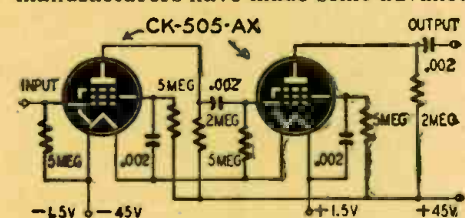
This plug-in amplifier is hermetically cast in a Bureau of Standards-developed potting (plastics) resin.

he could not count stock while writing, whereas the voice transmission to a competent stenographer works twice as fast.

At the present time Dr. Brunetti and his staff feel that while the electronic parts of their radios have shrunk to a size never contemplated before, the battery interests have not kept pace with electronic developments.

Both A and B batteries still bulk many times the space of electronic parts of the miniature radios. It is along this line of attack that greatest progress is expected in the immediate future.

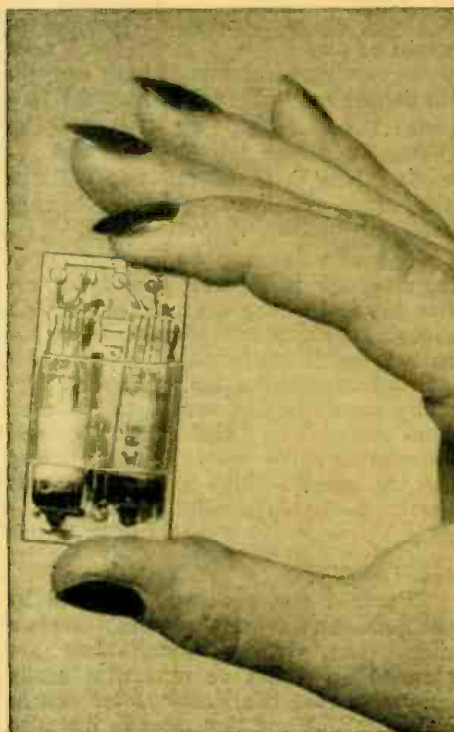
During the war years dry-battery manufacturers have made some advance



Schematic of the potted two-stage amplifier.

in reducing dry cells to smaller size, but they are still far too bulky and much too large.

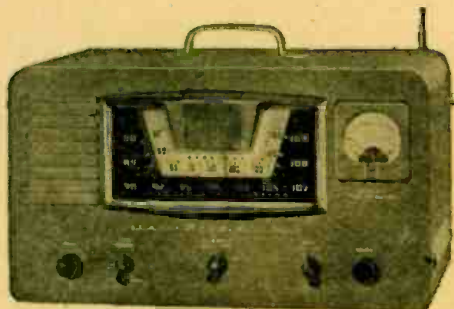
If it were not for the bulky batteries, Dr. Brunetti's various transmitters and receivers could be made far smaller than they are today. It is felt, however, that this problem too will be solved in the near future, once the battery interests understand how tremendously important sub-miniature radios will become in the future.



Another view of the new smallest transmitter, shown also on preceding page.

# Radio Set and Service Review

## ◀ Bendix Model 847S "Facto Meter"



THE new Bendix Model 847S field test receiver—called the Facto Meter—is an 8-tube, a.c.-operated, FM-AM portable set. It is designed specifically as an aid to radio installation crews and servicemen making field-strength measurements on FM and standard AM broadcast bands.

Its tuning range is 540—1620 kc and 88—108 mc.

The set is enclosed in a metal cabinet 11 inches high, 17¾ inches wide, and 6¼ inches deep and features a large built-in tuning meter and a 33¼-inch telescopic antenna that may be used on FM and AM reception. This antenna can be connected to either the FM or AM antenna terminals by a switch on the side of the cabinet. A 300-ohm FM antenna and a single-wire broadcast antenna and ground can be connected to terminal strips on the rear of the chassis.

The tuning meter has two sensitivity ranges. The ratio between ranges is 5 to 1 on the AM band and 10 to 1 on the FM band. It has a linear scale calibrated 0 to 10. When the meter reads 5 or above on the high range, excellent FM reception is possible at the location where measurements are made. When the needle falls between 1 and 5, reception is good. On the low range, readings between 1 and 5 show poor reception, and

above 5 shows good reception. The set should be tuned for maximum needle deflection on each station.

### FM vs. AM propagation

There is considerable difference in the propagation characteristics of standard broadcast frequencies and the very high frequencies used for FM. The broadcast signal—1600 kc or lower—has a tendency to follow the earth's surface and may be received on the ground wave for distances of 400 miles or more under normal terrain and atmospheric conditions. Obtaining fair broadcast reception is no problem—even in remote locations—as the average broadcast set will pull in a number of stations if given a chance.

In steel-framed buildings, the structure may absorb the signal and cause dead spots and poor reception on sets with built-in aerials. Outdoor aerials improve reception, but there are times when they are not practical or their use is prohibited. In such cases the Facto Meter can be used to locate spots accurately where signal levels are highest, and sets will give best results within the building. Areas of maximum signal strength are located by extending the antenna of the field test receiver and moving it around the room or building while watching the meter. Meter deflection indicates spots where the signal is strongest.

FM signals—in the order of 100 mc—act very much like light rays and travel in straight lines with comparatively little bending. Best reception is usually obtained when the receiving location is in the service area—where receiving and transmitting antennas are in the *line of sight*. This distance may be calculated from the formula:  $D1=1.4\sqrt{H}$ . D1 is distance in miles, H is elevation of observation point in feet, and 1.4 is a constant used to allow for v.h.f. refraction. Fig. 1 is a comparison of broadcast and v.h.f. signals.

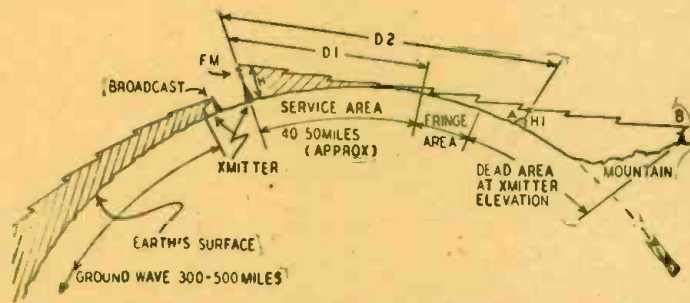


Fig. 1—A comparison of broadcast and v.h.f. signal propagation.

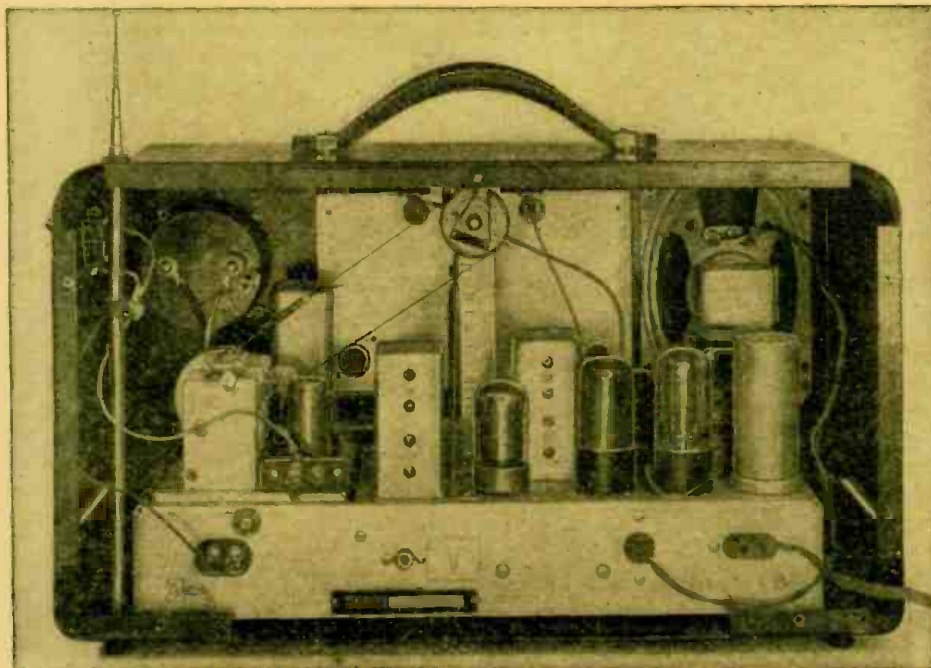
The service area of an FM station depends largely on the height of its antenna above surrounding terrain. The service area includes all the space within a radius of D1. H is the height of the transmitting antenna. Reception is possible in the fringe area where the receiving antenna is normally below the line of sight but signals are relatively weak. Best results are obtained when the receiving antenna is mounted as high as possible so as to extend the line-of-sight path between transmitting and receiving antennas. Signals may be received at any point A in the dead area if the receiving antenna is high enough. Its height may be found from the formula:  $D.2=1.4\sqrt{H}+1.4\sqrt{H1}$ . D.2 is the distance between transmitting and receiving locations, and H and H1 are heights of transmitting and receiving antennas in feet, respectively.

Good signals may be received atop the mountain at B—far beyond the service area—because the receiver is high enough for direct reception of the transmitted signal. (Antenna installation and orientation can become a problem normally requiring the services of two or more men.) The height, location, and orientation of the antenna and routing the transmission line are problems of particular importance.

### Field survey

The field test receiver, operated by one man, can answer these problems in a short time. Where installations are planned on a flat or otherwise easily accessible roof the Facto Meter can be carried about and the antenna installed

(Continued on page 76)



Above—The receiver with metal back removed. The telescopic antenna is partly collapsed.

# The Junior Demon 5-Watt Transmitter

By G. CARROLL UTERMAHLEN, W3HVD



"JUNIOR" was a prewar baby, born of my desire for a compact transmitter capable of local and dx contacts with a minimum of power. This midget demon has, at one time or another, gone all out in his efforts to mate with another c.w. station and, at such times, has disregarded his usual operating procedures. Junior, you see, is trying for WAS!

Most hams have been spoiled by high power, so here is the chance to test your operating ability with the barest essentials! Junior is capable of getting out in a big way. A good antenna, proper tuning, and clean operating ability will enable this peanut whistle to reach hundreds of miles out into the night.

A 70L7-GT tube was used because it was the only tube of its type available when the original Junior was built. A 117L7-GT tube may be substituted for the 70L7-GT by omitting the line-cord resistor and noting the proper changes in tube socket connections. The circuit component values are not critical, but substitutions should be made with care.

Several of these little rigs have been built by other hams, and while some did make changes in parts values, all of the rigs worked very satisfactorily.

Construction details will vary with the materials available. The following dimensions are given as a guide for those who are interested in duplicating the original unit.

The aluminum chassis is of 1/16-inch stock, and is 2 3/8 inches high, 6 inches long, and 3 1/4 inches deep.

A 3/16-inch slab of Masonite is used as a front panel. It is 5 1/2 inches high and 6 3/16 inches long. All voltage-carrying parts are mounted on the front panel (under the chassis) or, if chassis mounting is more convenient, the parts should be carefully insulated from the chassis itself. No ground should be al-

lowed to come in contact with the chassis or any voltage-carrying component!

The crystal, tube, both coils, and the antenna-tuner variable condenser are above deck. The remaining parts are below deck. A careful survey of the chassis and panel will indicate the proper placement of parts with the least possible crowding.

Nearly every amateur agrees that the 40-meter band is the best for all-around good results with low power. Forty meters offers interstate QSO's with low power during normal periods, and still greater distances may be spanned during periods of skip. The 5-watter is designed to operate on 40 meters. It has been used with good results on other bands (80 and 160), but the coil data are for 40-meter inductances only.

L1, the plate-tank coil, consists of 14 turns of No. 24 d.c.c. wire, wound on a standard 4-prong tube base 1 1/8 inches in diameter. L2, the link-line coupling coil, is wound over L1 (using a thickness of paper tape as insulation between coils) and consists of 4 turns of No. 24 d.c.c. wire wound near the "cold" end of tank coil L1.

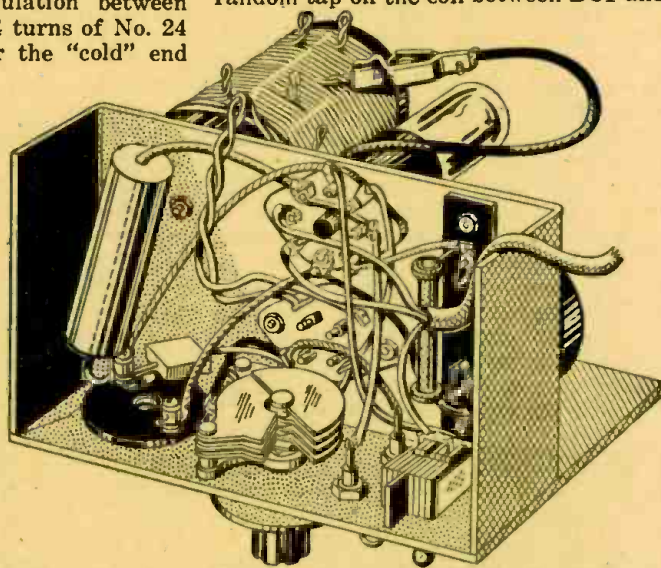
L3 and L4 are the antenna tuning coil. L4 consists of 38 turns of No. 14 enameled wire, close-wound, on a large size 4-prong coil 1 1/2 inches in diameter, and is tapped at the 8th turn starting from the ground end of the coil. After the first tap the coil is tapped at every 5th turn. The placement of taps is not critical, but the more taps available, the better the coupler can be adjusted to a given load. Coat L4 with Duco cement and allow to dry before adding L3. L3 consists of 2 turns of hookup wire wound over the first 8 turns of L4. L3 is first wound over L4, after which the remaining wire is twisted to form the link-line, the opposite end of which is connected to L2. Before winding L3-L4, remove the 4 metal prongs from the coil form by sawing them flush with the bottom of the form with a hacksaw. Drill a hole in the center of the bottom to mount it on the chassis. BC1 and BC2 are small

battery clips, and are shifted about on L4 when the transmitter is being matched to a given antenna.

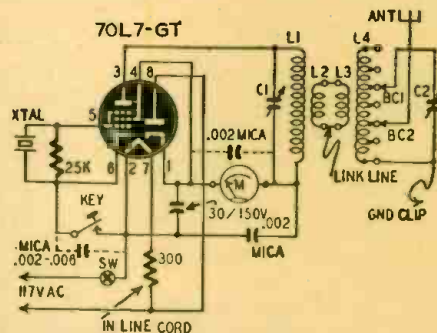
Putting Junior on the air is a very simple matter and requires little effort. Plug the line cord into a convenient outlet, either a.c. or d.c., and the coil L1-L2 and a 40-meter crystal into their sockets. Set C2 at minimum capacitance, and with BC1 and BC2 out of the circuit, close the key and rotate the tank tuning condenser C1 until a flashlight bulb attached to a small loop of wire and held over L1 glows brightest. Then back off C1 a bit, so that the oscillator is not at the peak of resonance. If this is not done, either the oscillator will quit when the antenna is coupled to the transmitter, or the emitted signal will be rough or chirpy. Remember: Do not operate the oscillator too near resonance!

## Antenna tuning

With the key open, attach BC1 about midway up the coil L4 and BC2 to a random tap on the coil between BC1 and

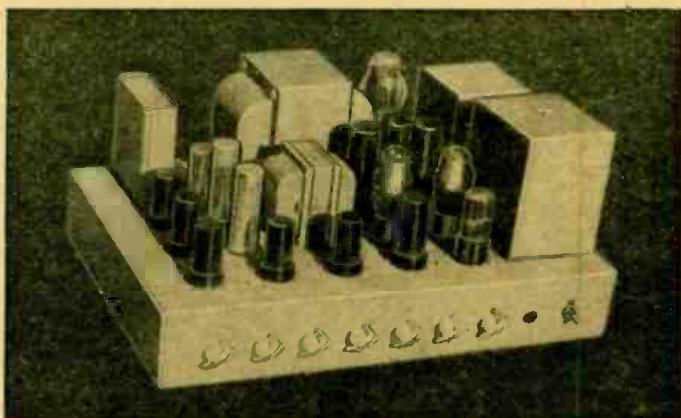


This illustration shows the under-chassis wiring of the 5-watt demon.



Schematic of the 1-tube a.c.-d.c. transmitter. Two additional capacitors are suggested.

# Hi-Fi 35-Watt Amplifier



Front of the 35-watt high fidelity public address amplifier.

*The author describes a good amplifier and tells how he obtained the design figures*

By H. R. E. JOHNSTON

THE primary consideration in the design of a PA amplifier for the reproduction of music is frequency response. It is easier to extend the frequency range of an amplifier than it is to eliminate the hum and distortion that an extended frequency range usually reveals. As power is increased the problem becomes increasingly difficult.

Tentative specifications of our proposed new amplifier were:

1. Frequency response flat  $\pm \frac{1}{4}$  db from 50 to 15,000 cycles;
2. Distortion less than 1%;
3. Hum level 62 db down from full output;
4. 18-db negative feedback;
5. Bass boost and attenuation;
6. Treble boost and attenuation.

To be sure of obtaining results approaching these specifications, a great deal of theoretical work was done before construction was started. The design considerations as well as the finished product may be interesting to readers.

For low-power applications, low- $\mu$  triodes operating class A give good results and offer no problems in design. As power increases, class-A operation becomes prohibitively inefficient. To keep the power input within reason for power (20 to 40 watts output), class-AB1 operation is necessary. It is also necessary to use pentode or beam-power tubes in the output stage.

The second-harmonic distortion generated in class-AB1 operation is easily eliminated by connecting the tubes in push-pull. Distortion due to imperfect voltage regulation is a different matter and is more difficult to eliminate.

The usual procedure for reducing distortion when beam-power tubes are used, is to apply 10% negative feedback from the plates to the grids. When 10% negative feedback applied to 6L6's, distortion is reduced by slightly more than half, or 6 db. The tube manuals rate 6L6's operating class AB1 at 2% distortion. Theoretically then, 10% negative feedback should reduce this distortion to less than 1%.

However, the figure of 2% distortion is valid only when the tubes are working into a pure resistive load and with perfect regulation of all voltages. But under actual operating conditions, distortion is usually much more than 2%.

In the amplifier illustrated, this problem of distortion was attacked from both ends. First, by increasing the negative feedback factor and, second, by improving the voltage regulation. Ten percent negative feedback over one stage was not considered adequate. It was decided that the feedback factor must be increased either by increasing the gain A in the feedback loop or the percentage of output voltage B fed back. The most practical method was to increase A

by applying negative feedback over 2 stages instead of one. The factor A then becomes  $A_1A_2$  where  $A_1$  is the gain of the driver stage and  $A_2$  the gain of the output stage.

The gain of the driver stage is 9. The coupling network (explained later) introduces a loss of  $\frac{1}{3}$  or a gain of  $\frac{2}{3}$ , and the output stage has a gain of 13. The total value of A in AB is  $9 \times \frac{2}{3} \times 13$  or 78. The negative feedback factor is 10% or  $-0.1$ , and is obtained from a separate winding on the output transformer. AB is then  $78 \times (-0.1) = -7.8$ .

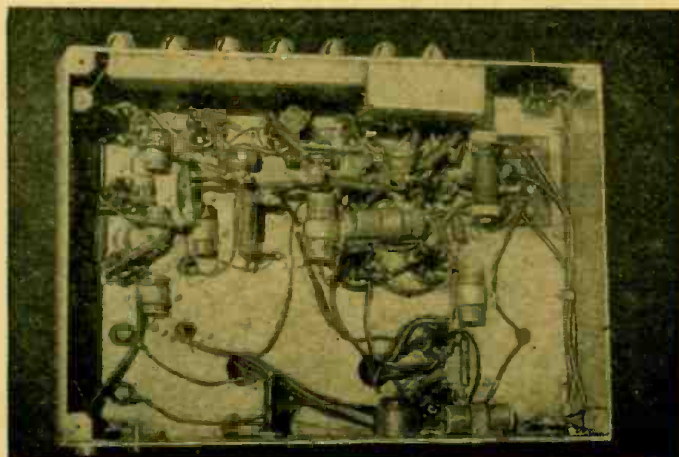
## Hum and distortion reduction

$1-AB$  is a factor by which the percentage of distortion without feedback is divided to determine the amount of distortion with feedback, and in this case is  $1 - (-7.8)$  or 8.8. Assuming that distortion within the tube is 3% and distortion due to reactance in the load is 5%, the total distortion without feedback is 8%. With negative feedback it would then be

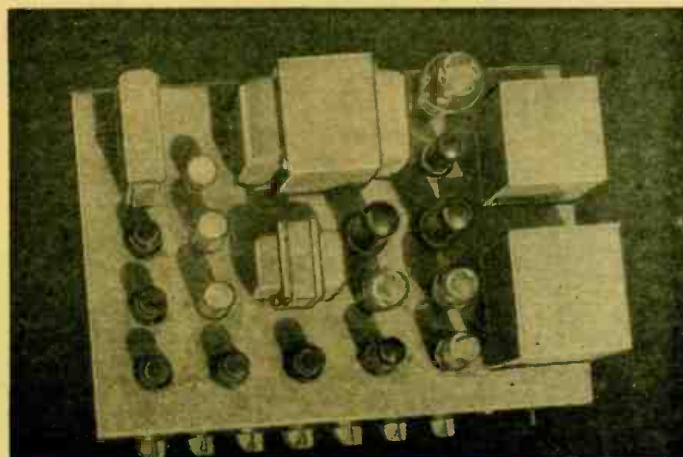
$$\frac{8}{8.8} = 0.91\%$$

Any hum in the output stage due to inadequate filtering is reduced in the same proportion:

$$\frac{\text{hum without feedback}}{1-AB} = \text{hum with feedback.}$$



Point-to-point wiring is used between stages of the amplifier.



The heavy transformers and chokes give good voltage regulation.



As a point of interest, the hum level in this amplifier is 38 db down from the standard reference level of .006 watt.

Negative feedback also lowers the effective output impedance of an amplifier as shown in the equation:

$$\text{Effective output impedance} = \frac{R_p}{1 - \mu AB}$$

where:

$R_p$  is plate resistance of output tube;  
 $\mu$  is amplification factor of the output tube;

$A$  is the gain between grid of driver and grid of output tube without feedback;

$B$  is the voltage feedback factor.

The lowered effective output impedance greatly assists in damping out transients in the voice coil.

When a large amount of negative feedback is applied over 2 or more stages, oscillation at very low and very high frequencies often results due to phase shift. The coupling network between the driver and output stage was designed to prevent this from occurring.

Another factor to be considered is that change in gain with negative feedback determines the peak voltage required at the grids of the driver tubes for full power output.

The change in gain with negative feedback is given by the equation:

$$\frac{\text{gain without feedback}}{1 - AB} = \text{gain with feedback.}$$

Since the over-all gain of the driver and output stages without feedback is 78 and  $1 - AB$  is 8.8, the total gain with feedback is 8.86.

The peak grid-to-grid voltage required by the driver is equal to the peak output voltage divided by 8.86.

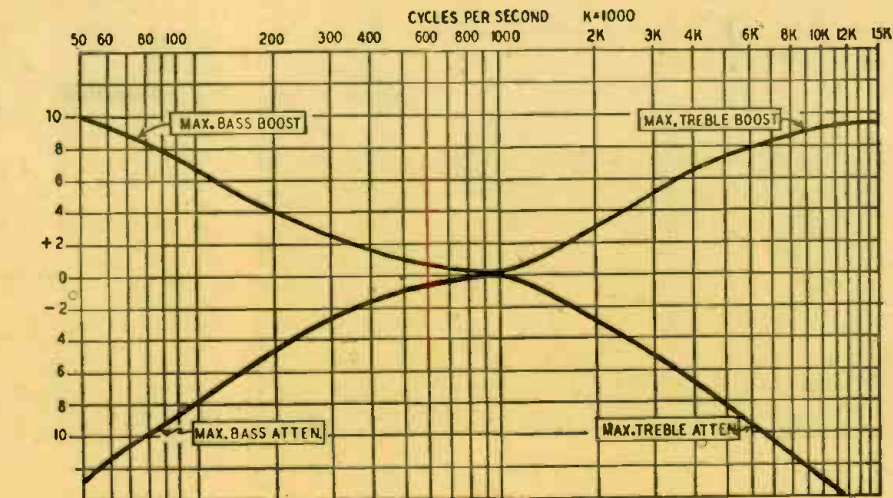


Fig. 1—Amplifier response under maximum tone control settings.

The r.m.s. plate voltage of each 6L6 at full output is the square root of  $\frac{1}{2}$  power output times  $\frac{1}{2}$  plate-to-plate load impedance, or:

$17.5 \times 3,300 = 240$  volts r.m.s. The peak-to-peak output voltage is  $240 \times 1.414 \times 2$  or 679 volts. The voltage required by the driver is 76.5 volts peak.

### The amplifier circuit

The front end of the amplifier is conventional. There are 4 inputs; 2 high-impedance microphone inputs, 1 phono input, and 1 radio input. There is a gain control for each input and a master gain control. The treble boost and attenuation circuit is located between the third and fourth stages. All single-ended stages are isolated from one another and the filtering in the decoupling network reduces hum to a very low level.

The frequency response is flat within

$\frac{1}{4}$  db from 50 to 15,000 cycles. Distortion is less than 1%, and the hum level is 62 db down from full output. Total negative feedback is 18 db.

The power transformer has 2 high-voltage windings. One winding supplies plate and screen voltages for the output tubes; the other furnishes the plate voltage for the voltage amplifiers. Good voltage regulation is obtained by using a single-section choke-input filter, with a low-resistance choke and a transformer with good regulation. Good screen voltage regulation is provided by using 2 regulator tubes in series across the screen lead. Note well the size of the components in the illustrations. Plenty of iron and copper are necessary for the best audio quality.

Choice of an output transformer is important, but is limited to those having

(Continued on page 75)

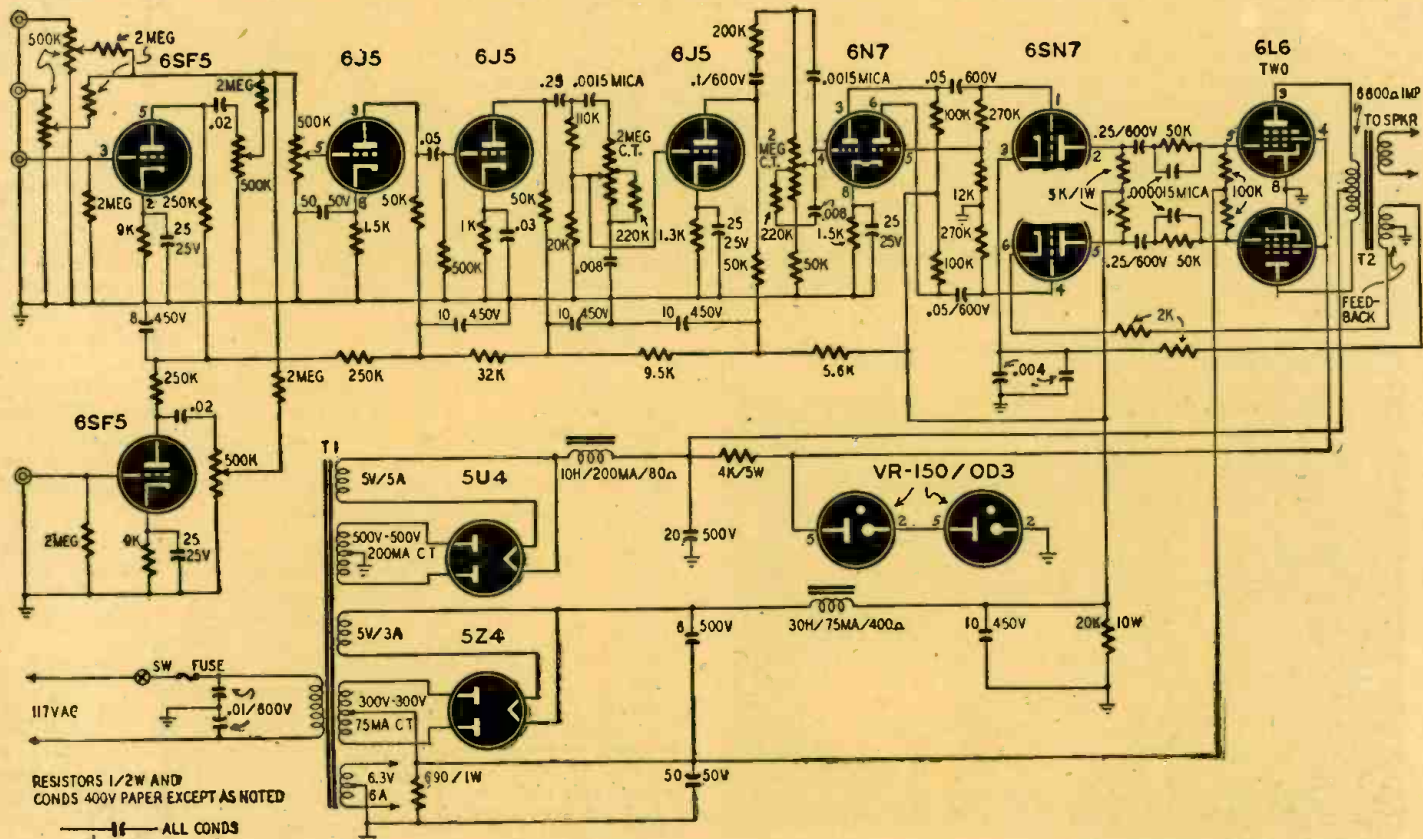
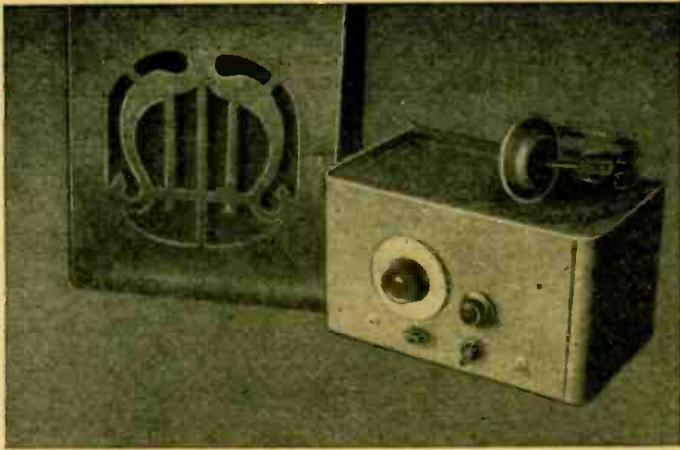
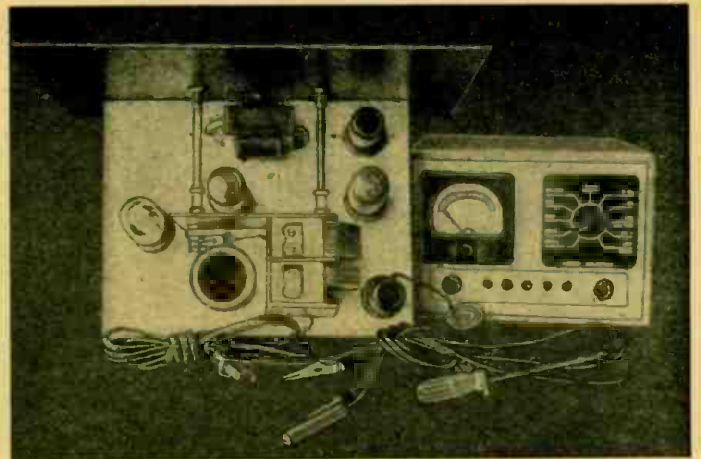


Fig. 2—The circuit of the amplifier. The bass and treble tone controls are located between the third and fifth amplifier stages.



