Build IC/VAMP Receiver–tunes 80-1700 kHz

AUGUST-SEPTEMBER
75¢

Science and Electronics

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SAFETY SIREN

a mini-project everyone should build and own!

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the exciting world of static electricity with

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the charge detector that tells you if it's there and what polarity!

SPECIAL CONSTRUCTION ISSUE

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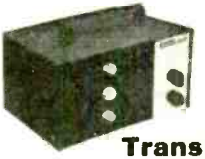

Translators

The electronics you need to create audio-stimulated light displays to your own imagination. Actuates Light Display Units, Strobe Lites, any lamp configuration (Xmas trees, patio lights, etc.) From $24.95 kit, $39.95 wired

Strobe Lites

High-intensity bursts of white light from Xenon tube flash in cadence with each beat of audio. From $24.95 kit, $39.95 wired.

Build the Stereo Kits praised by experts.

All amplifier power ratings according to IHF standards. Cortina® designed and manufactured in U.S.A. and guaranteed by EICO.

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70-Watt Silicon Solid-State Stereo Amplifier, including cabinet. Cortina 3070. $99.95 kit, $139.95 wired

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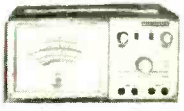

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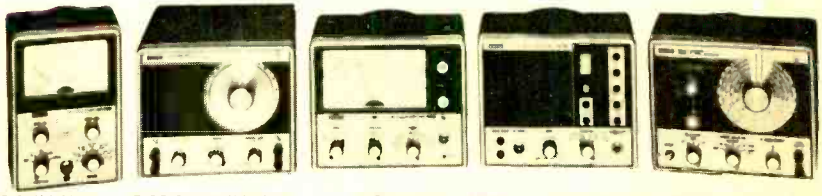

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Plastics Technician

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Clerk-Typist Commercial
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Power Plant Engineering
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Stationary Fireman
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August/September 1970

Science and Electronics

★ Cover Highlights

Cover illustration by Joe Rack

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Volume 28 **Number 4**

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POSITIVE FEEDBACK

Julian M. Sienkiewicz
EDITOR-IN-CHIEF

I can remember the time when a purchaser of a new television receiver was in store for some unique headaches. Today, the sands of time have drifted into the works of another consumer product. To prove a point, sit down and chat with a friend who purchased a new car in the last few weeks—and try to understand why his tears are genuine. Only recently, this editor had the "good fortune" to borrow a new station wagon for a vacation trip. The car had just 45 miles on the odometer when I pulled away from the curb into a most unforgettable experience.

Here are just a few of the wagon's defects: rear window jammed halfway down and must be forced the remainder of way, rear tailgate door didn't open, lock on rear door came apart in child's hand, fuel and ammeter dials were always fogged after rain (and couldn't be read), parking brake light was always *on*, spark plug was left unconnected (even after dealer's tune-up!), driver's door had to be slammed by grown man to shut properly, license plate light fell out of bumper, driver's manual was incomplete on the matter of how to drop rear seat, front seat could not be positioned forward or back, and last but not least—the car's electrical system failed on a major parkway at the height of the rush hour in a rainstorm. How do you like them apples?

Now let me tell you about my new color TV set. It's been working without fail for over a year. And this story is heard from many set owners of different makes. TV receivers are made more and more reliable each year and color sets are no exceptions! The weakest link in any set is the antenna, but the master antenna system (MATV) I installed recently (it's a Finney) goes a long way toward ensuring perfect reception.

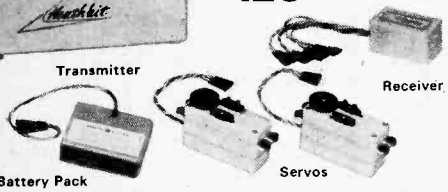
The consumer electronics industry is really delivering. What's wrong with Detroit?

Action—At Last. After nearly six years of combined efforts by CB operators and manufacturers, the FCC has authorized use of channel 9 for transmission of emergency communications *only*, including highway assistance. Channel 15 will be the new interstation channel to replace channel 9. Looks like CB is moving ahead again. Yipee! ■

8 New Action-Packed Kits From Heath—

Heathkit GD-101
$49.95*

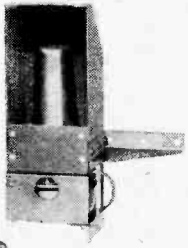
Heathkit GD-57
$129.95*



Transmitter
Receiver
Battery Pack
Servos

Heathkit Siren & Speaker
$99.95*

Amplifier & Controls



Exterior Horn
Concealed Horn

Heathkit MI-29
$89.95*

NEW Heathkit "Spectre" ⅛ Scale R/C Car
Join The Most Exciting New Hobby In America...

building and racing radio-controlled Grand Prix cars up to scale speeds of 200 mph. The Heathkit "Spectre" R/C car reaches that speed and has already proven itself a winner. And no wonder; its design is unique. It has a chrome plated steel chassis, adjustable caster and toe-in, specially formulated rubber tires that lock onto the cast nylon wheels, independent front suspension for excellent cornering and a 5.5:1 gear ratio for maximum torque at all speeds. The snap on, ⅛ scale car body (length: 19¾") is of high impact plastic — almost indestructable. Suspension is by real coil springs. The radio equipment compartment is dirt and oil proof. The Heathkit "Spectre" is the only complete car kit available. You get the body, chassis, wheels & tires, 4 oz. fuel tank & tubing, equipment case & protective foam, centrifugal clutch & gears, axles, servo linkages & mounting tape, all hardware, decals, numbers and a comprehensive manual. The "Spectre" accepts any .15 to .23 cubic inch R/C engine and any proportional R/C electronics system. It requires only two servos to operate the steering, brake and throttle. Get in on all the thrills of R/C car racing at the lowest possible price . . . order a Heathkit "Spectre".

Kit GD-101, R/C car only, 8 lbs.....**$49.95***
Assembled GDA-101-1, Veco .19 R/C engine, 1 lb.....**$19.95***

NEW Heathkit 3-Channel Digital Proportional R/C System
For Planes, Gliders, Cars And Boats

Ideal for use with the new Heathkit "Spectre" R/C car to give you total control . . . ease of handling. Here's what the Heathkit GD-57 R/C system includes: Transmitter with assembled, factory aligned RF circuitry; new 2 oz. miniature receiver that needs no IF alignment, in a tough nylon case; you also get two servos: all plugs; connectors; cables; charging cord; new flat-pack rechargeable nickel-cadmium transmitter and receiver batteries . . . and a special soldering iron. You can have your choice of five operating frequencies in each of three bands . . . 27, 53 or 72 MHz. This is the most value ever offered in a 3-channel rig.

Kit GD-57, transmitter, receiver, 2 servos, batteries, charging cord, switches and soldering iron, (specify freq. desired), 11 lbs.....**$129.95***
Kit GDA-57-1, transmitter, battery, charging cord, (specify freq. desired), 5 lbs.....**$54.95***
Kit GDA-57-2, receiver only, (specify freq.), 1 lb.....**$34.95***

NEW Heathkit Siren/PA
For Licensed Emergency Vehicle Only

Hey Chief! Save up to 60% on a new electronic siren/PA system by ordering the low cost Heathkit GD-18. The siren gives both "wail" and "yelp" warnings at 55 watts output power, and you can adjust the pitch. As a public address it will amplify your voice with a full 20 watts of power, and it's practically immune to acoustical feedback. (Either PA or siren can be interrupted to use the other.) Incoming radio calls can be channeled through the GD-18 so you can hear them when away from your vehicle. Use it on any 12-volt auto electrical system with either positive or negative frame ground. It will operate from -20° to 150° F conditions. Control panel is lighted. Comes with gimbal bracket mounting. Take your choice of speakers . . . concealed or exposed.

Kit GD-18, Siren/PA Amplifier, 7 lbs.....**$54.95***
Assembled GDA-18-1, Exterior Horn, 9 lbs.....**$49.95***
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System GD-18A, (includes GD-18 plus exterior horn), 16 lbs.....**$99.95***
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NEW Heathkit Solid-State Portable Fish Spotter

Costs half as much as comparable performers. Probes to 200 ft. Doubles as depth sounder. Transducer mounts anywhere on suction cup bracket. Adjustable Sensitivity Control. Exclusive Noise-Rejection Control stops ignition noise. Runs for 80 hrs. on two 6 VDC lantern batteries (not included). Manual explains typical dial readings. Get set for next season; order your Heathkit MI-29 today.

Kit MI-29, 9 lbs.....**$89.95***

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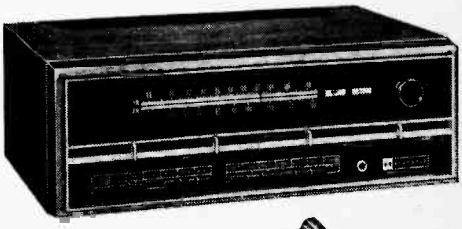
Kit SB-102, 23 lbs. **$380.00***
Kit SBA-100-1, mobile mt., 6 lbs. **$14.95***

Heathkit SB-102
$380.00*

NEW Heathkit 60-Watt AM-FM-FM Stereo Receiver

Superb stereo performance at budget price, that's the new Heathkit AR-19. A giant, electronically regulated power supply provides 60 watts IHF music power (ideal for all modular and high efficiency speaker systems) . . . frequency response is -1 dB from 6 Hz to 35,000 Hz . . . and Harmonic & IM distortion are less than 0.25% at *any* output. This advanced performance assures you of crisp, clean highs without ringing or breakup . . . solid, clean-cut lows without distortion — just pure, uncolored sound reproduction at all frequencies and power levels. The FM Stereo circuitry is unequalled by any receiver in this price class . . . a factory assembled & aligned FET FM tuners . . . superior overload characteristics & 2.0 uV sensitivity . . . a factory assembled & aligned FM IF circuit board with 4 IC's for superior AM rejection, hard limiting, greater stability and 35 dB selectivity . . . a precision ball-bearing inertia flywheel for smooth, precise tuning . . . two front panel tuning meters for exact station selection. Other features include modular snap-out circuit boards, built-in self-servicing capability, hi-fi AM reception and much more. Make the AR-19 the heart of your stereo system now.

Kit AR-19, 29 lbs. **$225.00***
Assembled AE-19, oiled pecan cabinet, 10 lbs. **$19.95***



Heathkit AR-19
$225.00*

Heathkit Solid-State Metal Locator

Here's versatile, professional performance in a metal locator at lowest cost. The all solid-state GD-48 uses a unique induction balance detection system that doesn't produce a tone until metal enters the search field . . . eliminates having to listen for a change in tone. The built-in Sensitivity control allows adjustment to detect varying size objects down to 6 feet. A built-in speaker audibly signals presence of metal . . . for higher sensitivity use the accurate front-panel meter. And the front-panel headphone jack lets you use headphones to screen out annoying background noise. Look no further for an excellent metal locator . . . order the GD-48 now.

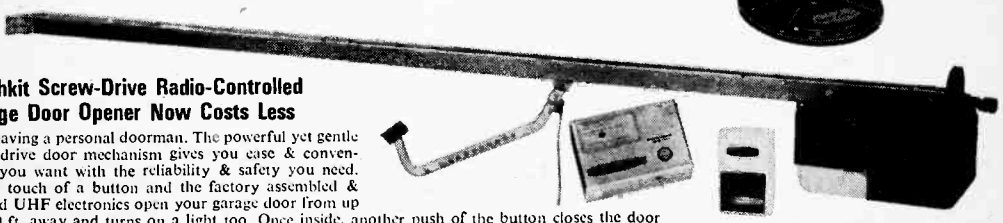
Kit GD-48, 4 lbs. **$69.95***
GDA-48-1, 9 V battery, 1 lb. **$1.30***

Heathkit GD-48
$69.95*

Heathkit Screw-Drive Radio-Controlled Garage Door Opener Now Costs Less

Like having a personal doorman. The powerful yet gentle screw-drive door mechanism gives you ease & convenience you want with the reliability & safety you need. Just a touch of a button and the factory assembled & aligned UHF electronics open your garage door from up to 150 ft. away and turns on a light too. Once inside, another push of the button closes the door safely behind you, yet the light remains on long enough for you to enter your home. Fast, easy one-night assembly . . . all wires pre-cut with connectors installed . . . no soldering. Fits any 7½' overhead, jamb or pivot single or double size residential doors. Automatic instant reverse feature prevents injury to kids, pets, etc. Send for yours now.

GD-209A, mechanism, receiver & transmitter, 66 lbs. **$139.95***
GD-209B, mechanism, receiver & 2 transmitters, 66 lbs. **$149.95***



New Lower Price
Kit GD-209A
$139.95*

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FREE 1970 CATALOG!
Now with more kits, more color. Fully describes these along with over 300 kits for stereo/hi-fi, color TV, electronic organs, guitar amplifiers, amateur radio, marine, educational, CB, home & hobby. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022.

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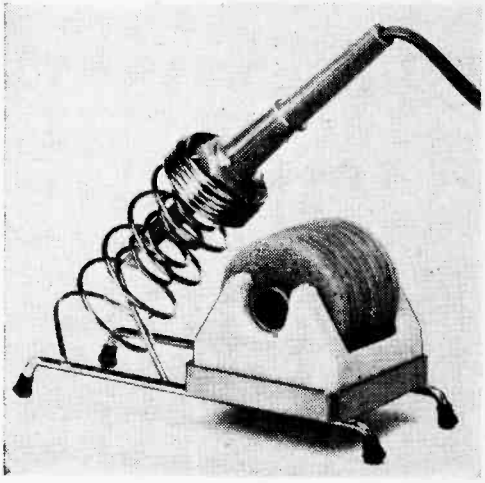
How to Be Tidy When Soldering

A combination soldering iron holder and rotary tip wiper, the Plato TWH-444 prevents iron burns, eliminates iron overheating, and increases operator efficiency. The unit incorporates the Plato TW-555 rotating tip wiper and a heavy wire double spiral iron holder mounted on a durable metal base with non-skid feet. The outer spiral of the holder prevents



Plato Soldering Iron Holder/Tip Wiper

the operator from touching the iron accidentally, while the inner spiral retains the iron securely and serves as a heat sink. Unit's design permits removal of the iron and cleaning of the tip in one continuous motion. The TWH-444 accommodates irons to 60-watt size. The complete unit is priced at $5.95; for further information write Plato Products, Inc., Box 1019, El Monte, Calif. 91734.

Bingo Bango Bongo

If you want to pretend you're in the tropics, you can add a calypso beat to your group with Knight-Kit's new solid-state Electronic Bongo Kit, model KG-391. You just plug the Bongo

Knight-Kit Electronic Bongos

PRODUCTS

Kit into your amplifier and tap the bongo heads with your fingertips as you would real bongo drums. The unit has a high and low bongo head, each with its own sustain control for varying the tone and making authentic-sounding noises. There's a volume control and *on/off* slide switch. The KG-391, which uses one 9-V battery, comes complete with wood base and step-by-step instructions; the price is $12.95. For further information write Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680.

Well-Dressed PCB Wears Soder-Mask

Soder-Mask is a liquid elastomer solder resist and coating mask that protects contacts, holes, and areas on printed-circuit boards that must be kept solder-free when boards are machine soldered. Soder-Mask is available in two types: regular and water soluble. The regular formula can be removed after soldering by peeling or rubbing. The water-soluble type is removed by washing in hot water. Either type can be applied by brushing, applicator, or syringe needle and will cure to form a tough coating which will withstand soldering temperatures of 500 to 550°F. Soder-Mask will also take a bake temperature of 300°F. for several hours, so it can be used as paint resist when coated, painted, or varnished parts must be oven cured. Soder-Mask is packed in 4-oz plastic bottles with applicator tips. Price is $2.49, and you can get more info from Solder Removal Co., Box 1678, Covina, Calif. 91722.

(More on page 12)

Solder Removal Company Soder-Mask

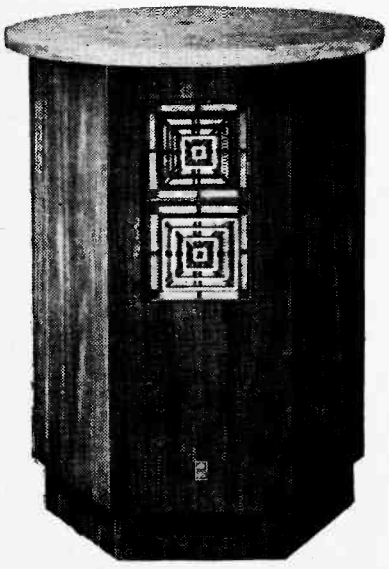
Spray-On Insulation

This new aerosal spray from Chemtronics is a refinement of their 10-year-old formula, NO-ARC. The new NO-ARC leaves a tough, thick protective red insulating coating capable of withstanding up to 30,000 volts. It's recommended for stopping arcing and corona shorts in high-voltage circuits, especially on color chassis. NO-ARC is also suggested for potting components, and for water-proofing and insulating printed-circuit boards and exposed wiring. You get 8 oz. for $2.79. For more dope (sic), write Chemtronics Inc., 1260 Ralph Ave., Brooklyn, N.Y. 11236.