The output transformer permits use of phones or magnetic speaker.



This top view shows how condenser placement avoids hand capacity.

# A Stable Regenerative Receiver

By OTTO L. WOOLEY

**M**ORE than 20 years ago we built our first receiver, a 1-tube regenerative. That 1-tuber, a WD-11, cost exactly \$5. Small wonder then that for economic reasons the most popular set of that era was the one using the minimum number of tubes! For some reason, that trend of thought has continued through the years; but today when the same amount of money will purchase a double handful of far better tubes, any set builder is passing up a good bet if he doesn't use enough tubes to insure consistent maximum performance.

Looking through the tube manual recently we had a sudden urge to see what could be done with our old regenerative circuit. The straight regenerative has certain drawbacks. It is likely to radiate and it is sensitive to hand capacity. These disadvantages were reduced to the point where they were no longer objectionable by careful design and layout. Radiation from the receiver was eliminated by including an untuned r.f. amplifier.

There is no noticeable gain in a stage of this type, but it stabilizes the detector, making the control of feedback

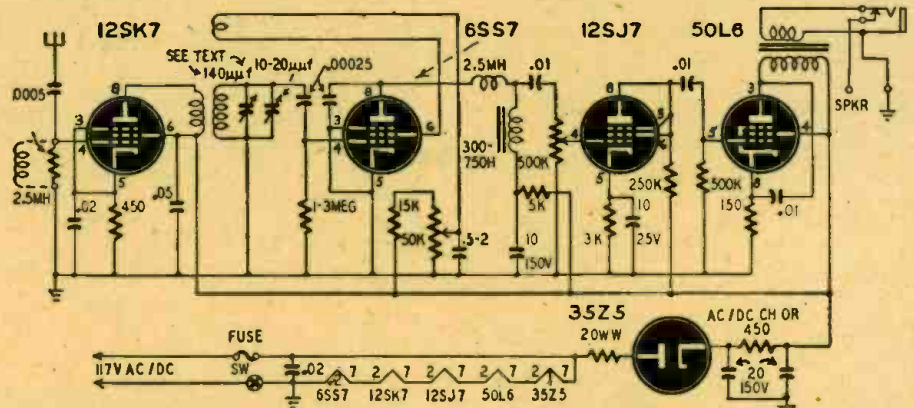
non-critical. Furthermore, antenna effects due to antenna coupling to the detector are almost completely wiped out.

Hand capacitance has been a real aspirin-sales booster since the earliest days of radio. To combat this nuisance, a substantial steel panel was used. It was well bonded to the chassis with a

voltage tubes all have the same pin connections and can be interchanged to compare their operation.

The 20,000-ohm resistor in the grid circuit of the untuned r.f. amplifier may be replaced by a 2.5-mh r.f. choke.

A broadcast-type tuning condenser was used in this set. One designed for



Complete schematic of the receiver. Choke coil or resistor may be used in antenna circuit.

short, heavy piece of copper braid. The parts were laid out so that the tuning unit and associated components remained well back on the rear portion of the chassis, and the band-set and band-spread condensers are coupled to the knobs by fiber shafts. The result is that no hand-capacitance effect is noticed, even on the 10-meter band.

There is nothing new in any part of the circuit except possibly the use of a remote cutoff tube for the detector in place of the more commonly used sharp cutoff type. However, the 3 low-

short-wave tuning might be preferred by SWL's. Standard, 3-winding, manufactured plug-in coils are used for the different bands. If these are unavailable they can be wound easily on standard coil forms.

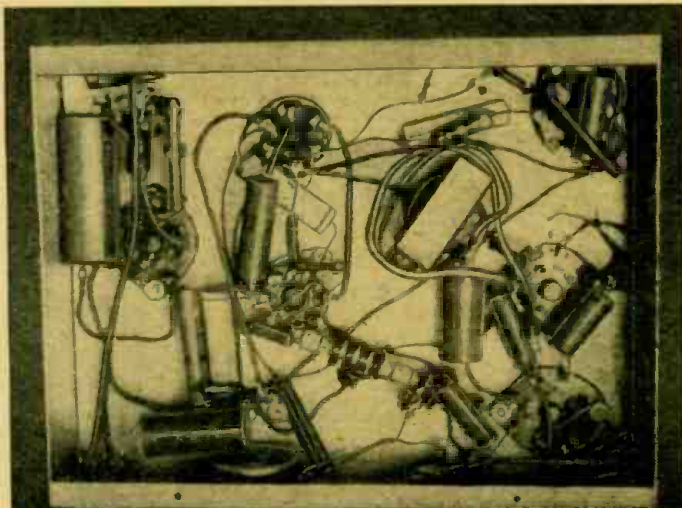
A coil for the broadcast band can be constructed with a primary of 25 turns No. 30 or 32, a secondary of 90 turns No. 28, and a tickler of 15 to 20 turns No. 30 or 32. The coil is wound on a 1½-inch diameter, 6-prong coil form. Coils for other bands can be determined by experiment.

Impedance coupling is used between the detector and the first audio tube. A small audio choke of at least 300 henries is used. This type of coupling permits the detector to work into a more suitable load than if resistance coupling were used between stages.

The audio system is conventional except that the first audio tube is triode-connected. The output transformer has a 2,500-ohm primary to match the 50L6

(Continued on page 83)

Under-chassis wiring is not critical except for the filament leads.



# Tone Control Adventure

**Engineer James Langham proves again  
that curves don't always mean results**

By JAMES R. LANGHAM

It was some time ago that the XYL came home with a story about a friend's big, fancy, custom-built radio. "Instead of just one knob that cuts out the highs, they have two. One boosts the lows, and one boosts the highs. Couldn't you rig us up something like that?"

"Why, I guess we can manage," I remarked foolishly. "You see, we make up an M-derived or constant K-filter section for highs and another for lows and..."

"I'm no engineer," she said. "You figure it out, and I'll build it."

I was young and innocent then: I believed what the textbooks said about filters, and I thought I knew a lot about electronics. So I got out the books and slide rule and spent about 2 hours computing the constants for a pair of bridged-T filters. I figured the sizes for 4 coils and 4 condensers and even plotted the theoretical curves for each. I drew up a sketch so she'd know just where to put them into the circuit and then tossed the papers lightly in her direction and departed. I don't know if I thought she'd have built it by the time I got home that afternoon or not. I may have. So help me, I may have.

The XYL was a mite irritated when I got home. "Look, knucklehead," she said, "you may be a fire-ball of a designer, but you sure aren't very practical."

"Mmmm?" I inquired. Mild curiosity. "Something troubling you, dear?"

She had a lot of catalogs and a worried look. "Where were you planning on getting these fancy chokes? Such as 0.183 henrys and 13.2 millihenries and—they're not standard sizes at all. Nobody sells them."

I grinned at her. "That's right, dear. You'll have to wind them up yourself or get someone else to do it."

My tone was a mistake. She announced immediately (and loudly) that by all that was holy she was not going to wind up any coils. If I could persuade someone else to do it, O.K. If not, I would have to wind them myself.

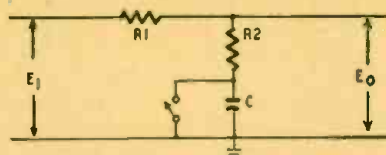
Well, after I phoned downtown to a couple of places, I announced I would be glad to wind them. "I don't see how they can expect \$15.00 for winding a simple little coil. I'll do it myself."

For the next month I wound coils. Air core and iron core. I used an egg-beater hand drill and bought quantities of wire. Then I would go over to the technical school and check them on the bridge. Then I would add or take off turns until the inductance was right. Then I would check the Q, and then get another form and start over again. Finally I had the 4 coils. They were within 2% of the design values, and they were nicely potted (beeswax and rosin). And I decided I

had learned something valuable—it isn't easy to wind coils.

The XYL kept her word and wired the things up. She bridged condensers and found room on the chassis and did her wiring neatly with squared corners. She was really excited about it.

She put on Scheherazade—lots of



$$E_0 = E_1 \frac{R_2}{R_1 + R_2} \text{ WITH SWITCH SHORTED}$$

$$E_0 = E_1 \frac{\sqrt{R_2^2 + X_C^2}}{\sqrt{(R_1 + R_2)^2 + X_C^2}} \text{ WITH SWITCH OPEN}$$

Fig. 1—A circuit to boost the bass notes.

highs and lots of lows. She wanted to twist the two new knobs and hear the ends go up and down.

Something was a little wrong. The low control made the hum level go up and down, but it didn't seem to affect the low notes in the music. The high control was better. You could hear an increase in the high level when the control was twisted, but there seemed to be an unpleasant accompanying distortion there too.

We stood there glaring at each other. "The wiring looks nice anyhow," I got in the first blow.

"The engineering looked good too," she said sweetly. "Those curves were

lovely. The theoretical ones, I mean."

I called for peace. "I guess that bass filter needs more shielding. It picks up hum."

She nodded. "I'll say it does."

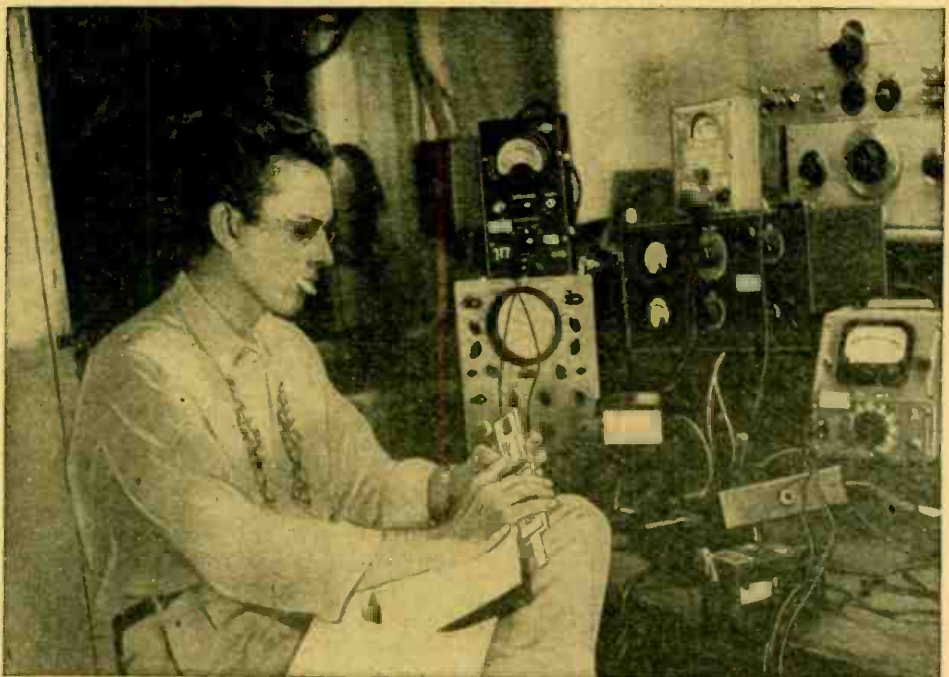
We tried shielding the coils. (Incidentally, the best shielding seemed to be beer cans.) Then we tried putting a higher level into the filters so the induced hum would be lower than the signal. We even lit the low-level filaments with d.c. so the hum would be low enough.

After we did enough things it got almost fair. There were limits to the amount of boost we could give it, though. If we turned up the bass much, it sounded muffled; and if we turned up the treble to match, the distortion came up with it. One day I came home to find the XYL showing off our outfit to a friend. She pointed to a newly blank panel. "No tone control at all," she said. "We find that if the tonal balance is proper, tone controls aren't needed. In fact, we avoid distortion by not having any tone controls."

I listened and it sounded good. She had jumped over the filters and, by golly, it sounded better than it had for some time. So I adopted her line of reasoning and argued with the fellows that really high-fidelity amplifiers shouldn't have any tone control.

I was squelched soon by this argument: "What if your pick-up or your speaker or the record falls off at the

(Continued on page 70)



I figured the sizes for 4 coils and 4 condensers and even plotted the curves for each.

# Most-Needed Circuits

Most-often-requested items are power supplies, converters, r. f. heaters and diathermy equipment

**O**UR technical staff receives repeated requests for diagrams of oscilloscopes, receivers, converters, electronic controls, and power supplies. A few of those most in demand are presented here.

## Power supply for BC-654-A

The BC-654-A, a part of the SCR-284-A, is a receiver and transmitter tunable from 3700 to 5800 kc. The receiver and transmitter are designed to operate with power units PE-104-A and PE-103-A, respectively. These operate from 6- or 12-volt vehicular storage batteries and supply the receiver and transmitter with plate, bias, and filament voltages.

The PE-103-A is available on the surplus market and delivers 500 volts at 160 ma while drawing 21 amperes at 6 volts d.c. or 11 amperes at 12 volts d.c. These units are equipped with circuit breakers and are ideal for marine, mobile, and emergency transmitters or amplifiers.

The a.c.-operated supply shown in Fig. 1 is designed to replace the battery-operated units. The codes on the output terminals refer to connectors and their respective pin numbers on the BC-654-A. Connections to pins 3 and 8 on connector 1K3 are reversed on sets with serial numbers below 9,500, and power-supply connections should be made accordingly.

Full-wave dry rectifiers are used in the low-voltage sections of the supply. Rec 1 and Rec 2 are Mallory types 1B12C3 and 1BR4, respectively. Other makes may be used if manufacturers' specifications are followed closely.

The voltage across terminals 3 and 4 should not exceed 10.8 volts with no load. If the output from the rectifier

with full load exceeds 6 volts, remove turns from Sec. 1. Maximum permissible a.c. voltage across terminals 1 and 2 is 3.6, and the output of the rectifier should not exceed 1.5 volts under load. Remove turns from Sec. 2 until voltage is normal.

These secondary windings supplying the dry rectifiers can be replaced with filament transformers altered to deliver the required output voltage. For example: Sec. 2 may be replaced with a 6.3-volt, 2-ampere center-tapped filament transformer. The halves of the secondary are connected in parallel.

Choke Ch 1 must carry at least 3 amperes. Its resistance should not be greater than 0.6 ohm. Ch 2 has a maximum resistance of 1.3 ohms and should carry 800 ma safely. Both chokes may be made by winding new coils on cores of old 200-ma chokes. Use No. 16 s.c.e. magnet wire on Ch 1 and No. 22 s.c.e. on Ch 2. Wind on as many turns as space permits and adjust the air gap for best filtering. The .013-henry, 4-ampere chokes currently available on the surplus market may be used for Ch 1 and Ch 2.

## All-band converter

A number of surplus receivers tune to 455 kc. Some tune from about 600 kc down as low as 15 kc. Others cover portions of the long- and short-wave bands. The converter shown in Fig. 2 is designed to extend the range of the RAK-7, BC-453, RBL-3, and similar receivers through the broadcast band to 18 mc.

Oscillator and antenna coils are standard commercial 3-band assemblies designed to tune from about 540 kc to 18 mc when used with 365- $\mu$ f condensers and 455- or 456-kc i.f. amplifiers. Oscillator padders Cp are selected for use

with the average assemblies tuning 540- to 1700-kc, 1700- to 5500-kc and 5.5- to 18-mc ranges. The capacitance of the padder increases with frequency range.

Other bands can be covered by selecting separate coils for the desired ranges. Follow manufacturer's specifications on oscillator padders. One set of broadcast coils and a set of 12- to 36-mc coils can be used to extend the range of the BC-348, BC-779, and similar receivers to include the broadcast and 10-meter bands.

The converter-output transformer T1 is a standard 455- or 456-kc i.f. transformer with the secondary coil and trimmer removed. The output of the converter is capacitance-coupled to the receiver antenna posts through a .006- $\mu$ f mica condenser.

## Low-voltage D.C. supplies

Low-voltage d.c. supplies are handy for operating electroplating equipment, pipe and electronic organs, generator fields, testing automobile radios, and numerous other applications.

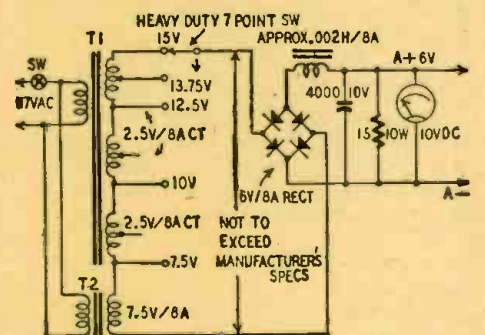


Fig. 3—A power supply for low-voltage use.

The circuit shown in Fig. 3 is designed to deliver 6 to 8 volts at up to 10 amperes, depending on the rectifier unit used. Operating conditions for dry rec-

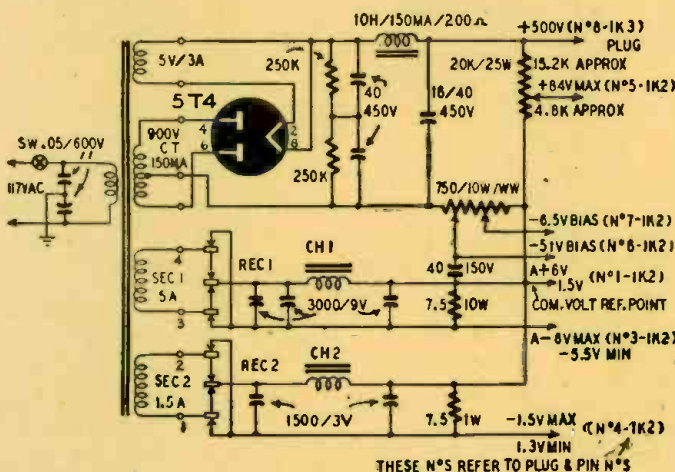


Fig. 1—Line-operated power pack for BC-654-A or similar receivers.

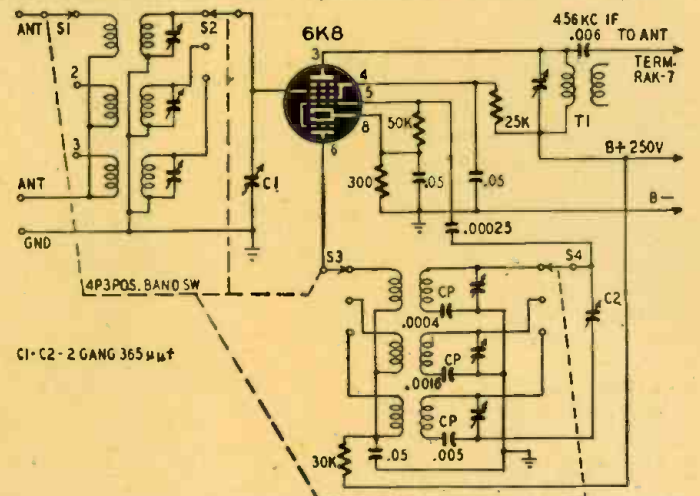


Fig. 2—This all-wave converter has an output frequency of 456 kc.

tifiers are comparatively critical, and manufacturer's specifications should be followed closely to avoid overloading or applying excessive input voltage when the unit is operating without a load.

Not too much data is available on the various types of commercial dry rectifiers although they are now in great demand for use in high-current supplies. The unit shown is a Mallory 1S16B7. Equivalents will work equally well. Just be sure that the rectifier selected is capable of delivering the required current. Do not permit the a.c. no-load voltage input to exceed manufacturer's specifications. Maximum no-load voltage for the 1S16B7 is 14.4 a.c. Do not use the 15-volt tap on the transformer unless line voltage is lower than normal.

T1 is a filament transformer with three 2.5-volt center-tapped, 8-ampere windings. T2 is a 7.5-volt, 8-ampere transformer. A heavy-duty 7-point switch is used to control the input voltage. This combination permits use of standard parts, though a specially wound transformer would be more convenient.

The filter choke is made by replacing the winding of a 200-ma choke with 100 turns of No. 14 enamel wire or No. 12 wire if space permits. Reassemble the choke and adjust the air gap for best operation.

### Induction heater

Judging from the number of requests received, r.f. heating has become very popular with experimenters. A 1-kw dielectric heater was described in the February, 1948, issue of RADIO-CRAFT.

Fig. 4 is the circuit of a 1-kw induction heater. A unit of this type can be constructed from tubes and parts readily available on the surplus market. If a 304TH is unavailable at surplus prices; you may use a 304TL by changing the fixed portion of the grid leak to 4,000 ohms and adjusting the 1,500-ohm control for best operation.

Power input is adjusted with a Variac or similar control. A time-delay relay in the power line prevents application of plate voltage until rectifier and oscillator tubes have reached operating temperature.

L1 is 30 turns of 3/16-inch copper tubing wound with an inside diameter of 7 5/16 inches and spaced to occupy 12 inches. L2 is a 1-turn winding around L1. It is 13 inches long and has an inside diameter of 8 1/4 inches. It is formed in a cylindrical shape from 1/32-inch sheet copper. A 1/2-inch gap lengthwise through the coil prevents shorting. The coils are constructed as shown in Fig. 5. Heavy leads to L3 are connected to both sides of the gap. The size and shape of the work coil L3 depends on the application. Experiment with the size of tubing and number of turns to obtain best results.

### Crystal-Controlled Diathermy

The FCC ruled recently that users of diathermy and r.f. heating equipment must either reduce radiation from their apparatus to a negligible degree by shielding or operate within narrow specified bands. In most cases, adequate

shielding is impractical—making operation on the diathermy bands the only alternative.

The crystal-controlled diathermy circuit shown in Fig. 5 operates on 27.32 mc. It was designed and constructed by members of the Application Engineering Department of Eitel-McCullough, Inc., and described in the October, 1946, issue of *Electronics*.

The circuit uses a 6AG7 oscillator doubling in its plate circuit from a 6.83-mc crystal, followed by a 6L6 doubler driving the 4-250A final amplifier on 27.32-mc. Coils are wound as follows:

- L1—12 turns No. 16 on 1-inch form, spaced to 1 1/2 inches.
- L2—10 turns No. 16 on 1-inch form, spaced to 1 1/4 inches.
- L3—5 turns 1/4-inch tubing on 2 1/2-inch form, spaced to 4 inches.
- L4—1 turn No. 8 around ground end of L3.
- L5 and L6—6 turns No. 8 on 1-inch form, spaced to 2 inches.
- L7 and L8—4 turns No. 8 on 1-inch form, spaced to 1 1/2 inches.
- L9—1 turn No. 8 mounted between output jacks.

Applicator pads for diathermy machines can be obtained from most electro-medical supply dealers.

### Editor's note

(We have enough material on hand to run another article of this type covering receivers, transmitters and oscilloscopes if readers desire it.)

There seems to be considerable interest in electronic controls such as photoelectric and capacity relays and timing, pulsing and counting circuits. Two or more of these circuits can be combined to produce some novel and interesting results. We may have just the circuit you are looking for. Let's hear from you.)

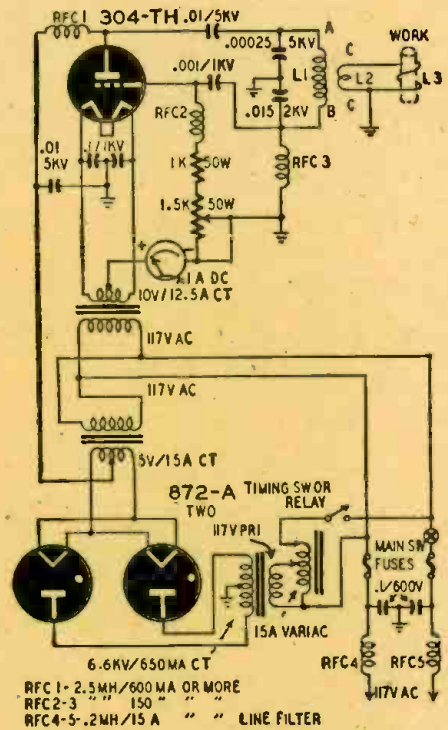


Fig. 4—A 1-kw r.f. induction heater.

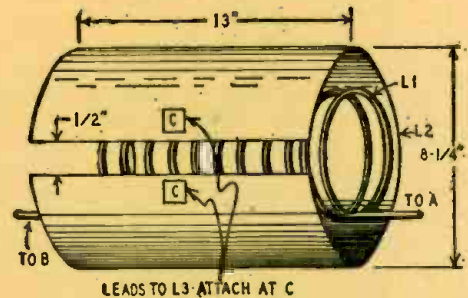


Fig. 5—The output coil is sheet copper.

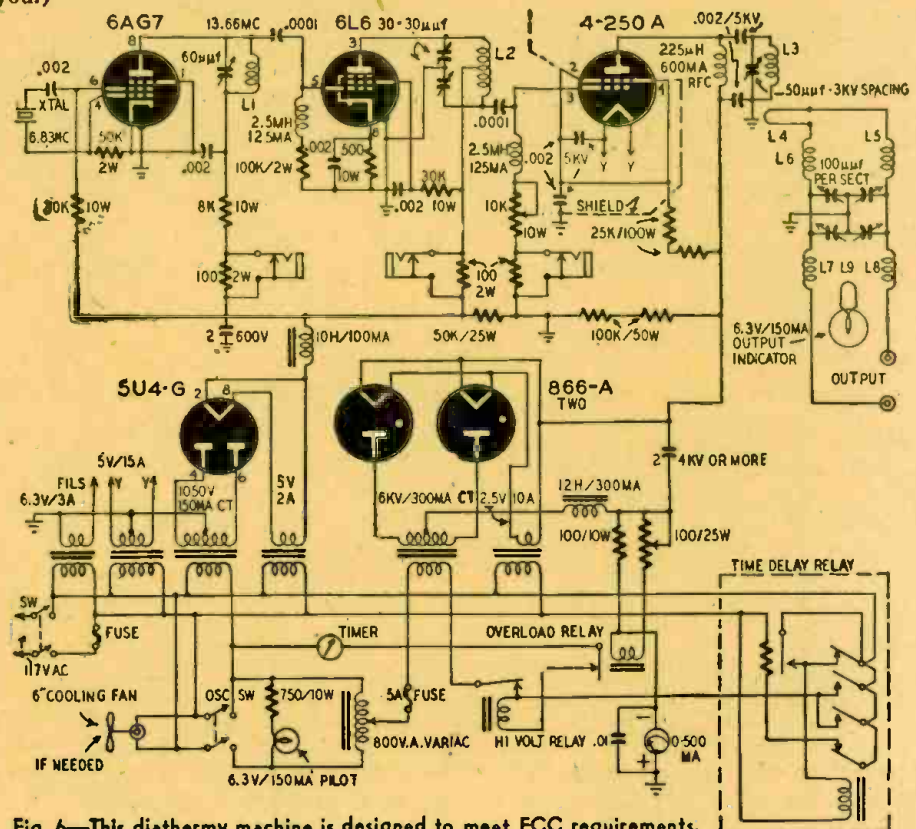


Fig. 6—This diathermy machine is designed to meet FCC requirements.

# Transatlantic News

By Major Ralph W. Hallows

RADIO-CRAFT EUROPEAN CORRESPONDENT



**W**HAT a marvelous instrument the modern television camera is! A few evenings

ago I watched on the television screen a play which was transmitted from a theater in London in the course of an ordinary performance and without a single lumen of extra lightning. One or two afternoons later I saw an international Rugby football match played on a typically English winter afternoon when low clouds, mist, and fine drizzling rain combine to produce what the poets call a "dim religious light." (Football fans have other words for it.) Not much use switching on, I thought, after a glance through the window at the gloom outside. To my utter amazement the images were clear, sharp, and full of detail, although the commentators sitting in the grandstand complained bitterly about the difficulty of seeing what was going on. We televisioners, obviously, saw better than they did!

It will be a strange business if commentators change over to the screen of a television monitor tube on days when the light is too dim for the human eye to see the game direct.

The camera now used by the BBC is more light-sensitive than the eye. It incorporates a modified form of Zworykin's orthicon. I wonder if users of television receivers in this and other countries fully realize the magnitude of their debt to that great American genius? But for the iconoscope, supericonoscope, and image orthicon tubes, television might still be in the scanning-disc stage, with little or no entertainment value.

## Table model televisers

I was interested to read in a recent number of RADIO-CRAFT that in America table-model televisers are expected this year to outsell consoles by about 2 to 1. The console is still the more popular model here, mainly because of the better quality of the sound reproduction, but it would not surprise me if people here soon begin to show a preference for the table model.

The height of the television screen above the floor is more important than many designers yet realize. It should not be much above or below that of the televisioners' eyes. The height depends, not only on the natural upholstery of the viewer and the artificial upholstery of

his chair, but also on whether he prefers to take his television while sitting bolt upright, or lolling back at his ease. Screen-height in the console is fixed. But with the table model the viewer can sit as he pleases and arrange the height of the televiser to suit his own requirements. If, for example, the set normally rests on a rather low table, it can always be raised with some of those large, unread books which so many people's bookshelves contain.

There's another reason why the table model is winning popularity on this side of the Atlantic. Try asking half a dozen friends to see a television program on a console model with a 48-square-inch image. You'll not find it too easy to seat



This unusual table lamp conceals a 3-tube radio as well as a built-in loudspeaker.

them so that all can see reasonably well. It's fine for those in the front whose eyes are at about the right level, but the fellows standing behind them may not be very enthusiastic over the distorted images that they see. With a table model and a little ingenuity you can give everyone a good view. Here's a chance for inventors. Why not a table-type televiser standing on spring-loaded lazy-tongs supports? Raise or lower it to the height you want and it stays put!