Chemtronics NO-ARC Spray

Decline of the Empire (In Price)

Empire announces that they've finally produced a 3-way, high powered, omnidirectional, down-facing woofer, wide-angle lens speaker system priced under $100.00. The Empire 6000 Grenadier has three drivers, an ultrasonic domed tweeter, a powerful midrange radiator for full presence, and a heavy 10-in. down-facing woofer that sends out its low frequencies through a complete circle. The 6000 Grenadier will handle up to 75 watts per channel, and has a frequency range of 30 to 20,000 Hz at 8 ohms. Diameter is 18 in., height 24⅜ in. Price with walnut finish top is $99.95; with a marble top it's $109.95. For more detailed specs, write Empire Scientific Corp., 1055 Stewart Ave., Garden City, N.Y. 11530.



Empire 6000 Grenadier Speaker

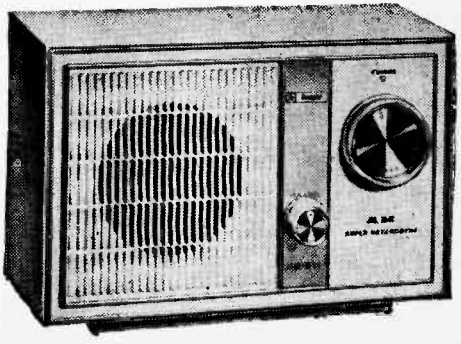
On Lancer . . . On . . .

You CBers will want to know about the new Lancer 500 series of mobile antennas from Mosley. Each model, 500A, 500B, 500C, features a high-Q coil, resulting in reduced mechanical height while maintaining power capability up to 500 watts. They also use a new guying device, located just above the coil, which prevents antenna lay-back even at top highway speeds. The Lancer 500 antennas are factory pre-tuned to minimum VSWR of 1.5 to 1 or better. There's a hinge feature so that antennas may be lowered and secured from either trunk or bumper mounting position. Each antenna is topped with a static ball to reduce corona effect and prevent loss of power. Prices are: 500A, $17.75; 500B, $22.85; 500C, $27.50. For more info write to Mosley Electronics Inc., 4610 N. Lindbergh Blvd., Bridgeton, Mo. 63042.

Mosley Lancer CB Antenna ⟶

Beginners, Here's Luck

Knight-Kit has a new, easily-assembled, tube-type AM table radio kit for all you students and beginners in electronics hobbying. Model KG-311 will give you a good working knowledge of superheterodyne radio circuits. It has 4 tubes, a rectifier, and automatic volume control. Unit operates on AC and tunes the standard 535-1650 kHz AM radio band. Size is 5¼ x

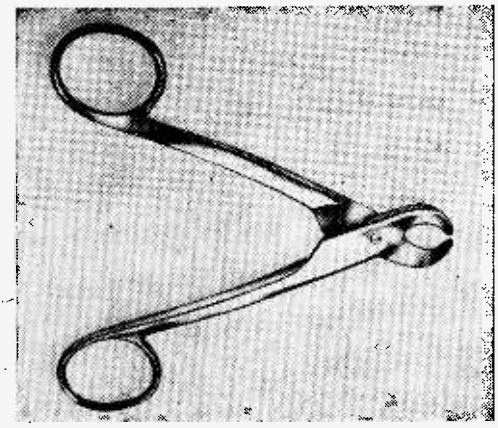


Knight-Kit AM Table Radio Kit

7¾ x 4 in., and it comes with ivory plastic case and detailed assembly instructions. Price is a mere $9.95; for full information, write Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680.

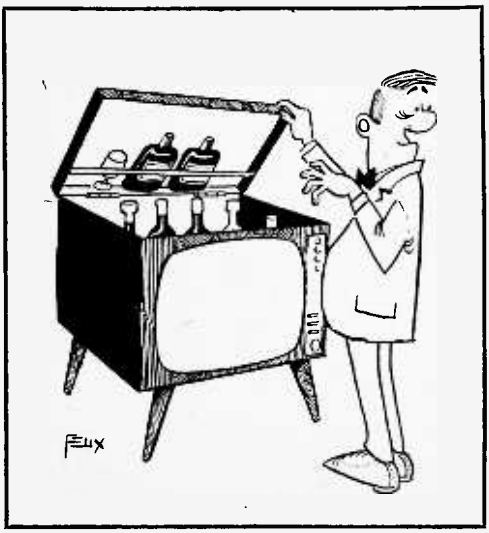
Stranded on Your Stranded Wire?

With these new 4⅜-in. cutters from the Brookstone Co. you'll have really neat slicing of insulation and/or stranded conductors. Their shape eliminates usual messy cuts with conductor strands mashed and spread apart, and



Brookstone 4⅜-In. Cutters

they'll also cut solid conductor wire. Suitable for copper and aluminum wire from the finest up to about ½-in. diameter over insulation, the cutters are forged of top-quality high-carbon steel and priced at $4.45. Sold only by mail from Brookstone Co., 539R Brookstone Bldg., Peterborough, N.H. 03458. ■

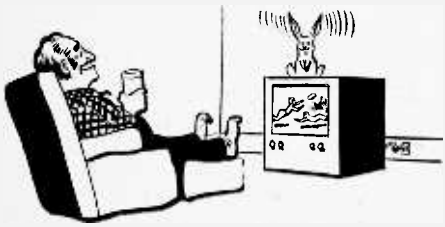


They'll Sell Anything

I recently saw an ad in a magazine on a "revolutionary" new omnidirectional outdoor antenna which the ad says will pull in TV (uhf and vhf), AM broadcast, FM stereo multiplex signals from every direction over a 75-mile radius. The ad also states that the antenna outperforms costly roof antennas 20 times its size. The illustration in the ad depicts the antenna as a small cylinder mounted on the side of a house and on a window sill. Since it's advertised for $12.98, how can it compare with a much more expensive antenna?

—C.J.S., Flushing, N.Y.

We don't believe the claims. Apparently some enthusiastic ad copy writer got carried away with himself without knowing much about TV reception. We also saw the ad which states "color pictures come in snow-free and stable in color and contrast." Under some conditions



this might occur, but we are betting against it with the odds in our favor. The ad also states "you couldn't get better results from a motorized antenna system selling for 10 times the the price." Frankly, we've looked inside the cylinder antenna and at the guts of other exotic devices offered in the past. For the most part they are just junk wiring packed into a plastic handsome case. In fact, the case brings in the $12.98 checks. Too bad the guts inside cannot bring in the signal. One key word to remember when reading these ads and that's *omnidirectional.* An omnidirectional antenna—an antenna that picks up signals from all directions—picks up signals from stations as well as ghosts. This is bad for any kind of TV reception.

Who Owns It Now?

I have a Cadre 501 citizens band transceiver that needs repair. My problem is that of finding replacements for the transistors in the transmitter section. One company quoted me a price on the exact replacements but the price is more than I want to pay for such an old unit. There's bound to be replacements for these transistors at a reasonable price.

—G. A., Rosenberg, Texas

The Cadre CB product line was bought by Amphenol then sold to Commander Electronics, 133 N. Jefferson St., Chicago, Ill. 60606. Commander should be able to help you.

A 50-Foot Pole?

I purchased a Lafayette (30-50 MHz) fire radio and a ground-plane antenna about three years ago. I always tune to county fire stations. I receive base-station dispatchers fairly well and get very little reception of mobile units. Could you please tell me how I could stepup reception so I can receive everything in that band?

—G.P., Glen Cove, N.Y.

Don't expect to hear mobile units well unless your antenna is very high above surrounding terrain. Bear in mind that you are listening to transmitters ranging in power from 15 to 100 watts compared to broadcast stations putting out 50,000 watts. You *could* get a vertically polarized beam antenna and a rotator and install them on a telephone pole or tower at least 50 ft high. But, is it worth the investment?

Did You Hear That Pane

Newspapers report the development of a laser microphone. Aimed at a windowpane, its beam would be modulated by the vibrations of the pane caused by conversion on the other side. If this mike is in production, planned for production, or if plans for building it are available, I would appreciate your letting me know.

—E.K., Chicago, Ill.

If it is in production, you probably couldn't afford one. Furthermore, using it would be an invasion of privacy. There's too much of that going on. Why don't you stick to party-line eavesdropping or get a 7X35 binocular. Do it like father did!

Buy New!

I have a Sears tape player which I would like to convert into a recorder. Is this possible without too great an expense, and if so, how?

—E. F., Lockport, Ill.

The expense might not be great, but the trouble would be. This is a mechanical project much more than electronics. Also, very few people can mount and align record heads. ■

You can now get a confirmed & guaranteed car reservation from National Car Rental in less than a minute.

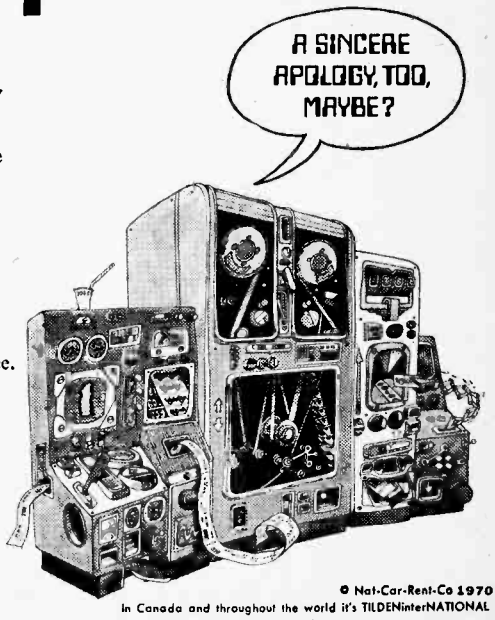
From all those other guys all you can get is a very sincere promise.

It's not that those other big city car outfits ever *mean* to leave you without wheels. It's just that at the moment they promise you a car they have no real way of knowing for sure that it will be there.

National does. Us country boys from Minnesota now have Max, the computer. You can call us for a reservation any time from anywhere in the U.S. toll-free by dialing 800-328-4567. Max knows, at the instant you call, what cars are available everywhere in the U.S. Before we guarantee your reservation, we talk to Max.

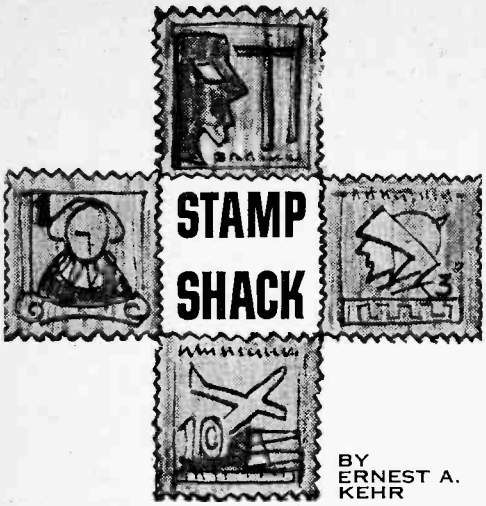
When you reserve a National Car at any of our locations, you also know you'll have your choice of a GM or other fine make, and that you'll get a fistful of free S&H Green Stamps.

It's your choice: a sincere promise or a National Guarantee. You can get either in about the same length of time.



NATIONAL CAR RENTAL

We make the customer No. 1



BY
ERNEST A.
KEHR

● ● Now that satellites are orbiting 22,000 and more miles over our oceans all over outer Space, nations around the globe are opening earth stations to take advantage of this revolutionary communications facility that augments terrestrial telephone and telegraph service.

● And just as fast as buildings are completed, postal administrations are producing special stamps to commemorate the linking with Intelsat systems. In recent months, Argentina, China and Hongkong have turned out colorful postal paper to mark the dedication and operations of their costly earth stations able to send and receive message signals via the Intelsat satellites.

● The idea of using Space satellites to bounce commercial signals from one part of earth to another began with "Early Bird," in 1965. Lani Bird I, II and III were subsequently launched and now hover over the Atlantic, Pacific and Indian Oceans, each capable of handling some 240 individual channel on a simultaneous basis. Now, with the orbiting of three more—the Intelsat III's——additional facilities have been added to supply 3,600 more channels to speed Man's messages.

● ● The Argentinian issue comprises two values: 20 peso, which shows a montage of the earth station with its immense "dish" antenna pointed skywards towards the Intelsat III, and 40 peso, which shows another view of just the station. The station has been erected in Balcare, in an open area some 300 miles south of Buenos Aires, and which is both capable of handling all telecommunications needs today and of being enlarged as demands for service increase in the future. Costing some $6 million, it was opened in December, 1969, with a live TV program in which Pope Paul appeared with greetings to the Argentinians from the Vatican. In Buenos Aires, President Juan Carlos Ongania thanked His Holiness and introduced Antonio Cardinal Caggiano, Catholic prelate of Argentina.

● ● China's stamps include three denominations ($1, $5 and $8 in local currency) and depict the Intelsat III flying through star-dotted heavens over the earth station. This facility is located on the hills of Chin-Shan-Li Yangmingshan, a short ten miles from Taipei.

● ● Hongkong's commemorative consists of a single $1 denomination in which designer V. Whitely shows its dish antenna and the Intelsat III framing an outline globe surrounded by waves symbolizing earth-Space signals. Hongkong's facilities were constructed by Cable and Wireless, Ltd., at Stanley Peninsula which juts into the China Sea between Repulse Bay and Tytam Reservoir on the southern end of Hong Kong Island. Cost estimates were submitted by the United States, Canada, Japan, Italy and Germany, but the £2,500,000 contract finally was let to British Marconi, Ltd.

● Hongkong long has served as a vital Asian communications point, especially for newsmen and business firms because of its convenient political independence in that part of the Orient so disturbed by wars and rumors of wars. In opening the station for business, the British colony promised that it would "mark a significant advance in an already highly-developed telecommunications point with links to the rest of the world."

● The new antenna, whose "dish" is 90 feet in diameter, will enable Cable and Wireless to transmit and receive messages via Intelsat from Japan, Hawaii, the United States, Australia and Thailand. The antenna has been designed to withstand typhoon winds of up to 210 mph when it is locked into "stow" position and pointing vertically upwards.

● A second earth station is being built to face west and eventually add New Zealand, Viet-nam and South Korea to the list of lands to be linked with the famous colony. ■

Hong Kong Issue

China (Taiwan) Issue

Rep. of Argentina
20 & 40 Peso Issues

BOOKMARK
BY BOOKWORM

Some Buy! It's only 50¢ and the best buy in town! Ameco's *License Guide* by Martin Schwartz is a Radio Amateur's question and answer course that every aspiring ham should own and read. Updated to include the latest FCC rule changes, this guide actually offers the questions with multiple choice answers you may

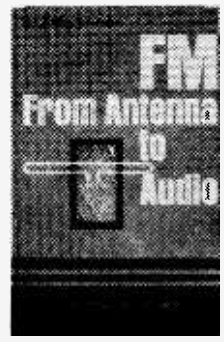
Soft cover
48 pages
50¢

see on your amateur radio exam. The *License Guide* is the next best thing to a crib sheet in the exam room. The Guide is divided into four major sections. They are: Novice class questions and answers; General class questions and answers; FCC-type Novice examination, and FCC-type General examination. Answers to the examination are given in back of the Guide. Most stores and mail order houses that sell amateur equipment also sell Ameco's *License Guide*. Can't find a copy, then write to Ameco Publishing Corp., 314 Hillside Ave., Williston Park, N. Y. 11596.

FM Theory. The fidelity and noise-free qualities of FM reception are known and enjoyed by many; just how these qualities are achieved, the principles and circuitry of FM broadcasting and reception, are less well known. *FM From Antenna to Audio* by Leonard Feldman presents a complete description of FM reception, with special emphasis on FM principles and receiver circuitry.

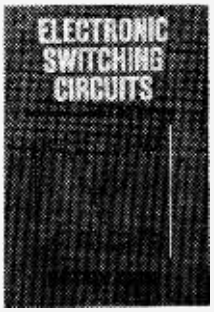
If co-channel and adjacent-channel interference and pre-emphasis and de-emphasis are unknown terms to you, don't despair. The author devotes two chapters in the laying of ground work before he takes up the receiving system. At the end the author dwells on FM receiver alignment and measurements.

In this concisely written book, the author presents a complete picture of FM reception and FM receivers, from basic principles to latest developments in AFC and tuning aids. To get your copy, write to Howard W. Sams & Co., Inc., Indianapolis, Indiana 46206.



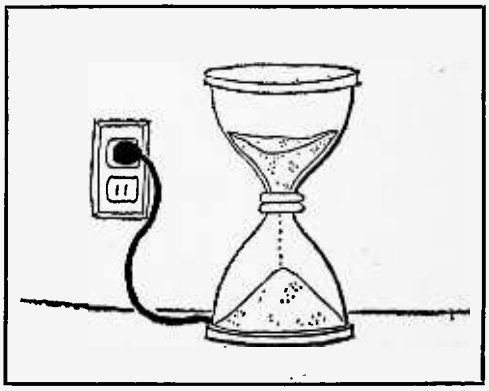
Soft cover
159 pages
$3.95

1 + 1 is 10. *Electronic Switching Circuits (Boolean Algebra and Mapping)* by Matthew Mandl is an up-to-date explanation of the basic principles of electronic switching that is presented for the first time at the technical-institute level. The text explains logic circuits using dia-



Cloth bound
229 pages
$12.50

grams, logic maps, and truth tables, and discusses parallel methods in detail with Karnaugh maps and Venn diagrams. This book is for the serious experimenter who plans a career in computer electronics. Pick up a copy at any bookstore or direct from Prentice-Hall, Inc., Englewood, N. J. 07632. ■



The ★ Skies Above Us

by Dr. Roy K. Marshall

☆☆ Here is the summer sky at its best, with Vega its brightest gem almost exactly in the zenith in the August map. Deep orange Arcturus, about as bright as Vega, is still up in the west; undeniably red Antares, about half as bright as Arcturus, stands lower in the southwest.

☆ Vega is the western corner of "the Summer Triangle," with Altair in the constellation Aquila, the Eagle, and Deneb ("the Tail") of the Swan, Cygnus, the other two corners. While Cygnus is classically the Swan, we all feel compelled to call the figure the "Northern Cross," because it looks like a cross (could there be a better reason?), which the better-known Southern Cross certainly doesn't. The latter is too far south to be visible except at very critical times, and then only from the utmost southern tips of continental U.S.A. Our 50th state, Hawaii, is more favored, if that is the word.

☆ Sagittarius, the Centaur-Archer, looks like a teapot in the south, Capricornus, the Sea-Goat (front part goat, with a fish's tail) like a triangle with distorted sides, but Scorpius looks like a pretty good Scorpion, with its curled-up tail and all. If you look at it later (or on the September map) you will see the Teapot seemingly tilted up so it is in position to pour hot tea on the tail of the scorpion. No wonder it's curled up!

☆☆ Another August event, this time an annual, is the meteor shower called by the Irish peasants, in older times, "Tears of St. Lawrence," for the man considered very responsible in the conversion of Rome; he was martyred in 282 A.D. His feast day is Aug. 10, but his "tears" appear in maximum numbers about Aug. 12. In 1970, I have calculated the maximum for August 12 at about noon, Eastern Daylight Time, a time of day when "shooting stars" are normally not visible, so consider the

(Continued on page 20)

THE AMAZING WORLD OF SOUND

ASTRO-COM TELEPHONE-AMPLIFIER

Transforms any ordinary telephone earpiece into a unique sound-control amplifier! It's a space-age electronic concept that assures the maximum in hearing range and comfort... attaches instantly and securely to any phone with a simple, snug-fitting band.

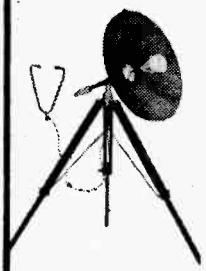
Carry it in your pocket... or in purse, it's that portable! Especially suited for high-noise factory and office areas. And, it's a low-cost practical answer to public phone distractions. What's more, the hard-of-hearing, and elderly folks find it a definite aid, while guaranteeing privacy!

Precision-built for reliable performance, the ASTRO-COM amplifies any normal speaking voice up to five times. Complete with easily adjustable fingertip touch volume control.

Amplification: More Specification than 30db
Circuitry: 4 transistors
Case: High Impact Polystyrene
Battery: For best results, use Saxton #B-103 battery or equivalent. Battery life expectancy—25 hours.

only $9.95
(less battery)

THE BIG EAR



"HOMES IN" on faint sounds up to 100 feet away... twice as far over water.

Exclusive cordless Broadcast Accessory also available—Increase sensibility tenfold.

- USE INDOORS OR OUTDOORS—from baby sitting to bird watching.
- ENTERTAINING, PRACTICAL AND INSTRUCTIONAL for young and old.
- THE LATEST IMPALID STATE CIRCUITRY.
- PROTECTIVE DEVICES to listen for intruders at night.

The "BIG EAR" is an amazing electronic device which is completely portable. Basically it combines the principle of a parabolic microphone, a high gain amplification system and stethoscope earphone for intimate listening.

The "BIG EAR" comes complete with its own sturdy adjustable tripod base for convenient use anywhere... operates for hours on standard 9 volt-transistor battery.

Complete with Stethoscope earphones ONLY $19.95
(less batteries)

BIG EAR BROADCAST ACCESSORY

Plug in our exclusive cordless Broadcast Accessory and convert Big-Ear into a group entertainment listening device. The "Big-Ear Broadcaster" let you broadcast sound to any FM receiver up to 30 feet away. With it you hear everything, without connecting wires with 30 times amplification.

Stay indoors and listen to bird calls and animal sounds. Place it in a baby's room or near the baby carriage or use it as a sick room monitor.

BROADCASTER COMPLETE ONLY $14.95
(less batteries)

"SKY-SPY" NOW!! Add A New Dimension To Listening... Up!

Complete SKY-SPY only! $16.95
(less batteries)

Amazing... excitingly new! "SKY-SPY" allows reception from planes within a range of 75 miles; even permits reception from the aircraft tower itself within a 15 mile range.

Hear how aircraft are instructed to land, weather conditions, delays in launchings, etc....

This unique device uses 1.52 hearing aid batteries... giving it a 65 hour life span.

EYEGLASS RADIO

Clips to your glasses, receives the whole AM broadcast band, can be used wherever you go 'cause it weighs a few ounces. Comes with earphone plug for privacy, convenient on-off and tuning knobs. Includes 1.5v. hearing aid batteries for many long hours of listening pleasure.

only $15.95

ASTRO-COM WRIST RADIO Transmitter

- Broadcasts your voice to any FM receiver within 50 feet in any direction.
- No wires! Powerful tiny silver oxide battery good for hours of broadcasting!
- Great for party fun; kids' games; keeps you in touch with playroom, bedroom, or sick room.
- Complete with replaceable silver oxide battery, nylon strap, rugged case, "whip" antenna, and tuning device.
- Electronic components designed by Saxton first in miniature electronic equipment.

SPECIFICATIONS: Frequency Response: 300 to 6,000 hz.; POWER: 6 MW input; RANGE: Up to 50 feet, depending upon conditions; Frequency: FM broadcast band, (tunable ± 3 megacycles through 88 megacycles); Audio Sensitivity: Normal voice at approximately 10 feet; Case: High impact polystyrene-electronics encapsulated in epoxy; Weight: 4 ozs.

SPECIAL INTRODUCTORY PRICE ONLY $14.00

D & D SALES CO. DEPT. WS-8
60 E. 42nd Street
New York, N.Y. 10017

Please send me the following items on a full money back GUARANTEE, if I'm not completely satisfied.
I enclose my check (or money order) for $_____.

ITEM	NUMBER OF UNITS	UNIT PRICE	TOTAL PRICE
BIG EAR		$19.95	$
BROADCASTER		14.95	
PHONE AMPLIFIER		9.95	
SKY-SPY		16.95	
WRIST RADIO		14.00	
EYE GLASS RADIO		15.95	
		Plus Postage & Handling 1.50 per unit	
		New York State Residents add appropriate tax	
		TOTAL AMOUNT ENCLOSED	

nights of August 11 and 12 as sharing the maximum.

☆ Meteor showers occur as the earth passes through a swarm of tiny objects traveling along like an elongated cloud, pursuing an orbit around the sun. The path followed by these August meteors is the same as that of the comet discovered in 1862 by Lewis Swift, which is expected to return in about 1984, but the meteors appear every year, having been observed as early as in 900 A.D., so they must be strewn along the path of the comet from which they may have leaked.

☆ Officially, they are called Perseids, because they seem to radiate from the constellation Persesus, low in the northeastern September map. Most meteors will be seen if the observer looks in that direction, but many will be seen in other parts of the sky. Save some late-evening or after-midnight hours for meteors, between Aug. 9 and 14, even if the moon will cut down the optimum rate of about 60 per hour.

☆☆ On the evening of August 16, a full moon occurs, but a close watcher will see a smudge deepening at the upper left edge, about 8:15 p.m. and at last, at 9:18, a definite nick will begin, and grow as the moon goes into partial eclipse near the eastern corner of Capricornus. Maximum eclipse, with 41% of the moon's diameter immersed in the earth's shadow, occurs at 10:24 and the important part of the show ends at 11:30, although the "smudge" continues for about an hour. The diagram tells more of the story.

☆ An annular eclipse of the sun, like a total, but with the moon not quite able to cover all of the sun, thus leaving an annulus or ring of the sun around the black lunar disk, will occur on August 31, but forget it, unless you plan to be in the South Pacific in some part of a narrow path from New Britain through Melanesia almost to the point where Antarctica reaches out toward the tip of South America.

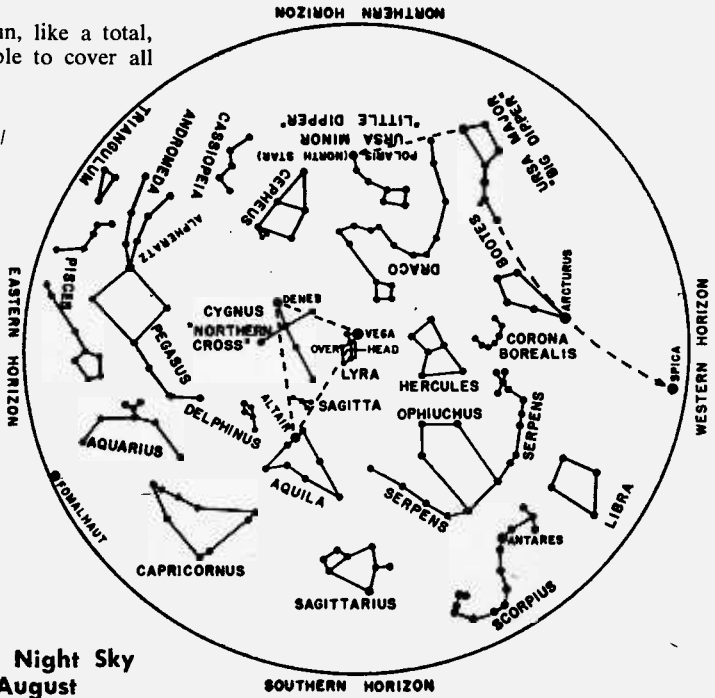
☆ To return to the August 16 lunar eclipse, the moon will rise at about sunset for everyone on earth on that date, because the full moon occurs then, when the moon is exactly opposite the sun. But only those who live where the moon is in their sky from 9:18 to 11:30 p.m., E.S.T. (which will be 10:18 p.m. Aug. 16 to 12:30 a.m., Aug. 17, Eastern Daylight Time, for most of us) will be able to see all of the important part of the eclipse—the passage of the northern 41% of the moon's diameter through the umbral shadow of the earth.

☆ Unless only a bright point of light is the source, the shadow of any object will have a dark core and a tapering-off border. The part of the shadow that gets no light at all from a larger-than-a-simple-point source is called the *umbra*, the Latin word for "shadow;" the falling-off outer border surrounding the umbra is called the *penumbra*, Latin for "next to the shadow." Some light gets into the penumbra from the edges of the source when it is larger than a very small area, such as a tiny arc at a considerable distance.

☆ So the sun, a source about a half-degree wide as seen from earth (a copper cent at seven feet), by no means a point, is able to produce

(Continued on page 22)

☆☆☆ The maps show the principal stars which are above the horizon at latitude 34° North at about 9 p.m. standard time at the middle of the month. These maps are practical star location guides anywhere in the United States throughout the month showing the sky at 10 p.m. on the first and at 8 p.m. on the last of the month. To look at the night sky in June and July, select the proper map and hold it vertically. Then turn the map so that the point of the compass toward which you are facing shows at the bottom of the map. ☆☆☆ Our special thanks go to the Griffith Observatory in Los Angeles, California. ☆☆☆



The Night Sky in August

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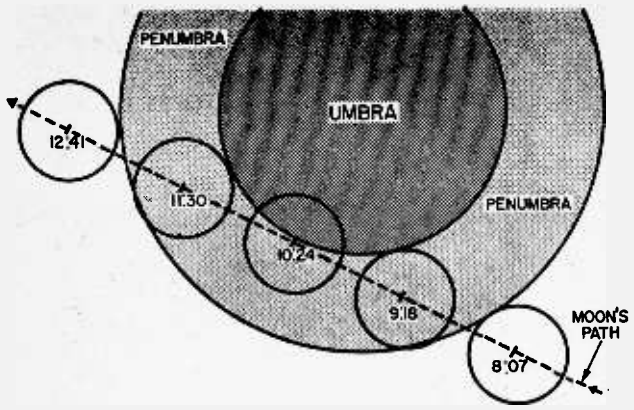


In this diagram of the passage of the moon through the earth's shadow, producing the partial lunar eclipse on the evening of Aug. 16, 1970, the times are E.S.T., so they must be increased by one hour for Eastern Daylight, taken as they are for Central Daylight, diminished by one hour for Mountain Daylight and by two hours for Pacific Daylight Time. The moon's three middle representations indicate the portion of the eclipse that will be obvious.
North is at the top.

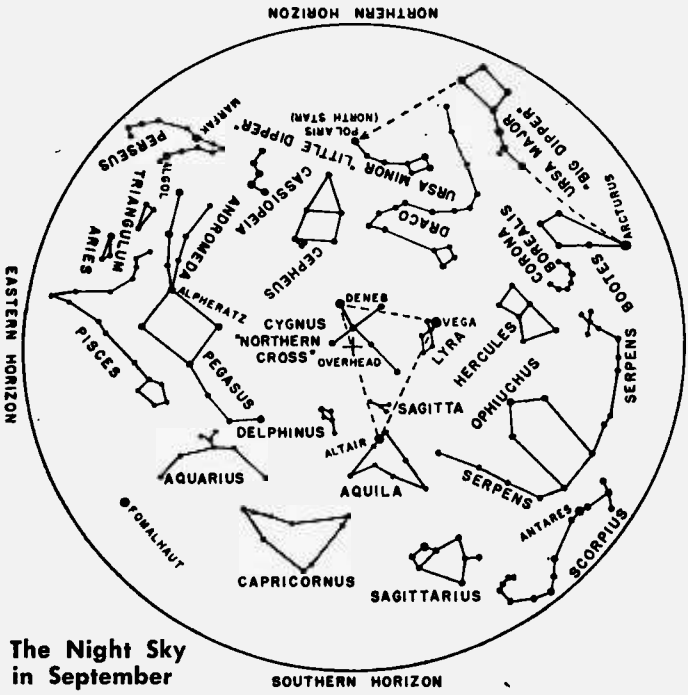
a shadow of the earth that has an umbra and a penumbra. At the very outer edge of the penumbra, the full sunlight is shining; as we go in farther, less and less of the full disk of the sun is exposed, so the penumbra deepens until, at last, the moon enters the umbra.

☆ But the earth's atmosphere bends some sunlight into the umbra, so it also deepens toward its center and we can expect the "bite" in the edge of the moon to be darker, farther from the moon's center, at mid-eclipse. Because the long red wavelengths of sunlight get through our air more plentifully than others as it is refracted, the umbra appears reddish, from bright bronze to dull old copper or even, if there is a lot of cloudiness around the rim of the earth, very, very dark. There have been instances when, because of extreme cloudiness or, more significantly, when violent volcanic explosions have loaded the high atmosphere with dust, a totally eclipsed moon has been visible only with difficulty.

☆ With new high-speed color films (Anscochrome 500, for example), color photographs are now easier, provided the focal length of the lens of the camera is great enough. The moon looks big in the sky, but it will be an insignificant little spot on the film exposed in an ordinary camera, so don't waste the film.

☆ At the mean distance of 238,855 miles, the moon's diameter on a film is given by dividing the focal length of the lens by 110. A common focal length for what is called a 35 mm. camera is two inches, so the moon's image diameter will be a little less than one fiftieth of an inch. So get a long lens, if you're not set up to attach a camera body with the film in the focal plane of a telescope lens or mirror. I use a 16-inch telephoto lens on my camera and get an image about one-sixth inch in diameter that is worth enlarging.