## The slot antenna

Quite a bit of attention is being given to the possibilities of the slot antenna for v.h.f. reception, including television. Briefly, if in a sheet of metal you punch a narrow slot of the correct dimensions and connect a feeder line to it as shown in the drawing, it behaves as a half-wave dipole, except that the polar diagram is the exact opposite of what you'd expect. The vertical slot has the same polar diagram as a horizontal half-wave dipole, and vice versa. In theory the plate in which the slot is made should be of infinite area, but very good working results are obtained with plates of reasonable size. The slot antenna was

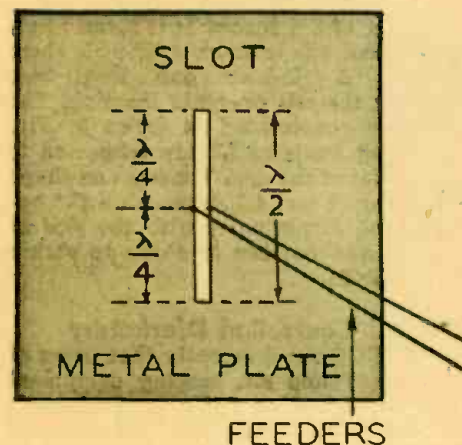
first used during the war, for centimeter radar. It's a ticklish job to erect and feed an array of half-wave dipoles for a wave length of, say, 5 centimeters. But the difficulty vanishes if you punch out the array as a pattern of slots in the walls of a wave guide, and the results are first rate. It is possible that arrays of slots made in the steel framework of apartment buildings can be used as master antennas to provide FM and television reception for every home in the building.

## Map making by radar

There are enormous areas of the world surface which have never been accurately surveyed and mapped. Today their survey is being speeded by radar techniques. The old way of making maps is to cover the ground on foot, establish datum lines, sometimes of great length, and base triangulations and levelings on these lines. This method makes for great accuracy; but it takes a long time and the cost is high, particularly if dense forests and precipitous mountains make the going difficult. The modern method is to photograph the ground from airplanes, piece the photographs together, and make the map from the resulting composite picture. But such a map is not accurate unless the photographs are referred to a system of points on the ground whose positions are fixed with precision. That is where radar comes in.

Radar survey methods are now used in both the great African continent and in New Zealand. In New Zealand the main purpose of the radar survey is to add contour lines and other details to existing maps, but in Africa the object is to produce, at the rate of at least 100,000 square miles a year, accurate maps of huge tracts of country of which nothing more than a rough survey has been made so far.

The radar beacon is one of the most  
(Continued on page 69)



This novel antenna was used first for radar.

The New Model 777

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BY

**SUPERIOR INSTRUMENTS CO.**

227 FULTON STREET  
NEW YORK 7, N. Y.

# FM STATION LIST

**R**ADIO-CRAFT presents this month its first list of FM radio stations of the United States. It has not been practical to print such a list in earlier issues, as the number of FM stations was increasing so rapidly that any such list would have been almost useless by the time it could be printed. This list is complete as of February 25, 1948.

In addition to those below, there are also 38 non-commercial FM stations between 88 and 92 mc, on which information is not immediately available. We hope to include all these in the June list.

New stations are still coming on the air daily, but the

initial rush is over, and we believe it will be possible from now on to keep a reasonably up-to-date list. To this end, we will print revised lists as often as necessary—every other month for a time. Shortwave station data will appear in alternate issues.

Stations are listed by frequencies for easy identification. A listener may not always hear the call letters perfectly, but can always note the frequency of an unknown station on the dial of his own receiver. As many stations announce their channel numbers, a conversion table of frequencies and channel numbers is printed on this page.

FREQUENCY (MC)	CALL	LOCATION	FREQUENCY (MC)	CALL	LOCATION	FREQUENCY (MC)	CALL	LOCATION
44.1	W2XMN	Alpine, N. J.	94.7	WAPO-FM	Chattanooga, Tenn.	94.9	WMRC-FM	Greenville, S. C.
90.5	KWGS-FM	Tulsa, Okla.	94.7	WENR-FM	Chicago, Ill.	94.9	WQAM-FM	Miami, Fla.
92.1	KLZ-FM	Denver, Colo.	94.7	WMAS-FM	Springfield, Mass.	94.9	WWCF	Greenfield, Wisc.
92.1	W2XEA	Alpine, N. J.	94.7	WMCP	Baltimore, Md.	94.9	KSCJ-FM	Sioux City, Iowa
92.3	KUMB	Des Moines, Iowa	94.9	KAKC-FM	Tulsa, Oklahoma	95.1	KFXM-FM	San Bernardino, Calif.
92.3	KVNJ-FM	Fargo, N. D.				95.1	WEW-FM	Sf. Louis, Mo.
92.3	WCOH-FM	Newnan, Ga.				95.1	WGPA-FM	Columbus, Ga.
92.3	WCOL-FM	Columbus, Ohio				95.1	WHBS-FM	Huntsville, Ala.
92.3	WDUL	Duluth, Minn.				95.1	WRXW	Louisville, Ky.
92.3	WEBC-FM	Superior, Wisc.				95.1	WTRF-FM	Bellaire, Ohio.
92.5	KCMC-FM	Texarkana, Texas				95.1	WTMA-FM	Charleston, S. C.
92.5	KYWF-FM	Philadelphia, Pa.				95.3	KGBS-FM	Harlingen, Texas
92.5	WFRS	Grand Rapids, Mich.				95.3	KSJO-FM	San Jose, Calif.
92.5	WGOV-FM	Valdosta, Ga.				95.3	WSRS-FM	Cleveland Heights, Ohio
92.5	WINC-FM	Winchester, Va.				95.5	KECA-FM	Los Angeles, Calif.
92.5	WMBD-FM	Peoria, Ill.				95.5	KRBA-FM	Lufkin, Texas
92.9	KDKA-FM	Pittsburgh, Pa.				95.5	KPRA	Portland, Oregon
92.9	KGDM-FM	Stockton, Calif.				95.5	WBGE-FM	Atlanta, Ga.
92.9	KOAD-FM	Omaha, Neb.				95.5	WDLM	Chicago, Ill.
92.9	KONO-FM	San Antonio, Tex.				95.5	WHPE-FM	High Point, N. C.
92.9	WBNY-FM	Buffalo, N. Y.				95.5	WPAM-FM	Pottsville, Pa.
92.9	WBUR-FM	Burlington, Iowa				95.6	WKNB-FM	New Britain, Conn.
92.9	WBZ-FM	Boston, Mass.				95.7	WMMW-FM	Meriden, Conn.
92.9	WEEU-FM	Reading, Pa.				95.7	WMUR-FM	Manchester, N. H.
93.1	KWBW-FM	Hutchinson, Kan.				95.7	WTPS-FM	New Orleans, La.
93.1	WAIR-FM	Winston-Salem, N. C.				95.9	WEMZ	Allentown, Pa.
93.1	WFBL-FM	Syracuse, N. Y.				96.1	WBCM-FM	Bay City, Mich.
93.1	WHYN-FM	Holyoke, Mass.				96.1	KCRA-FM	Sacramento, Calif.
93.1	WJBK-FM	Detroit, Mich.				96.1	KFMX	Council Bluffs, Iowa
93.1	WKAT-FM	Miami Beach, Fla.				96.1	KLCN-FM	Blytheville, Ark.
93.1	WKBH-FM	La Crosse, Wisc.				96.1	WMBH-FM	Joplin, Mo.
93.3	WGBR-FM	Goldsboro, N. C.				96.1	WOHS-FM	Shelby, N. C.
93.3	WIP-FM	Philadelphia, Pa.				96.1	WOWO-FM	Fort Wayne, Ind.
93.3	WJTN-FM	Jamestown, N. Y.				96.1	WTAG-FM	Worcester, Mass.
93.3	WKPB	Knoxville, Tenn.				96.3	KRKD-FM	Los Angeles, Calif.
93.3	WKYC	Paducah, Ky.				96.3	WBK	Chicago, Ill.
93.3	WRBL-FM	Columbus, Ga.				96.3	WINX-FM	Washington, D. C.
93.3	WTMJ-FM	Milwaukee, Wisc.				96.3	WJCM-FM	Rice Lake, Wisc.
93.5	KOCS-FM	Ontario, Calif.				96.3	WQXR-FM	New York, N. Y.
93.7	KRFM	Fresno, Calif.				96.3	KRON	San Francisco, Calif.
93.7	KXOK-FM	St. Louis, Mo.				96.5	KSEI-FM	Pocatello, Idaho
93.7	WCSI	Columbus, Ind.				96.5	KXYZ-FM	Houston, Texas
93.7	WLAW-FM	Lawrence, Mass.				96.5	WGH-FM	Norfolk, Va.
93.7	WSGN-FM	Birmingham, Ala.				96.5	WHEF-FM	Rochester, N. Y.
93.9	KSPI-FM	Stillwater, Okla.				96.5	WTIC-FM	Hartford, Conn.
93.9	WCOU-FM	Lewiston, Maine				96.5	WBUZ	Bradbury Heights, Md.
93.9	WNYC-FM	New York, N. Y.				96.7	WEAW	Evanston, Ill.
93.9	WRC-FM	Washington, D. C.				96.7	WSTC-FM	Stamford, Conn.
94.1	KERN-FM	Bakersfield, Calif.				96.7	WVAW-FM	Cheviot, Ohio.
94.1	WGST-FM	Atlanta, Ga.				96.9	KCRK	Cedar Rapids, Iowa
94.1	WHBC-FM	Canton, Ohio.				96.9	KFBK-FM	Sacramento, Calif.
94.1	WIBG-FM	Philadelphia, Pa.				96.9	KRBC-FM	Abilene, Texas
94.1	WKOK-FM	Sunbury, Pa.				96.9	WBR-FM	Buffalo, N. Y.
94.1	WMIX-FM	Mt. Vernon, Ill.				96.9	WIBX-FM	Utica, N. Y.
94.1	WEAU-FM	Eau Claire, Wisc.				96.9	WJHP-FM	Jacksonville, Fla.
94.3	WDRC-FM	Hartford, Conn.				96.9	WLAN-FM	Lancaster, Pa.
94.3	WGUY-FM	Bangor, Maine				96.9	WLAV-FM	Grand Rapids, Mich.
94.3	WJLK-FM	Asbury Park, N. J.				96.9	WOPI-FM	Bristol, Tenn.
94.5	KAMT-FM	College Station, Texas.				96.9	WPAD-FM	Paducah, Ky.
94.5	WIS-FM	Columbia, S. C.				96.9	WXHR-FM	Cambridge, Mass.
94.5	KGKL-FM	San Angelo, Texas				97.1	KKLA	Los Angeles, Calif.
94.5	WMLL	Evansville, Ind.				97.1	KPFM-FM	Portland, Oregon
94.5	WMOT-FM	Pittsburgh, Pa.				97.1	KTUL-FM	Tulsa, Okla.
94.5	WNDB-FM	Daytona Beach, Fla.				97.1	WASH	Washington, D. C.
94.5	WSYR-FM	Syracuse, N. Y.				97.1	WBZA-FM	Springfield, Mass.
94.7	KOCY-FM	Oklahoma City, Okla.						
94.7	KROC-FM	Rochester, Minn.						

## FM frequencies and channel numbers

Channel mc.	Channel No.	Channel mc.	Channel No.	Channel mc.	Channel No.	Channel mc.	Channel No.
88.1	201	93.1	226	98.1	251	103.1	276
88.3	202	93.3	227	98.3	252	103.3	277
88.5	203	93.5	228	98.5	253	103.5	278
88.7	204	93.7	229	98.7	254	103.7	279
88.9	205	93.9	230	98.9	255	103.9	280
89.1	206	94.1	231	99.1	256	104.1	281
89.3	207	94.3	232	99.3	257	104.3	282
89.5	208	94.5	233	99.5	258	104.5	283
89.7	209	94.7	234	99.7	259	104.7	284
89.9	210	94.9	235	99.9	260	104.9	285
90.1	211	95.1	236	100.1	261	105.1	286
90.3	212	95.3	237	100.3	262	105.3	287
90.5	213	95.5	238	100.5	263	105.5	288
90.7	214	95.7	239	100.7	264	105.7	289
90.9	215	95.9	240	100.9	265	105.9	290
91.1	216	96.1	241	101.1	266	106.1	291
91.3	217	96.3	242	101.3	267	106.3	292
91.5	218	96.5	243	101.5	268	106.5	293
91.7	219	96.7	244	101.7	269	106.7	294
91.9	220	96.9	245	101.9	270	106.9	295
92.1	221	97.1	246	102.1	271	107.1	296
92.3	222	97.3	247	102.3	272	107.3	297
92.5	223	97.5	248	102.5	273	107.5	298
92.7	224	97.7	249	102.7	274	107.7	299
92.9	225	97.9	250	102.9	275	107.9	300

94.9	KFPW-FM	Fort Smith, Ark.
94.9	KING-FM	Seattle, Wash.
94.9	KSFH	San Francisco, Calif.
94.9	WABW	Indianapolis, Ind.
94.9	WCMW-FM	Canton, Ohio

## WANTED: FM SCOUTS

FM is a new art in Radio. Much of it remains to be learned by engineers. The behavior of radio waves in the FM band is still understood imperfectly. According to theory, FM signals should not reach much beyond the horizon. Yet often they do. In some cases extraordinary DX reception has been reported.

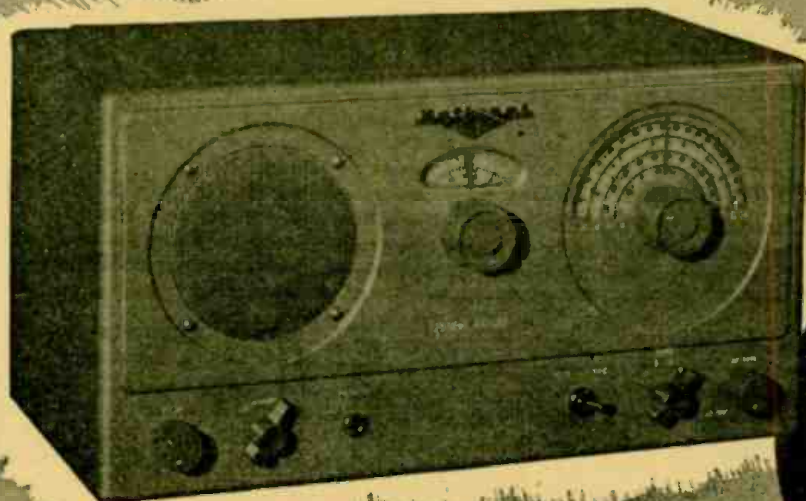
RADIO-CRAFT readers can render the radio art a distinct service in reporting such phenomena as well as others, to us regularly. We will publish such information as well as the "FM Scouts" name in this department, beginning with the June issue. Address all letters to FM Department, c/o this magazine.

THE EDITORS.

(Continued on page 73)



**Now!** BIG RECEIVER QUALITY IN THE LOW-PRICED FIELD!!



THE NEW  
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NC-33  
**\$65.95**  
AMATEUR NET

Here's the receiver you've been waiting for! A real communication receiver covering all frequencies from 500 kcs to 35 mcs, the brand new NC-33 offers the same fine workmanship that distinguishes National's more expensive receivers. Dollar for dollar, feature for feature, it's better built, better looking, better performing! See it — compare it — today at your dealer's. You'll decide it's the perfect choice for your shack, living room, playroom or den!

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- Cabinet dimensions 8 1/2" x 13" high by 17" deep.
- Provision for external synchronization.
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- Deflection sensitivity .65 volts per inch full gain.
- Frequency response plus or minus 20% from 50 cycles to 50 KC.
- Input impedance 1 megohm and 50 MMF.
- Tubes supplied: 2 6SJ7, 2 5Y3, 1 884, 1 5BPP.
- Operates from 110 volt 60 cycle AC.
- Power supply delivers 1100 volts negative, 350 volts positive, making 1450 volts available for the CR tube.
- All oil filled condensers used, assuring long life.



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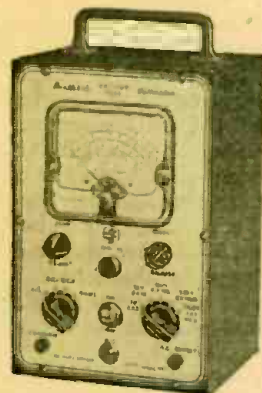
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• Convenient, portable—Dimensions 9" x 6" x 4 3/4" deep, weight 4 1/2 lbs. Complete with detailed blueprints which enable the constructor to assemble an instrument he will be proud to own.

- Useful harmonics to over 100 MC.
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- Uses 6SN7 as oscillator and audio frequency amplifier and 6X5 as transformer power supply rectifier.

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**\$24.50**



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Build this high fidelity amplifier and save two-thirds the cost. Push pull output using 1619 tubes (military type 6L6's), two amplifier stages using a dual triode (6SN7), and a phase inverter give this amplifier a linear reproduction equal to amplifiers selling for ten times this price. Every part supplied; punched and formed chassis, transformers (including quality output to 3-8-15 ohm voice coil), tubes, controls, and complete instructions. Add postage for 20 lbs. 12" PM speakers for above.....\$6.95



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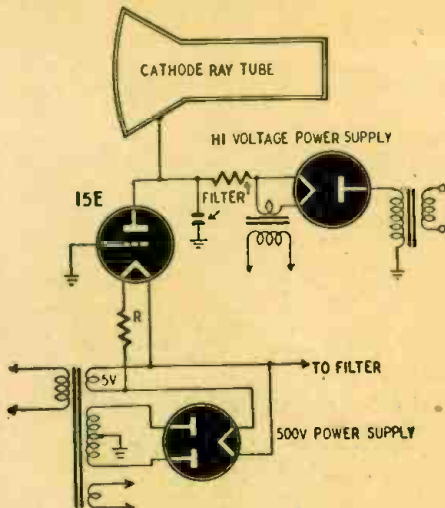
The **HEATH COMPANY**

DEPT. C. • BENTON HARBOR, MICHIGAN

# RADIO-ELECTRONIC CIRCUITS

## TV CAPACITOR DISCHARGER

The bright spot appearing on television screens after the set is turned off is due to the charge remaining on the high-voltage filter condenser. A simple, inexpensive method of removing the charge uses a 15E tube.



The plate of the tube is connected to the high-voltage power supply, but draws no current because the tube is cut off by the high bias voltage. As soon as the power is turned off, the bias voltage drops rapidly to below cutoff before the 15E filament has cooled off appreciably. The tube then conducts and quickly discharges the high-voltage condenser through the low-voltage bleeder.

To prolong the tube life, use a 1.2-ohm, 5-watt resistor to drop the filament voltage to about half its value. If the 5-volt supply cannot furnish the additional current, use a separate 2.5-volt transformer.

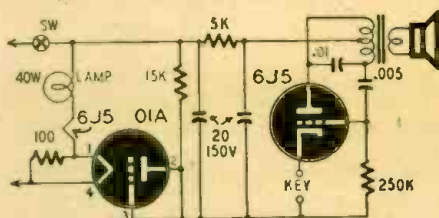
Any other high-voltage tube may be used if the 15E is not available. Cutoff bias can be found by dividing the plate voltage by the amplification factor.

RICHARD H. HOUSTON,  
Washington, D. C.

## AUDIO OSCILLATOR

Designed for classroom use, this simple audio oscillator uses a push-pull output transformer as the tank coil of a Hartley oscillator. The output frequency is close to 1,000 cycles, but can be changed by either juggling the values or switching condensers across the output transformer primary.

Any triode with a 0.3-ampere filament and grid and plate tied together, or a 25Z5, can be used as a half-wave recti-



fier, and a 40-watt lamp drops the line voltage to the right value for the tube filaments.

The values are not critical and the whole unit can be built into a small cabinet.

GLENN KETCHNIE,  
Blyth, Ontario

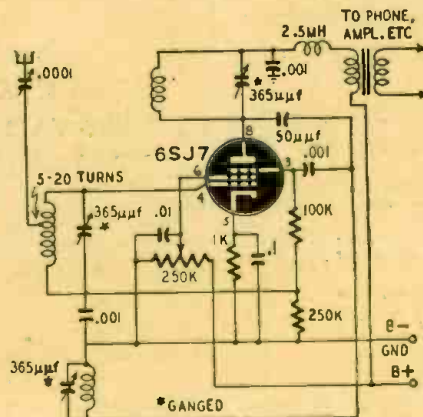
## SUPER REFLEX RECEIVER

The reflex receiver shown uses a single 6SJ7 and has r.f. feedback from both the plate and the suppressor grid, giving very great amplification. Detection takes place in the suppressor-grid circuit, and the audio is amplified in the plate circuit.

The coils are close-wound adjacent to each other with No. 30 d.s.c. wire on a 2-inch diameter form and have 70 turns each.

If the set overloads on strong signals, adjust the 250,000-ohm volume control for best reception.

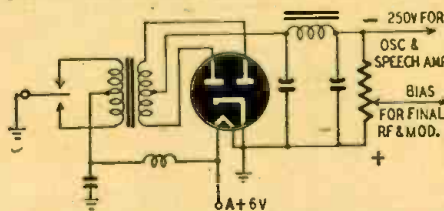
ROBIN TUCKER,  
Montreal, Quebec



## NOVEL POWER SUPPLY

Here is a simple way of getting the most output with the least battery drain in a car transmitter.

Use a 250-volt Vibropack to power the oscillator and speech amplifier, and a 500-volt dynamotor to power the r.f. amplifier and modulator. But, instead of



grounding the negative terminal, ground the positive lead. Now the Vibropack can supply bias voltage to the r.f. amplifier and modulator and still leave the full 250 volts for the speech amplifier and oscillator.

Some of the advantages of this system are:

1. Bias voltage does not subtract from the voltage available to the oscillator and speech amplifier.

2. There is no power loss in dropping resistors from high voltage supply for oscillator and speech amplifier use.

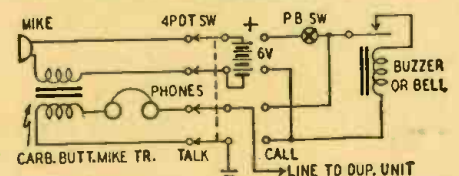
3. There is no loss of high voltage due to cathode resistor, either in the r.f. or modulator stages.

4. The oscillator plate-tuning condenser can be grounded without using parallel feed, since the positive on the Vibropack is grounded.

ZOLTAN T. BOGAR,  
Laurel, Maryland

## SIMPLE INTERCOM

A single-wire line and a good ground are the only connections needed for this intercom system. It can be easily made with surplus microphones and head-



phones. To call the other station, throw the switch to the call position, press the button, and throw the switch back to the talk position.

When not in use, both switches should be in the call position.

RICHARD HERMAN,  
Chicago, Illinois.

(A surplus handset, type TS-15, would be ideal for this type of simple intercommunicator.—Editor)

## FULL-WAVE BIAS SUPPLY

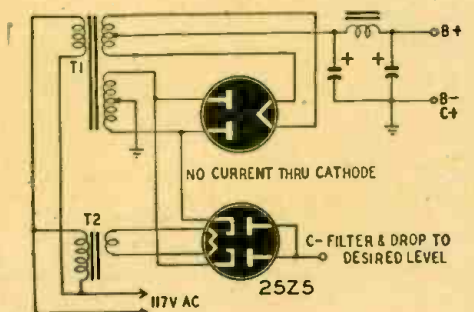
A 25Z5 is used in this circuit as a full-wave bias rectifier operating from the high-voltage plate supply transformer. The cathodes of the 25Z5 are connected to the plates of the high-voltage rectifier tube.

In operation, current flows through the cathode attached to the plate of the main rectifier which is not conducting at the time.

The filament transformer for the 25Z5 can be replaced with a 290-ohm, 5-watt resistor to drop the line voltage to 25.

This bias supply should not have more than 245 volts r.m.s. applied to the cathodes to prevent breakdown between the cathode and the heater, which might otherwise occur.

JOHN KWIETINSKAS,  
Duquesne, Pa.



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The Dumont Inputuner tunes continuously from 44 to 216 megacycles without a break, covers all 13 channels as well as FM, amateur, and aviation channels. For ease and convenience of operation no band switching of any kind is required when tuning from channel to channel with the inputuner system. Just one simple operation to reach any desired station.

Assemble the Champion model of your choice, 10" flat surface screen picture, 51 sq. in. picture, 12" screen picture with 75 sq. in. picture or the 15" screen picture with 120 sq. in. picture.

All Champion Models are complete with all tubes and components including the CR Tube.



10" FLAT SURFACE

**\$ 273.10**

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12" SCREEN PICTURE

**\$ 303.10**

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15" SCREEN PICTURE

**\$ 393.10**

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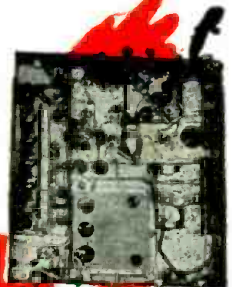
## *Standard Models*

NOW AVAILABLE WITH  
THE STANDARD MODELS—  
FM RADIO AT A SLIGHT  
ADDITIONAL COST OF  
\$7.95.



All Television Assemblies are complete and include: 29 RCA Tubes-1 CR Tube-Heavy Duty RCA 6.8 oz. slug 12" PM Speaker-Specially designed dipole antenna with 60 ft. lead in.

Superior performance is obtained with a new IF Video & Sound IF Strip (Pat. Pend.) aligned, wired, pretuned, tubed and tested. All circuits are contained on one chassis ready to use with the front end unit supplied. This front end will handle 13 channels and is aligned and tested, mounted on a separate chassis. Merely connect 8 plus filament and output IF leads to the television chassis. It is not necessary to make any RF alignments. These units utilize a clipper circuit which filters out ignition noises.



10" FLAT SURFACE

**\$ 229.50**

NET

12" SCREEN PICTURE

**\$ 259.50**

NET

15" SCREEN PICTURE

**\$ 349.50**

NET

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**1000 FM\* & 2250 AM  
BROADCAST STATIONS**  
the FCC indicates will be in  
operation by the end of 1948

\* As of Jan. 1948:  
374 FM stations  
on the air.  
636 FM stations  
with construction  
permits and  
conditional grants.



**MAIL COUPON TODAY  
FOR THIS 24-PAGE  
FREE BOOKLET!**



**Yes, Plenty of Good-Paying Jobs...  
BUT Only for those Qualified**

FM is actually coming into its own this year . . . more than 1000 with permits and grants now on the air, or soon to be. Over 1500 standard broadcast stations now in operation . . . 2250 on the air by the end of the year. Television receivers are on mass production lines. New TV stations are going on the air throughout the country.

Radio-electronics is not only expanding in job opportunities but it is also growing in technical complexity. Rapid developments in every branch of the field are leaving many radio technicians and servicemen far behind the parade of progress. These are the men who fail to realize that their technical knowledge must grow with the expansion of the industry.

What does this mean to you? It means

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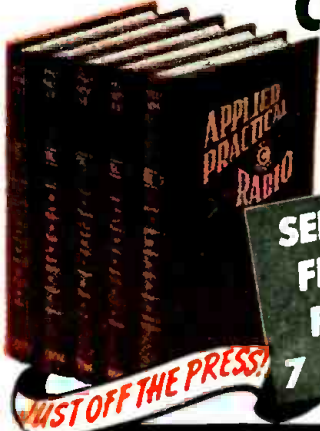
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## European Band-Change System

AN INTERESTING type of receiver, this Italian model, is basically a 4-tube superheterodyne, but is novel because a rotating coil turret is used to switch the different coils into the circuit. The photograph of the chassis shows the band-switch turret rather well.

The band switch is divided into two sections, one half containing the an-

By D. E. RAVALICO

tenna and mixer coils, and the other half the oscillator coil. Five wiping contact points on each section connect the coils to the various circuits. (This system is similar to the one used in the Meissner Signal-Shifter.)

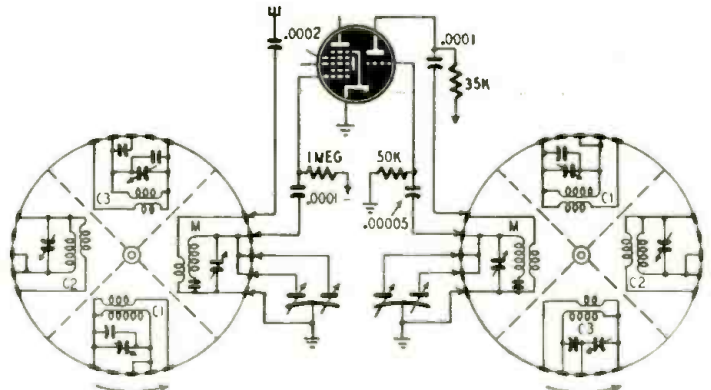
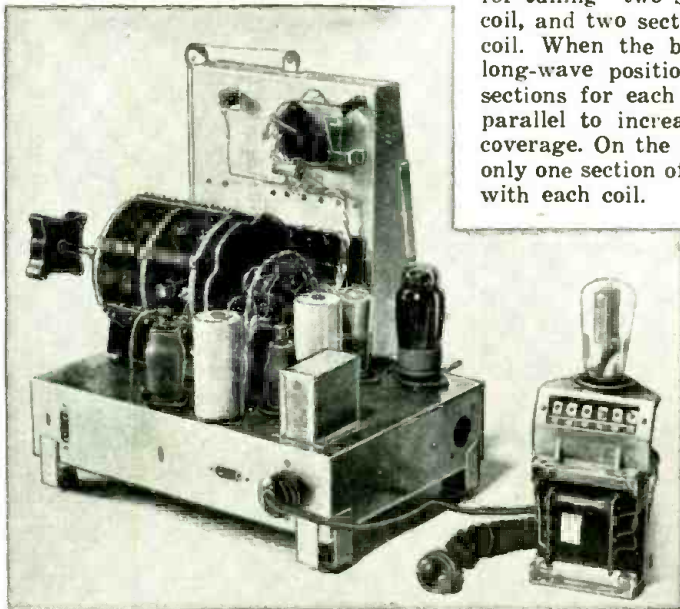
A 4-gang variable condenser is used for tuning—two sections for the mixer coil, and two sections for the oscillator coil. When the band switch is in the long-wave position, the two condenser sections for each coil are connected in parallel to increase the low-frequency coverage. On the other bands, however, only one section of the condenser is used with each coil.

Unlike American sets, the band-switch knob is on the side of the cabinet.

Only the mixer-oscillator tube and the coil-switching circuit are shown in the diagram, the rest of the receiver circuit being conventional.

The receiver operates on a.c. on any line voltage from 110 to 275 by means of a specially tapped power transformer. The power transformer and rectifier are a separate unit which is connected to the receiver by a power cable. The d.c. filter is on the receiver chassis. A separate loudspeaker plugs into terminals on the chassis.

An electron-ray indicator tube near the top of the dial is used as a tuning indicator.