☆ Use exposures of 1/50 to 1/25 second, at f/8 or f/11, where most lenses perform best, on film with ASA speeds of 100 to 500. Take a lot of exposures—film is the cheapest ingredient—at various speeds and openings, and I hope you get at least a few very good ones. Lots of luck! ■



The Night Sky in September

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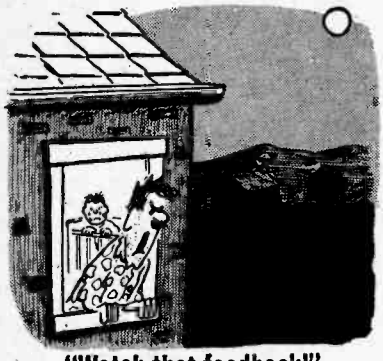
IN THE HEAT OF THE NIGHT

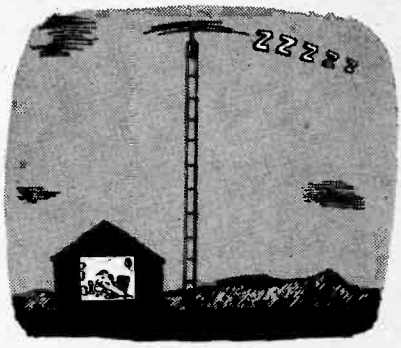
by Jack Schmidt



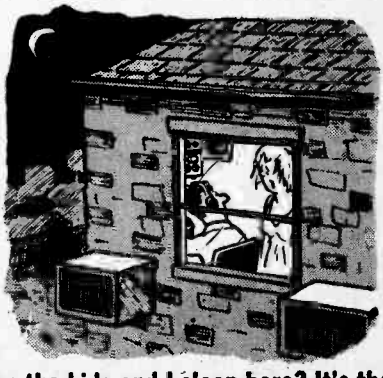
"Watch that feedback!"

"Don't try, Harold. The room is full of electronic sensors!"

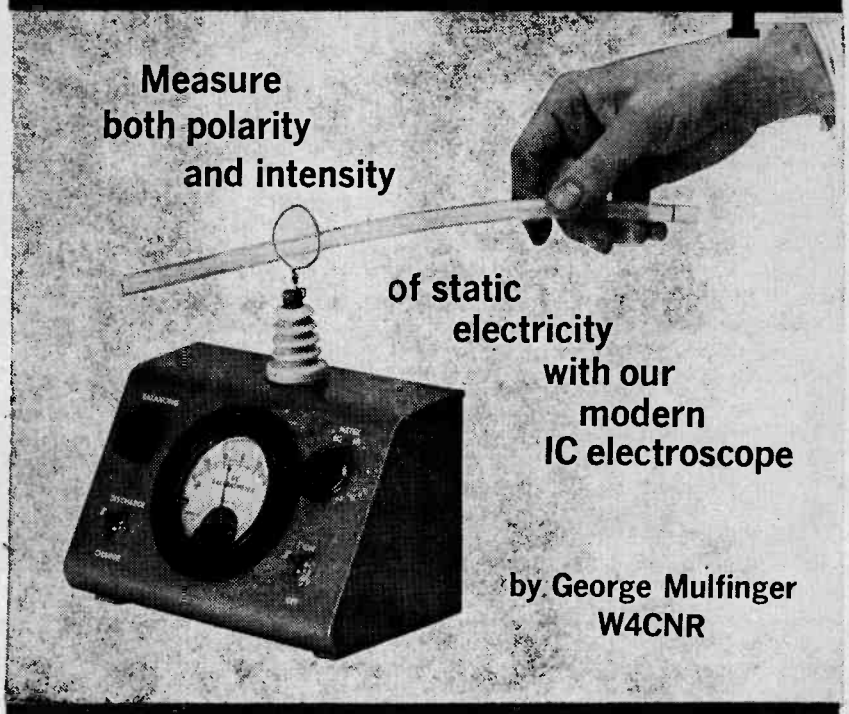
"About now, Arnold, we should be getting some sort of answer!"



"... 15 transistors, 7 diodes, variable squelch, double-sideband ..."



"Can the kids and I sleep here? It's the only cool room in the house!"



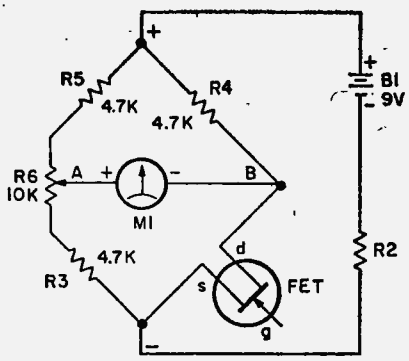
Measure both polarity and intensity of static electricity with our modern IC electroscope

by George Mulfinger W4CNR

Electro-Snoop

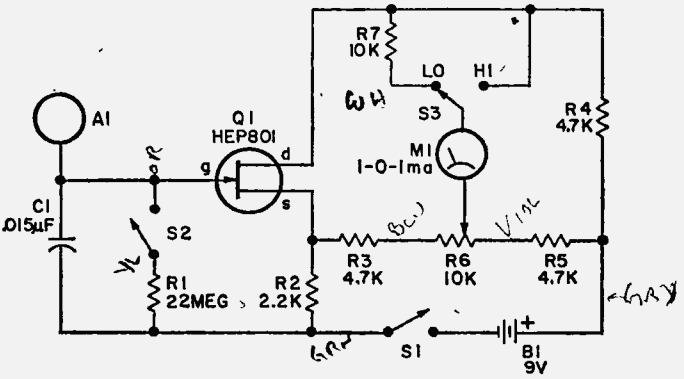
electroscope has its problems. The gold leaves are hard to maintain and the instrument can't distinguish directly between a plus and minus charge. The Braun electroscope represents a considerable improvement over this, but still requires an external neon lamp to determine polarity. Vacuum-tube electroscopes work nicely for negative charges, but a positive charge placed on the grid is quickly neutralized by electrons from the filament. This problem is completely circumvented by the use of a field effect transistor (FET). The absence of a filament coupled with its extremely high imput impedance allows a charge of either polarity to remain undisturbed on the gate (g) while the meter is being read.

The unit forms a neat self-contained package—no external connections or power source are needed, and it can be used anywhere, indoors or out. Battery drain is quite low, less than 1 mA when the bridge is balanced. It increases to something better than 1 mA with a positive charge and drops to ½ mA or even less with a negative charge.



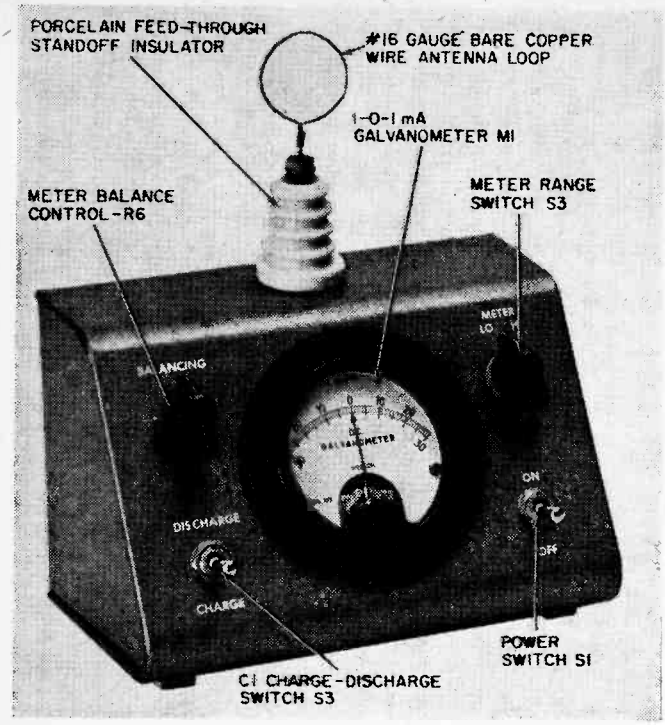
Redrawn Electro-Snoop shows Wheatstone Bridge formed by resistors R3-R5, pot R6, and FET.

How Electro-Snoop Works. We've redrawn the heart of *Electro-Snoop's* circuit into a conventional Wheatstone Bridge configuration, as shown in our simplified circuit drawing. From this it can be seen that current flows in two separate paths. Using the negative input at the bottom of the diagram as a starting point, it can be seen that electrons may travel up the left side through resistors R3, R6, and R5 to the positive, or up the right side through the FET and R4, and



PARTS LIST FOR ELECTRO-SNOOP

A1—Wire loop antenna, made from #16 bare copper wire, loop 1½-in. diam.
B1—9 volt transistor radio battery (Burgess 2U6 or Eveready 216, or equiv.)
C1—0.015 uF, 600 volt tubular capacitor (Lafayette 34E82536 or equiv.)
M1—1-0-1 DC galvanometer Weston model 375 or equiv.)
Q1—Field effect transistor, Motorola HEP801
R1—22-megohm, ½-w resistor
R2—2200-ohm, ½-w resistor
R3, R4, R5—4700-ohm, ½-w resistor
R6—10,000-ohm, linear-taper potentiometer, Lafayette 33E11255 or equiv.)
R7—10,000-ohm, ½-w resistor
S1, S2—Spst toggle switch (Lafayette 34E33026 or equiv.)
S3—Single pole, two position rotary switch (Lafayette 30E49202 or equiv.)
1—Battery connector (Lafayette 99E62879 or equiv.
1—Battery holder (Keystone 203P or equiv.)
1—Porcelain stand-off feedthrough insulator (Lafayette 33E32012 or equiv.)
1—7 X 4 X 4¼-in. utility cabinet (Bud AC1613 or equiv.)
OPTIONAL (see text)
1—Transistor socket and mounting ring (Lafayette 32E42195 & 32E42260 ring or equiv.)
1—4¾6 X 4½ X 4¼-in. universal meter case (Lafayette 12E83175 or equiv.)
MISC.—Perf board, push-in pins (Lafayette 19E83022 or equiv.), rubber feet knobs, wire solder, spacers, bolts, nuts, etc.



Don't like antenna loop topside? Metal foil square also works.

meet at the positive pole at the top of the diagram.

The purpose of R2 is to limit the voltage on the FET to approximately 2V. By adjusting R6 a balance position can be found at which points A and B in the diagram are both at the same potential, approximately 6.5V. Therefore, since there is no potential difference across the meter, it will read zero. In this balanced state, whenever a charge is placed on the gate of the FET, the bridge will respond, with the meter swinging either to the right or left depending on the polarity of the charge.

Whenever a negative charge is placed on the gate of the FET, electrons will be inhibited from passing through the FET. This in effect is equivalent to raising the resistance in this arm of the bridge, which, in turn, increases the voltage drop across the FET proportionally. Point B now assumes a higher potential than point A, and since there now is a difference in potential across the meter, current flows through the meter, deflecting the pointer to the left.

When a positive charge is placed on the gate, electrons will flow more easily through the FET, thus in effect lowering its resistance. The voltage now divides between R4 and the FET in such a manner that the voltage of point B is lowered with respect to point A. Again, because there is a difference in potential, current will flow through the meter, this time deflecting the pointer to the right. By using a value for R2 specified in the Parts List there will be latitude for good deflection in both directions.

Referring back to *Electro-Snoops's* complete schematic, it will be noted that a capacitor (C1) and a resistor (R1) are in the input circuit. When S2 is closed (*Discharge* position) these form a DC RC circuit having a time constant of about ⅓ second. This provides sufficient time for the meter to be read when a charge is placed on the antenna of *Electro-Snoop*. The circuit then quickly returns to normal as C1 discharges through it.

Capacitor C1 also prevents the meter from oscillating unduly as a charged object is being withdrawn from the antenna loop. With S2 open (*Charge* position), C2 merely stores cumulatively whatever charges are placed on the antenna until switch S2 is again closed to discharge the capacitor through R1.

Switch S3 is a meter sensitivity switch. With S3 in the *high* sensitivity position the meter is connected directly to the bridge. When S3 is placed in the *low* sensitivity position the meter is connected in series with R7 to limit current through it.

Construction. Our model *Electro-Snoop*, shown in the photos, was housed in a 7 x 4 x 4¼-in. sloping panel utility cabinet. You'll have to punch out a big hole (size dependent on the meter you use) to mount the meter in the sloping front panel. If you don't want to work so hard punching out this hole, buy a standard sloping panel meter case. It comes with a hole ready punched for a 2-in. meter and a knockout to enlarge it to 3-in., if need be. However, it doesn't come in the 7-in. width so you'll have to use a smaller piece of perf board to mount the FET, resistors, and capacitors used in the

Electro-Snoop

circuit. Even so, this should present no hardship since they are small and don't require as much space as was actually used in the model.

If you don't want to go to the expense of a special sloping panel cabinet the unit will work just as well in any case you have available since the circuit isn't critical to parts placement beyond the normal good wiring practices.

In addition to the meter hole, two ½-in. holes for the toggle switches are drilled near the bottom of the sloping panel, one on either side of the meter. Another ½-in. hole is drilled in the top of the case for the feed-through insulator for the antenna. Two ⅜-in. holes are drilled near the top of the front panel spaced to line up with the two bottom holes, one to the right of the meter for the meter-range switch and one to the left of the meter for the balance-potentiometer. When these holes have been drilled and de-burred you are ready to mount the various components in their respective mounting holes.

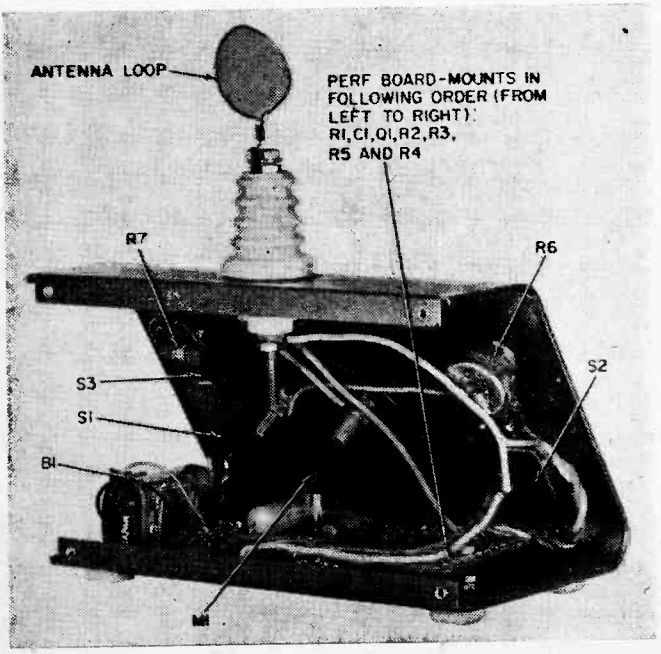
The antenna is a length of #16 bare copper wire formed into a closed loop with a continuing lead-in long enough to attach it by the top nut of the feed-through insulator.

For the model in the photos we mounted the balance of the components on a 4½ x 2¼-in. piece of perf board. If by chance you use the smaller meter case, the perf board will, of necessity, be smaller. We used a socket to plug-in the FET. This isn't an absolute necessity, and you may want to mount all of the parts, including the FET on push-in pins (they make good supports and also make it easier to replace soldered-in parts). Should you decide to eliminate the socket for the FET, be sure to protect the FET with a heat sink, made from a small alligator clip temporarily slipped on the lead being soldered.

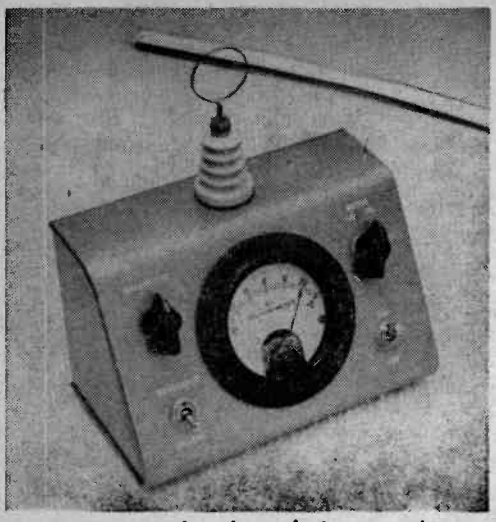
The perf board is fastened to the cabinet by two 6-32 machine screws and nuts. Raise the board away from the base of the case either by using ¼-in. spacers or extra nuts on the mounting bolts to avoid possibility of shorts between the board and the case. The interconnecting leads are now wired to the proper points. Leave the leads long enough for the circuit board to be lifted out of the cabinet if the need should arise. Resistor R7 in connected directly to S3. The lead from the lower end of the feed-through insulator should be connected directly to S2 rather than to the circuit board. The battery holder is mounted near one end of the circuit board. Trim the leads from the battery connector to fit the location.

If the high cost of the galvanometer specified in the Parts List deters you from building *Electro-Snoop* we've found an inexpensive alternative instrument. Lafayette Radio offers an edgewise balance and tuning meter in which the pointer rests center scale when no current is flowing. It will swing either right or left of center, depending on the polarity of the current flow.

The sensitivity of this meter is ± 100 μA, which is considerably more sensitive than the meter we used in the model. You should use this meter with the meter



Electro-Snoop's neat innards bared to show parts placement.



Bringing positively charged lucite rod near 'tenna loop, you'll see meter swing to right.

sensitivity switch in the *Low* sensivity position at all times.

One point to consider: if you build *Electro-Snoop* for classroom or other large group demonstrations this alternate meter is harder to read from a distance a few feet away from the meter. Also, if you do use the alternate meter, remember not to punch the large round hole in the front panel. It mounts in a slot 1 5/16-in. long by ½-in. high. Lafayette's part number for this tuning meter is 99E50346; it's priced at $2.50. The meter we used, in contrast, is about $18.00 new and about half that price used.

Calibrating and Operating. The only calibration necessary is to balance the bridge before using the instrument. With S3 in *High* sensitivity position, and S2 in the *Discharge* position, turn S1 to *on* and proceed to operate *Balance* control R6 until the meter is centered on zero. This completes the balance calibration and you're ready to experiment with *Electro-Snoop.*

A negatively charged object held near the antenna will deflect the meter pointer to the left while a positively charged object will deflect it to the right. You may hear a slight sparking sound as the charge jumps across the gap between the object and the antenna.

A negative charge can be generated by rubbing a hard rubber (ebonite) rod with wool; the minus charge appears on the rod. This is the classical method and is hard to beat. It is best to stroke the rod repeatedly in the same direction rather than rubbing back and forth. The rod is then touched to the antenna, or better still, pulled along the antenna in order to build up the charge.

Another way of developing a negative charge is by combing the hair with a nylon comb; the nylon will acquire a fairly respectable negative charge. Still another method is walking across a thick carpet, then, when holding a finger near the antenna a spark will jump from the finger to the antenna sending the meter pointer strongly to the left.

The old textbook method of rubbing glass with silk to produce a positive charge isn't recommended. Too often only a very feeble charge will be the result. A good healthy positive charge can be generated by rubbing a lucite rod with wool or cotton. Thus the same piece of cloth can be used to develop both positive and negative charges by alternating a lucite rod (which will produce positive charges) with an ebonite rod (which will produce negative charges).

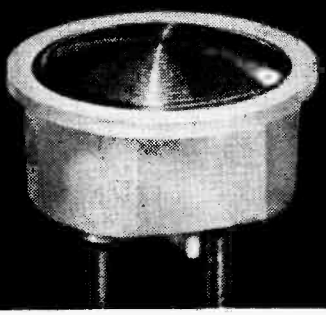
With S2 placed in the *Discharge* (closed) position, charges placed on the antenna are merely sampled and the bridge quickly returns to normal. However, with S2 in the *Charge* (open) position, charges will be accumulated on C1 and the meter reading will hold constant until the next charge is applied. Several consecutive charges of the same polarity will increase the meter reading up to a maximum high value. Then, closing S2 returns the reading to *zero* even though the battery is left turned *on.*

Editor's note: The author wishes to express his thanks to Bill Greaves, Chief Engineer of station WMUU, who suggested the basic idea for this project. ■

Find out what state of charge your horoscope is in. Leo's positive while Aries's negative.

Let our peeper-pleasin' wallet teaser doll up your test gear!

NO-SQUINT



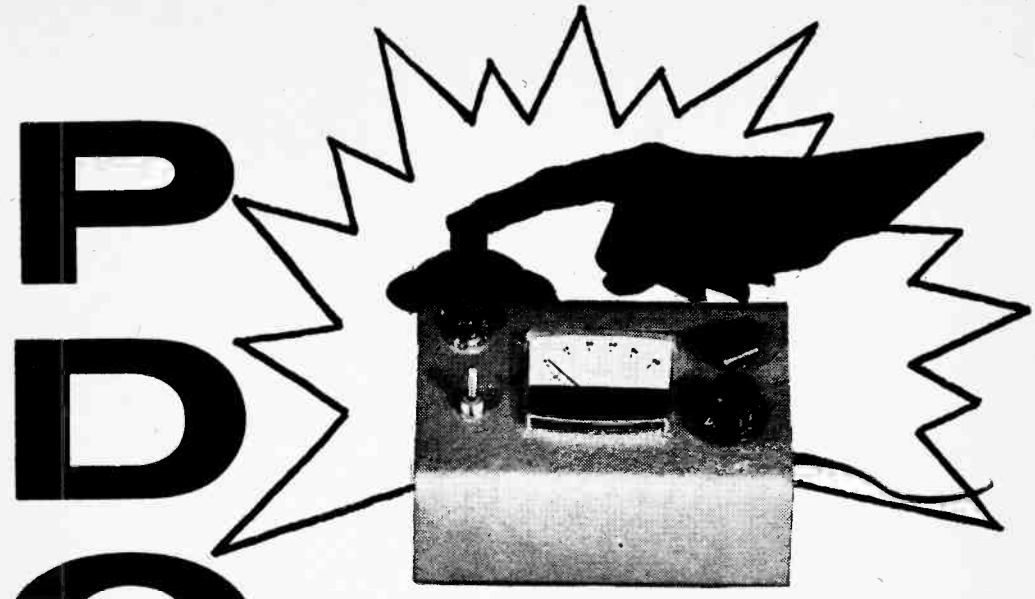
MOST of us have unintentionally allowed some test equipment to roast on our workbench overnight at some point in our electronics career. You thought the darn thing was turned *off*; a red-hot power transformer told you otherwise upon your return to the scene of the crime next day. If you're tired of searching high and low for unmistakable power-*on* indications every time you plug in line-operated equipment, then swivel your baby blues toward our *No-Squint*.

Our neon super-shiner lobs its rays at you under all indoor (or outdoor!) lighting conditions. Magnifying glasses you won't need to gaze upon this almost inch-wide pilot lamp; unlike ordinary line-operated neon indicators, this baby practically stands up and waves its orangey self at you.

No-Squint also passes the buck—back into your wallet. Four bits, give or take a few pence, entitles you to one of these ⅞-in. diameter white plastic beauties. And you can install our penny-pinching pilot light in a half hour, easily making *No-Squint* the fastest and cheapest means of protecting all of your plug-in gear from those unnecessary stew-ins.

Drill 'n' Fill. It'll take less time to mount *No-Squint* than it does to read about its virtues. Cut a ⅞-in. hole in the instrument's panel with a chassis punch. Before you actually mount *No-Squint* in this hole, squish a bead of plastic cement around the base of the hole. Press the pilot-light assembly into the hole and place some pressure on it until the glue's dry. Solder connections can be made directly to the metal prongs emerging from the business side. For safety's sake, slip a short length of spaghetti tubing over the prongs after soldering.

Plunk down 59 cents and you can pick up *No-Squint* from Lafayette Radio Electronics. They stock it under number 34E52448. —*Elmer Carlson* ■



REACT-OR

It brain-boggles while your tactiles tease it

by Stephen Daniels, WB2GIF

LIVING in the days of old Dodge City a feller had to be greased-lightning-fast with his shootin' iron. Few men dared draw against characters like Jesse James; they figured by the time their hand'd reached their holster, ol' J. James would've emptied his Colt, generally in the direction of their person.

Peculiar Twentieth Century situations involving the horseless carriage turn most mortals into modern-day Wyatt Earps. For instance, how quickly can you maneuver your Brakeless Wonder out of the path of another tired missile attempting a land speed record? Fact is, your reaction time is often your sole defense on a crowded pike. Or, driving along Main Street, U.S.A., you're confronted with a child darting unaware between parked cars in chase of an errant soft-ball. The difference between a safe child and a sorrowful driver is three-quarters of a second—your reaction time under *ideal* conditions.

Whether you drive a 3000-lb. auto or a 3-oz. golf ball, chances are your timing could stand some improvement. And better timing can be yours not by practicing on the open road, or golf course, or even in a shooting gallery, but seated in an easy chair at home. Pretty Darn Quick is the name of our reaction-time improver. Built into a compact sloping-panel cabinet, our PDQ swiftly and accurately indicates your reaction time. It sports a novel no-cheat circuit, so you (or the person you're testing) can't run up a better score than deserved. Twenty-five clams, plus a few tin-lead acrobatics, assembles PDQ. And that should hasten your workshop reaction time!

How it Works. Take a look at our schematic of PDQ. You'll see that it's divided into four distinct sections. Let's start with unijunction transistor, Q1, and associated circuitry. This gizmo's lashed up as a relaxation oscillator; capacitor C2, resistor R2, and *Time* pot R5 determine the time interval between output pulses. In this case, the RC components selected give up a pulse every 15 to 35 seconds depending upon R5's setting. One sawtooth-shaped pulse blips out of Q1's base 1 and knocks at the gate of Q2, a silicon controlled rectifier.

Note switch S1 wired in series with SCR's anode and relay K1. It's a spring-loaded

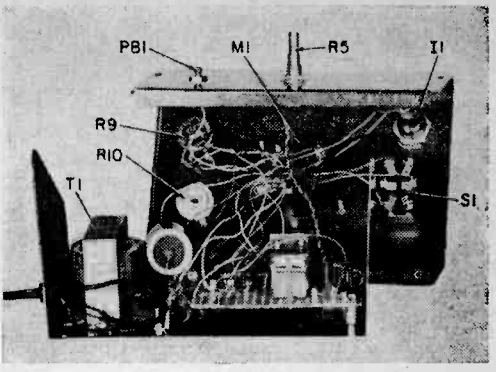
PDQ

affair contributing to PDQ's no-cheat accuracy.

Glancing over at the third circuit section, we see that Q3, a field effect transistor, is connected along with the neighboring electron-eaters as a high-impedance voltmeter. This mini FET-VM measures the voltage in the first remaining on C3. Here's how C3 gets this voltage in the first place: when S1's held down by PDQ's operator, the SCR's anode makes connection with K1. An incoming pulse arriving from Q1 triggers *off* the SCR. As this happens, the relay energizes, simultaneously extinguishing lamp I1 and switching capacitor C3 to resistor R6. The combination of C3 and R6 forms a simple RC network which serves to discharge C3.

Now let's see why you need a spring-loaded switch for S1. Immediately after I1 goes out, our nimble-fingered operator lets S1 zap back to its original position; Q2's anode connection is broken with the relay, and S1 connects the FET-VM to capacitor C3. Remember, you might be faster than a speeding locomotive, but it'll take you a finite amount of time to react to I1's disappearing act. In the meantime, of course, C3 merrily discharges through R6. That's how your bullet-quick reaction time's measured. Simple, isn't it!

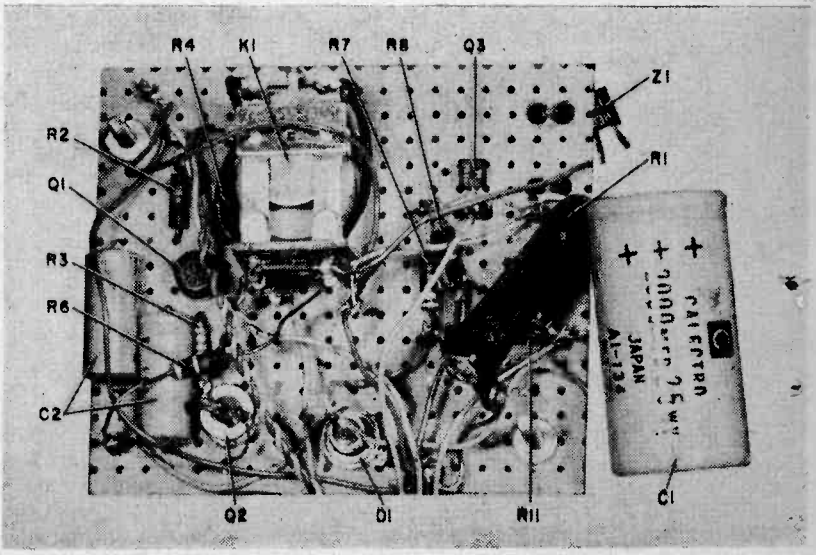
Now let's delve into the last circuit section. You won't need to get hot under the collar over this conventional power supply. Consisting merely to stepdown transformer T1, encapsulated bridge rectifier Z1, filter capacitor C1, dropping resistor R1, and zener diode D1, this supply gives you oodles of room to switch n' swap your spare parts. If you've a handy 12-volt source gathering dust in the workshop, save yourself a chunk o' change by making the substitution.



Author mounted meter M1, dpdt switch S1 on front panel of prototype reaction timer.

Construction Capers. Start your construction efforts by wiring the power supply if you're building it in. Drill a ¼-in. hole for the power-cord strain relief. Then ream it out slowly until the relief fits in snugly. The power transformer is mounted close to the panel wall. A 6-lug terminal strip sits in front of it.

Wire T1's secondary and primary leads to the terminal strip. Note that Z1's AC side connects to the transformer's secondary leads; the positive and negative rectifier



Note author substituted two paralled 100-μF capacitors for part C2. He also raided spare-parts box for stud-mounted 10-watt zener diode, D1. Part C2 makes connection to terminal lugs found between board, transformer T1.

leads connect to push-in terminals conveniently located on the perf board. Solder the power-supply filter capacitor leads to the remaining terminal strip lugs, running wires from Z1 to C1's leads. Don't forget your polarity rules here; positive rectifier output terminal connects to positive filter capacitor lead.

Now solder one leg of R1 to C1's positive terminal. Resistor R1's other wire hangs fancy-free until it's eventually connected to diode D1 and the positive power-supply bus.

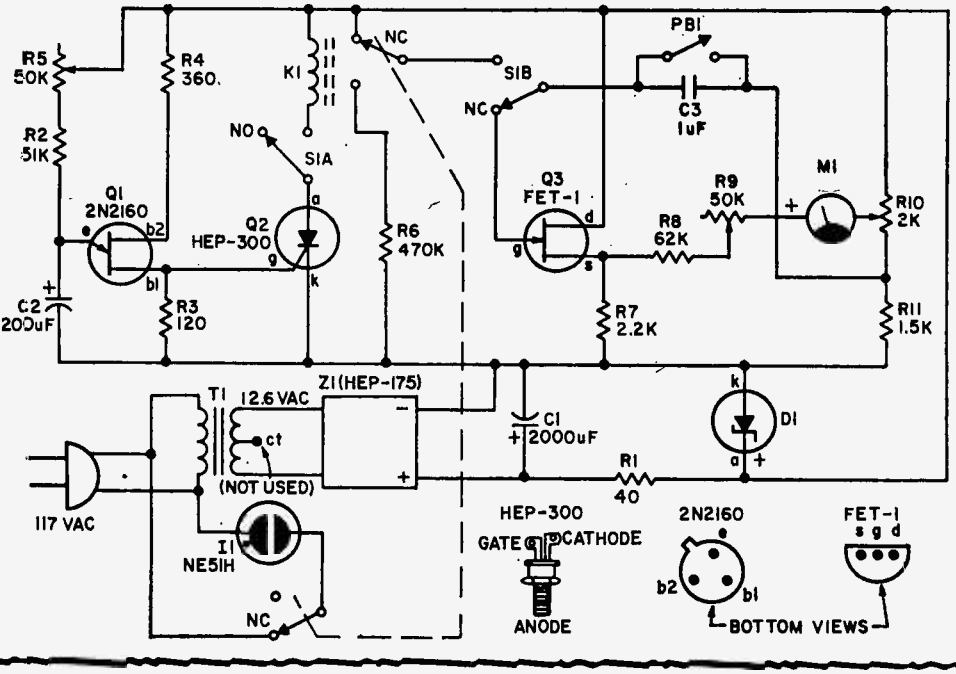
Start work on the circuit board by cutting out a 3½-in. square piece of perfboard. You've scads of wiring freedom, so don't be bashful about raiding your spare-parts collection. Stick flea clips into the perf board between your point-to-point parts. After drilling a 7/16-in. hole for Q2, scrounge up a solder lug for it. The lug's wedged between the SCR and perf board, so's to make con-

(Continued on page 97)

PARTS LIST FOR PDQ

C1—2000-uF, 25-VDC electrolytic capacitor (Cornell-Dubilier BR 2000-25 or equiv.)
C2—200-uF, 15-VDC electrolytic capacitor (Sprague TE 1164 or equiv.)
C3—1-uF, 200-VDC mylar capacitor (Cornell-Dubilier 2W1 or equiv.)
D1—12V, 1 Watt zener diode (Motorola HEP 105 or equiv.)
I1—NE-5 H neon pilot lamp
K1—Dpdt relay, 12-VDC (Magnecraft W88-X7 or equiv.)
M1—0-50 uA. meter movement (Lafayette 99E 50429 or equiv.)
PB1—Spst miniature pushbutton switch, normally open (Lafayette 99E 62184 or equiv.)
Q1—Unijunction transistor, GE 2N2160 or equiv.
Q2—50V @ 5 amps SCR (Motorola HEP 300 or equiv.)
Q3—Field effect transistor, GE FET-1
R1—40-ohm, 10-watt wirewound resistor
R2—51,000-ohm, ½-watt resistor, 5% tol.
R3—120-ohm, ½-watt resistor
R4—360-ohm, ½-watt resistor
R6—470,000-ohm, ½-watt resistor
R7—2,200-ohm, ½-watt resistor
R8—62,000-ohm, ½-watt resistor
R11—1,500-ohm, ½-watt resistor
R5, R9—50,000-ohm, linear taper potentiometer (IRC Q11-123 or equiv.)
R10—2,000-ohm, linear taper potentiometer (IRC Q11-110 or equiv.)
S1—Dpst momentary spring return switch (Lafayette 99E 61830 or equiv.)
T1—Filament transformer; primary 117 VAC, secondary 12.6 VAC @ 2 amps (Stancor P-8130 or equiv.)
Z1—50 PIV @ 1 amp bridge rectifier (Motorola HEP 175 or equiv.)
1—Line cord
1—Neon lamp housing with clear lens (Dialco 52-0463-0997-211 or equiv.)
1—4¼ x 7 x 4-in. sloping panel cabinet (Bud AC-1613 or equiv.)
1—6 lug tie strip (H.H. Smith or equiv.)