# ALLEN'S Money Savers on GOV'T SURPLUS ITEMS

**SCR 578 TRANSMITTER** (Gibson Girl) complete with tubes, 300' antenna wire on reel; all lights, handles, holding strap, hand driven generator. Brand New..... **\$9.95**

**PARACHUTE** over 70 sq. ft. orange nylon material; over 192' of 3/16" double reinforced white nylon braid; also 15' of 1/4" webbing, 3 safety buckles **\$4.95**



**RUBBER BALLOON** extra heavy; inflate to 4' in dia. Brand New..... **\$1.49**

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**BOX KITE** collapsible; 17" sq 34" high..... **\$1.49**

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**BC357 RECEIVER** complete with tubes, highly sensitive relay. Operates on 4/10 mil. can be converted to 2 1/2 to 6 and 10 meter receiver. Price..... **\$2.50**



**STANDARD LIP MICROPHONE T-45**—complete with PL291-A plug; ready for use. Instruction book included. Brand New..... **25c**

**THROAT MIKE T-30**—double throat type; PL-291 plug, M199 neckband. Works into any 200 ohm impedance input circuit. Instruction sheet included..... **39c**

**HS-23 HEADSET**—8000 ohm impedance. PL-54 plug..... **98c**

**HS-33 HEADSET**—600 ohm impedance..... **98c**

**KELLOGG operator transmitter carbon microphone T-28E;** adjustable swivel and extension bracket, with special 10 ft. ES2528-8 cord. Brand New..... **\$7.95**

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**HANDSET TS-15A**—200 ohm, same as above can be used in intercom, radio & telephone work..... **\$1.98**

**HANDSET TS-9AP**, 75 ohm imp, 6' cord. Brand New..... **\$2.50**

**R-57 ARMS RECEIVER**, 11 tubes, 3 xtals; 328 to 335 Mc. Brand New..... **\$14.95**

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**R-5 ARN7 RADIO COMPASS RECEIVER**, Three bands 200 to 1750 Kc complete with 15 tubes. This set is ideal for conversion to home broadcast. Can also be converted to meet CAA approval for use in plane. 115v 400 cycle power supply. Schematic included. Like New. Special..... **\$19.85**

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**INVERTER PE-115B**..... **\$12.50**

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**WHIP ANTENNA AN-131A**—Half wave 40 to 48 meg. 10 1/2 ft. long. Comes in 8 all brass sections, connected on a spring steel cable. Good for FM reception, mobile or fixed station; can be converted to fishing rod. In original sealed carton. Brand New. Only..... **\$1.00**

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**BC-456B MODULATOR UNIT** complete with tubes, 3 relays; parts worth more than our low price of..... **\$3.95**

**BC AL429**—6 tube communications receiver & **BC AL430**—4 tube transmitter, with tubes, less coils. Each \$6.95. Both..... **\$15.95**

## RADIO RECEIVER BC-1023A

Ultra High Frequency, covering 62 to 80 mc range. An extremely sensitive relay, works on 4/10 of mil. Contains 4 tubes—12GH7—6SQ7—6SC7—6U6TG. Brand New... **\$3.50**



**TBX 2-5-6 NAVY MODEL TRANSMITTER RECEIVER**, versatile because of freq. range of 2 Mc to 4.5 Mc for transmitter and 2 Mc to 8 Mc for receiver. It's adaptable for various types of power supplies, such as 8v-12v-24v dynamotor and 110v AC powerpacks. This unit is excellent for ship to shore and ship to ship communication. Range 30 miles CW and 15 miles phone. Complete with tubes and 29 crystals without cabinets..... **\$29.95**

**JENSEN LOUD SPEAKER**—12 inch, high fidelity, enclosed in metal housing; like new..... **\$12.00**

**BC-191 & 375 TRANSMITTER**, complete with tubes and 5 tuning units..... **\$29.50**

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BC 341A..... **\$14.50**

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**RECEIVER AN CRW2** high freq., 6 tubes and 2 sensitive relays. Can be used for controlling purposes. Complete with tubes & dynamotor. Brand New..... **\$7.00**

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**CONVERTER**, electronic; 110v DC to 110v AC; 250 watt cap; complete with plugs and heavy duty vibrator..... **\$14.95**

**TEST EQUIPMENT IE/46B**—Freq. meter 906D; Receiver 1066B; Signal generator 196B; complete with antennas, tubes, charts, etc. Brand New. All three units..... **\$29.85**

**FIELD TELEPHONES EE-8** with handset generator, ringer, etc. in strong leather case..... **\$10.00**

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**SA-280U**—Beautiful black plastic microphone switch; 2 1/4" long, 1" diameter; push button make and break, press to signal. Screw type, can be used with or without case. Good for interoffice buzzer, closet lights, doorbells, phonograph recorder. Can be mounted or used by hand. Each..... **26c**



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## TECHNOTES

### ... MECK TRAIL-BLAZER

New sets using miniature tubes may have considerable hum at low volume. The B-voltage is too high, causing the oscillator to produce a strong signal which results in interference from the short-wave bands. Both of these troubles may be eliminated by connecting a 75- to 100-ohm, 1-watt resistor between the 35W4 cathode and the input filter condenser.

H. R. NEWELL,  
Bradford, N. H.

### ... HAMMARLUND HQ-129 X

The defect in this receiver was progressive loss of signal in the first stage over a period of time. This was due to particles of metal from the switch contacts being deposited on the insulating material of the switch and partially short-circuiting the coil. Measuring across the switch with the coil not in circuit, a resistance of 50 ohms was found.

To repair the set, I applied high voltage from the power supply across the switch. This eliminated the partial short circuit.

ALVA H. CLARK,  
Tarboro, N. C.

### ... PHILCO 46-806

Complaint: distortion and fading. To eliminate this trouble, replace the .006 paper coupling condensers in the audio stages (C-200 and C-202 on manufacturer's diagram) with mica condensers of the same capacitance. Usually only one of these condensers is defective, but replacing both will prevent any further trouble.

R. V. BLIKFONTEIN,  
South Africa

### ... I.F. INTERFERENCE

Interference from marine radio stations, whose signal frequencies are close to the intermediate frequency of a receiver, may be eliminated by connecting half of an i.f. transformer in series with the antenna. The i.f. coil and trimmer condenser form a parallel-resonant wave trap which, when tuned to the interfering signal, should eliminate it completely.

R. N. HORAN,  
Poughkeepsie, N. Y.

### ... GE MODEL 50 RADIO CLOCK

A common complaint about these radios is that the power switch cannot be turned to the radio position. The trouble in this case is cleared up by merely putting a drop of oil on the cam that operates the switch contacts.

JACK C. WHITE,  
Jackson, Miss.

### ... HUNTING INTERMITTENTS

When servicing intermittent sets that cut out after long periods of time or unexpectedly, a 250-watt heat lamp may be used to open up the defective component. Concentrate the heat from the lamp on different parts of the set. Take care that condensers are not ruined by excessive heat.

ANDY R. HARCAR,  
Birdsboro, Penna.



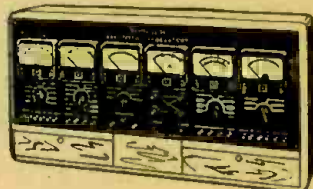
**New**

# RADIO-ELECTRONIC DEVICES

## METER PANEL

Simpson Electric Co.  
Chicago, Ill.

The Model 1005 electrical laboratory combines the functions of over 60 separate instruments. It consists of 6 individual 4 1/2 inch rectangular instruments, each with a complete set of ranges. In addition to a.c. and d.c. voltage and current ranges, a multirange ohmmeter and a single-phase wattmeter have been included. For extreme sensitivity required in testing circuits where only a small amount of current is available, an instrument is provided with a sensitivity of 50 microamperes, providing 20,000 ohms per volt on all d.c. voltage ranges.



There is also a complete coverage of decibel ranges from minus 10 to plus 55 for volume indications.

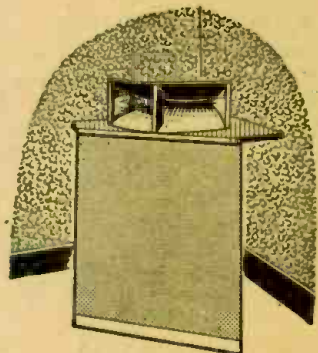
The unit is approximately 34x17x9 inches and weighs 37 lbs. Two compartments for accessories and instructions are located at the base of the cabinet. All connections are made to binding posts located on the panel. Test leads and break-in plug are furnished.—RADIO-CRAFT

## SPEAKER SYSTEM

Brociner Electronics Laboratory  
New York, N. Y.

The Klipsch speaker system uses a horn for the low frequencies as well as for the high-frequency range.

The low-frequency horn is folded and uses a corner of a room as an integral part of the acoustic system so its performance is equivalent to much larger conventionally designed horns. With both the high- and low-frequency speakers coupled to horns, their relative efficiencies are nearly equal. It is not necessary to attenuate the high-frequency unit to match the low-frequency output. The high-frequency horn



provides a 90-degree horizontal distribution pattern of frequencies above 500 cycles, to match the dispersion of the low-frequency horn. The frequency range of the system is from 30 to 15,000 cycles. The dividing network is a constant-resistance, parallel type, providing 12 decibels per octave attenuation, and has a crossover frequency of 500 cycles. An L-pad permits adjustment of balance to suit individual conditions. Because of the horn loading, even at full power, distortion is of the order of 1/100 to 1/400 of that of direct radiators.

The system is available as a complete unit, or individual components can be obtained separately. Model 1A is rated at 20 watts and other models provide power-handling capability up to 60 watts in one unit.—RADIO-CRAFT

## SWEEP CALIBRATOR

Browning Laboratories, Inc.  
Winchester, Mass.

The Model GL-22 sweep calibrator is a pulsed timing marker oscillator de-



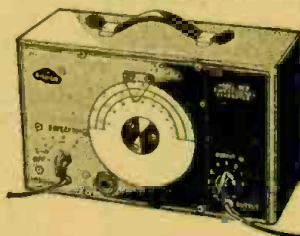
signed for use with standard oscilloscopes and synchroscopes for accurate measurement of time intervals on either triggered or recurrent sweeps. Variable amplitude markers of either polarity are provided for use as intensity markers or directly on the cathode-ray tube plates as deflection markers. Markers available are 0.1, 0.5, 1.0, 10, 100 microseconds. A positive or negative variable-width gate pulse output is provided for test purposes. The pulse duration corresponds to the duration of the marker group. Operation is by external synchronizing triggers or from an internal trigger generator, with output triggers of both polarities available at the front panel.

The unit measures 14x7x7 inches and weighs 20 pounds.—RADIO-CRAFT

## SWEEP GENERATOR

McMurdo Silver Co., Inc.  
Hartford, Conn.

The new Model 909 sweep generator is designed to permit rapid and simple visual alignment of FM and television



r.f., i.f., and video amplifiers. It covers a center-frequency range of 2 mc through 226 mc in 3 bands. Frequency modulation is adjustable from 40 kc to over 9 mc, and output is adjustable from zero to 1/2 volt maximum with panel controls. Synchronization of the oscilloscope, used to trace visually alignment "pictures" is at power line frequency (or selected multiple or sub-multiple), or by a 120-cycle, saw-tooth synchronizing voltage available from the generator.—RADIO-CRAFT

## POLYSTYRENE WINDOW

American Phenolic Corporation  
Chicago, Illinois

A clear polystyrene windowpane for radio applications makes it possible to bring the antenna lead-in into the room without cutting through the window casing or drilling through the glass. The glass pane is replaced with the plastic sheet which can be drilled to accommodate feed-through insulators or to



pass wire or co-axial cable. The polystyrene does not discolor under light or absorb water.

These windowpanes are available in all sizes and thicknesses.—RADIO-CRAFT

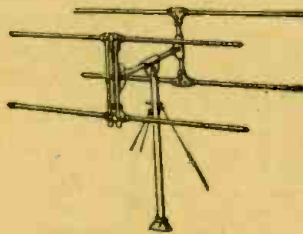
## TELEVISION ANTENNA

Camburn, Inc., Woodside, N. Y.

The Double Decker antenna is designed to give a favorable standing-wave ratio over the entire range of television frequencies. The stacked dipoles provide broad band response and high signal strength. Reception is unidirectional at right angles to the antenna.

The array can be rotated and tilted for best signal strength.

This antenna is also available for FM.—RADIO-CRAFT



## REMOTE SPEAKER

Dapco Products, Inc.  
Defiance, Ohio

An auxiliary radio speaker has been designed for easy installation on the package deck behind the rear seat in an auto sedan or coach. It does not require a recess hole to be cut in the shelf, but is held in place with 2 small self-tapping screws.

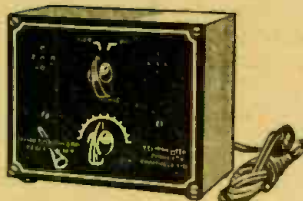
The Re-Mote 5-inch speaker has a sealed, dustproof voice coil and fixed resistors to match all standard car radios, and includes a volume control.

It is housed in a plastic case, with louvers on top for proper acoustical balance and tone quality.—RADIO-CRAFT



## TELE-FM PREAMPLIFIER

Vision Research Laboratories  
Richmond Hill, N. Y.



This television preamplifier boosts the strength of weak stations to a point where suitable reception is possible. It is entirely self-contained and is connected to the television set by attachment in series with the antenna. A 2-position switch on the front panel is switched on for the preamplifier or off for normal set operation.

The unit is 3x5x6 inches and is furnished in 3 models covering channels 1-6, 7-13, and 88-108 mc.—RADIO-CRAFT

## ANTISTATIC POWDER

General Cement Mfg. Co.  
Rockford, Illinois

This is a powder which minimizes auto radio static interference due to the accumulation of static electricity on the car. The powder is poured into a powder injector which is screwed onto the tire valve. Air pressure is then used to blow it into the inner tube.—RADIO-CRAFT

## PORTABLE RECORDER

Air King Products Co., Inc.  
Brooklyn, N. Y.

This recorder embodies a 5-tube (including rectifier) amplifier with radio attachment cord. It plays either 10- or 12-inch records and comes equipped with permanent needle. Recordings from the phonograph or radio can be made directly through the amplifier, and voice also can be dubbed in through the microphone while recording from radio.

The recorder includes an automatic shutoff to turn the motor off after the wire rewinds. A safety lock prevents accidental erasures, and a visual indicator checks recording level.—RADIO-CRAFT



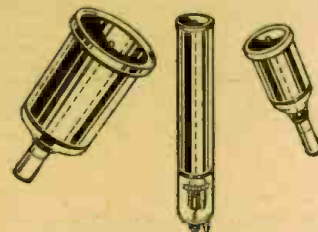
## GEIGER COUNTER

Amperex Electronic Corporation  
Brooklyn, N. Y.

These Geiger-Mueller counter tubes are physically redesigned for standardized production.

New developments include direct bonds between mica and metal and mica and glass, eliminating many of the difficulties inherent in gasketed or waxed seals.

The first series to be released includes counter tubes for beta, gamma, and X-rays.—RADIO-CRAFT



## PICKUP EQUALIZER

Radio-Music Corp.  
Port Chester, N. Y.

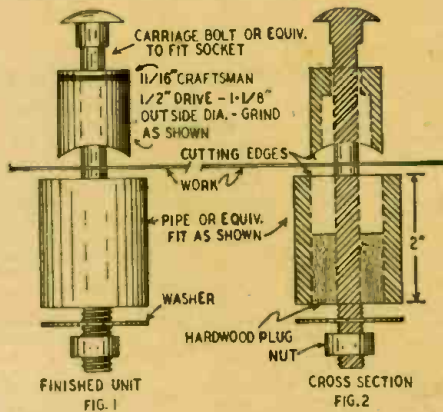
The new EL-3 equalizer has been designed for simplified operation plus good reproduction from both vertical and lateral recordings. The system allows using one arm for vertical only and one arm for lateral only, on one turntable or separate tables, by connecting both arms to the equalizer. Switching the equalizer from vertical equalization to lateral allows changing from one arm to the other . . . at the same time, the correct equalization is thrown in. Both the RMC vertical and lateral reproducers can be replaced by the RMC universal head.—RADIO-CRAFT

# TRY THIS ONE

## TUBE SOCKET PUNCH

This socket punch is easily made and can cut about 20 holes before it needs resharpening.

To make the cutter, grind a socket from a socket-wrench set to the shape shown in the drawing. The outside diameter of the socket is  $1\frac{1}{8}$  inches (for a  $1\frac{1}{8}$ -inch hole), but a larger or smaller size may be used if desired.



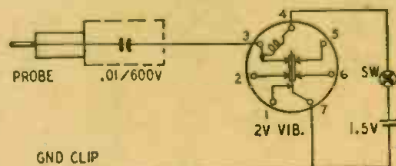
The die for the cutter is made of a piece of thick-wall pipe cut off square. It should fit snugly around cutter but not bind, if the hole is to be a clean one. Force a hardwood cylinder halfway into the pipe and drill it accurately through the center for a snug, sliding fit for the bolt.

Choose the bolt to fit the drive hole of the socket without any play. If the socket has a square drive hole, use a bolt with a square collar that can fit into it.

JOHN KWIETINSKAS,  
Duquesne, Pa.

## SIGNAL GENERATOR

An excellent signal generator can be constructed from a surplus 2-volt vibrator. It provides a.f. and r.f. signals for trouble-shooting and aligning of re-



ceivers. It is compact and easily carried around, and the operating cost is low because it uses only a  $1\frac{1}{2}$ -volt battery. A volume control can be added to control the output.

JOHN ZVERLOFF,  
Akron, Ohio

## HANDY TOOLS

Hacksaw blades can be ground into small sharp knives that are useful around the workshop. Facial tissue can be cemented to a piece of broken blade to get into places that a pipe cleaner cannot reach.

ELMER C. CARLSON,  
Brooklyn, N. Y.

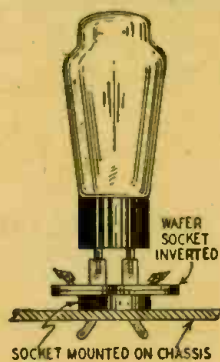
## FOR EASY SOLDERING

When it is necessary to solder a lead or component to a chassis and solder with rosin flux will not stick, try using Kester aluminum solder. I have used this a number of years and have not been troubled with corrosion. It will even adhere—but not too well—to that white brittle metal often used for phono tone arms and dial drums.

THOMAS RUMNEY,  
Toronto, Canada

## TEST-POINT ADAPTER

Test-point adapters may be made cheaply from midget wafer tube sockets.



Remove the tube from the set and plug it into an inverted wafer socket. Then plug the whole back into the socket on the chassis. The prongs from the wafer socket project and can be hooked onto easily with pee-wee or crocodile clips. The receiver can, in most cases, be tested without removing it from the cabinet.

JOHN ZVERLOFF  
Akron, Ohio

## TUBE REMOVER

A sewing-machine screw driver is the basis of this novel tube remover. To make it, hold about  $\frac{3}{4}$  inch of the screw driver blade in a vise and bend it sharply 45 degrees.

Slip the bent end of the screw driver blade between the base of the tube and its socket. A little leverage on the handle will force the tube out easily.

OSCAR E. MALECH,  
San Francisco, Calif.

## CLEANING SPEAKERS

An easy way to remove iron filings and bits of metal from between the voice coil and field pole of dynamic speakers is to pass alternating current through the field coil. This demagnetizes the core and permits the small bits of metal to be shaken or blown out.

W. HARVEY MERWIN,  
Jensen Beach, Florida

## SELENIUM RECTIFIER HOLDER

Here is a new way to install selenium rectifiers in radios designed for vacuum-tube rectifiers. Cut a slot the width of the new unit in a tube base to within  $1/16$  inch of the bottom. Solder insulated leads to the terminals and fit the entire assembly into the slot. Pull the wires through the prongs in the base and

solder them. The wires should be pulled tight to hold the rectifier firmly in place.

After the circuit wiring is changed, plug the new rectifier into the tube socket.

GEORGE J. DASKO,  
Oka, Quebec

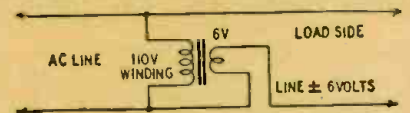
(Another method of installing a selenium rectifier was suggested by R. V. Johnson of Chicago, Illinois. It is to solder a tube prong to each strap attached to the unit. The rectifier is installed by merely plugging it into the tube socket after rewiring the set. Many parallel suggestions have been made by servicemen and experimenters. —Editor)



## VOLTAGE BOOSTER

Where low line voltage causes poor reception on receivers, a toy or filament transformer can be used to boost the line voltage to close to its normal rating.

The required transformer secondary voltage depends upon the amount of increase desired, and can be varied in



many toy transformers. The 2 windings must be connected to add voltages and to prevent bucking—correct connections can be determined with a voltmeter.

GEORGE PURAINEN,  
Sudbury, Ontario

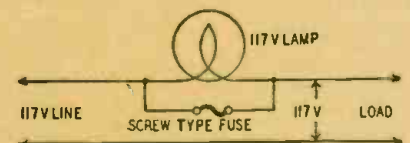
## STRIPPING LITZ WIRE

Do you have trouble stripping insulation from Litz wire and the fine wires commonly used on pickups and headphones? If so, try passing a lighted match slowly under the end of the wire. This will char the insulation sufficiently to permit it to be pulled off. Use care so that the fine wires will neither char nor melt.

FRED PEARSALL,  
Medford, N. Y.

## SHORT INDICATOR

A light bulb connected in parallel with the fuse connected to the service bench is a good short-circuit indicator. If the fuse melts, the lamp will light. The



lamp should be a small one, that will not impair the action of the fuse. A  $7\frac{1}{2}$ -watt bulb is adequate.

JOHN A. FLOR,  
Milwaukee, Wis.

# BUY from America's STOREHOUSE of QUALITY PARTS

## VOLUME CONTROLS



1000 ohm wire wound midgets - manufacturers close out - 1/4" shaft 3/8" long - list \$1.25 - over 90% off.

EACH **12c**  
SEALED Box of 252 **24.95**

## OUTPUT TRANSFORMERS

Clean stocks - long leads - mounting feet - made to fit where you need them. For 6F6-6K6 - to 4 ohm voice coil - size 2" x 1 1/4" x 1 3/8". 50L6-35L6-25L6 to 4 ohm voice coil 1 3/8" x 1 3/8" x 1 3/8". Specify quantity of each type you need at.....



**49c**

## MULTI-USE WIRE

An old favorite - back again! Stranded No. 22 tinned wire - glass "ROCKBESTOS" 1000 volt insulation - fireproof aircraft wire - a wartime development - at this low price you can use the best.



100 feet..... **45c** 1000 feet..... **3.89**

## Pep-Up PHILCO CHANGERS

Here are the two most important items in "Beam of Light" changers - and priced to give you more profit! Selenium cell only, no holder, post paid..... **1.80**

Special original equipment lamp.... **27c**

## 8/8/8 - 450 VOLT CONDENSERS

A nationally advertised triple 8 mfd. - 450 volts - inverted screw mounting - insulated aluminum can 1 1/4" x 4" - insulated leads 6" long. List price \$4.25. One time only at..... **89c**

## MIDGET I. F. TRANSFORMERS

Back again - by popular demand! RSE scores again with a new and better I.F. 1 400-500 KC range - 4 1/4" square x 2 1/2" high - ceramic based mica trimmers - high gain iron cores - pep up old receivers - ideal for new construction - and now available in either input or output types - for peak performance! Individually boxed in the colorful RSE carton. List price \$2.10. LR1 - input; LR2 - output; Specify Type.

Each	Matched Pair	Dozen	Egg Crate of 100
<b>36c</b>	<b>69c</b>	<b>3.95</b>	<b>29.00</b>

## PANEL METERS

Top quality instruments! All new - not war surplus - boxed - seven popular types - priced right - your chance to get those meters you've always wanted!

Model 332 - 0-150 A.C. volts - 3" round flush mounting black brass case.

Model 221 - 0-30 D.C. volts - 2" round flush mounting bakelite case. Model 324 - 0-400 D.C. volts - 3" round projection mounting - bakelite case.

Model 331 - 0-30 A.C. amps. - 3" round flush mounting bakelite case. Model 322 - 0-150 D.C. volts - 3" round flush mounting black brass case.

Model 347 - 0-150 MA radio frequency thermocouple - 3" square bakelite case.

Model 341 - 0-500 MA radio frequency thermocouple - 3" round bakelite case.

Supply limited - order now - list models you desire.

**2.95**  
EACH

**3.95**  
EACH

# RADIO SUPPLY & ENGINEERING CO., Inc.

125 SELDEN AVE. DETROIT 1, MICH.

## .5-300 VOLT CONDENSERS



A name brand manufacturers close-out special - we pass the savings on to you! New fresh stock - size 3/4" x 2 1/4" - tinned leads - all guaranteed 60c List - your discount 90%.

Net Each 10 for 100 for  
**6c 49c 395**

## VOLUME CONTROLS

Our own private brand - made by a nationally known manufacturer - you have this same control on your shelf now - the same kind that net for \$1.09! Standard noise-free carbon construction - 3/8" bushing - 1/2" shaft, 2" long - complete with switch. Ideal all purpose replacement control - individually boxed in our colorful carton carrying the RSE quality seal of approval.



Full range of sizes - with attached switches!

10 M ohms	15 M ohms	25 M ohms	50 M ohms	100 M ohms	250 M ohms	500 M ohms	1 Meg ohms	2 Meg ohms	500 M Knurled Shaft
									500 M ohms less switch, 39c ea. 100 for \$35.00

**59c each**  
**55.00 per 100 assorted**

## MODEL 451A AC-DC Volt-Ohm-Meter



A dependable instrument of wide utility - sensitivity 1000 ohms per volt. Ranges: Volts AC, DC, and Output Ranges: 0-10/50/100/500/1000. Ohms full scale, 500,000. Ohms center scale, 7200.

TEST LEADS **.59**

NET complete with batteries..... **14.90**

## MODEL 312 Volt-Ohm-Milliammeter



An economy pocket meter featuring a 2" moving vane meter.

Reads: AC-DC volts, 0-.25/50/125/250; Mills AC-DC, 0-.50; Ohms, 100,000; mfd. .05-15.

Jacks provide range selection  
TEST LEADS **.59**  
NET Complete with cord and plug.... **6.75**

## OZ4 TUBES



New, guaranteed, made by the only maker of OZ4's. Buy now! Hit that car radio business hard - \$2.20 List - 60% or more off - limited quantity

In colorful RSE box  
Egg crate of 100 **\$.79.**

## PAPER BY-PASS CONDENSERS



Name brand condensers made by a prominent eastern manufacturer! Regular nationally advertised jobber - serviceman line! New, fresh, full capacity standard merchandise - not surplus - all guaranteed! Check the list prices - our low nets - no need to figure the discount - buy 'em now, they've hit bottom!

Mfd.	Volts	List Price	Net Each	Per 100
.01	600	30c	10c	\$ 9.15
.02	600	30c	11c	\$ 9.95
.05	600	40c	14c	\$12.95
.1	600	45c	16c	\$14.95

Quantity Prices not assorted.

## A STAR STUDDED STOCK



And every item a "Star Studded Item" - only standard merchandise by nationally known manufacturers is ever advertised by RSE. Remember our policy - your money back if not 100% satisfied!

## PHONO PICKUP CRYSTALS

Standard types - Set Manufacturers close-out - all Guaranteed



P30-W60 - One of the newest and finest - osmium tipped permanent needle - 1.8 volts output - fits standard mounting holes. List price \$7.50 you pay us..... **2.69**



P93-W57A - stamped metal case - pin type terminals - 1/2 oz. pressure - 1.6 volt output - 5000 cycle cutoff. List price \$5.55 - Our special..... **1.98**



L70 - new postwar design - solder terminals - 1 1/4 oz. pressure - 1 volt output - 4000 cycle cutoff. List price \$5.55 - we quote you..... **1.98**



L75 - another new type - 1 1/4 oz. pressure - .75 volt output - 6000 cycle cutoff. List price \$5.55 - 64% off..... **1.98**



L40 - the prewar favorite in a die cast case - used in millions of phonographs - solder terminals - 1 1/4 oz. pressure - .6 volt output - 4500 cycle cutoff. List price \$4.45 - your cost..... **1.98**

## SEND FOR FREE CATALOG



DEMAND THIS SEAL OF QUALITY

## ORDER INSTRUCTIONS

Include full remittance with orders of \$3.00 or less. Include 25% deposit with all C.O.D. orders of \$3.00 or more. All shipments sent express collect if postage is not included. Prices subject to change without notice. BE SURE TO INCLUDE SUFFICIENT POSTAGE. EXCESS WILL BE REFUNDED.

**RADIOMEN'S HEADQUARTERS - WORLD WIDE MAIL ORDER SERVICE !!!**

**BUFRAD CAR RADIO ANTENNAS**

All of our car radio antennas are made of triple plated Admiralty Brass Tubing, complete with low loss shielded antenna leads and high quality fittings.

**SIDE COWL—BR-1**, 3 sections extend to 66". Your price—single units—\$1.50; in lots of 12—\$1.35 ea.

**SKYSCRAPER—BR-2** has 4 heavy duty sections that extend to 98". Your price—single units—\$2.45; in lots of 12—\$2.25 ea.

**TILT ANGLE—BR-3**, may be adjusted to all body contours. 3 sections extend to 66". Single unit price—\$1.50; 12 lot price—\$1.25 ea.

**VERSATILE—BR-4**, single hole fender or top cowl mounting may be adjusted to conform with all body contours. 4 sections extend to 56". Single unit price—\$2.90; 12 lot price—\$2.75 ea.

**THE MONARCH—BR-5**, single hole top cowl mounting, 3 sections extend to 66". Single unit price—\$1.90; 12 lot price—\$1.75 ea.

**BENDIX SCR 522—Very high Frequency Voice Transmitter-Receiver—100 to 166 MC.** This job was good enough for the Joint Command to make it standard equipment in everything that flew, even though each set cost the Gov't \$2500.00. Crystal Controlled and Amplitude Modulated—HIGH TRANSMITTER OUTPUT and 3 Microvolt Receiver Sensitivity gave good communication up to 180 miles high altitudes. Receiver has ten tubes and transmitter has seven tubes, including two 832's. Furnished complete with 17 tubes, remote control unit, 4 crystals, and the special wide band VHF antenna that was designed for this set. These sets have been removed from unused aircraft and are guaranteed to be in perfect condition. We include free parts and diagrams for the conversion to "continuously variable frequency coverage" in the receiver.

The SCR 522 complete with 24 volt dynamotor sells for only \$37.95. The SCR 522 is also available with a brand new 12 volt dynamotor for only \$42.95.

**SPEAKERS—**These PM speakers are the finest that are available. All have heavy oversize Alnico V magnets.

3 1/2"	\$1.15	6 for \$6.67
4"	\$1.15	6 for \$6.60
5"	\$1.10	10 for \$9.50
6"	\$1.50	6 for \$8.70
7"	\$4.50	6 for \$21.50
8"	\$3.95	6 for \$20.50
8 1/2"	\$4.95	6 for \$26.50
10"	\$5.50	6 for \$30.00
12"	\$7.95	6 for \$42.00

**AUTO RADIO DEALERS! ATTENTION!**

Nationally advertised brand of 1948 car radio which will fit practically any car and every pocketbook. Six tube superheterodyne with three gang condenser and 6 1/2" speaker. \$32.20 for sample, or Dealer price \$29.97 each, in lots of two or more.

Here is an item that no serviceman who repairs auto radios should be without. Nationally advertised ATB battery eliminator that supplies perfectly filtered 12 VDC or 6 VDC at 14 amp from 110 VAC ..... \$36.00

**RADIO SERVICEMEN!** Buffalo Radio Supply's lower prices mean increased profits for you. Order all of your needs from us and receive in return courteous service and first class merchandise at the lowest prices in the country.

**TUBES—**All types in stock. 60% off on all tubes if ordered in lots of 10 or more.

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**POWER TRANSFORMERS—**Half-shell type, 110V, 60 cy. Center-tapped HV winding. Specify either 2.5 or 6.3V filament when ordering.

For 4-5 tube sets—850V, 40MA, 5V & 2.5 or 6.3V ..... \$1.49  
 For 5-6 tube sets—850V, 45MA, 5V & 2.5 or 6.3V ..... 1.75  
 For 6-7 tube sets—875V, 50MA, 5V & 2.5 or 6.3V ..... 1.90  
 For 7-8 tube sets—700V, 70MA, 5V & 6.3 or two 2.5V ..... 2.35  
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 For 8-9 tube sets—700V-90MA, 5V-3A, 2.5V-3.5A ..... 2.85  
 2.5-10.5A ..... 2.85  
 For 9-11 tube sets—700V, 5V & 6.3V-4A ..... 2.85  
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**CONDENSERS—PAPER TUBULAR** 500 WV—.001, .002, .005  
 .01, .05  
**LYTICS:** 8mf 200v—20c; 10mf 35v—20c; 30mf 150v—23c;  
 20/20mf 150v—35c; 30/20 150v—46c; 50mf 150v—43c; 8mf  
 475v—34c; 16mf 350v—65c; **OIL CONDENSERS:** 4mf 600v  
 49c; 2mf 600v—29c; 3X.1mf 600v—29c.

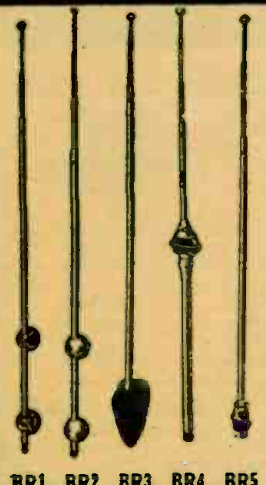
**\$9.95**

**TAKES ALL THREE BIG BARGAINS**

- AUDIO AMPLIFIER** Undreamed of value. Uses 6V6's. Has 4 microphone inputs brought to jacks at rear panel. Various output impedances available at rear panel connections. Steel case with chrome handles. 9" long x 9" high x 6" deep. Tubes included. New in original carton. Shipping weight 20 lbs. **SUPER SPECIAL—\$4.95** while supply lasts.
- RADIO HEADSETS** Latest supersensitive type with rubber earpieces. Every pair guaranteed perfect. **\$5.99** per pair OR **3 PAIRS FOR \$10.00.**
- HOME WORKSHOP AT BARGAIN PRICE** Accurate and precise 2 speed guaranteed hobby lathe, the essential machine for the home workshop. Sturdy enough for light production work or factory standby service. Supplied with 56" of belting for connecting to any available electric motor or power take-off, such as on a jeep or tractor. Also included in this unbelievable offer are such accessories as a 1/2" drill chuck with specially hardened tool steel jaws, a 4" electric furnace high speed grinding wheel, a cotton buffing wheel with a large supply of buffing compound, and a 4" steel wire scratch brush. Your cost \$8.00. Sole export agent. Distributor inquiries invited.

**NO C. O. D.—ORDER NOW—DON'T DELAY**

Cable Address: BUFRAD



BR1 BR2 BR3 BR4 BR5

**CLOSING OUT THE FOLLOWING DESIRABLE ITEMS AT SACRIFICE PRICES TO MAKE ROOM IN OUR WAREHOUSE FOR INCOMING STOCK**

**5" 50" RADAR P.P.I. SCOPE,** complete with 9 tubes including 807 tube in final power stage that provides deflecting current for magnetic yokes. Selsyn motor and self-contained 110 V. power supply designed to run on the AC supply on LST and PT boats. Various ranges from 2 to 80 miles. The most satisfactory scope available for navigational radar or panoramic television applications.—Nationally advertised as surplus at \$100.00. Our price, only \$39.95.

**947A ONE KILOWATT HIGH FREQUENCY TRANSMITTER.** This relay controlled transmitter includes a 115V, 60 cycle power supply, protected by 3 magnetic circuit breakers, that alone is worth more than the price we are asking for the whole rig, even on today's surplus market. On the front panel are six 3 1/2" GE or Weston meters, including 250 MA, 50 MA, 1000 MA, 150 V AC and 1800 V DC at 1000 ohms per volt for screens and plate. The rack-type 21" x 15" x 36" unit contains six amplifier and rectifier tubes aggregating over \$60.00 at W.A. current wholesale prices. Western Electric's price to the government was \$1500.00. Shipping weight 400 lbs. Your cost at closeout price as in. Formerly \$69.95, now only ..... \$39.95

**LORAN INDICATOR OSCILLOSCOPE** complete with 26 tubes and a 5" cathode ray tube. Greatly superior to other scopes because the multivibrator circuit incorporated can be used to present two traces simultaneously on screen. Thus input and output of an amplifier stage can be viewed at same time on screen. Distortion is indicated conclusively by difference between input and output traces, while fidelity is made evident by identical traces. Government instruction manual included. .... \$39.95

**FILTER CHOKES:** 200, 300, 400, 500 ohm light duty—59c; 200 or 300 ohm heavy duty—99c; 250 ma 35 ohm, made for U.S. Navy, fully shielded—\$1.95; 75 ohm, 125 ma—25c or 25 for \$4.25; "Melsaner type" tapped filter chokes—25c; 8 amp. iron core A filter—25c; Choke-condenser combination, ideal to replace any size speaker field when installing FM speaker—79c.

**110V. CIRCUIT BREAKERS** of Magnetic type. Following Current Ratings in Stock: 1.5, 3, 4, 8 Amps. Please specify. \$1.95 each.

**SEVEN ASSORTED I.F. TRANSFORMERS—\$1.98;** Five Asstd. Oscillator Coils—69c.

**SELENIUM RECTIFIERS—**Dry disc type 1 1/2", 1", 1.2 Amp. maximum, suitable for converting DC relays to AC, for supplying filament source in portable radios, converting -DC meters to AC applications, and also may be used in low current chargers—90c.

**METER RECTIFIER—**Full wave, may be used for replacement, or in construction of all types of test equipment—\$1.25. Half Wave—90c.

**FREE ! ! ! THIS MONTH ONLY.**  
**A HIGH GRADE CRYSTAL PICK-UP WITH THE PURCHASE OF EACH PHONO MOTOR AT \$4.95.**

**MICROPHONES—**All nationally known brands. Bullet crystal—\$5.45; Bullet Dynamic—\$7.45; Mike Jr.—60c; Handy Mike—90c; Lapel Mike—93c; SHURE T-17 MIKES, with push to talk switch—99c.

**20 ASS'ED COIL FORMS.** Including 11 ceramic, 3 polystyrene, and 6 fiber, all useful sizes—50c.

**VARIABLE CONDENSERS:** 350 MMFD, 5 gang—\$1.95; 4 gang—\$1.49; 3 gang—83c; 7.5 to 20 MMFD, 1750v spacing extra long shaft Hammarlund—69c; miniature variables, 25 MMFD—69c; 140 MMFD—79c.

**INTERRUPTION FREQUENCY COILS** for super-regenerative receivers or the tremendously popular FM adapters for standard broadcast sets. Iron core with a resonant frequency of 50 KC—39c; Air Core, 100 KC—29c.

**30 MC IF TRANSFORMERS,** double slug tuned—25c.

**30 MC VIDEO AMPLIFIER PLATE COILS—**Slug tuned—25c.

**REMOTE CONTROL UNIT:** Aluminum case 4x3x2" containing 2 potentiometers, triple pole switch, 4 knobs, gear mechanism, counter and phone jacks—59c.

**MODULATION TRANSFORMERS—**10 watt, metal case 96c; 30 watt, open-type, \$1.95; 40 watt, cast aluminum case, \$2.95; Class "B" input transformers, cast aluminum case, \$1.95; Transceiver audio transformers, 65c; Transceiver modulation transformers, 65c.

**MINIATURE PLIERS SET** contains one of each of the following: Needle nose, flat nose, parrot nose, standard nose. All contained in a leatherette case. Your cost—\$1.98.

**SOCKET WRENCH SET** consisting of 5 sockets ranging in size from 5/16 to 1/2" and a handle—79c.

**AUTOMATIC WIRE STRIPPERS** will strip up to 1000 wires per hour, a handy tool for any service job—\$3.52.

**FLUORESCENT LIGHT BALLASTS.** Single 30 or 40 watt—\$1.68; Dual 40 watt High Power Factor—\$3.75.

**HEADPHONES—**Highest quality Signal Corps headsets with 12" cord and plug \$1.25. 5' rubber covered patchcords with phone plug and socket—45c.

**LINE FILTERS—**110V—each unit contains two 2 mfd. oil filled condensers and a 15 amp. iron core choke. This filter has innumerable uses such as oil burner line filter, etc. A ten dollar value for 96c.

**RT-1579** consists of a three stage cascade 6SJ7's and 6F6 output stage high gain, high fidelity amplifier with 60 cycle, 110V power supply on the same 13 1/2 x 14 1/2 chassis, which is protected by a substantial steel cover over tubes and parts. Made by Western Electric with typical quality components such as a husky power transformer and oil condensers, this unit is obviously intended to give years of trouble-free service with no more need for repairs than a telephone. Disconnecting one wire each, from the special input and output filters, will result in as high a fidelity amplifier as can be obtained. Your cost with tubes, diagram and parts list included—\$14.95.

We also offer the RT-1579 with a Raytheon Magnetic Voltage Regulator already installed beneath the cover. Imagine an amplifier complete with tubes, built to Western Electric quality standards, and immune to line voltage variations besides, making it perfectly suited for the most difficult industrial, circus, carnival or commercial installations, offered for a total price of only \$19.95, our price for both units.

**AT LAST YOU CAN AFFORD A LABORATORY STANDARD MICRO VOLTER**

The famous Measurements Corp. Model 78B, 5 Tube Laboratory Standard Signal Generator (that sold new, FOB Bonton, N. J., for \$310.00 net) is available in perfect condition for 25 to 60 cycle, 115 V AC operation. Until now this is the sort of spotlight lab equipment that discriminating buyers have only vainly hoped would be released at a bargain price. Worth every cent the manufacturer asks, but available FOB Buffalo while our limited supply lasts for only \$79.95.

Such companies as Admiral Corp. and John Meek, Inc. have ordered from us and repeated many times on these 78 Model 78-B Standard Signal Generators for use in National Generator. Two Frequency Bands between 15 and 250 mc cycles.

**"REMEMBER THAT A STANDARD IS ONLY AS RELIABLE AS ITS MAKER."**

Minimum order \$3.00—All prices subject to change—25% deposit with C.O.D. orders



**BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. 4 C. BUFFALO 3, N. Y.**

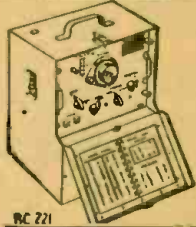
# RADIOMEN'S HEADQUARTERS WORLD WIDE MAIL ORDER SERVICE!!!

## DUE TO POPULAR DEMAND WE REPEAT THESE TERRIFIC BARGAINS

- Three assorted new MICROPHONES, including push-to-talk type .....\$1.49
- Ten assorted R. F. Chokes including high frequency types .....\$ .35
- Five assorted AUDIO or FILTER CHOKES .....\$ .99
- One Hundred assorted RESISTORS .....\$1.95
- Ten assorted JAN CABLE CONNECTORS, including SCR274,522 and BC375 types .....\$ .99
- Six assorted OIL FILLED CAN TYPE CONDENSERS, all with mounting brackets.....\$1.49
- Ten assorted METAL & BAKELITE KNOBS—(no wooden knobs) .....\$ .39
- Six assorted VARIABLE CONDENSERS, including butterfly types .....\$1.49
- Six assorted POWER and AUDIO TRANSFORMERS, all new .....\$1.98
- Six assorted isolantite and bakelite R. F. COILS, shielded and unshielded .....\$ .99

The above ten assortments totaling over \$12.00 at the unbelievable bargain prices listed can be purchased together as one lot at a super-special total price of only \$10.00. All merchandise guaranteed to be as advertised.

Aluminum gear box 18x8x7 that contains two powerful electric motors and two matched gear trains, 62 gears in all varying in size from 1/2 to 4 inches in diameter. This unit is readily converted to rotate a beam antenna or any other similar usage.....\$3.00  
**BRAND NEW 110 V AC INPUT POWER SUPPLY**, in grey enameled shock-mounted case 9" x 10" x 16". Several heavy duty resistors, 3 chokes, 4-1000 V and 600 V oil-filled condensers, 1 relay, 2-5U4's, 3 voltage regulator tubes, safety interlock, and several fuses are included in this regulated power supply at the bargain price of .....\$9.95



**BC-221 FREQUENCY METERS** with calibrating Crystal and calibration charts. A precision frequency standard that is useful for innumerable applications for laboratory technician, service man, amateur, and experimenter at the give away price of only \$36.95.

**100 KC crystal calibrator kit** containing everything that is necessary to construct a 100 KC osc. that will supply 100 KC marker points to your receiver so that it may be used for frequency determination. The 100 KC crystal is worth far more than the price that we are asking for the complete kit.  
 Kit 100K Plate and fil voltage supplied by receiver .....\$9.95  
 Kit 100KA Same as above, including 110 VAC or DC self-contained power supply .....\$12.95

RT1463 7 tube amplifiers containing 3-7F7, 1-7Y4, 3-7N7, 4 potentiometers, numerous resistors, filter and bypass condensers, filter chokes, power and audio transformers, and six sensitive plate relays. A military development that provided amazing stepless control proportional to correction required for alterations, rudder and elevator, in the original application. A control amplifier of the ordinary type would deflect the rudder by some arbitrary amount when the ship was blown off the course to port or starboard. The result would either be that the correction was insufficient and the plane continued off course, or the correction would be too great, starting a series of tackings and would greatly increase fuel consumption and elapsed time in reaching the objective. This phenomenal unit, with its 3 amplifiers and six 5000 ohm relays in bridge circuits, will accurately control any 3 operations, related or unrelated, in minutely adjustable uniquely quantitative variations in either forward or reverse directions. 9"x7"x8" black crackle aluminum case. Brand new in original carton. \$9.95.



### SCR-274N COMMAND SET

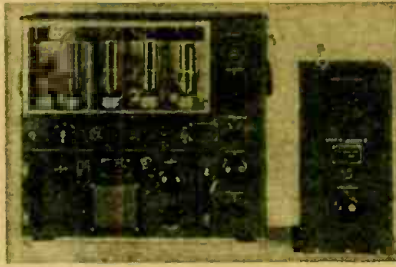
The greatest radio equipment value in history

A mountain of valuable equipment that includes 3 receivers covering 190 to 550 KC; 5 to 6 MC; and 6 to 9.1 MC. These receivers use plug-in coils, and consequently can be changed to any frequencies desired without conversion. Also included are two Tuning Control Boxes; 1 Antenna Coupling Box; four 28 V. Dynamotors (easily converted to 110 V. operation); two 40-Watt Transmitters including crystals, and Preamplifier and Modulator. 29 tubes supplied in all. Only a limited quantity available, so get your order in fast. Removed from unused aircraft and in guaranteed electrical condition. A super value at \$29.95, including crank type tuning knobs for receivers. Without these knobs the receivers can't be tuned, and are only useful for parts. Don't buy without knobs!

**RECORDING AMPLIFIER**, 3 stage, 110 V, 25 or 60 cycle high gain amplifier built by recently bankrupt manufacturer specifically for recording use. Transformer for low impedance wire recorder head or magnetic cutter included on chassis. Tone and volume controls and switches on chassis for playback, recording or use as public address amplifier. Complete with tubes .....\$9.95

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has its own oscillator and power amplifier coils and condensers, and antenna tuning circuit—all designed in black crackle, and the milliammeter, voltmeter, and RF ammeter are mounted on the front panel. Here are the specifications: **FREQUENCY RANGE:** 200 to 500 KC and 1500 to 12,500 KC. (Will operate on 10 and 20 meter band with slight modification). **OSCILLATOR:** Self-excited, thermo compensated, and hand calibrated. **POWER AMPLIFIER:** Neutralized class "C" stage, using 211 tube, and equipped with antenna coupling circuit which matches practically any length antenna. **MODULATOR:** Class "B"—uses two 211 tubes. **POWER SUPPLY:** Supplied complete with dynamotor which furnishes 1000V at 350 MA. Complete instructions are furnished to operate set from 110V AC. **SIZE:** 21 1/2 x 23 1/2 inches. Total shipping weight 200 lbs., complete with all tubes, dynamotor power supply, five tuning units, antenna tuning unit and the essential plugs. These units have been removed from unused aircraft but are guaranteed to be in perfect condition.

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- 13 or 26 V DC input. Output 300 V DC, 400 V DC @ 135 MA, and 9 V AC .....\$15.00  
 (By running on 6 V AC, 60 cycle input, with a small amount of DC for field excitation, the above dynamotor will provide a good source of 12, 24, 400 or 800 V DC.)

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### SCR-284 TRANSMITTER-RECEIVER

This medium power transmitter and the accompanying 7-tube very sensitive receiver are natural for 80 or 40 meter operation (phone or CW), on either fixed stations or mobile applications. These units are brand new and come complete with 17 tubes, key, microphone, 200 KC calibrating crystal and instructions and diagrams for use with up to 100 watts input to the final stage on 40 meter band. Your cost .....\$39.95  
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# New Radio-Electronic Patents

By I. QUEEN

## LOCATION OF TRANSMISSION LINE FAULTS

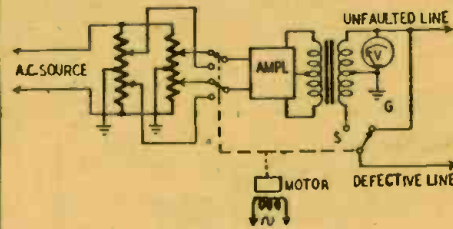
Dale H. Nelson, Southampton, N. Y., and James R. Cosby, Towson, Md. (assigned to Western Union Tel. Co.) Patent No. 2,425,554

Several methods have been available for the approximate location of a transmission line fault, such as a short-circuit or an open. A bridge or similar device may be used to calculate the approximate position. If the insulation remains unbroken, however, the exact location cannot be definitely determined.

If the defective conductor runs parallel and close to another conductor known to be good, the following method will determine the exact location of a fault. Audio power, for example at 1000 cycles, is applied in opposite phase to the lines. This may be done by connecting each line at opposite ends of a transformer secondary, with the center terminal grounded.

A linesman with portable detecting apparatus near the lines will pick up the fields radiated by them. So long as there is no defect in either conductor the radiation from either of them is cancelled by the other. A pair of headphones or a meter indicates no signal. As the linesman passes the point of defect this cancellation no longer occurs, and a loud signal will be heard.

In some cases the two lines may not have the same impedance per length, and in addition the



secondary winding of the transformer may not be exactly center-tapped. This produces some signal even without a line fault. The schematic shows a modified form of the invention which eliminates this difficulty and produces an abrupt change at a fault. Three ganged switches are operated by a motor M so that they periodically change from one circuit to another. When the switch S is in the upper position (as shown) it connects the faulted line to the same transformer terminal as the unfaultered line. In the lower position the faulted line is connected to the opposite end of the winding. The input potentiometers are adjusted for correct voltage at V (about 50 volts) at each position of the switches and for equal input voltage either side of ground. The adjustment is necessary because the impedance of both lines together will differ from the impedance of only one line.

To detect a faulted point the linesman adjusts the potentiometers and as the motor operates there will be alternate periods of no signal and a loud signal so long as no fault exists. As the linesman passes a line defect there is an abrupt and very noticeable change in the signal character because no cancellation exists. Only a continuous signal is then heard.

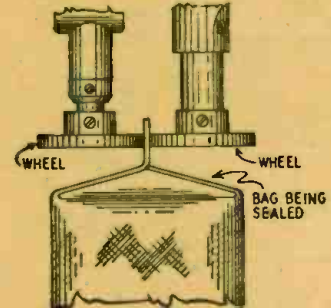
## ELECTRONIC SEWING

Benjamin W. Merz, Narberth, Pa. and Albert M. Schweda, Chicago, Ill. (assigned to Union Special Machine Co.) Patent No. 2,434,330

This instrument is designed to seal or "sew" electronically. Either one or both parts to be bonded may be a thermoplastic although this is not necessary.

A variable-speed motor controls 2 rotatable shafts, to each of which is fixed a wheel. Each shaft (and wheel) is insulated from the other, and each is supplied with r.f. power from a transmission line. Preferably, each line including shaft and wheel is a quarter-wave in length so that a potential loop exists at each wheel.

The material to be bonded may be in the shape of a bag or package. This bag is placed between the wheels which rotate in opposite directions, so that the bag is moved along between them. The r.f. energy produces heat between the wheels and causes the thermoplastic material to become



sticky. When the material is not thermoplastic, it is necessary to add a strip of film of thermoplastic substance between the sides of the bag. Again heat causes it to become sticky sealing the bag. The wheels and shafts should be of good heat-conducting material, otherwise the work (such as a bag) may overheat.

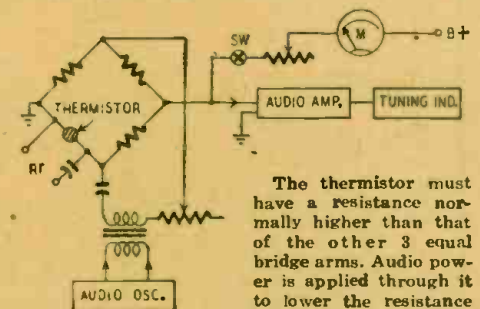
## POWER MEASUREMENT

George N. Kamm, Boston, Mass. (assigned to United States of America, as represented by the Secretary of War) Patent No. 2,432,199

For several years thermistors have found important use in power measurement. Because of their tiny size and high sensitivity to changes in heat, they can be used at very high frequencies to measure power in the order of microwatts where other methods are strictly limited.

As ordinarily used, the r.f. power heats the thermistor and lowers its resistance. If the element is removed from the r.f. circuit and measured on a bridge, the new resistance value will indicate the power dissipated in it. Special care must be taken since the bridge current itself may heat the thermistor.

In this new circuit the problem is much simplified. Since the thermistor forms part of a bridge during power measurement, the instrument becomes direct-reading and indicates continuously after a preliminary calibration.



The thermistor must have a resistance normally higher than that of the other 3 equal bridge arms. Audio power is applied through it to lower the resistance and balance the bridge.

This is indicated by absence of an audio signal through the amplifier. Then the d.c. switch SW is closed and current is adjusted for

$$I = 2 \sqrt{\frac{W}{R}}$$

through M. In this equation R is the resistance of the thermistor at balance and W, the power being dissipated in the thermistor, is also equal to the full-scale reading of the tuning indicator. With this current flowing through the bridge the amplifier gain is adjusted for full-scale reading on the indicator which may be calibrated in watts.

The instrument is now calibrated for power readings. The d.c. switch is opened, and the r.f. is applied to the thermistor through an isolating condenser. The calibration may be checked at intervals to eliminate errors due to changes in ambient temperature.

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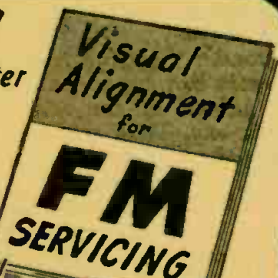
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# 'Scope Checks Car Radios

By WALTON N. HERSHFIELD

WHEN servicing car radios, time is often a very important factor, particularly when an irate tourist or a traveling salesman simply must have that radio repaired immediately. Several short cuts will speed up work when the serviceman is pressed for time.

The oscilloscope is now becoming an everyday item in the modern service shop. Its application to car radio servicing merely requires a certain amount of know-how.

Excluding tube failure, most car radio trouble is found in the power supply

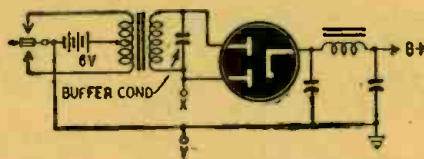


Fig. 1—Nonsynchronous vibrator power supply.

system. Because of the rugged construction necessary for car radios, considerable time is often required to open the radio, inspect the power supply, and diagnose the trouble. The power supply is often shielded, and to inspect it requires still more labor time. If the rectifier tube or vibrator can be removed from the socket, it is possible to check the power

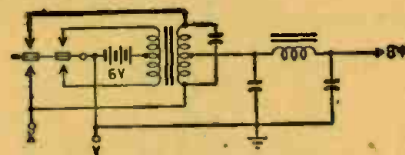


Fig. 2—The less common synchronous vibrator.

supply without opening the set further. Wrap a wire around either plate pin of the rectifier tube or in the case of a synchronous vibrator, connect the wire to one of the secondary pins of the vibrator. Take care to prevent the wire from shorting to ground, or serious damage to either the vibrator or transformer may result. Once the wire is in place merely connect the vertical plates of the 'scope between this point and ground.

For general reference, the circuit in Fig. 1 is a nonsynchronous power supply and Fig. 2 a synchronous one. The 'scope is connected between points X and Y on both circuits.

### Wave forms tell the story

Turn on the set and study the waveform from the rectifier or vibrator on the 'scope.

Fig. 3 shows an ideal vibrator wave shape. The distance a-b represents the duration of point contact; b-c represents

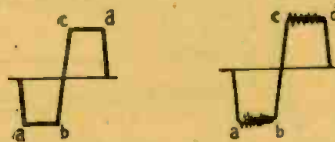


Fig. 3

Fig. 4

the time required for the vibrator reed to swing and contact the other point for time interval c-d; b-c also represents the amount of voltage change taking place in the vibrator transformer. Keep in mind that the horizontal axis represents time and the vertical axis voltage.

In Fig. 4 we see a ragged line for the point contact periods a-b and c-d. This means that the vibrator points are worn or pitted, and replacement is necessary.

The small notch at a and c in Fig. 5 shows insufficient buffer capacitance. If the buffer is open, the wave shape becomes like the dotted line, and the peak voltages become excessive. The vibrator points are rapidly ruined due to arcing caused by the absence of buffer capacitance to absorb the voltage surges when the vibrator points open.

In Fig. 6 excessive buffer capacitance is indicated by the lack of sharpness at points b and c. This indicates that the value of the buffer condenser is too large. A shorted buffer condenser causes the fuse in the radio to burn out; or if the fuse does not open, excessive current is drawn through the vibrator, the points become red hot and eventually fuse together. If a wave shape similar to that of the dotted line is observed on the 'scope, this is what has happened.

### Sells new vibrators, too

Since most vibrators have a vibration frequency of 120 cycles, a new vibrator can be checked and the horizontal sweep settings of the 'scope noted. After this

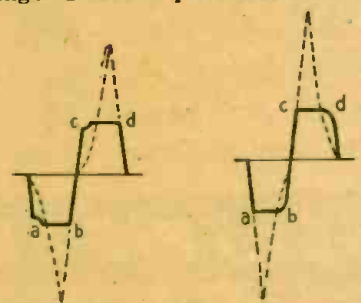


Fig. 5

Fig. 6

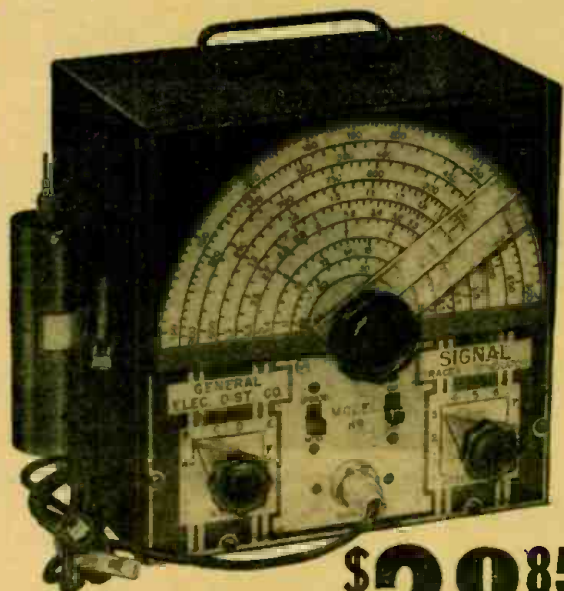
setting frequency changes from normal due to metal fatigue and loss of temper in the vibrating reed, are easily seen. Use only one complete cycle of the vibrator for comparison on the 'scope screen.

It is apparent that in many cases a vibrator with worn contacts or a leaky buffer condenser, can be found and replaced while the radio is in the shop for other repairs. This will help maintain the shop reputation for "keeping them fixed." The hum of the vibrator tells very little except in extreme cases. From the standpoint of sales it is often a good policy to invite the customer to the service bench to see the condition of his vibrator. For comparison plug a new vibrator into the socket to show the new and improved wave shape. The 'scope does the selling.



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The Model 88 comes complete with all test leads and operating instructions.

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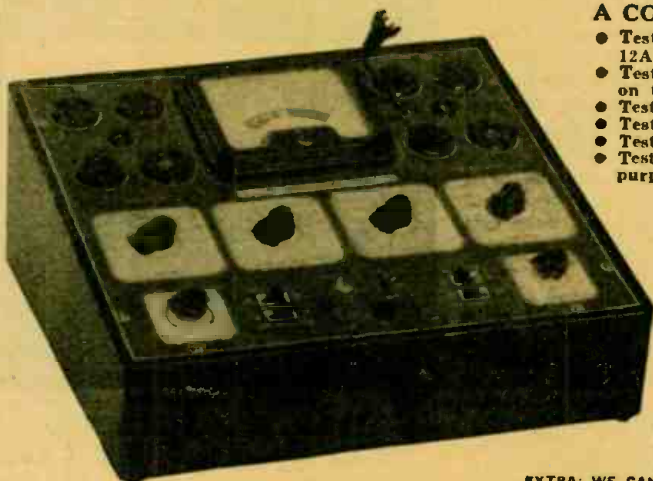
### Signal Generator Specifications:

- ★ Frequency Range: 150 Kilocycles to 50 Megacycles.
- ★ The R.F. Signal Frequency is kept completely constant at all output levels. This is accomplished by use of a special grid loaded circuit which provides a constant load on the oscillatory circuit. A grounded plate oscillator is used for additional frequency stability.
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- ★ Uses the new Sylvania 1N34 Germanium crystal Diode which combined with a resistance-capacity network provides a frequency range of 300 cycles to 50 Megacycles.
- ★ Simple to Operate—Clips directly on to receiver chassis, no tuning controls.
- ★ Provision is made for insertion of phones of any impedance, a standard Volt-Ohm Milliammeter or Oscilloscope.