Misc.—hardware, knobs, perforated board, flea clips, wire, solder, etc.



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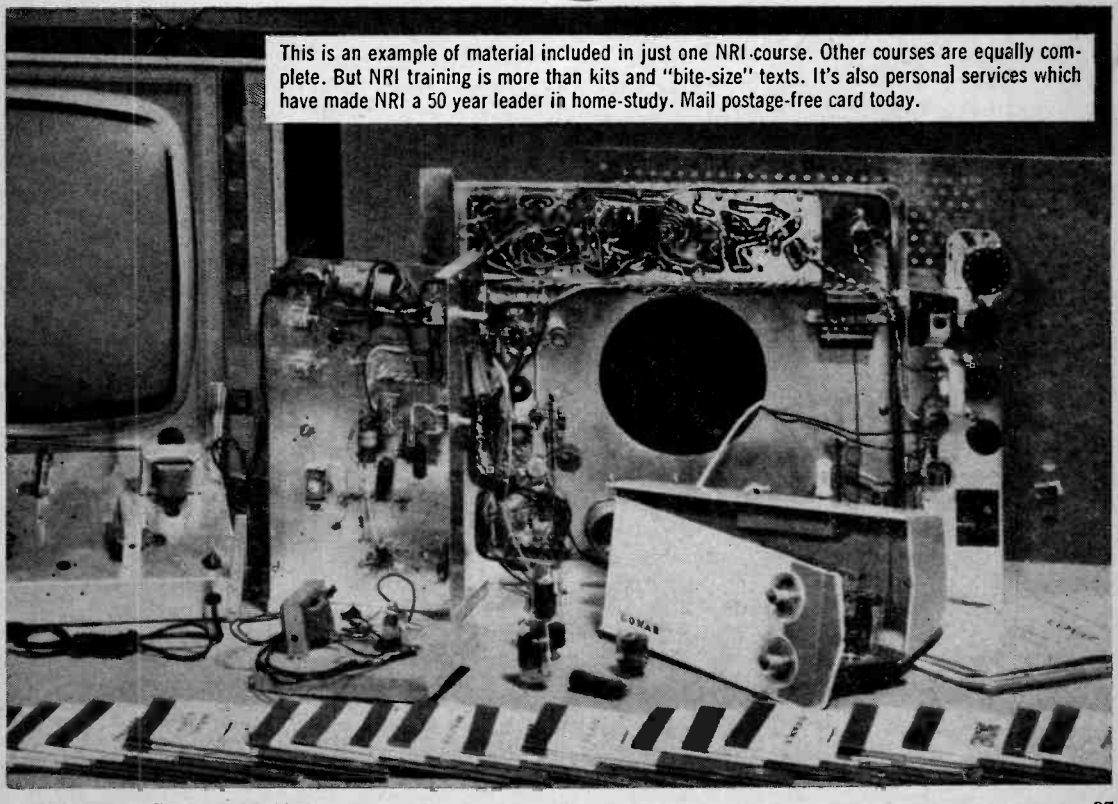

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Benjamin Thompson (Count Rumford)—thermodynamics

GREAT MEN OF SCIENCE

by Webb Garrison

STALKING through workshops of the military arsenal at Munich, Bavaria's prime minister hesitated. He wet the tip of an index finger, waved it about for an instant. Then he turned to workmen busy boring a cannon.

"What are you doing differently today?" he demanded.

"Nothing, sir. We work just as always," a foreman responded.

"But you do not always find your brass becoming hot?" probed the prime minister.

His subordinates tried to conceal their chuckles. "But of course," the foreman said. "Always, when one bores a cannon he runs the risk of burning his hands. Have you never heard that proverb, my lord?"

Count Rumford shook his head impatiently. This fellow was bordering on impertinence. Swinging his swagger stick he broke off the conversation and moved briskly to another section of the workshop. But he pondered the meaning of what he had heard—and felt.

A few months later, in London, he arranged an experiment to prove a radical new theory. All the effects of heat were universally believed due to action of a subtle fluid known as *caloric*. No one had ever seen or measured caloric, but every physicist in Europe took it for granted. All but Rumford, that is.

In a flash of intuition he had leaped to the conclusion that heat is not a substance—but an effect or "form" of motion.

To demonstrate that heat couldn't possibly be a substance, he inserted a blunt steel borer into a brass cannon. Into a box surrounding the cannon he poured 26.5 pounds of cold water. Then he signalled for artisans to set their machinery in motion.

"The cylinder, revolving at the rate of about 32 times in a minute, had been in motion but a short time when I perceived, by putting my hand into the water and touching the outside of the cylinder, that heat was generated," Rumford reported to the Philosophical Society in 1798.

Using a thermometer, at the end of an hour he found that the temperature of water in the box had been raised 47°. Half an hour later, as the boring continued without interruption, water measured 142°. At the end of two hours, its temperature was 178°. About half an hour later, water in the box surrounding the cannon *boiled without any fire.*

Count Rumford demolished all inherited ideas about heat, laid the foundation for the modern science of thermodynamics. Contrary to all that seemed logical to his contemporaries, he showed that friction (or motion) produces heat by affecting substances at the molecular level.

(Continued on page 98)

SCIENCE FAIR PROJECT

the MOVING COIL METER

Here's a real winner for a Science Fair project. It gives you the opportunity to show off your knowledge and understanding of basic measuring instruments as well as your dexterity with tools.

In previous issues we included articles on how to build more primitive meters. The August/September 1969 RADIO-TV EXPERIMENTER (the former name of SCIENCE AND ELECTRONICS) featured a construction project on a hot-wire ammeter. The October/November 1969 SCIENCE AND ELECTRONICS detailed construction of a moving-vane type meter (SnFe Moving Vane Ammeter). Now we consider you as graduate students ready to build the more sophisticated moving-coil type meter.

Moving-coil meters are used universally to measure DC current in all types of test instruments because they are highly sensitive, rugged and reliable, and relatively

Build our accurate model of a moving coil meter and learn exactly how they work

by Charles Green, W6FFQ

MOVING COIL METER

inexpensive. They can also be used to measure AC current by first rectifying the AC with a small meter rectifier. Meters to measure AC directly without using a rectifier may look very similar to DC moving-coil meters. However, they are moving-vane instruments.

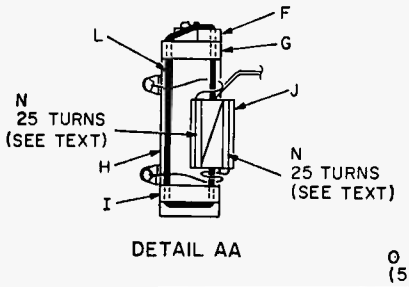
How Meters Read. The name moving-coil meter implies that a coil of wire will move whenever current flows through it. All DC moving coil meters employ a coil of fine wire suspended in a strong stationary magnetic field. The coil is pivoted so that interaction between the magnetic field of the fixed permanent magnet and the magnetic field created by the coil carrying the DC current being measured, rotates the moving coil assembly.

A pointer, attached to the moving coil,

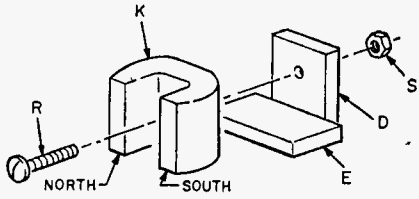
BILL OF MATERIALS FOR MOVING COIL METER

A—6 x 7 x ¾-in. white pine
B—¾-in. sq. x 1½-in. white pine (4-Required)
C—4 x 5 x ¼-in. plywood
D—1¼ x 1 x ¼-in. plywood (see text)
E—1¾ x 1 x ⅜-in. plywood
F—⅜ x 1 x 3/16-in. white pine with end notch
G—¾ x 1½ x ¼-in. plywood with end notches
H—¾-in. sq. x 2-in. white pine (see text)
I—¾ x ⅞ x ¼-in. plywood with end notches
J—½-in. sq. x ¾-in. balsa wood with slot
K—Alnica magnet (Lafayette 14E33028 or equiv.)
L—Rubberband (see text)
M—Meter pointer (#18 copper buss wire—see text)
***N**—50 turns 38 enameled magnet wire (see text)
O—Five #4 x ½-in. wood or sheet metal screws (Lafayette 13E43748 or equiv.)
P—Solder lugs (Lafayette 13E43433 or equiv.) (6-Required)
Q—Fahnestack clips (Lafayette 33E71028 or equiv.) (2-Required)
R, S—8-32 x 1 or 1¼-in. machine screw and nut
T—4 rubber bumpers
U—4 x 5½-in. heavy white paper for meter scale
Misc.—Hookup wire, 200-ohm rheastat (Lafayette 33E16064 or equiv. 1½-V. battery, VOM or DC milliammeter

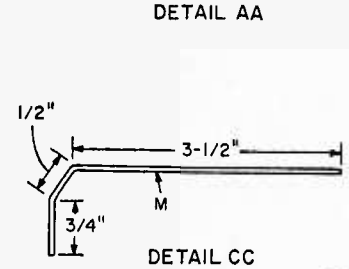
* ¼ lb. #38 enameled magnet wire (Lafayette 32E30802 or equiv.) • If #38 not available use wire from an audio transformer or the secondary of an old power transformer. You may have to add or subtract turns because of differences in wire gauge to have meter as sensitive as the model.



DETAIL AA



DETAIL BB



DETAIL CC

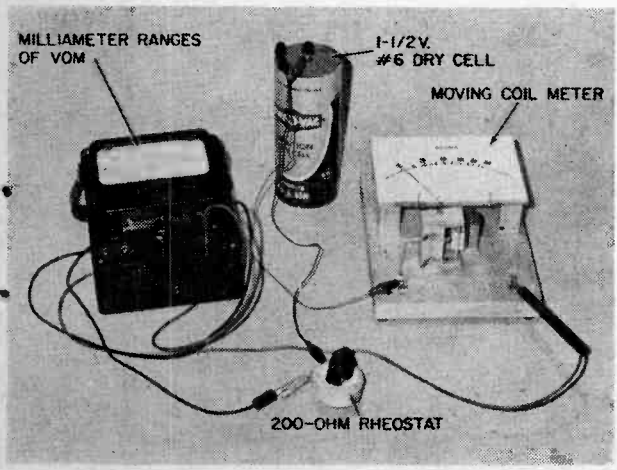
NOTE:
SEE MATERIALS LIST
FOR DIMENSIONS

is deflected across an arced line calibrated in units to provide a relative value for the measurement. A hairspring formed in a helix is fastened to the coil at one end and to the basic structure of the meter at its opposite end.

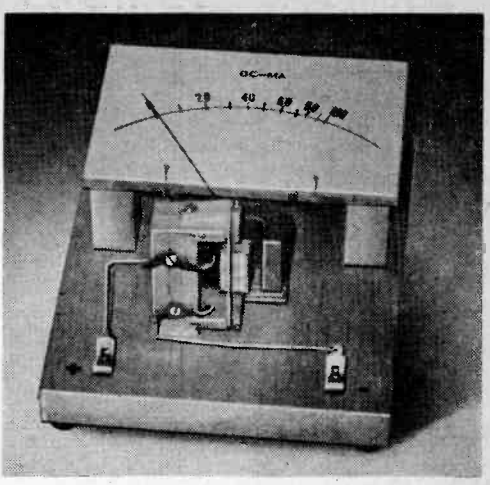
As the coil is rotated by current flow, it exerts force against the spring. When the resistance of the spring becomes equivalent to the rotating force, the pointer stops and we read the value on the scale at the point directly under the pointer. An adjusting screw is provided to set the pointer on the scale's zero when no current is flowing.

In order to ensure greater accuracy means are taken to reduce friction and drag of the moving coil to a minimum. The coil is usually wound on a very lightweight, nonmagnetic metal form which is pivoted in jeweled bearings. Within the last few years a new method of suspension called taut-band suspension has been developed. Instead of using jeweled pivots with their inherently small friction to suspend the moving coil the coil assembly is suspended on a thin metal strip that is stretched tight to hold the coil accurately in position. The helical hairspring is dispensed with by twisting the thin metal strip. This method of suspension provides an even more friction-free meter movement which results in a more sensitive instrument.

Be An Instrument Maker. As you can see from our photos and drawing, our model of a moving-coil meter has been made in a very simplified form to facilitate construction. It's a taut-band moving-coil instrument by virtue of the rubber band suspension of the moving-coil assembly. We used wood for the various supporting structures because it's easier to work with and most everyone has the very few hand tools required.



A VOM is very helpful in calibrating the Moving Coil Meter. If no VOM is handy try a 0-100 mA milliameter in same circuit.



Here's how your finished MCM will look. Its innards are very similar to a bought meter.

Size is relatively unimportant. However, we suggest you follow the dimensions and construction details given in the drawing and Parts List. In this way you should have no difficulty in making the meter and you won't have to fiddle with changing the number of turns of wire for the moving coil to compensate for a change in physical size.

You should cut out all of the various pieces of wood and sand them smooth before actually starting to assemble the meter. Mount rubber feet on the bottom four corners of the base (A) and then glue the 4 supports (B) to A, as shown in the drawing. Next cement the scale platform (C) to these supports. We used our electric glue gun, but epoxy cement, Elmer's glue, Pliobond, etc., can be used with equal success.

Now you're ready to cement the magnet and moving-coil assembly supports to base A. Pieces D, E, G, and I are made from ¼-in. plywood. First step is to cement D and E in their respective locations and fasten the magnet in place. If the magnet you use isn't drilled at the bottom center of the U to allow a bolt to go through it to hold the magnet in place, it too can be cemented to D and E.

At this point the main support block H should be readied for cemeting. But first you must notch it out so that piece I can be properly fastened to it. Hold H on the base (A) adjacent to piece E and mark H

MOVING COIL METER

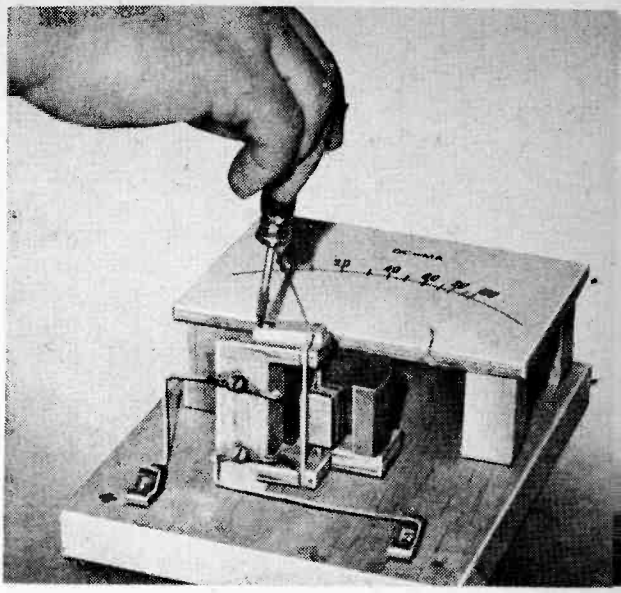
so that the top of the notch will be even with the top of piece E. The notch should be about ¼-in. deep. Best way to determine its depth is to hold piece G in position at the top of H and place piece I so that its notched end is even with the notched end of G.

Mark the depth of the notch in block H based on the position of the end of piece I that will be inserted in the notch when its free end is matched with piece G as mentioned above. Be sure that the notch in block H is cut square so that the surface of piece I will be square with the surface of block H when I is cemented in place. The notches in the free ends of I and G are required only to hold the rubber band in position. Cement block H in position, and also piece G to block H as shown in our drawing.

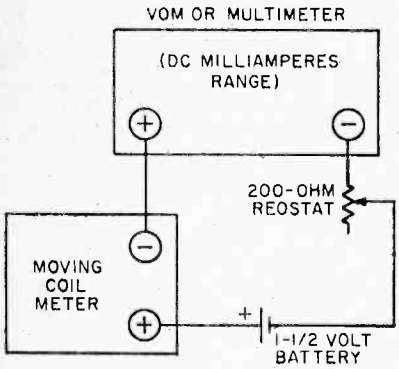
The form block for the moving coil (J) is made from balsa wood, which is lighter in weight than any other wood and therefore contributes to the sensitivity of the instrument. Cut a slot in the center of J as shown in our drawing. The rubber band (L) is cemented in this slot. We used a rubber band approximately 1¾ x ⅜ x 1/16 in.

The moving coil is made in two sections by winding 25 turns of #38 enameled magnet wire on each half of J. After completing the first 25 turns, without cutting the wire, continue to wind another 25 turns on the other half of J in the same direction. Put a touch of cement to the ends of each coil to hold the wire in place and leave 6-in. lengths of the start and finish of the two-section coil for future connection to it.

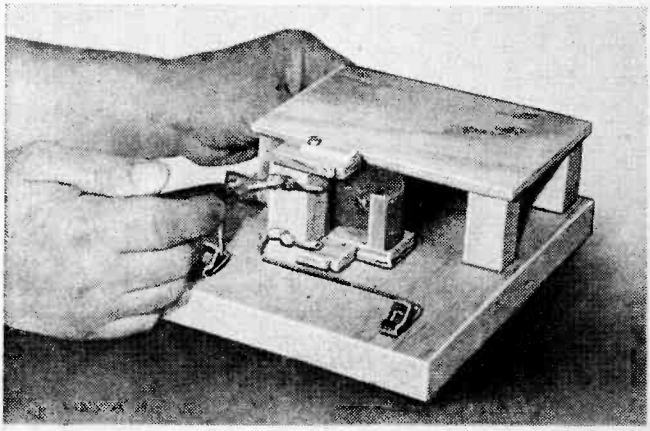
(Continued on page 100)



To zero pointer, simply loosen screw and move wood block, thus repositioning coil assembly.

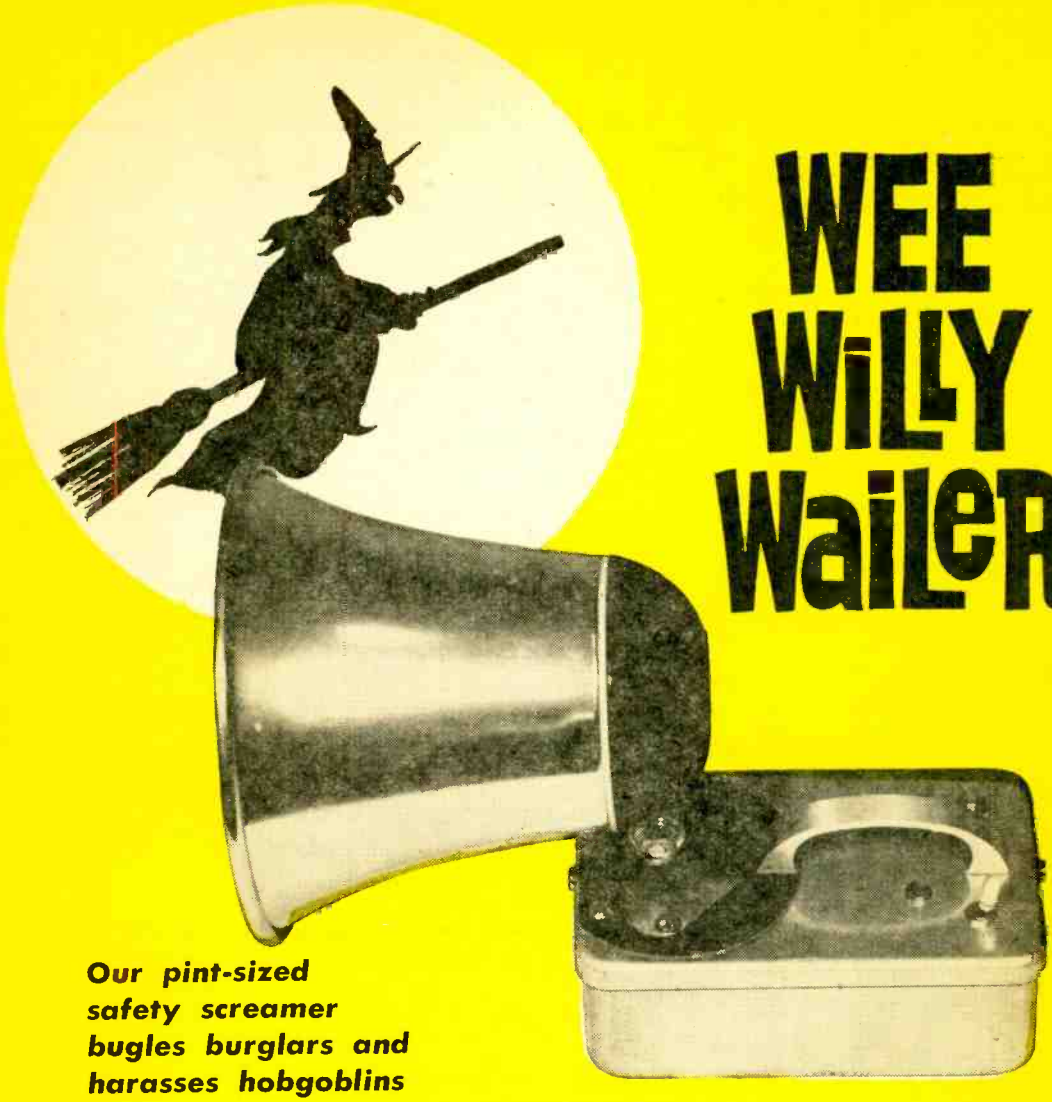


You don't have to use a VOM or multimeter for calibrating your Moving Coil Meter. Any 0-100 mA or higher milliameter will do the job just as well, provided that its accuracy is fairly good.



By this stage you've almost completed the project. Except for cementing the scale on its platform, mounting the moving coil, and calibrating it, you're ready to make measurements or enter the Fair.

WEE WILLY WAILER



Our pint-sized safety screamer bugles burglars and harasses hobgoblins

by Charles D. Rakes

HALLOWEEN will soon be creeping up behind us, pointing its bony hand toward Jack o' Lanterns, hobgoblins, and pumpkin pies. If a member of your family gleefully participates in this great annual Trick-or-Treat Rite, you can add to his Hallowed Eve's tomfoolery with our *Wee Willy Wailer*. As Wee Willy's name implies, it's an electronic siren small enough to tuck under a gypsy, or ghoul, or giant costume—and big enough in the sound department to scare the shoes off your neighbors or the pants off a burglar. W.W. Wailer's no ordinary screamer, either; it can imitate a police siren's rising and falling pitch down to the last detail. And you won't need to grovel for funds City-Hall style to build Wee Willy, as fifteen leaves of Washington lettuce pay our screamer's way onto your workbench.

WEE WILLY

Satanic Sounds. Muscle your orbs toward Wee Willy's schematic. You'll see it's a three-stage affair consisting of a unijunction transistor sawtooth oscillator, speaker power-amplifier stage. and a field effect transistor hooked up as a variable resistor.

Let's see how Wee Willy wails. When power's first applied via switch S1, unijunction transistor Q2 merely sits there like a three-legged lump. It doesn't do anything because it's not biased sufficiently in its forward-conducting state. Transistor Q3's direct-coupled to Q2's base 1; if Q2 doesn't generate pulses, Q3 has nothing to do. Naturally the end result is earnumbing silence from the speaker.

We'd like to give you a few words of wisdom about that speaker. Any miniature speaker of 8-ohm impedance you can scrounge up works in this circuit. For instance, you've probably cannibalized many an All-American Five for its 4-ohm speaker. If this rings your brain's bell, go ahead and bring two of those golden toners to life again by wiring them in series.

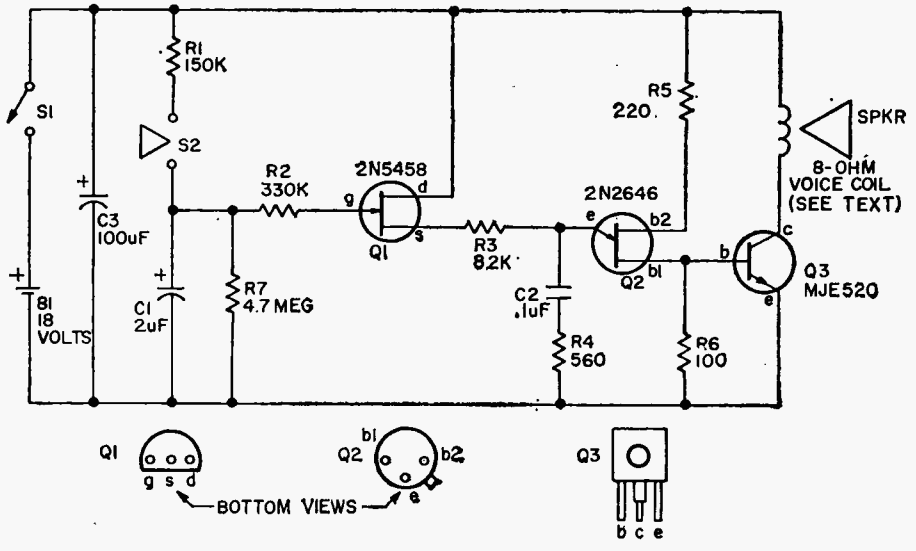
Want more sound power from your siren? Find *two* speakers having identical 16-ohm voice-coil resistance. Wire them in parallel, and connect the pair where one speaker's shown in the schematic. But back to Wee Willy's modus operandi.

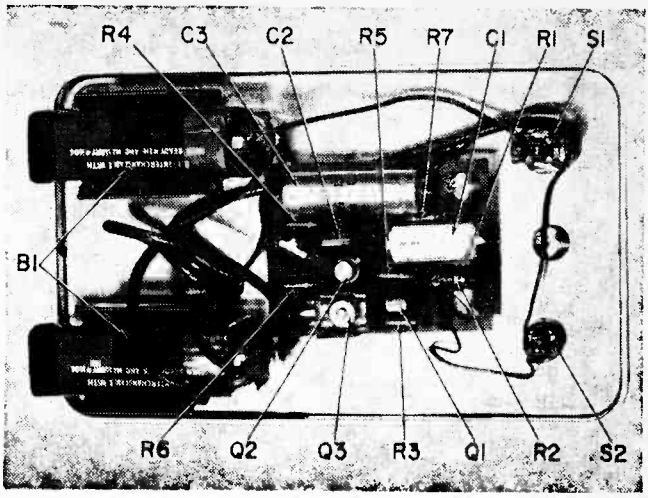
You're standing in a neighbor's doorway, treat bag in hand, and it's time for your wailer to give with its gangbusters introduction. Press switch S2, and capacitor C1 begins to charge toward the battery's peak positive voltage through resistor R1. This action, in turn, drives Q1's gate positive; in effect, we're causing Q1 to conduct more

PARTS LIST FOR WEE WILLY WAILER

B1—18-Volt battery (2 Burgess 2U6 or equiv. in series)
C1—uF, 50 VDC electrolytic capacitor (Sprague TE-1301 or equiv.)
C2—uF, 100 VDC mylar capacitor (see text) (Sprague 10491 or equiv.)
C3—100-uF, 25 VDC electrolytic capacitor (Sprague TE-1211 or equiv.)
Q1—2N5458 transistor (Motorola)
Q2—2N2646 transistor (Motorola)
Q3—MJE520 transistor (Motorola)
R1—150,000-ohm, ½-watt resistor (see text)
R2—330,000-ohm, ½-watt resistor
R3—8,200-ohm, ½-watt resistor
R4—560-ohm, ½-watt resistor (see text)
R5—220-ohm, ½-watt resistor
R6—100-ohm, ½-watt resistor
R7—4,700,000-ohm, ½-watt resistor (see text)
S1—Spst switch (Continental-Wirt GF 323 or equiv.)
S2—Spst momentary switch (Switchcraft 101 or equiv.)
Spkr—Speaker with 8-ohm voice coil (see text)

Misc—Battery connectors, battery holder, case, flea clips, hardware, perf board, solder, wire.





Turning Willy into burglar bugler entails few changes. First situate speaker so it will make itself heard in area being protected. Then substitute trip wires for switch S2. Arrange wires at devices to be protected so they make contact when they're touched. You can protect any number of your valuables by connecting all trip-wire sets in parallel with switch S2.

heavily by increasing the FET's gate bias.

As Q1 is driven harder and harder, more current's drawn through resistor R3. This resistor is in series with Q1 *and* Q2. As more current flows through R3, transistor Q2's emitter voltage also rises. At some point Q2 will start to behave like a sawtooth oscillator and, *voila,* Wee Willy lets loose. But hold on—you're not finished yet!

Capacitor C2, you'll remember, is charging up toward B1's 18-volt level. Yes, we're driving Q1 harder, and drawing more juice through R3. Wee Willy's voice steadily rises from baritone to soprano, all the while serenading you and your hapless neighbor in fortissimo. Now take your finger off S2; the wailer will slowly shift its vocal range downhill. Capacitor C1's discharging through resistor R7, eventually bringing us back where we started from—pianoforte, and then silence.

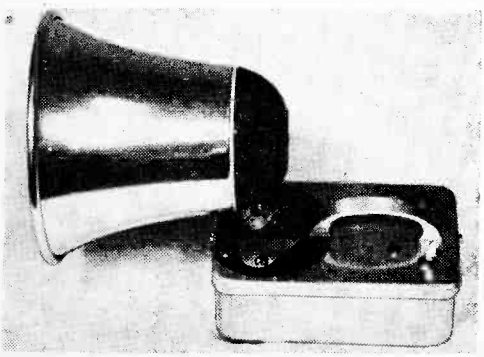
Workshopping Wee Willy. Our siren falls into the "anything goes" construction category. The author built his siren into a 5 x 3 x 1¾-in. metal box. He even whipped up a printed circuit board for his prototype version. But we like to get more yocks using Wee Willy, so to save time it's the perfboard route for us. Note B1's two 9-volt batteries connected in series. They can be secured to the perfboard in any manner you can think of. The easiest and cheapest battery holder consists of a rubber band looped over the ends of each battery.

End loops of the rubber band are inserted through the perfboard, and connected together on the perfboard underside with a short length of wire inserted through these loops and twisted together.

We needn't say too much about electrolytic capacitor polarity. And do exercise caution while you're soldering home the transistors. These little devils could never appreciate heat applied to their leads.

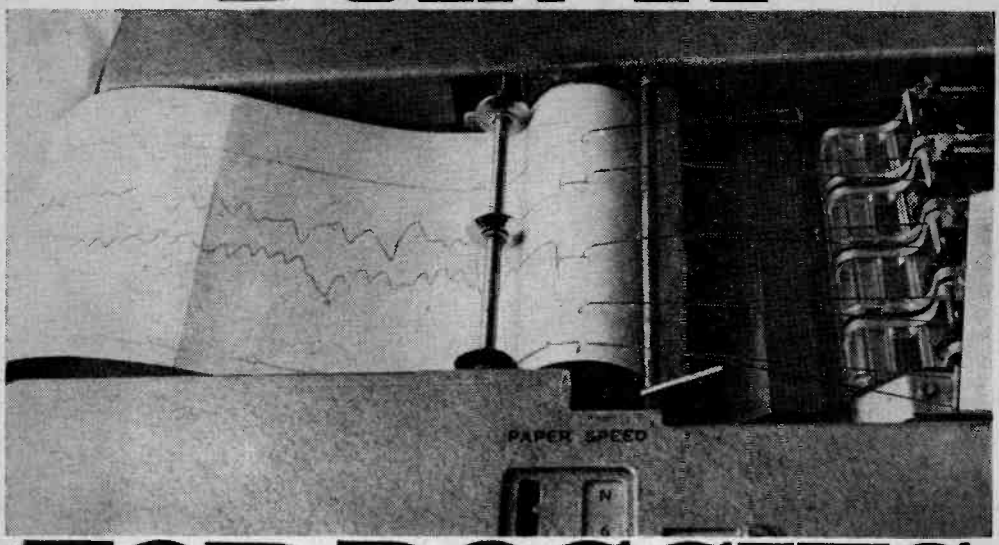
You might try building Wee Willy into your treat bag or costume. If you've got a large head mask for the occasion, wire two speakers as described and glue them into your mask's cheeks. Other Frankensteins will find the treat holder's their bag. These poltergeists will glue S2 to the bag handle, so it's easy to activate.