## The New Model 60-T **TUBE & SET TESTER**



### A COMPLETE TUBE TESTER

- Tests all tubes including the new post-war miniature locals such as the 12AT6, 12AU6, 35W4, 50B5, 11723, etc.
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- 6 A.C. VOLTAGE RANGES:  
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- LOW RESISTANCE RANGE:  
0 to 2,000 Ohms (1st division is 1/10th of an ohm.)
- 2 MEDIUM RESISTANCE RANGES:  
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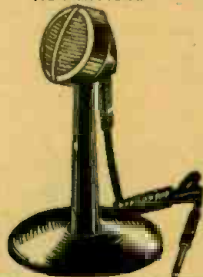
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1A5GT	59	7B6	44
1U5	36	7F7	49
1V	45	7Y4	44
1L4	55	7X7	44
1T4	69	7AF7	44
185	69	12A6	35
2A5	65	12A8GT	45
2A6	79	12AT6	50
2X2	79	12BA6	50
3A4	69	12BE6	50
384	69	12J5GT	49
5U4G	50	12J7GT	45
5W4GT	40	12K7GT	45
5Y3GT	40	12K8	65
5Y3G	42	12Q7GT	45
5Y4G	40	12SA7GT	40
5X4G	40	12SF7	39
6A7	50	12SQ7GT	40
6A8GT	49	12SK7GT	45
6AC5	98	12SR7	39
6AC7	65	12SJ7GT	55
6AK5	74	14A7	65
6AG7/6AK7	89	14B6	59
6B7G	55	24A	49
6C4	29	43	54
6C5GT	40	47	49
6C6	45	57	45
6C8G	37	58	45
6F6GT	45	71A	39
6H6	45	75	50
6H6GT	45	76	45
6J5GT	45	77	35
6J7GT	42	80	40
6K6GT	45	83V	99
6K7GT	49	85	49
6L6G	50	25L6GT	49
6Q7GT	47	25Z5	49
6S7	59	25Z6GT	45
6U7G	35	35W4	43
6V6GT	45	35Y4	43
6X5GT	49	35Z3	44
6SA7GT	44	35Z5GT	43
6SJ7GT	44	35L6GT	45
6SK7GT	49	35/51	49
6SL7GT	49	50L6GT	50
6SN7GT	49	117Z6GT	89
6SQ7GT	44	50B5	42
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# Renew That Cabinet!

BY HARRY LEEPER

WHILE your customer is unable in most cases to see replacements made in repair jobs, he or she will be quick to note improvements made on the radio cabinet. Such improvement tends to instill a pride of ownership in the customer as well as confidence in your ability and in the repairs hidden under the chassis. Appearance of the radio cabinet usually may be brightened and scratches stained by using a few inexpensive tools as illustrated below.

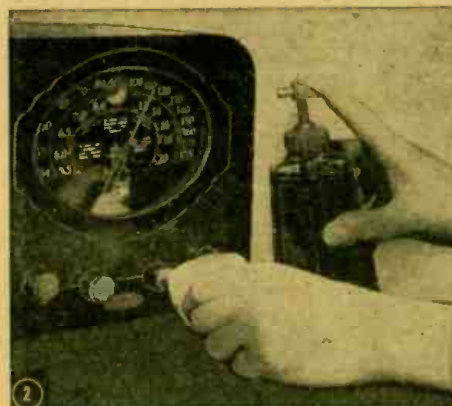


Photo 1. Dust from the speaker grille cloth and around the edges of the cabinet wood is quickly removed with a small brush picked up at the dime store.

Photo 2. Cleaning of glass dial faces is speeded up and done efficiently with liquid window cleaner used in a sprayer. The inside of the glass also should be cleaned while the chassis is out of the cabinet.

Photo 3. Stains and marks from various substances contacting the cabinet can usually be removed with light brushings of carbon tetrachloride.

Photo 4. Shallow scratches are easily treated with a *Scratch Stick* made by General Cement Co. The bare spot is first stained with the crayon end of the stick.

Photo 5. The stick is reversed and the oiled brush end is used. This works well with walnut and mahogany finishes. However, deep cuts may require application of regular liquid stain with a small brush.

Photo 6. The last step is the use of a good furniture polish over all the cabinet. A cloth should be carried in the tool kit and final polish given the cabinet after it is replaced in the customer's home.

## NAZIS USED WAR TELE

Television was used by the German military in experiments with guided missiles during the last war according to a report on TV progress by the Office of Technical Services, Department of Commerce. Civil television remained at a standstill during the war though programs were supplied to military hospitals until the transmitter was bombed.

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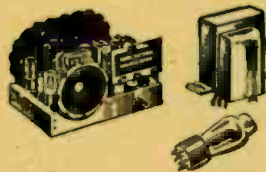


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## Six New Tubes

RCA has announced six new Tubes. Three of them, the "Special Red" 5691, 5692, and 5693—specifically designed for industrial and commercial applications requiring tube features of at least 10,000 hours life, exceptional uniformity and stability of characteristics, and rigidity to resist shock and vibration. The unique structural design of these tubes make them capable of withstanding impact shocks of 100g for extended periods.

The 5691, 5692, and 5693 are recommended in general as replacements for the 6SL7-GT, 6SN7-GT, and 6SJ7, respectively, in equipment where long life, rigid construction, extreme uniformity, and exceptional stability are needed, and where the operating conditions are within their ratings. Except for slight differences in characteristics, they are identical with their standard receiving-tube counterparts.

The "Special Red" Tubes are distinctive in appearance—the glass-octal types 5691 and 5692 have red bases and the metal type 5693 has both a red base and a red envelope.

The other three are beam power tubes of the miniature type. They are the 6AS5, 35C5, and 50C5.

The 6AS5 is intended for use in the output stage of automobile and a.c.-operated receivers. It is capable of delivering 2.2 watts at the relatively low plate and screen voltages.

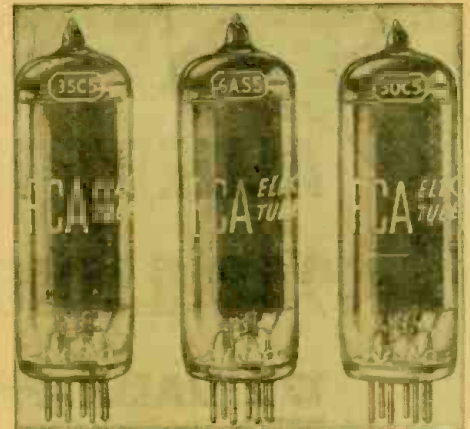
The 35C5 and 50C5 are designed for use in the output stage of a.c.-d.c. receivers. They are capable of providing 1.5 watts and 1.9 watts, output respectively, with only 110 volts on plate and screen.

Except for slightly higher voltage ratings, and a different basing arrangement, the 35C5 and 50C5 are the same as the types 35B5 and 50B5. They are also, within their maximum ratings, the performance equivalents of the 35L6-GT and 50L6-GT. The typical operation characteristics of the 6AS5 and the maximum ratings of the 35C5 and 50B5 are shown in the following tables:

6AS5		
Heater:		
Voltage (a.c. or d.c.)	6.3	Volts
Current	0.8	Ampere
Typical Operation:		
Plate Voltage	150	Volts
Grid No. 2 Voltage	110	Volts
Grid No. 1 (Control-Grid) Voltage	-8.5	Volts
Peak AF Grid No. 1 Voltage	8.5	Volts
Zero Signal Plate Current	35	Milliamperes
Max. Signal Plate Current	36	Milliamperes
Zero Signal Grid No. 2 Current (Approx.)	2	Milliamperes
Max. Signal Grid No. 2 Current (Approx.)	6.5	Milliamperes
Transconductance	5600	Micromhos
Load Resistance	4500	Ohms



The "Special Red" long-life filament tubes.



Miniature output tubes 35C5, 6AS5 and 50C5.

Total Harmonic Distortion	10	Per cent
Max. Signal Power Output	2.2	Watts

35C5		
Maximum Ratings, Design-Center Values:		
Plate Voltage	135	max. Volts
Grid No. 2 (Screen) Voltage	117	max. Volts
Plate Dissipation	4.5	max. Watts
Grid No. 2 Dissipation	1.0	max. Watt
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	180	max. Volts
Heater positive with respect to cathode	180	max. Volts
Bulb Temperature (at hottest point on bulb surface)	250	max. °C

50C5		
Maximum Ratings, Design-Center Values:		
Plate Voltage	135	max. Volts
Grid No. 2 (Screen) Voltage	117	max. Volts
Plate Dissipation	5.5	max. Watts
Grid No. 2 Dissipation	1.25	max. Watts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	180	max. Volts
Heater positive with respect to cathode	180	max. Volts
Bulb Temperature (at hottest point on bulb surface)	250	max. °C

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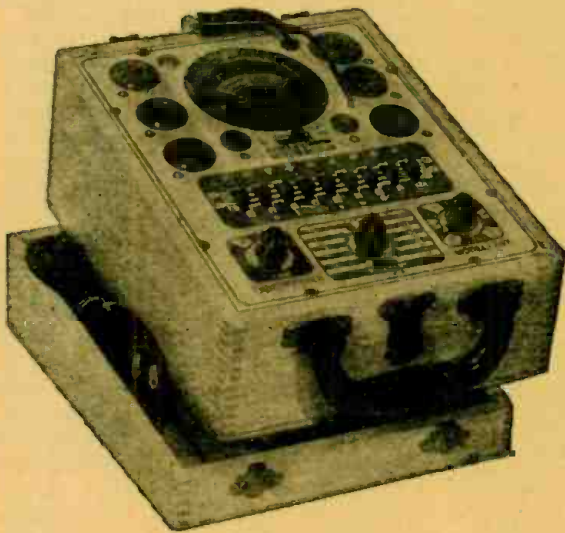
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Incorporates a newly designed element selector switch which reduces the possibility of obsolescence to an absolute minimum. Any pin may be used as a filament pin and the voltage applied between that pin and any other pin, or even the "top-cap."

The new free-point system described above permits the Model 247 to overcome the difficulties encountered with other emission type tube testers when checking Diode, Triode and Pentode sections of multi-purpose tubes, because sections can be tested individually when using the new Model 247. The special isolating circuit allows each section to be tested as if it were in a separate envelope.

The Model 247 provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals. Continuity between various sections is individually indicated. One of the most important improvements, we believe, is the fact that the 4 position fast-action snap switches are all numbered in exact accordance with the standard R. M. A. numbering system. Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.



### The New Model 650 SIGNAL GENERATOR

RANGE

100 Kilocycles to  
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THE MODEL 670 COMES HOUSED IN A RUGGED, CRACKLE-FINISHED STEEL CABINET COMPLETE WITH TEST LEADS AND OPERATING INSTRUCTIONS. SIZE 5 $\frac{1}{2}$ " x 7 $\frac{1}{2}$ " x 3".

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## TUBELESS HOMO-HETERADIO

(Continued from page 23)

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to  
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### THE NEW NC-108 FM TUNER-RECEIVER

Now...National offers an 88-108 Mc. band FM tuner-receiver designed to meet the most exacting demands of high-fidelity enthusiasts! Flat from 50 to 18,000 cps,  $\pm 2$  db, the new NC-108 may be connected to your amplifier or the phono input of your radio. Built-in speaker, audio output stage and tone control also permit use as separate monitoring receiver. Built to National's famous standards of quality, the NC-108 is worthy of the finest in amplifiers and speakers. Nine tubes plus rectifier and tuning eye.

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slightly out of step, will at certain times reinforce, at others neutralize each other. This alternate reinforcement and neutralization takes place at a frequency which is the *difference* between the two frequencies. Thus, by *heterodyning* an inaudible 500-kc signal (for instance) with an equally inaudible one of 501 kc, an audible 1-kc (1,000-cycle) note is produced. This principle is still the standard method of receiving continuous-wave telegraph signals.

In the Heteradio, the supersonic sound frequency is adjusted to *exactly* the carrier frequency of the incoming wave. For example, to receive a station on 1,000 kc, the sonic generator is set to that frequency. It is then at *zero-beat*, and as long as the carrier is unmodulated, nothing will be heard. As soon as modulation is applied, *sidebands* appear above and below the carrier, and these are heterodyned by the siren. For example, if a 100-cycle note is sounded on an instrument at the 1,000-kc station, a frequency of 1,000,100 and 900,900 cycles appears as well as the original 1,000-kc (1,000,000 cycles) of the carrier. The siren heterodynes with both of these to produce a note of 100 cycles. A symphony orchestra is reproduced in the same manner. See Fig. 1 page 23.

Since the strength of a signal reproduced by the heterodyne method depends on the product of the received and the heterodyning signal, the power output can be made very great by selecting a siren of desired size and output.

Now, when the proper adjustment is made on the Heteradio rheostat a point will be reached where the supersonic siren waves will clash with the radio frequency waves. A careful adjustment is made with the rheostat whereby the siren waves will be at *dead beat* with the radio waves. The result now becomes audible through the sound loud speaker cone shown in illustration, page 22.

This siren draws its air supply from a horn-shaped collector which is turned in the direction of the broadcast station. As pointed out, the molecules of air are acted upon by these waves, actually being set into mechanical motion. Thus the air stream drawn into the siren is actually modulated with the program transmitted by the station.

This sounds much more complicated than it actually is and once you understand the theory you will ask yourself why it had not been done long before. The answer is that, like all important inventions, no one had thought of it before.

I next calibrated my rheostat to read not in the speed of the motor, but in kilocycles as shown in the illustration. To tune the set to receive the various stations, I merely turn the rheostat from one point of the scale to the other. In this way I can do fine tuning so that whatever broadcast station I wish to get, I tune in, just as I would tune any regulation radio set—it is that simple.

The housing which contains the motor

and the siren is formed from a plastic shield. The housing thus becomes a wave mixer. In order to get the maximum effect—since my sound collector is highly directional—I revolve the entire housing with its two cones by means of gears attached to a dial. Thus the wave apparatus can be rotated through 180 degrees around its axis. At certain points radio broadcast stations will come in much stronger than at others, as would be expected. The same thing occurs with a standard portable radio that has a loop aerial; stations will come in better in one position of the set than in another.

My mechanical radio receiver works in a like manner. I had no difficulty in bringing in all the local stations after I had built in certain refinements in my wave apparatus.

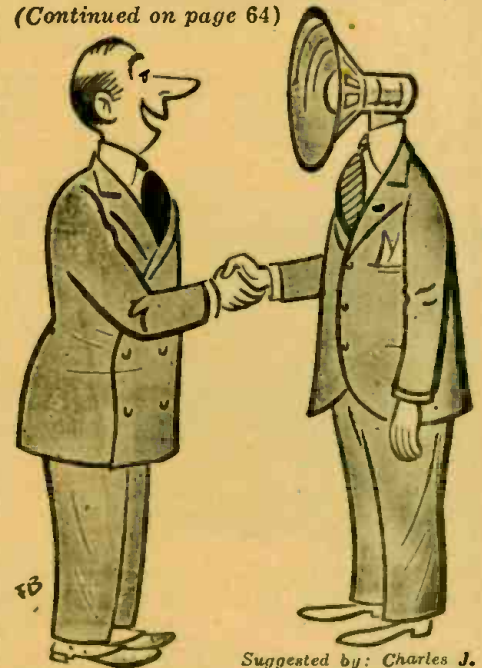
In order to show how the wave action works out in practice we have added a diagram which explains the Homo-Heterodyne feature. See page 22.

You may ask: where is the volume control? There isn't any, except the rotating control that spins the wave apparatus on its axis. At the best point on the compass the sound issues loudest. At right angles to this, the volume is weakest.

How loud is the loudest station? Not quite as loud as a regulation radio set, but good enough to hear the stations all over the room. If more intensity of sound is required it would be necessary to build a somewhat larger siren in order to obtain more volume. That is the only way that sound intensity can be increased with the Tubeless Homo-Heteradio.

You will appreciate that the set described here is one of my early models and that other refinements will come

(Continued on page 64)



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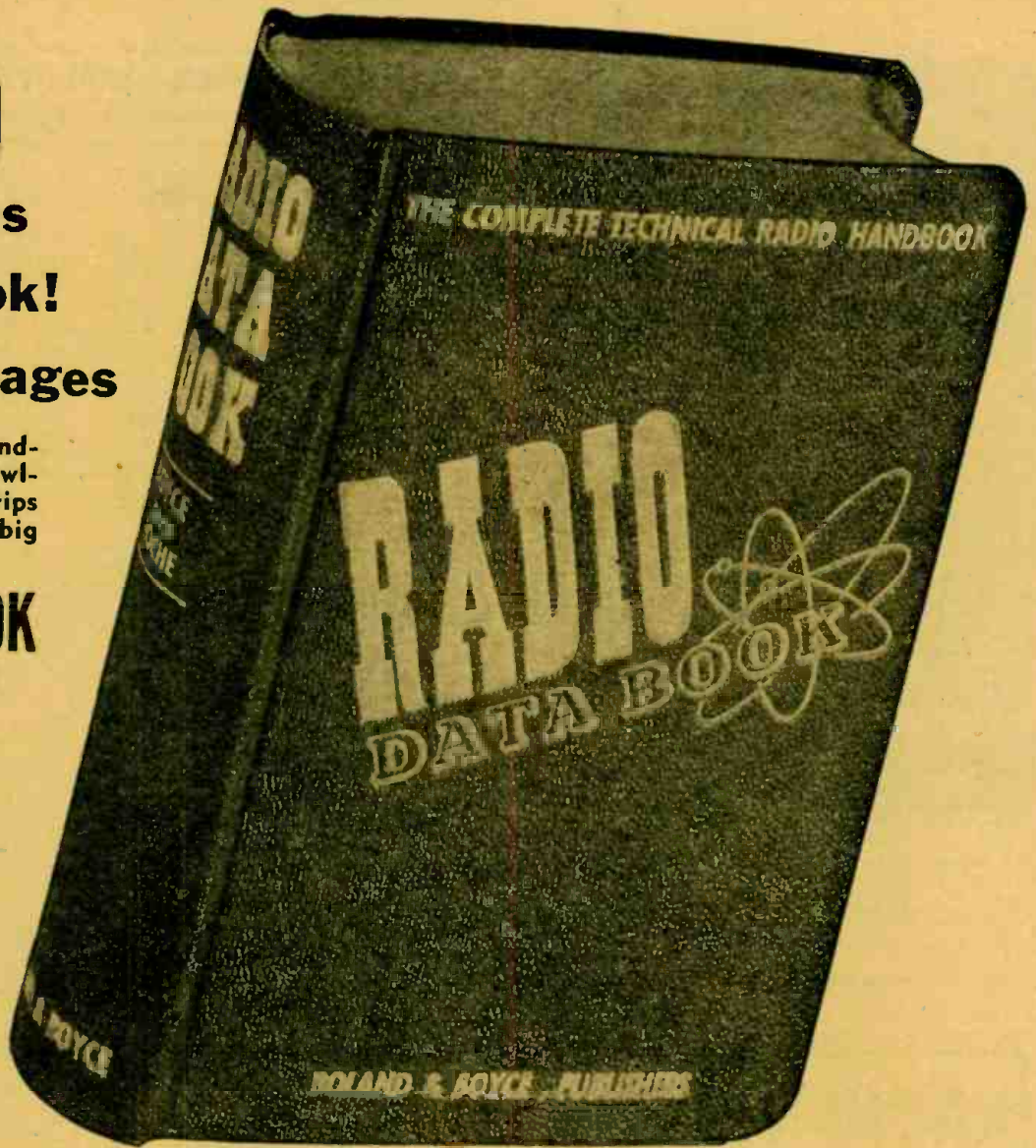
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## TUBELESS HOMO-HETERADIO

(Continued from page 62)

later. Note that the receiver which I have shown in these pages is purely experimental and does not represent a model such as will be built later and sold to the public.

Here are a few things that I must mention, in connection with the Homo-Heteradio.

Experimenters building this receiver will have to be very careful because at a certain point in the supersonic spectrum one runs right smack into an unknown field. There are human risks in the supersonic siren.

These were recently reported by Drs. C. H. Allen, H. Frings, and I. Rudnick, of the Pennsylvania State College.

While the siren cannot be heard by human ears, after a while, a person close to it gets dizzy. At certain supersonic speeds the sound kills insects by overheating their bodies. Indeed, at certain frequencies the siren heats anything the sound blast touches.

I had no trouble with my own siren because it runs at far greater speed than the normal supersonic whistles or sirens. But, if you experiment with it, necessary caution must be taken.

I must further report an incident which greatly grieves me and which shows once more that the path of the pioneer is not easy nor strewn with roses. I was asked to give a lecture on my new tubeless radio invention before a number of radio manufacturers at the New York State Radio College recently. A big crowd had assembled to listen to my revolutionary new radio receiver and

after a successful demonstration there was a tremendous amount of excitement among the milling crowd, who closely inspected my Tubeless Homo-Heteradio.

In order to answer a number of questions, the audience was seated again, while I proceeded to the blackboard in order to explain certain technical phases of the Heteradio.

In the midst of the lecture I was shocked beyond words when suddenly someone started to shoot at my Heteradio which was standing on a table at my right. It seems the madman had concealed a machine gun and it only took a few bursts to wreck every vestige of a receiver. I then heard of angry talk that a receiver of this type would certainly wreck the entire radio industry.

Evidently some fiend who thought I would take away his livelihood was bent on killing me, so I promptly took refuge under the table near the blackboard. Just then another round of bullets whizzed above me. There ensued a panic in the audience and in a few seconds the hall was cleared.

After a few minutes I ventured from my hiding place beneath the table. Just then there was another sound of something falling down—right beside me. I looked around, but there was no one in sight. Shaking and stupefied at the near tragedy I picked up the object that had fallen from the wall. It proved to be a large leaf calendar, such as used in schools. I picked it up gingerly. It had been riddled with bullets, but the date still remained intact. Mockingly it read:

APRIL 1.

## TINY SELF-POWERED ELECTRONIC VOLTMETER

(Continued from page 24)

little device, voltage multiplier and signal tracer probes were constructed. The voltage multiplier probe (Fig. 2) extends the range up to 5,000 volts, multiplying the existing ranges 10 times. With this probe, the effective input resistance is 75 megohms. The signal tracing probe (Fig. 3) makes it possible to use this instrument for simple r.f. and a.f. measurements. It cannot be used for exact a.c. measurements since the rectification efficiency of a crystal diode probe is not constant for varying voltages, and the d.c. output is not proportional to the a.c. input. Nevertheless it is very useful for making comparative gain measurements and checking antenna efficiency. For best results, voltages measured with this probe should not exceed 50. The effect of plate current on the meter is neutralized by applying some of the filament voltage across it through the 1,000-ohm potentiometer. The potentiometer is varied till the

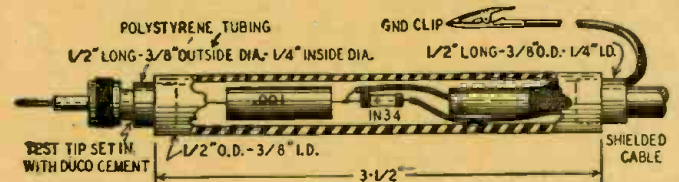


Fig. 3—This probe makes a signal tracer out of the v.t. voltmeter. The 1N34 rectifies radio and audio frequency at all signal levels.

meter reading is reduced to zero.

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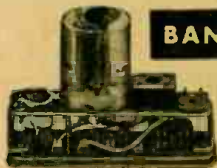
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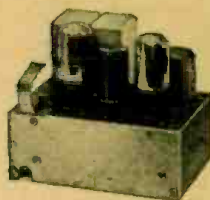
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**INTRUDER ALARM**

(Continued from page 25)

age appears on its grid as negative bias. Under normal conditions, the 50L6 plate current is just sufficient to throw the relay.

A 50,000-ohm, wire-wound control permits the screen-grid voltage to be varied from 90 to about 115, thus controlling the sensitivity of the unit by varying the amplification of the 50L6.

When anyone nears the feeler, the oscillator is detuned and the plate current rises, producing a greater voltage across R1. The 50L6 plate current is cut off or reduced to a point where the relay drops out, opening or closing the external alarm or control circuits connected to the relay contacts.

The relay is an 8,000-ohm, s.p.d.t. unit designed to close at 3 ma and open at 0.6 ma. It was made by Sigma and is a popular surplus item. Its armature and movable contact are connected to the frame, so we mounted it on insulating material before fastening it to the chassis. Other relays of equal sensitivity will work just as well, of course. Remember that the relay is tripped under normal operation. If you want an external circuit to close when the capacity relay operates, the plate relay should have normally closed or double-throw contacts. Contacts on sensitive relays are seldom designed to carry more than 1 amp; use an auxiliary relay if heavier current flows in the controlled circuit.

The unit was built on a 7 x 4 x 2-inch metal chassis. The third tube shown in the photograph is not used. The chassis was left over from previous experiments, so a dummy was plugged into the empty socket to improve the appearance of the unit. The electrical circuit is isolated from the chassis to avoid possibility of shock. Some constructors may find it advisable to shield the entire control unit so the relay will not trip when you approach it.

**Operation and adjustment**

When the unit is wired and checked, turn it on and measure the voltage between the 12J5 grid and the bottom of the oscillator coil. Be sure to use a v.t.v.m. or sensitive d.c. voltmeter—20,000 ohm per volt or better. Voltage at this point indicates oscillation. We measured 5 volts at this point with a v.t.v.m., but voltage varies with different tubes and operating conditions.

(If the oscillator is adjusted to about 550 kc, you can check for oscillation by listening for the fundamental or harmonics on a near-by broadcast set.—Editor)

With C1 at full capacitance, resonate the plate circuit. Resonance can be indicated by temporarily connecting a low-range d.c. milliammeter between the plate coil and R1.

If the relay has adjustable contacts, adjust them so there is very little space between the armature and fixed contact when the relay coil is excited. This adjusts the plate relay to its most sensitive point.



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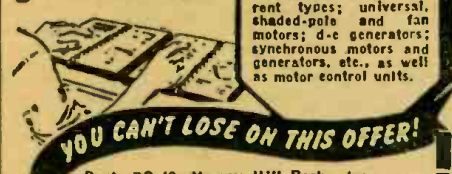
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Attach the antenna or feeler, and open C1 slowly until the relay armature is attracted. Keep away from the feeler when making this adjustment.

When the unit is properly adjusted, there is about 35 volts of bias on the 50L6. When anyone approaches the feeler, this voltage rises to about 40, cutting off plate current and releasing the relay. These voltages vary slightly with different tubes, so try different ones if you have trouble with the circuit. Other combinations of tubes can be used by selecting the proper filament dropping resistor.

### TRANSATLANTIC NEWS

(Continued from page 38)

important aids to radar mapping. Thanks largely to the miniature radio tube, it is now so small and light that the ground survey parties can transport and install it, even in the most difficult country—and a small number of radio beacons, accurately placed, makes it possible to survey a vast tract of land from the air.

### Table lamp radio

The latest type of invisible home radio hails from France. It looks exactly like any ordinary table lamp, with a frilly silk shade. But built into the pedestal is a 3-tube superheterodyne. The loud-speaker (concealed by the shade) is just below the light-bulb socket, and the wire frame supporting the shade forms the antenna. The set is intended only for local reception. A single small knob operates preset tuners to give a choice of 5 stations. The idea of a table lamp radio is not new. I recall reading about 25 years ago in an American magazine an article called "Reading by Audion Light." It describes a receiving set, using the original battery-operated audions, made in the form of a hanging lamp. The 5 tube sockets were arranged so that the tubes were upside down and threw all the light from their filaments on to the table below. As the audions were bright emitters requiring about 3/4 amp at 4 volts for their filaments, the 15 watts consumed by the 5 tubes in the set should have given the ingenious inventor quite a reasonable amount of light for his reading.

The French government levies a tax on all radios—500 francs on the first one, and 100 francs for each additional set. In return it is responsible for eliminating all sources of noise interference from the radio. Thirty technicians—members of the government's "parasitic service"—cover Paris and the surrounding area to check on all reports of interference. About 7,000 investigations are made each year.

Locating the trouble is not easy, since all electric conductors and appliances are possible transmitters of parasitics. Frequently, the interference comes from a doctor's old-fashioned diathermy machine or an electric razor. The owners of these noisemakers are legally subject to fines and imprisonment, but those who refuse to correct abuses are the most likely to be punished.

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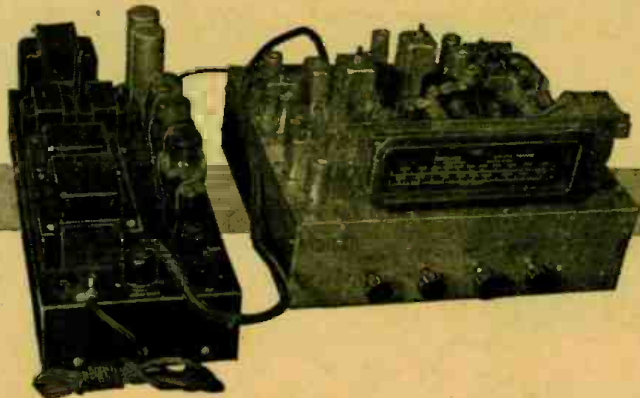
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Audio fidelity, flat within plus-minus 2db. from 50 to 15,000 CPS.

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Hum level, 65 db. below full output.

Sensitivity, less than 20 microvolts.

Phonograph Input, compensated for either magnetic or crystal pickup.

Tone Control, combination control provides bass boost up to 11db. at 40 CPS and treble attenuation up to 13db. at 10,000 CPS.

Power Supply, 105 to 125 volts, 50-60 cycle. Consumption, 190 Watts.

Tube complement, 3 type 6SK7, 1 type 6SA7, 1 type 6H6, 5 type 6AG5, 1 type 6C4, 2 type 9001, 1 type 6AL5, 2 type 6J5, 1 type 6U5/6G5, 1 type 6SN7GT, 2 type 6L6, 1 type 5Y3G and 1 type 5V4G.

Chassis Weight, tuner, 18 pounds, amplifier, 27 pounds.



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**CORRECTION:** The grid of V120A in the RCA 630TS Televiser Schematic, January, 1948, page 49, should be connected to pin 1, not pin 4 as shown.



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### tone control (Continued from page 35)

low end or the high end? Aren't tone controls desirable to compensate for unbalance in other parts of the system?" That argument is right and proper, so I shut up.

I breadboarded. I spent my evenings for some time reading up on controls, trying them out and wondering what made them work. Finally I saw what was going on. All I wanted was an a.c. voltage divider that used reactances in one leg. Something that would give a different ratio at one frequency than at another.

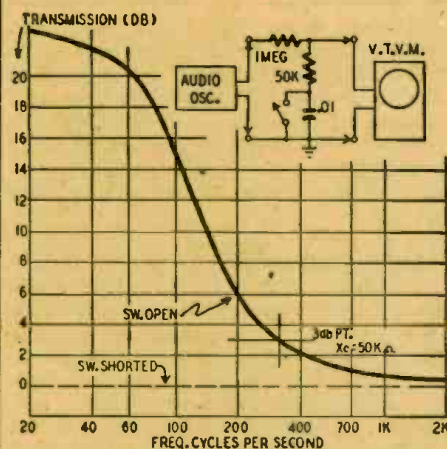


Fig. 2—Operation of the bass-boost circuit.

This is what I ended with: Fig. 1 shows the basic circuit for lows. Close the switch and you have a normal voltage divider.

$$\text{Output is } \frac{R2}{R1 + R2} \times \text{input.}$$

Now let's open our switch—the condenser then comes into the circuit. At low frequencies the reactance is high and we have an output:

$$\frac{\sqrt{R2^2 + XC^2}}{\sqrt{(R1 + R2)^2 + XC^2}} \times \text{input.}$$

We can easily pitch that anywhere we want by juggling the size of C and R2. We will end with a curve like Fig. 2. The bass rise will start up and be 3 db where the reactance of C equals R2. It will go up at a rate that approaches 6 db per octave until it starts to level off. The leveling-off spot (3 db from the top) will be where R1 equals the impedance to ground or  $(R2^2 + XC^2)^{1/2}$ .

O.K. you say, but you're still not boosting the bass! You're just cutting down the treble. That's right, but you don't have to look at it that way. You can say this is a filter with an insertion loss of N db. When the switch is flipped, you get a bass boost of 0.8N db. Try it and see. You can make the resistors 1 meg and 50,000 ohms, which will give an insertion loss of 26 db and a bass boost of approximately 20 db (when you flip your switch). Make C a .01-μf condenser, and the bass rise will start around

400 cycles and go up very nicely. What's that? You want smooth control and not 20-db boosts? Okay, take out the switch and put in a potentiometer. Try a 500,000-ohm pot and see how nicely you can bump up the bass in your radio programs.

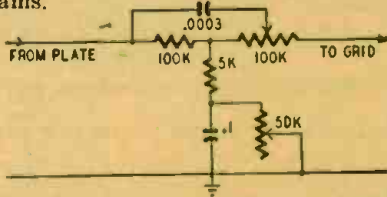


Fig. 3—A treble boost condenser is included.

How about treble? Easy! Now we want a series condenser instead of one to ground. Let's put an isolating resistor at the output of our bass booster and run a condenser across it to the input of the next stage. Since we have pretty high resistances it will have to be a small condenser to have just the highs affected, so let's cut everything down by 10. We can use a 100,000-ohm, series-dropping resistor, 5,000 ohms in the leg to ground and, a bass condenser of 0.1  $\mu$ f. Then let's use another 100,000 ohms to isolate the back end, and fool around with different-sized condensers for the treble. A .0003 mica seems about right. The treble rise begins around 2,500 to 3,000 cycles. Amazingly enough, that's where the reactance of the .0003 condenser equals the 200,000 ohms in parallel with it. Fig. 3 shows how it works.

That one can be made smoothly adjustable too. Let's make the isolating resistor a 100,000-ohm variable. Then the condenser will slide back to where our bass-boost voltage divider will keep any highs from getting through, or slide up toward the next grid where our highs will pound out like mad.

Here's something to remember: if you keep your resistances and reactances in the same proportion, you can multiply your constants by 10 or 1/10 or anything else. That means you can juggle things around to suit varying conditions. If this circuit is to follow a triode with low plate impedance, keep the 100,000 ohms, 0.1  $\mu$ f, and 5,000 ohms. If you are using a pentode, you'll lose gain with it because a pentode likes a higher load resistance. O.K. then, change to 1 megohm and .01- and 50,000-ohm values. It'll still act the same. If you want your bass or treble boosts to come lower in the audio band, just increase the capacitance a bit; if you want higher boosts (louder, I mean), juggle your resistance ratio. I prefer these sample values because they suit my ear and my turntable rumble. Don Lee put out something like \$1,500 for his turntables because he wants the rumble to be very low. Us guys with our \$10 motors—we can't boost our bass too much or we listen to rumble instead of music. Don't forget, too, that we are throwing away gain with this business. We throw away 26 db with these constants and get about 20 db back at the extreme ends of the band. Our middle is still down 26 db. So let's plan on having an extra 26 db of gain somewhere else in our system.

(Continued on page 72)



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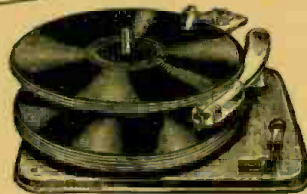
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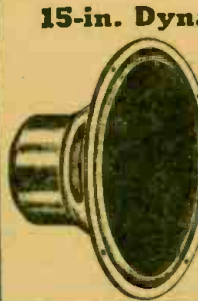
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#### TONE CONTROL

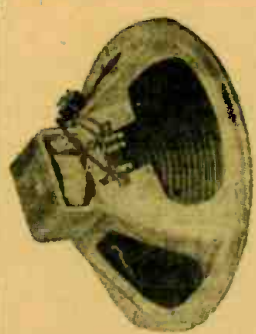
(Continued from page 71)

Another thing. This whole system merely illustrates a method of correcting tone. You can use any part of it anywhere in an amplifier if you keep your levels and impedances in mind. To get 1 volt out at 1 kc, you have to put in 21 volts. So don't try to get 20 volts out. Not many tubes will put 400 volts in. Also if you run in a millivolt, you'll get only about 1/20 millivolt out; and that's pretty low, and you may have troubles with hum.

The hum has to be kept down with any system that boosts bass. You can shield your early filaments or even use d.c. if the level is very low and you want a lot of bass. Care in layout and wiring is most important. A 100-ohm potentiometer across the filament leads with the center to ground is handy. Most filament center taps aren't at the center, and you can balance out hum beautifully with a potentiometer. This was standard practice in the old receivers which used 26's and 45's in the audio end, and some of them had pretty good quality!

We arrived at this particular system by trial and error and fooling around. Others have also arrived at it. In case you never ran across it or in case you never understood it—here it is. The controls are completely independent of each other, and you'll be pleased with the way it works.

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(Continued from page 40)

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97.3	WKWK-FM	Wheeling, W. Va.
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97.9	WMAR-FM	Baltimore, Md.
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98.1	WFNC-FM	Fayetteville, N. C.
98.1	WSAL	Saginaw, Mich.
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99.5	KRIC-FM	Beaumont, Texas

FREQUENCY (MC)	CALL	LOCATION
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99.5	WABF	New York, N. Y.
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99.9	KMYC-FM	Marysville, Calif.
99.9	KVEC-FM	San Luis Obispo, Calif.
99.9	WBT-FM	Charlotte, N. C.
99.9	WCLO-FM	Janesville, Wisc.
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99.9	WHFB-FM	Benton Harbor, Mich.
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99.9	WSAN-FM	Allentown, Pa.
99.9	WTRT-FM	Toledo, Ohio.
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00.1	WLBK-FM	Lebanon, Pa.
00.1	WMUS-FM	Muskegon, Mich.
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00.3	KMPC-FM	Hollywood, Calif.
00.3	KSL-FM	Salt Lake City, Utah
00.3	WACE-FM	Chicopee, Mass.
00.3	WCLT	Newark, Ohio
00.3	WGBG-FM	Greensboro, N. C.
00.3	WHO-FM	Des Moines, Iowa
00.3	WMGM-FM	New York, N. Y.
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(Continued on page 79)

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**RADIOMEN, SERVICEMEN, BEGINNERS — MAKE** more money, easily, quickly. \$250 weekly possible. We show you how. Information free. Merit Products, 216-32L, 182nd Avenue, Springfield Gardens 13, New York.

**PHONOGRAPH RECORDS 20c. CATALOGUE.** Paramount, KQ-313 East Market, Wilkes-Barre, Penna.

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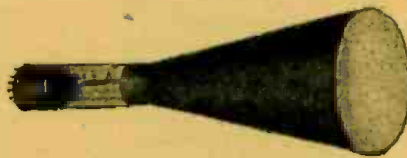
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## THE RADIOMAN EXPANDS

(Continued from page 20)

"Your business methods are sound, your deposits have shown an above-average increase, and we are willing to supply the financial aid required." Need more be said? From the jobber, "The outlook for your type of service looks good. Go ahead." From the businessmen, "We wouldn't be expanding ourselves if we didn't think it wise."

Once the decision to expand has been made, don't become overly optimistic, because the work has only just begun. The next step should be to determine which facilities need to be expanded and to what extent. In our individual case, we own our present building, which was built to our specifications immediately following the close of the war (see RADIO-CRAFT, March, 1947). The size of this building was determined entirely by the amount of materials available at the time and was necessarily smaller than we desired. However, we kept the thought of future expansion in mind, and designed this original structure in such a way that future additions would not detract from the unique features incorporated in it.

A review of our records showed us that our auto radio service was growing by leaps and bounds. This meant that to continue to handle this service on a year-round basis drive-in facilities would have to be incorporated in our new building. This drive-in had to be arranged so that it would not interfere with the floor space required for additional shops in which to house our rapidly growing personnel. Our final plan called for drive-in space to handle three autos under cover and three glassed-in service shops identical to the one in our original building.

The next step was to prepare detailed scale floor plans and specifications. We were fortunately able to prepare these ourselves, thus saving architectural expenses and also assuring us that our windows, lighting fixtures, and structural supports would be placed where we wanted them. At this point, it began to look like the deck hadn't been shuffled very well because the next two cards we drew were jokers. These jokers were in the form of estimates prepared from identical plans and specifications. One for slightly over \$4000, the other a few dollars under \$2000. Again we called upon our friend, the banker, for advice. He assured us that both men were of equal integrity and ability so we chose the lower bid of the two. We later learned that the contractor submitting the higher bid maintained his own material supply yard with several employees here and a large clerical staff to prepare his cost estimates, while the other one worked from his home and all of his employees were "on the job workers."

After the contractor moves in you might feel that your worries are over, but you have many headaches in store yet. Material shortages, delays, bad weather, and many other unforeseen problems continue to arise.

But eventually everything is completed. You at last relax in an easy

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chair, place your feet on the desk, and doze into a dream of what a nice little business you have when suddenly you are rudely awakened by the thundering calm that has descended on the old place. A quick survey shows you that with extra floor space, added employees, and increased efficiency, the boys are no longer dashing around at a mad pace but are actually hunting for a job to do. It is then up to you to expand your business as well.

Here are a couple of methods we have used to good advantage in securing new business as well as holding our old customers. Your remodeling or building program is news to your community, so avail yourself of the free reader publicity that your local paper will carry for you if you give them your plans and an outline of your expanded service in your locality. The following business promoter has more than paid for itself in the three months that we have had it in operation. We purchased 14 small table model radios of a well-known brand and offered a free loan service to our customers while their radio is under repairs. All of our advertising carries the catchy phrase "uninterrupted listening pleasure, you may use our radio while yours is being repaired."

Here's how it works. We charged the initial cost of these radios to equipment. They are not offered for sale, and the tag on each radio plainly states this fact. However, the basic laws of psychology tells us that the general public wants something they can't have. This results in a great number of sales with no effort on your part. When one of these radios is sold, it is immediately replaced. The profits from this sale are placed in an equipment reserve and used to maintain these radios.

### HI-FI 35-WATT AMPLIFIER

(Continued from page 33)

the special feedback winding. (The Stancor A-3851 and Thordarson T-17S13 are examples.) It should be rated at 35 watts at least. Plate-to-plate impedance should be 6,600 ohms.

The amplifier is built on a 12 x 17 x 3-inch chassis. Controls from left to right are: master gain, No. 1 microphone gain, No. 2 microphone gain, phono gain, radio gain, treble control, and bass control.

Point-to-point wiring is used throughout, with all components securely fastened to the chassis. All controls and input leads are shielded to keep hum pickup at a minimum. All circuit values were carefully calculated and should be adhered to if duplicate results are to be expected.

In actual operation, music and speech are reproduced with a clarity seldom heard in an ordinary public address system.

Readers will note that manufacturers do not recommend the use of 6L6's at the ratings given in this article, though such ratings have been deemed permissible in the past. Cautious constructors might reduce voltages to bring power output down to about 25 watts or—possibly even better—use 807's in place of the 6L6's.



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1A7GT	1.10	6AK5	.69	6Y6G	.89	37	.69	804	6.75
1B24	2.49	6AL5	.99	6X4	.98	38	.89	805	3.75
1B38	4.50	6AQ5	.98	6X5	.89	39/44	.59	807	1.25
1G4	.98	6AT6	.75	7AE7	.75	41	.69	808	2.95
1G5	.44	6AU6	.89	7B7	.69	45	.64	809	1.50
1G6	.98	6B4	1.29	7C4	1.50	47	.90	810	5.95
1H4G	.98	6BB6G	.89	7C5	.89	50B5	.89	811	1.95
1L4	.89	6B8	.99	7F7	1.25	50L6GT	.75	812	3.15
1R4/1294	1.29	6BG6	3.49	7L7GT	1.39	70L7	.89	812H	6.90
1T4	.58	6C4	.64	10Y	.69	71A	.69	813	5.95
1H5	.99	6C5	.51	12A6	.89	75	.69	814	4.39
1N5GT	1.10	6C6	.75	12AH7	2.39	75T	2.39	815	2.25
1L5	1.92	6C21	12.95	12AT6	1.10	77	.75	826	1.75
1R5	1.10	6D4	.89	12BA6	.89	78	.75	829A/B	2.95
1S5	1.10	6D6	.49	12BE6	.89	79	1.10	830B	5.25
2A3	1.39	6FA	1.39	12C8	.89	80	.53	832A	2.25
2C22	.69	6F5	.51	12H6	.44	82	.98	833A	34.50
2C26A	.75	6F6	.79	12J5	.69	83V	.89	836	1.15
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2JB51	4.95	6K8	.49	12SR7	.79	215A	3.00	884	.75
2X2	.69	6K7	.59	12X3	.98	217C	2.50	923	.49
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3B7	.98	6L6	1.25	14B7	1.10	304TL	2.49	955	.49
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3Q4	1.10	6Q5G	.98	23D4	.49	394A	4.50	991	.50
3Q5GT	.58	6Q7	.98	23D6	.98	417A	19.95	1005	.39
3S4	4.25	6R7	.89	24G	.89	446A	1.25	1006	.39
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5Y3	.60	6SL7	.89	34	.98	723A/B	5.50	1626	.49
5Y4G	.58	6SN7GT	.69	35L6GT	.75	725A	12.50	1629	.59
5Z3	.89	6S07	.89	35Y4	1.10	725A	12.50	1631	1.49
5Z4	.89	6SR7	.89	35W4	.69	800	2.25	1631	1.49
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**RADIO SET AND SERVICE REVIEW**

(Continued from page 30)

at the spot where signal is strongest. The antenna is oriented by turning the set on its side so the telescopic antenna is horizontal. The set is given a quarter-turn in each direction and the meter reading noted. The dipole should be mounted parallel to the antenna of the set for maximum signal.

Fig. 2 shows how reflected and direct signals may aid and oppose each other at the receiving antenna. Each serrated section represents one wave length. The direct and reflected signals are in phase at A, and the signal is strongest. At B, they are out of phase—do not arrive at the antenna at the same time, as indicated by the unequal wave-length sections—and the signals cancel to create a dead spot or minimum-signal area. This condition is most serious in television, where it causes ghosts, but may have a decisive effect on FM reception.

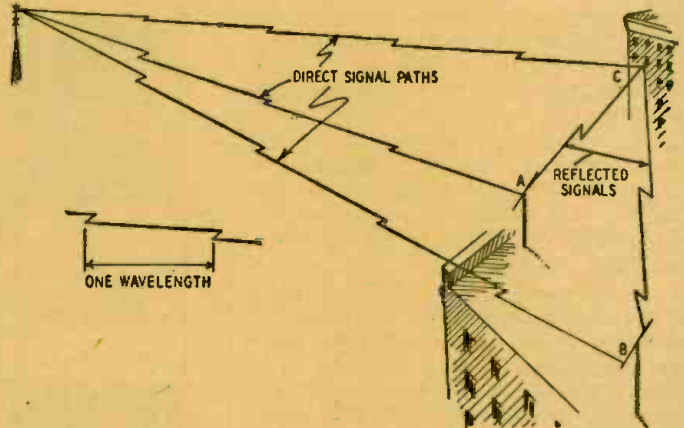


Fig. 2—Reflection aids direct signal at A but opposes it at B.

In areas where signals are generally weak, the serviceman can mount a good FM dipole on a 15- or 20-foot pole and connect it to the test receiver through a 300-ohm line. The antenna can then be moved about the roof to locate the best spot for installation.

Many FM tuners and receivers have built-in aerials. If outdoor aërials are prohibited—as they are in many apartment buildings and hotels—a serviceman should make a field strength survey inside the building to see if the signal is strong enough for good reception before completing the sale or making an installation.

While making the measurements, the test receiver should be moved around the room and the relative strength of signals from all stations in the vicinity noted. One station may come in strongest in one place in the room, and another station may be weakest at the same place. The set should be installed where it gives best reception from all stations. Loops

are usually employed in sets with built-in antennas. These are often highly directional, and it is possible that the set may be placed so it will not receive desired signals with best results. The Facto Meter may be turned on end and rotated for maximum signal. The set when installed should then be so its loop

is parallel to the telescopic antenna when in a position of best reception. Fig. 3 shows how reflected and direct signals may aid or oppose inside a room. Signals may be reflected from the walls of the room just as they were from the building at C in Fig. 2. A and B have the same meaning in each drawing.

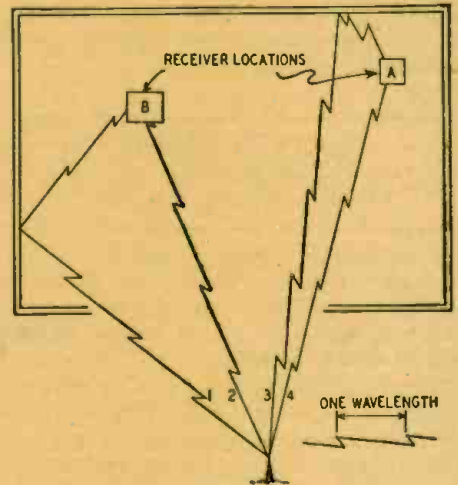


Fig. 3—Room reflections may affect signals.

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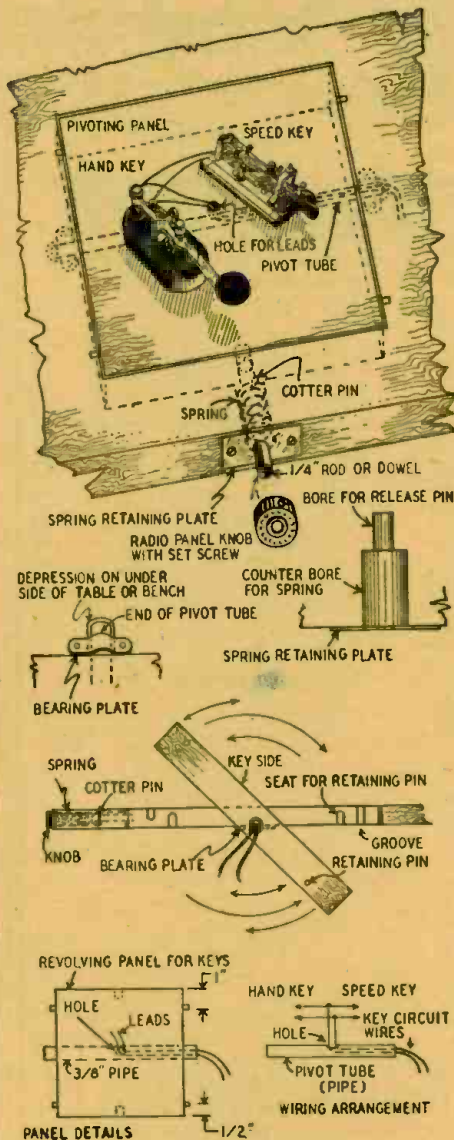
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A hole was drilled through the center of the panel, as shown, and a piece of 3/8-inch brass pipe driven through it to allow about 3/4-inch to project on each side. A 1/4-inch hole was previously drilled in the pipe and positioned to coincide with a hole in the key side of the panel.

The panel was then fitted into the opening and the under side of the bench marked for depressions which must be cut to bring the panel flush with the table top. Small bearing plates hold the



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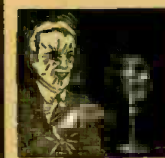


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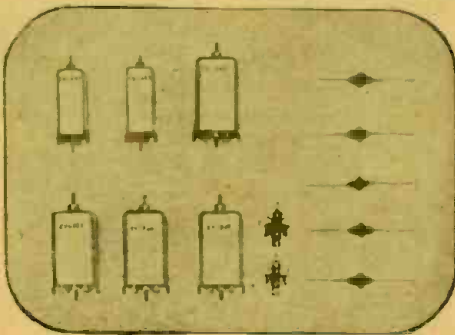
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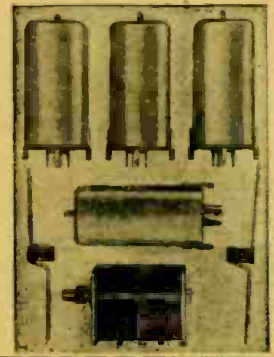
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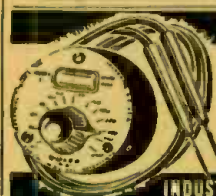
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Wired Vol. & Tone \$2.75  
Control  
Uses 12SQ7, 50L6, 35Z5.  
Wired & Tested  
Set of 3 Tubes ..... \$1.95  
Output Trans. .... .39  
3" Astatic Spk. .... 1.19

### PHONO OSC-2-TUBE

Wired & Tested \$2.75  
2 Tubes—\$1.50

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We Specialize in Mail Orders  
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## RISCO ELECTRONICS WHOLESALE DISTRIBUTORS

Television network problems have now been solved, E. W. Engstrom of RCA laboratories told the Sigma Xi Society at Cornell University last month. Radio relays and co-axial lines have conquered technical obstacles and television is also well on the way toward solving its economic problems, he said.

## GREYLOCK

### A Dependable Name in RADIO TUBES

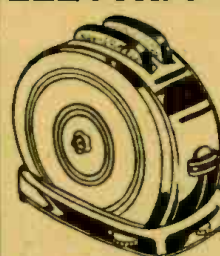
GT, Glass, and Miniature Types.  
All Tubes Individually Boxed.  
12SA7, 12SK7, 12SQ7, 50L6, 12AT6,  
12BA6, 12BE6, 35W4, 50R5 ..... each 39c  
1R5, 1S5, 1T4, 3A4, 3Q4, 6AK5, 6AC5, 6AC7,  
6AQ5, 6BE6, 6BA6, 6AU6, 6BJ6, 6X4 ..... each 49c  
32L7, 70L7, 117L7 ..... each 59c  
All Tubes Carry RMA 90-Day Guarantee

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no burning... adjust-  
able to light, medium,  
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cleaning... al-  
chromium in attractive  
design. Complete with  
cord.

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New FM stations will go on the air at the average rate of 50 a month in 1948, the FM Association predicted in January.

## FM STATION LIST (Continued from page 79)

FREQUENCY (MC)	CALL	LOCATION
103.3	WSM-FM	Nashville, Tenn.
103.5	KYSM-FM	Mankato, Minn.
103.5	WSTV-FM	Steubenville, Ohio.
103.7	KQW-FM	San Francisco, Calif.
103.7	WROV-FM	Roanoke, Va.
103.7	WSAR-FM	Fall River, Mass.
103.7	WTBY-FM	Gadsden, Ala.
103.9	KENO-FM	Las Vegas, Nev.
103.9	KOPP-FM	Ogden, Utah.
103.9	WDLB-FM	Marshfield, Wisc.
103.9	WFAS-FM	White Plains, N. Y.
103.9	WJEM	Springfield, Ohio
103.9	WTAL-FM	Tallahassee, Fla.
103.9	WXNJ	Green Brook Twp., N. J.
103.9	WXNJ-FM	Plainfield, N. J.
104.1	KFUO-FM	St. Louis, Mo.
104.1	KMPM	Monroe, La.
104.1	WJW-FM	Cleveland, Ohio
104.1	WMUN	Muncie, Ind.
104.1	WSJS-FM	Winston-Salem, N. C.
104.3	KGNC-FM	Amarillo, Texas
104.3	KTOK-FM	Oklahoma City, Okla.
104.3	KWLK-FM	Longview, Wash.
104.3	WITH-FM	Baltimore, Md.
104.3	WLOS-FM	Asheville, N. C.
104.5	KIXL-FM	Dallas, Texas
104.5	KRCC	Richmond, Calif.
104.5	WHIS-FM	Bluefield, W. Va.
104.5	WWST-FM	Wooster, Ohio
104.7	WHVA	Poughkeepsie, N. Y.
104.7	WIST	Charlotte, N. C.
104.7	WJEJ-FM	Hagerstown, Md.
104.7	WOPT-FM	Oswego, N. Y.
104.9	KURY-FM	Edinburg, Texas
104.9	KONG	Alameda, Calif.
104.9	WMCK-FM	McKeesport, Pa.
105.1	KCLI	Los Angeles, Calif.
105.1	WDNC-FM	Durham, N. C.
105.1	WQDI	Quincy, Ill.
105.1	WFMJ-FM	Youngstown, Ohio
105.3	WWHG	Hornell, N. Y.
105.5	WFOB	Fostoria, Ohio
105.7	KIMV	Hutchinson, Kan.
105.7	KUOA-FM	Siloam Springs, Ark.
105.7	KXEL-FM	Waterloo, Iowa
105.7	WDAE-FM	Tampa, Fla.
105.7	WMBS-FM	Uniontown, Pa.
105.7	WRUN-FM	Rome, N. Y.
105.7	WSIC-FM	Statesville, N. C.
105.9	KFI-FM	Los Angeles, Calif.
105.9	KOMA-FM	Oklahoma City, Okla.
105.9	KSBS	Kansas City, Kan.
106.1	KGO-FM	San Francisco, Calif.
106.1	KIDO-FM	Boise, Idaho
106.1	WKJG-FM	Fort Wayne, Ind.
106.1	WKNP-FM	Corning, N. Y.
106.1	WLOB-FM	Claremont, N. H.
106.3	WMLN	Mt. Clemens, Mich.
106.5	WBEN-FM	Buffalo, N. Y.
106.5	WFML	Washington, Ind.
106.5	WRGA-FM	Rome, Ga.
106.5	WSTP-FM	Salisbury, S. C.
106.7	WGTM-FM	Wilson, N. C.
106.9	WMIT	Winston-Salem, N. C.
107.1	WAJL	Flint, Mich.
107.1	WCAP-FM	Asbury Park, N. J.
107.1	WWDX-FM	Pateron, N. J.
107.3	KSEO-FM	Durant, Okla.
107.3	WBNB	Beloit, Wisc.
107.7	KFSA-FM	Fort Smith, Ark.
107.7	WAYS-FM	Charlotte, N. C.
107.9	KXOA-FM	Sacramento, Calif.

## LET'S GET ACQUAINTED!

THREE 35Z5 TUBES (Std. Brand) \$1.00  
SEND CASH CHECK OR MONEY ORDER  
10, 12SQ7 TUBES \$4.90 • 10, 5Y3 TUBES \$3.30  
All Tubes Std. Brand and in Individual Cartons  
10, 40-20 150V COND \$4.90  
50 Assorted BY PASS \$3.50  
OUTPUT TRANS, 2,000; 5,000; 7,000-3.5ohms .55  
THIS COUPON MUST ACCOMPANY ORDER  
RADIO SERVICEMEN. Write for Free, Illustrated  
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**LOW  
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PRICE!**

### MASTER-REMOTE INTER-COMS

Push button selection for 1 to 5 remote stations from this quality built 4 tube, 2 watt Master station. Several remotes can be "paged" at one time. Remote stations can originate call to Master. Very simple to install with any 3 conductor cable. Sturdy, good looking wood cabinets, walnut finished. Master 12 x 7 1/4 x 6 1/4". Remote 6 1/4 x 7 x 4".  
 No. 32A234K, Master Station and  
 One Remote—ONLY..... **\$29.95**  
 No. 32A235X, Additional  
 Remote Stations—ONLY..... **\$7.88**  
 No. 2A113, 3 Conductor  
 Cable—100 Foot..... **\$2.60**

### THE "DOUBLE TWENTY" FLUORESCENT UNIT

- Plugs in Any Outlet
- Hangs in Any Position
- Underwriter's Approved



Improved heavy steel, high reflection baked white enamel inside, gray outside. Hangs anywhere, with wire or chain, in a "jiffy." With 6 foot attached cord ready to plug in any outlet. Ideal for your hobby nook, repair shop, store, etc. Shipped complete with two 20 watt lamps. Size 25 1/4 x 9 1/4 x 5 1/4", wt. 10 lbs.  
 No. 30A60..... **\$8.28** 6 of  
 Spec. Each..... **\$7.73**

WRITE FOR YOUR COPY OF CATALOG No. 481 IF YOU DID NOT RECEIVE IT.



## SPECIALS!

BC-454 COMMAND RECEIVER (274N Series)  
 3 to 6 MC—Complete with tubes— **\$5.95**  
 New

COMMAND TRANSMITTERS  
 (274M Series)—Complete with tubes & crystal  
 BC-457: 4 to 5.3MC ..... **\$5.95**  
 BC-458: 5.3 to 7MC ..... **5.95**  
 BC-456 MODULATOR (Brand New) ... **2.95**

RADIO PARTS  
 Assorted—100 mica condensers ..... **\$1.19**  
 100 Resistors 1/3 to 1 watt ..... **.95**  
 100 Tubular bypass condensers, assorted  
 .01 to .1, all 600 Volt ..... **4.69**  
 Electrolytic condensers 50-30, 150 Volt  
 10 for **2.89**  
 1/2 Meg. Volume Controls 1" shaft with  
 switch ..... **10 for 3.00**  
 1/2 Meg. Volume Controls 1" shaft with  
 out switch ..... **10 for 1.95**  
 Crystal Pick-up, new light wt. .... ea. **1.79**

## Brand NEW! TUBES Brand NEW!

CATHODE RAY TUBES } **\$1.19** each  
 5CP1 - 5BP1 - 5FP7 - 7BP7 - 3FP7  
 5BP4 ..... **\$1.95** each

RECEIVING TUBES  
 954 9006 12SR7 } **39c** each  
 957 35W4 12K8 } Lots of 50-10%  
 9003 12C8 } discount  
 1625 } **19c** each  
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304TL Transmitting tube **\$1.95** each  
 Brand New

All Shipments F.O.B. Chicago  
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 4701 Sheridan Rd., Dept. RC, Chicago 40, Ill.

## RADIO AS A VOCATION (Continued from page 17)

yet he had a mentality of the highest caliber; and most of his knowledge was gained from books and publications.

In the final analysis, everything depends upon yourself. The more you know about a given subject, the more you specialize in it; and the more you know about it the greater are the chances that you will succeed.

Coupled with this, you require other qualities. It is, for instance, not enough that you are another Edison or a Marconi unless others know about your qualifications. The world, as a rule, does not run after you, *you must put yourself ahead*; in other words, you must know how to sell yourself to the radio industry. This can be accomplished only by bringing yourself to its attention, either by personal contact, by letter writing, or by writing for various radio publications and thus getting a reputation in the radio industry.

The radio industry is no different from any other, when it comes to man-power. Competition is just as keen in radio as it is in any other industry, and perhaps in many respects more so. It has, however, plenty of room for the young man of the right mental caliber. Every radio organization needs good men and is willing to pay their price; every organization needs specialists in their own line, men who can think for themselves, men who can do things, men with initiative, and men who believe in the future of radio. And after everything is said and done, always remember that radio is still in the earliest stage of its infancy; and that the young men who enter radio (and its legion of subdivisions) today, will "make" the great radio industry of tomorrow.

## Radio Thirty-Five Years Ago In Gernsback Publications

HUGO GERNSBACK Founder	
Modern Electric	.....1908
Electrical Experimenter	.....1913
Radio News	.....1919
Science & Invention	.....1920
Radio-Craft	.....1929
Short-Wave Craft	.....1930
Wireless Association of America	.....1908

Some of the larger libraries in the country still have copies of ELECTRICAL EXPERIMENTER on file for interested readers.

From the April, 1914 ELECTRICAL EXPERIMENTER  
**Sources of Energy for Radio Transmitters**  
**Design and Construction Details of Radio Antennae by H. Winfield Secor.**  
**Marconi Lights a Lamp Six Miles Away**  
**A Simple Radio Break-In System by J. W. Waite.**  
**An Adjustable High-Tension Condenser by I. Rabi.**  
**Crystal Detectors on Parallel by Alexander Polson.**  
**Lamp Test for Adjusting Detectors by Arthur R. Darling.**

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There is no other radio like Hallicrafters' precision-made Model S-38. Four bands bring you thrilling land, sea, air communications from all parts of the world plus finer quality on your favorite broadcast program. Perfect for den, library, office. Extra clear, strong reception anywhere. AC/DC. Write for Catalog P38 and where to buy.  
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New circuits for the first time enable you to attain full benefit from the new General Electric Model DL 1RM 6C Variable Reluctance Magnetic pickup. Employs an exclusive, humless (DC on heaters) pre-equalized pre-amplifier to produce the most satisfying musical amplifier the world has ever known. If you are a perfectionist, you are the one for whom the ACA-100GE was designed. Send for technical literature.

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Portable radios will be powered by sunlight within 25 years, predicts Columbia's president Frank Stanton.

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## TELEVISION-CATHODE RAY HIGH VOLTAGE

2000 volt D.C. Power Supply

For an unbelievably low price, we can supply a completely filtered television or cathode ray 2000 volt D.C. power supply. Why bother with bulky and dangerous 60 cycle supplies or expensive R.F. power supplies when you can purchase a complete 2000 volt D.C. unit (not a kit), ready to plug into the 110 volt A.C. power line. The ridiculously low price has been made possible by a fortunate purchase of high quality components. These units are brand new, completely tested and guaranteed.

PRICE .....\$7.95

## 4000-6000 VOLT TELEVISION SUPPLY

Similar to the unit above, but has a much higher D.C. output voltage suitable for use with the new 7" and 10" television tubes.

PRICE .....\$12.50

## RADIO KITS

The kits contain all the required parts except wire and solder for their construction into an efficient working unit comparable with the best post-war type of units. The simplified diagrams furnished make it possible for any radio student, experimenter, or amateur to construct these kits.

5 Tube AC-DC superhet kit furnished in a brown plastic cabinet of artistic design, cabinet size (9"x5"x6")

Variable condenser tuned; with 2 double tuned I. F.'s.

Tubes used: 1 - 12SA7, 1 - 12SQ7, 1 - 12SK7, 1 - 35Z5 and 1 - 50L6

PRICE \$11.95 Including 3 Standard tubes

## 6 TUBE 3 WAY PORTABLE KIT

• For operation on 110 volt AC or DC and battery

• Superheterodyne circuit

• Full vision dial

• High gain loop

• Cabinet of Blue Aeroplano cloth finish, size 13x9x7"

• Tubes used 1A7, 1H5, 3Q5, 117Z6 and 2 - 1N5

PRICE \$13.75 Not including tubes Extra for kit tubes \$3.75

## 6 TUBE, 2 BAND SUPERHET KIT

Bands covered BC 550-1600 KC and 6-18 MC

Power supply 105-125V AC, DC

Full vision dial

Variable condenser tuned, with two double tuned I. F.'s 455KC

Walnut veneer wood cabinet

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Resonated at approximately 4500 cycles effectively reducing objectionable needle scratch without altering the brilliancy of reproduction.

Contains a HI-Q SERIES resonated circuit. Tested by means of an audio oscillator and an oscilloscope to give 22 db. attenuation with very low signal loss. Attention may be regulated by means of a SPECIAL MINIATURE gain control.

EASY TO ATTACH

Just two wires to clip on. Compact. PRICE \$1.65

## THREE TUBE PHONO AMPLIFIER

An assembled unit ready for installation using tone and volume control and six feet of rubber cord

(Not including Tubes)

With Complete Set of Tubes .....\$3.95

## PHONO OSCILLATOR

Wireless phono oscillator transmits recording for crystal pick-ups or voice from carbon mike through radio without wires. Can also be used as an Intercomm by using P.M. speaker as mike. Price \$2.95 (excluding tubes)

With Complete Set of Tubes .....\$3.95

## SPECIAL! SPECIAL!

Mammoth assortment of radio and electronic parts, not less than TEN POUNDS of new transformers, chokes, condensers, resistors, switches, coils, wire, hardware, etc. A super-buy for experimenters, servicemen, and amateurs for only ..... \$1.25

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## 5-WATT TRANSMITTER

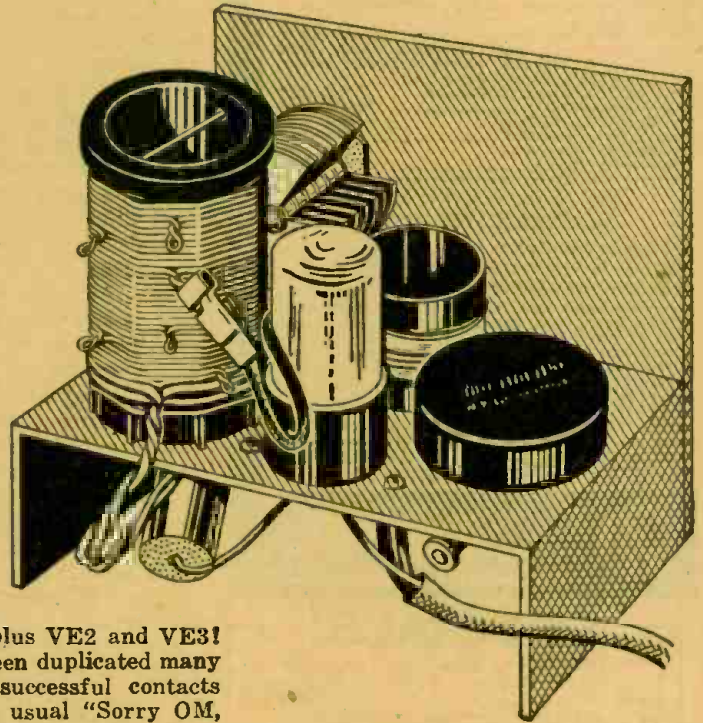
(Continued from page 31)

shows a meter reading of 50 ma at 110 volts. A mere 5.5-watt input; but just take a few looks at Junior's record!

As an experiment, on a sultry July afternoon, a 15-foot piece of wire was attached to the rig and stretched down an upstairs hall. A W8 was raised, but the QSO was not completed. A W9, in Chicago, was also raised; this contact also fell through, but not before Junior had been given a signal report of RST 5-8-9X! With a 132-foot antenna, working a gainst ground, the little rig has worked (from Baltimore) about 20 states in the following districts: W1, W2, W3, W8, W9, and W0, plus VE2 and VE3! These QSO's have been duplicated many times, some being successful contacts and some being the usual "Sorry OM, QRM got you that time" variety.

(Sent to RADIO-CRAFT for testing, the little transmitter was set up in the Bronx, and worked W3, W8, W9, and—Crown of the evening—G2! Tests were stopped immediately. T9 note was reported on most contacts, though the note can be stopped by tuning the output too

close to the crystal frequency.—Editor)  
And all this with a transmitter that uses less than five dollars worth of mafe-



rial and can be thrown together in a few hours by any reasonably adept ham! Cost is not the only advantage, either. With more attention to compactness, this would make an ideal rig for vacationing amateurs, fitting in a corner of the suitcase.

Considering expenditure and results, this 5-watter is a really useful addition to any ham shack, whether the operator is a beginner or an old timer. Give Junior a whirl some frosty winter night, and you'll forever rue the day that you started buying high-power transformers and bottles. Unless, that is, you prefer brawn to brains. And some do!

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Here is the book every radioman needs. Brand new, up-to-the-minute. Tells all about modern radio and electrical testing equipment and how to use it. Money-making short-cuts on trouble-shooting, servicing, construction, and other jobs. Over 350 pages, 220 photos and diagrams. Covers Multipliers, Resistors, Ohmmeters, Oscilloscopes and many others. You see actual equipment torn down in step by step photos. All data pre-tested in the Coyne radio shops.

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20 mfd. 150 V. ....	10 for \$1.79
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8 mfd. 450 V. ....	10 for 1.85

Postage extra. 25% deposit on C.O.D.  
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## TUBE SPECIALS

**FROM OUR FREE CATALOG**

- ★ 5 tube Kit: 50B5, 35Z5, 12SA7, K7-Q7.....\$2.75
- ★ 5 tube Kit: 50B5, 35W4, 12AT6, 6A6, 6BE6.....\$2.75
- ★ Acorn tubes: Nos. 954, 956, 956, 957, 958A... 49c
- ★ Hear Aid Tubes: CK501AX to CK509AX... 49c
- ★ Submini. Proximity fuse diodes, 6.3 fil. .... 49c
- ★ 70L7.....79c
- ★ 70L7.....79c
- ★ TUBE SPECIALS.....59c each, 10 for \$5.00
- ★ 1K5, 1K5, 1T4, 1V, 354, 6AH6, 6AK5, 6AL5, 6AN5, 6AT6, 6BA6, 6BE6, 6C4, 6H6, 6L6, 6N4, 6N7, 6X4, 12BA6, 12BD6, 12SA7, 12BE6, 25Y5, 50B5, 717A, 9001, 9002, 9003, 9006
- ★ RK-34 and RK75 transmitting tubes .....90c ea.
- ★ Scarce Tubes: 6AC5, 25A6, 25A7 .....79c ea.

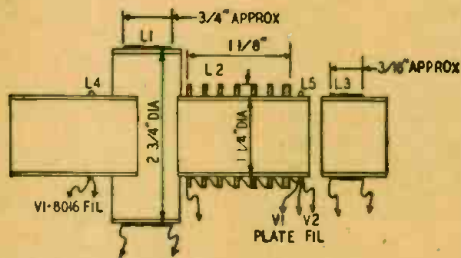
Write for free catalog  
20% Dep. Bal. C. O. D.—Min order: \$3.00

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36 BRATTLE STREET, BOSTON 6, MASS.

## HIGH-VOLTAGE R.F. COILS

The experimenter who wishes to construct an r.f. high-voltage generator, such as described in the May, 1947, issue of RADIO-CRAFT, can make the coils without a coil-winding machine by winding the wire on spider-web forms cut out of thin composition board or heavy stencil paper, both of which are available in art supply stores. (Excellent forms for this purpose could be cut from polystyrene sheets.—Editor)

In cutting and winding the forms the inside dimensions and the number of turns given in the original descriptions should be followed. The layers may be spaced with nuts or spacing washers from a discarded condenser. The screw holding the forms together should be brass.



My original coil forms had 7 sections, but the coils will be flatter and neater if a larger number of sections are cut, at least 11 or 13. The forms must be cut with an odd number of sections.

Coil forms of this type will take up much more space than the conventional type, but the experimenter can try smaller diameter forms and more layers. With this arrangement, it pays to experiment with the number of turns in the grid coil.

Coils of this type may not be as efficient as those of modern design, but they can be made without special equipment.

Incidentally, for those who do not have a beam-power tube handy, other tubes will work. I used a 59. It operates more efficiently as a triode, with the control and screen grids tied together and the suppressor grid connected to the plate. I found a low value of grid resistor gave best results.

HAROLD WALKER,  
Philadelphia, Penna.

## A STABLE REGENERATIVE RECEIVER

(Continued from page 34)


to the speaker voice coil. The output terminals are brought out to the rear of the chassis. Inserting the headphone plug in the jack silences the speaker.

A small a.c.-d.c. choke may be used in place of the 450-ohm resistor in the power supply.

Since the set uses an a.c.-d.c. power supply, take care not to ground the chassis. A 1-ampere fuse in the line is sufficient protection in case of an accidental short circuit.

If you have wondered what a good regenerative receiver is capable of doing try building this one. The results are really worthwhile. It is no temperamental plaything, but a receiver you will enjoy listening to and operating.

RADIO-CRAFT for APRIL, 1948



# NOW! BUILD 15 RADIOS

## COMPLETE KIT ONLY... \$14<sup>75</sup>

**ABSOLUTELY NO KNOWLEDGE OF RADIO NECESSARY  
YOU NEED NO ADDITIONAL PARTS!**

### PROGRESSIVE SCOOPS!

#### FM COIL & CONDENSER KIT

Designed for operation on 88-108 MC (new band), contains 2 IF transformers, 1 Limiter Transformer, 1 Discriminator Transformer, 1 RF coil, 1 Variable condenser, Schematic and wiring instructions. Excellent for schools, experimenters and Radio Hobbyists.  
Price only ..... \$4.95

#### CONDENSER KIT

50 Paper Tubular Condensers. Values from .002 mfd to .1 mfd. 400 V. DC to 600 V. DC.  
Only \$1.95

#### RESISTOR KIT

100 Carbon Resistors, 1/2 Watt., RMA color-coded. Values from 120 ohms to 2.2 megohms \$1.50  
10-10 MFD. 450 W.V. DC Electrolytic Condensers ..... 65c  
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Antenna and RF Coil Set (Broadcast Band) ..... 59c  
6" Alnico Slug Speaker... \$1.69  
Selenium Rectifiers ..... 79c  
Midget Soldering Iron 35 Watts 110/120 volts UL approved 69c  
55 Watt Soldering Iron UL approved ..... \$1.90  
75 Watt Soldering Iron UL approved ..... \$2.40  
Long Nose Pliers and Cutters ..... \$1.45

#### PROGRESSIVE RADIO TOOL KIT

contains 75 Watt 110/120 Volt soldering iron, long nose pliers & cutters, screwdriver, insulated alignment tool ..... \$3.25

#### ESPEY CUSTOM-BUILT AM-FM HIGH FIDELITY RECEIVERS--Model No. 7-8C

1. AC Superhet AM-FM receiver.
2. Frequency Modulation Circuit.
3. 11 finest quality tubes, including rectifier.
4. 4 dual purpose tubes give 15 tube performance.
5. Automatic volume control.
6. Full-range volume control.

7. High-Fidelity AM-FM reception.
8. Full-range combination bass-treble tone control.
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placement purposes. The remainder were sold for export and to government agencies.

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# Communications

WANTS STRAIGHTFORWARD CIRCUITS ONLY

Dear Editor:

James R. Langham's article, "Adventures in High Fidelity" was a *wow*. I have not yet made up my mind as to whether I ought to sue you for injuries to my laughing gear. I am old-fashioned in my ideas on the requirements and tubes for quality amplifiers. Have nothing but Bronx cheers for feed-back, Ring-around-the-Rosy circuits when a plain class-A 1- to 5-watt amplifier is more than enough to blow speakers and drive a good recording head.

I am a fall guy for such articles as "Build Your Own Recording Studios," etc. The more I read the more confused I become, what with the 3 different reference levels, the K's vs the M's, the condenser markings and the different recording characteristics, which are ridiculous and change overnight.

I took up a general discussion of these matters with an expert "record jockey"

at NBC in New York City, a while ago, and it ended in his telling me that I should take a recording course and get modern ideas. Looking around, I found a school over in Jersey. I was dumfounded at the vast number of tubes in the amplifiers to drive the 2 recording heads on a pair of small recorders which looked like the machines the late Thomas Edison used to work with.

The instructor turned on the amplifiers and a swell 200-horsepower howl started up. He then explained he had forgotten to close the studio door. I backed out and have given up the idea of becoming modernized on sound. I am going back to Western Electric's principles and systems, except the up-and-down recording.

Let's have a few more nonsensically sensible articles by Mr. Langham.

RALPH W. NICHOLS,  
Miami Shores, Florida

## COSMO-COMPO RADIOS WILL RUIN SERVICEMEN?

Dear Editor:

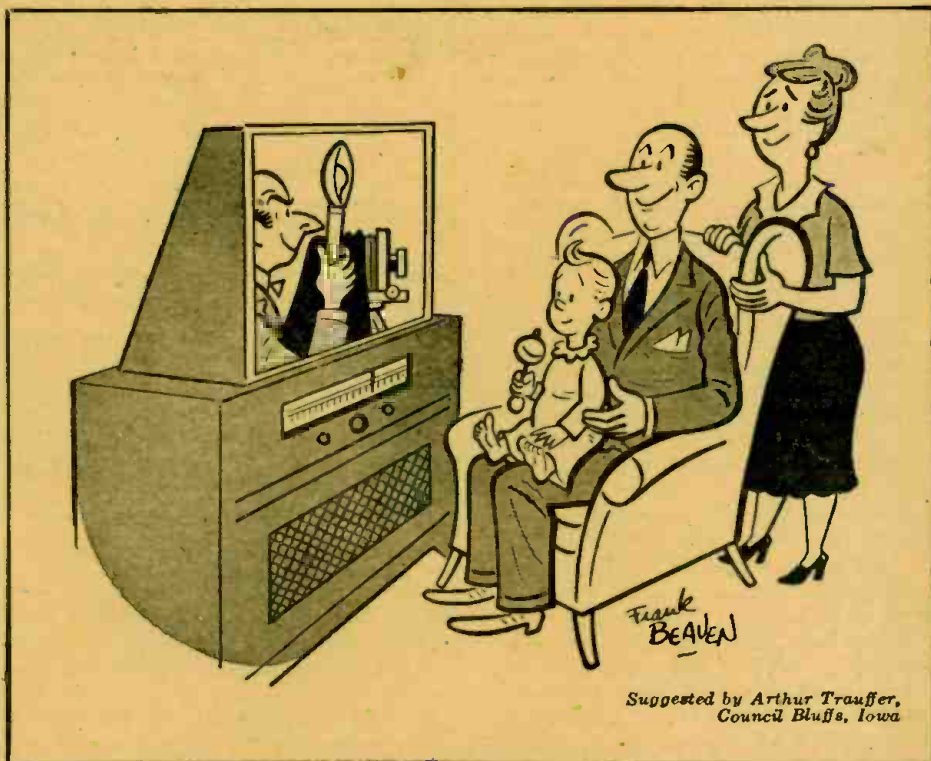
Your December, 1947, RADIO-CRAFT has an article on the new *Cosmo-Compo* radio.

The heading of the article reads: *This Radio Services Itself*. Above it is a hand holding a soldering iron. What is of the gravest importance to every serviceman is the *cross that cancels that figure out*. That cross means the cancellation of the efforts made by every serviceman now in business, those who are still learning to read diagrams and

those who have spent years learning how to do an artistic, neat, and complicated job of wiring.

The only thing this new idea has done is to make it possible for the customers to take the profit out of the servicing profession. This means that the good old American way of life, which carries with it security, education, better economic conditions and luxuries, will soon be only a dream for the serviceman.

This smart idea coming on the market means that the art of radio serv-



Suggested by Arthur Trauffer,  
Council Bluffs, Iowa

icing returns to the days when any *jack-out-of-the-box* with a nail file and a pair of pliers, was a radio repairman. This radio would cause all the hours of work and hard study, and the many dollars for test equipment, to have been spent in vain. And all the labor and time spent in developing a successful servicing business would also be wasted.

With this type of radio the public would be able to make *any repair* the same as if only a tube were out. Why not let the radio profession stay out of the hands of the novice? Let him change tubes, but don't make it possible for him to replace any stage of his set that may be dead.

Radio servicing is a proud profession for those who are in it, and can still be the idol that catches the eyes and interest of many to come. It will cease to be such if there are no profits in it for the poor serviceman who even now finds it hard to meet his bills. The radio serviceman is a human being, and is entitled to win his bread the same as anyone else. He has to buy food, clothing, shelter, and all the things that are necessary for a decent life. They should not be cut off just because someone has per-

fectured an idea that will put him on Easy Street.  
**KENDALL W. WILLIAMS,**  
*Xenia, Ohio*

(Even if it were true that this invention might make it necessary for some radio technicians to seek new jobs, that would be no argument against it. Would our correspondent wish us to still ride horseback to work? In fact, if his ideas were followed, we would have no radios to repair, as the earlier inventors of electrical equipment would have been prevented from throwing the artisans in older crafts out of work.

But it is not true. The wagon makers Studebaker and Fisher, for example, did not starve to death with the invention of the motor-driven vehicle, but prospered as manufacturers of automobiles and motor car bodies, respectively. The intelligent radio technician will progress and prosper with improvements in the technique.

It is, of course, not entirely certain that this new technique will prove technically and economically superior to present methods of production and servicing. *All the more reason for the serviceman to keep alert!*—Editor)

### WANTS FEDERAL SERVICEMAN'S LICENSE

Dear Editor:

I want to add a few words to the subject: Should servicemen be licensed?

I think that the serviceman should be licensed by the Federal Government and that licensing requirements should be uniform for the whole country. The serviceman could post this federal license in his shop to prove to his customers that he knows his business.

The examination should be similar to the radio operator license examinations except that it should be devoted to questions on radio servicing. The license should be issued free after the serviceman passes the test.

The licenses could be of different classes: one type would be for the learner, or the fellow just starting out in servicing; another class would be for the

man with a fairly good knowledge of servicing; and a third class for the all-around serviceman with experience in FM and television. There could be also a separate license for sound-system technicians.

A board of radio engineers and servicemen could be set up to determine the nature of the examination questions.

The Government should not regulate wages or charges for servicing, because rates vary in different parts of the country.

I believe that this licensing would obviate any comment from the public about underhanded dealings in the radio servicing industry.

**HERBERT C. TAYLOR,**  
*Keysville, Virginia*

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**AN APPROACH TO RADIO**, by J. B. Shrewsbury. Published by Electronic Industries. Stiff cloth covers, 6 1/4 x 9 inches, 288 pages. Price \$4.50.

The author has written this book to present radio theory in a very simple and non-technical manner. It gives the necessary information to the beginner to permit him to approach a more detailed study of radio.

The book is divided into eight chapters covering receivers, audio oscillators and amplifiers, and transmitters. There are many drawings and schematics throughout the book and information is given for the construction of simple receivers.

**PATENT NOTES FOR ENGINEERS**, prepared and edited by C. D. Tuska and other members of the patent Department of RCA Laboratories. Published by RCA Review. Stiff cloth covers, 6 x 9 1/4 inches, 165 pages. Price \$2.50.

The material in this book was prepared primarily for use by the patent department of RCA Laboratories. However, inventors, research groups and engineers will find its contents useful in obtaining a better understanding of patent terminology and the problems of the inventor and the patent attorney.

The book clearly defines an invention and sets forth the requirements of a patentable invention. A number of citations or case records have been included to show some of the problems that may be met by the inventor. It is worth a place on the bookshelf of all persons engaged in research and development work.—R.F.S.

**HOWARD W. SAMS DIAL CORD STRINGING GUIDE**, compiled and published by Howard W. Sams & Company. Heavy paper covers, 5 1/2 x 8 1/4 inches, 112 pages (not numbered). Price 75 cents.

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**AUSTRALIAN SHORT WAVE HANDBOOK**, edited by John Moyle, VK2JU. Published by Associated Newspapers Pty. Ltd. Paper covers, 8 x 11 1/4 inches, 120 pages. Price 2 shillings (Australian).

This handbook of radio call signs and short wave technique was prepared for the Australian radio amateur and set builder. It begins with a short introduction to short waves and includes hints on receiving conditions and on obtaining short wave verification or QSL cards. Its second chapter is a listing of Australian commercial and amateur radio stations.

The remainder of the book includes circuits and construction details on receivers, transmitters, antennas, and modulators. This material, reprinted from *Radio and Hobbies* (Australia), is of interest to any radio experimenter or amateur.—R.F.S.

**UNDERSTANDING VECTORS AND PHASE**, by John F. Rider and Seymour D. Uslan. Published by John F. Rider. Flexible fiber covers, 5 1/4 x 7 inches, 153 pages. Price 99 cents.

A book for the radio serviceman, this is an excellent example of what can be done by the practical writer for the practical reader. The authors realized that vectors are inherently far simpler than much of the mathematics traditionally taught as preparation to their study, and have produced a book which can be understood by any radioman with a knowledge of arithmetic and simple geometry.

Methods of handling vectors and calculating impedance, reactance and resistance in circuits containing various combinations of resistors and reactors are clearly explained. Incidentally, many radio servicemen will find in this book their first understandable exposition of the FM discriminator.

**RADAR BEACONS**, edited by Arthur Roberts. Published by McGraw-Hill Book Co. Stiff cloth covers, 6 1/2 x 9 1/4 inches, 489 pages. Price \$6.00.

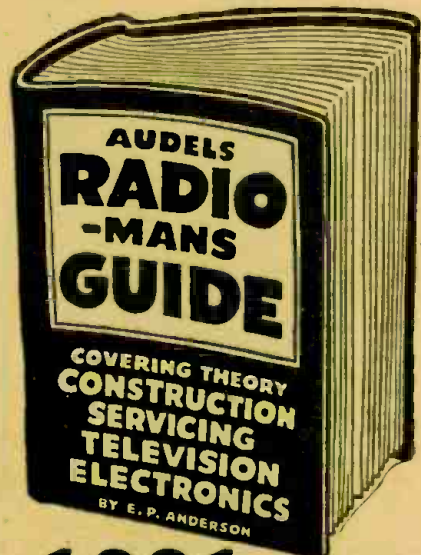
This book is Volume 3 in the M.I.T. Radiation Laboratory Series. The equipment and systems described in it, however, are the collective result of work done in the United States, England, Canada, and other countries.

The book is divided into four parts. The first discusses the nature of radar beacons and the principles on which beacon systems are designed. The second section deals with the design of radar beacons, covering r.f. components and circuits in beacon systems.

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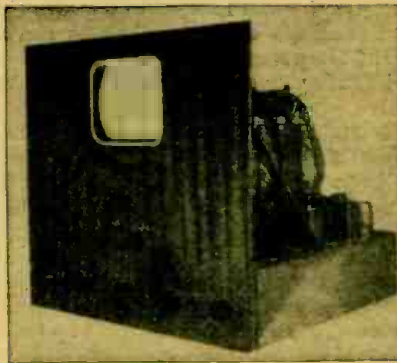


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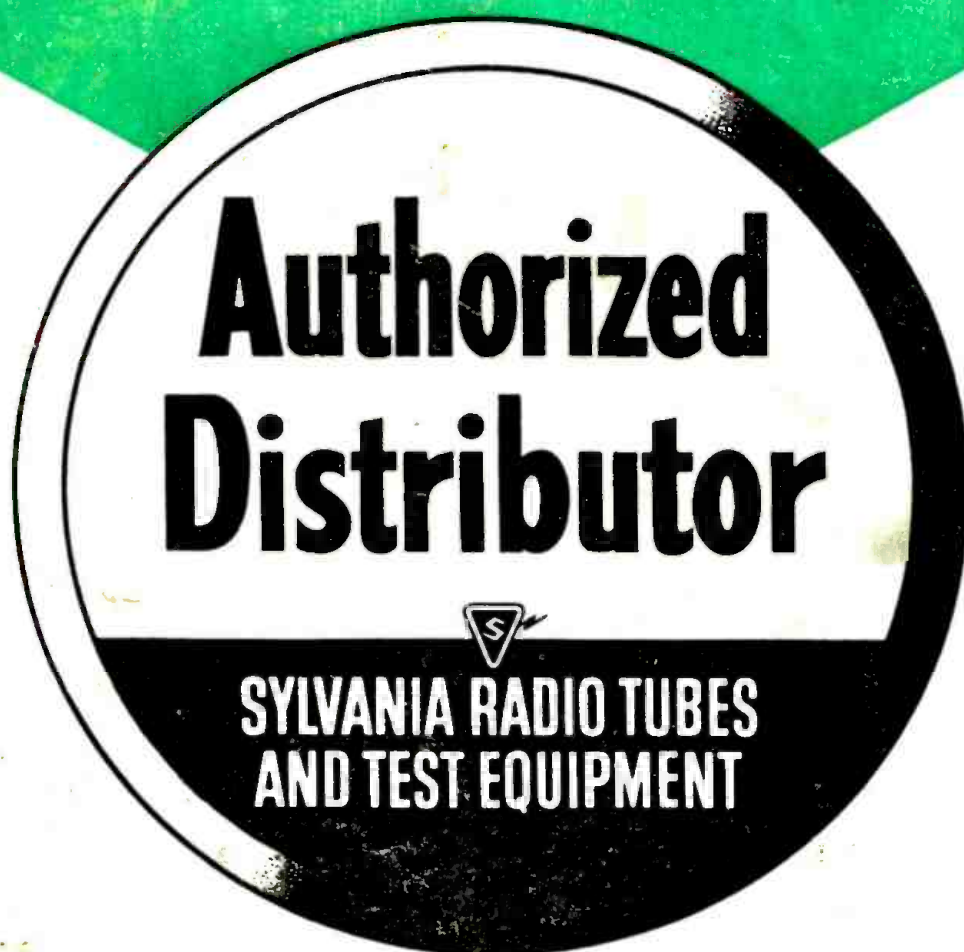
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