If you want to fiddle with Willy's wail, then experiment with resistors R1 and R7. Varying these components' ohmic values changes capacitor C1's charge and discharge rate. Resistor R4 can serve as a volume control if you substitute a 1000-ohm potentiometer for it. And finally, varying capacitor C2 changes Willy's basic frequency range. ■



Funnel-shaped thing shown on top of prototype version is author's speaker. Lafayette Radio sells it as stock no. 99 E 45080.

DOIN' IT

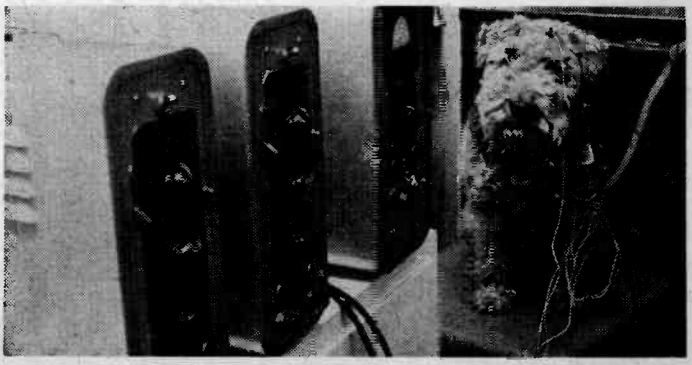


FOR DOGGIES

WHEN a London veterinarian could find nothing wrong with a Welsh terrier called "Fella," the dog went the route many a human has gone. He was referred to a specialist—in this case, Dr. Phyllis Croft, who is one of the first to use the electroencephalograph to determine what ails animals in the brain department.

Basically, the machine measures brain impulses. As such, it's used on humans to discover whether they have brain ailments. Similarly, this machine, which cost Dr. Croft some $1500.00, will help her determine whether Fella is suffering from epilepsy, a brain tumor, or brain damage of any sort. When Fella was brought to her, Dr. Croft quickly attached the machine to his head with small needles which lead to the unit by wires (the process is harmless and doesn't hurt the dog in any way). Once in operation, the machine measures the dog's brain impulses and automatically records them on a special kind of graph paper (see our photo above).

A leading animal specialist, Dr. Croft has already received a medal from the Royal Veterinary College for her work in improving conditions during animal surgeries and in many laboratories. If things go well for Fella, chances are he'll extend a thankful paw when Dr. Croft has concluded her work with him. After all, how many vets do you know who go to such lengths in an effort to return favors bestowed by the animal that's come to be known as Man's Best Friend? ■



Looking tense and anxious in manner of many a human patient, Fella sits quietly while electroencephalograph records his brainwaves. Plotted on graph paper (see above), charts help determine whether dog is victim of any kind of brain damage.

COLD-FLASH

By the flashing lamp in that window they shall find you

by James G. Busse

BLINKING a light is no great electronic feat (there are dozens of circuits around for that purpose). But how about a blinking light that can be seen for several miles in the dark of night and that won't burn out unexpectedly? How about one that will run for more than a year from sunrise to sunset on a single lantern battery? And get this, what about one that will continue to operate in low temperatures till battery voltage drops considerably because of temperature and then will start up again when battery voltage is restored by rising temperature, without affecting loss of power or life? Believe it or not, you can build one for just a few dollars.

Cold-Flash is based on a high-performance, high-reliability blinker beacon originally developed in Canada for navigation and rescue applications. In its present form *Cold-Flash* makes an ideal camp, trail, and dock marker. Put one on your boat or camp trailer. Mount *Cold-Flash* on a buoy to mark the location of underwater obstructions or a favorite nighttime fishing spot. Two units will permanently mark the entrance to your driveway at home in any kind of weather. And these are but a few of the countless uses for *Cold-Flash*.

How It Works. Basically, *Cold-Flash* employs a spiked pulse generator coupled to a stepup transformer to produce a high-voltage pulse that fires a fluorescent lamp bulb, much in the manner of a strobe. There are only nine components in its all-solid-state circuit. Silicon transistors for Q1 and Q2 are mandatory for maximum efficiency, for resistance to temperature extremes, and for the ability to handle hefty pulses of millisecond duration that may reach half an amp or more when the unit fires.

A cadmium sulfide photocell (PC1) is used to turn on *Cold-Flash*

at dusk and to extinguish it at dawn. When the cell is exposed to normal daytime light levels, its resistance drops to less than a few hundred ohms, thus dissipating the charge on electrolytic capacitor C1. Its flash rate of approximately one flash per second, obtained with the capacitor and lantern battery specified in the Parts List, is established by the value of C1 and the impedance of the 6V battery (B1). Light levels to turn *Cold-Flash off* and *on* will vary somewhat, depending on the characteristics of PC1.

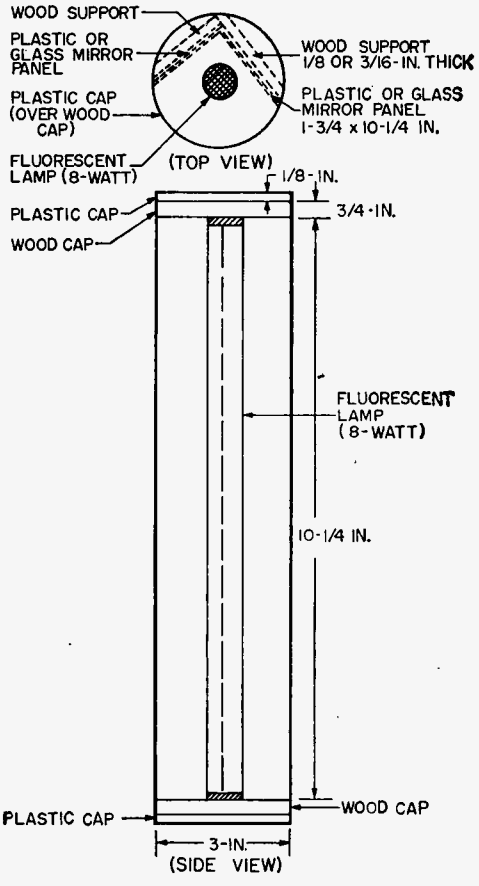
Long Battery Life. In the *off* state, current drain is less than 140 μA, which accounts, in part, for the exceptionally long battery life afforded by the unit. Equally important is the use of a fluorescent lamp bulb, operating like a giant neon bulb, in place of the usual incandescent lamp with its current-wasting hot filament.

Another obvious advantage offered by the fluorescent lamp is that it will last for years in *Cold-Flash* since the starter filament in the lamp isn't used to initiate fluorescence that produces illumination. Also, for all intents and purposes, the fluorescent lamp is almost a foot-long source of illumination. In addition, its blue-white light can be seen at much greater distances than the yellow-white light from incandescent-type blinkers.

If cold weather should affect the battery's output voltage, causing it to eventually drop below 2 volts, *Cold-Flash* will stop in the *off* state, thus minimizing power drain. It will start blinking again when the battery begins to recuperate as the temperature rises and the voltage reaches a couple of volts, provided, of course, that the light level outside is low enough to affect the photocell (PC1).

A right angled, dual panel, mirror-reflector, shown in our illustrations, was used to increase the unidirectional light output of *Cold-Flash*. The author used the model unit as a directional navigational aid. Actually, the fluorescent lamp assembly can be mounted permanently in any position to suit its particular application. It can even be used as an underwater beacon provided the lamp electrodes are properly insulated.

Construction. With the exception of the fluorescent lamp and the battery, all components are mounted inside a sturdy molded plastic box, 3¾ x 6¼ x 2-in., to protect them from the weather. Clear or black silicone rubber sealant, available from most



You can convert unidirectional Cold-Flash lamp assembly to omnidirectional one simply by omitting right angled mirrors. Make supports for top and base from rods.

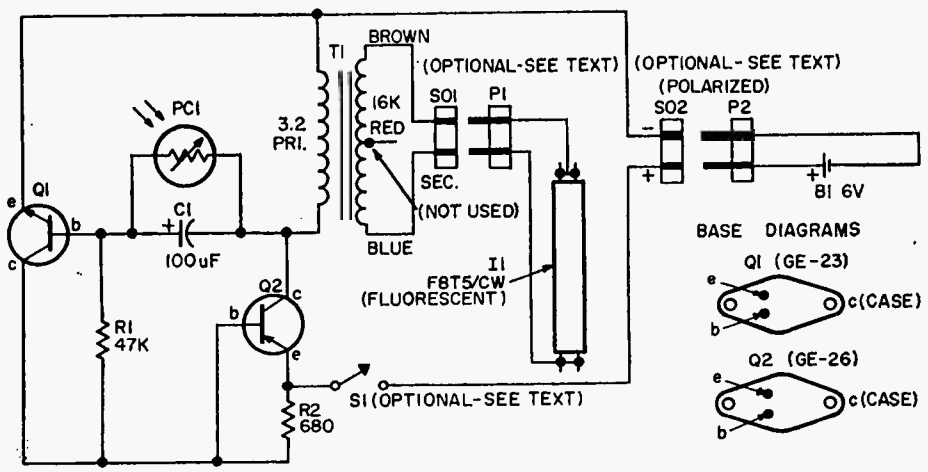
hardware or auto parts stores, is used to seal the cover and the holes around P1 and P2, S1 and PC1. Don't forget to also seal the bolts holding transformer T1 and the perfboard subassembly in place in the cabinet.

Circuit components Q1, Q2, C1, R1, and R2 are mounted on a small piece of perfboard, cut to fit the contour of the inside of the plastic box. Interconnected by point-to-point wiring, they form a subassembly. Parts layout isn't critical, but keep in mind that the power transistors' cases are their collectors. Therefore, insulate them from one another and from the other components. Use two small bolts to secure each of the transistors to the perfboard.

Drill two small holes through the top of the plastic box for the leads from PC1. The photocell is held in place on the outside top

PARTS LIST FOR COLD-FLASH

B1—6-V lantern battery (Eveready #731 or equiv.)—see text
C1—100 uF, 15 V electrolytic capacitor (Lafayette 34E5144 or equiv.)
I1—8 W. miniature fluorescent lamp bulb F8T5/CW)
P1—2 contact plug (may be any type available) —optional, see text
P2—2 contact polarized plug (Lafayette 34E20015 or equiv.) optional, see text
PC1—Cadmium sulfide photocell (Lafayette 99E63216 or equiv.)
Q1—Npn silicon transistor, AF power type, GE-23
Q2—Pnp silicon transistor, AF power type, GE-26
R1—47,000 ohm, ½ watt resistor
R2—680 ohm, ½ watt resistor
S1—Spst subminiature toggle switch (Lafayette 99E61624 or equiv.)
S01—2 contact socket to match P1
S02—2 contact polarized socket to match P2 (Lafayette 34E20460 or equiv.)
T1—5 to 8 watt tube type output transformer: primary, 16K to 25K ohms; secondary, 3.2 ohms (Lafayette 33E81415 or equiv.)
1—6¼ X 3¾ X 2-in. plastic box (Lafayette 19E20016 or equiv.)
1—Blank cover for above box (Lafayette 19E37010 or equiv.)
Misc.—Bolts, nuts, silicone rubber sealant, press-on letters (Datak or equiv.), zip cord, two plastic or glass mirror panels/and scrap wood for mounting them (for the corner reflector of the fluorescent lamb bulb), wire, solder, hot melt glue (optional), etc.



surface of the box with the silicone rubber sealant. For maximum sensitivity, PC1 must look straight up into the sky. Power switch S1 is optional—you can turn *Cold-Flash on* simply by plugging in the battery leads, thus not needing a switch to turn the unit *on* or *off*. Aside from saving the cost of the switch, it's one less component that has to be sealed.

If your *Cold-Flash* will be permanently installed, you can eliminate both plugs and sockets. Drill two holes to pass the battery and fluorescent lamp leads through the side of the plastic box. Use grommets to protect the wires and help in sealing the openings. On the other hand, the plugs and sockets are worthwhile accessories if you make your *Cold-Flash* portable so you can take it with you when you go boating or camping. The fluorescent lamp bulbs are relatively inexpensive, selling for under $2.00; therefore, you may prefer to mount several of them permanently on your boat, your trailer, your home, etc., and move just the control and power source with you wherever you may roam. In that way you get the benefits of owning several *Cold-Flash* units with an investment just a little more than the cost of one or two.

Power transformer T1 is a speaker output transformer used as a step-up transformer. Thus, as we have applied it, the voltage of the pulses fed its 3.2-ohm primary (normally the secondary when used as a speaker transformer), will be raised by a factor of more than 50. The output of its 16,000- to 25,000-ohm secondary (actually the primary in its original circuit application) is fed directly across the fluorescent lamp to fire it to produce a burst of light. Since the fluorescent lamp is really a self-rectifying tube, no

COLD-FLASH

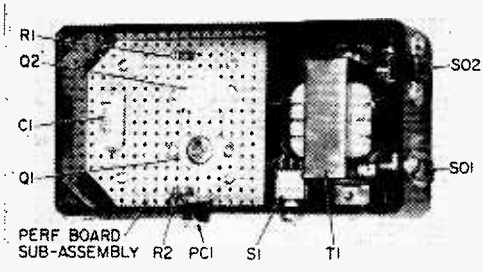
external rectification is required.

Though you would certainly save space and weight by using a transistor-type output transformer, the 5- to 8-watt capacity of the larger tube-type transformer reduces the possibility of momentary overload and subsequent insulation breakdown. Some output transformers, including the one specified in the Parts List, have an additional tap in their secondaries, which should be ignored for this application.

A word of caution. Though approximately 300 volts are developed with each short-lived pulse that emerges across the high-voltage output of T1, physical contact with this *hot* line isn't particularly dangerous. It does have a *bite* though, so take care in handling this line. Also, persons who may be susceptible to epileptic seizures shouldn't stare at a flashing *Cold-Flash* at close range.

Do *not* operate the *Cold-Flash* control unit without the lamp connected, or with a load greater than the 8-W fluorescent bulb we've specified. Though the unit will fire a smaller 4- or 6-W fluorescent lamp, loading the control unit with a larger lamp or a regular strobe tube will damage either one or both of the transistors. Accidental reversal of battery polarity input will almost always damage transistor Q2. That's why the polarized plug and socket is used for the battery supply leads.

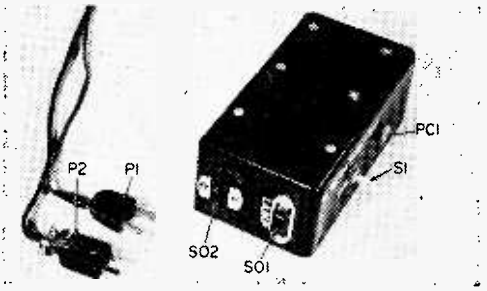
Reflector Assembly. Solder the leads that



By mounting all parts except T1, S1, PC1, SO1, and SO2 on perfboard and keeping battery and lamp separate, there's ample room inside plastic box for complete unit.

connect the lamp to the control unit directly to the pin contacts at each end of the fluorescent lamp as shown in our drawing, making sure that there is good contact on both pins. Mount the lamp in whatever manner that best suits your particular application. It can be mounted inside a clear or colored plastic tube sealed at both ends for safe marine installations.

Or, if you're looking for maximum light output in a specific direction, build a reflector assembly similar to the one shown in the photos and drawings. This reflector was fabricated from two plastic mirrors mounted on pieces of scrap wood cut to fit the mirrors and assembled with an electric glue gun. (Glass mirrors will do just as well, though they may be a bit heavier.) Sockets for the fluorescent lamp bulb are superfluous since you won't be replacing it.



We used a polarized plug and socket for B1 to ensure correct polarity to unit at all times to avoid damage to transistors. PC1 should always be pointed skyward.

Checkout. Make certain that S1 is in the *off* position before plugging in the fluorescent lamp and the battery. Then flick the switch *on*. If enough light reaches PC1 to keep *Cold-Flash* in the *off* state, the lamp will flash only once. Cover the photocell with your hand and the lamp should begin flashing immediately at approximately one flash per second. Remove the cover over the photocell and it will stop flashing.

Now move *Cold-Flash* outside the shop. With PC1 *looking* up to the sky the lamp should stop flashing and start again as daylight diminishes or PC1 is shielded from outside light. There are no critical adjustments to be made. However, you may want to try a photocell having a different light response. The more sensitive the cell, the earlier Cold-Flash will come *on* in the evening and go *off* in the morning.

Troubleshooting. If construction details were carefully followed there should be no troubleshooting required. If the unit doesn't flash, turn *off* the power immediately and carefully doublecheck your wiring, particularly the polarity of the battery connections and the connections soldered to the fluorescent lamp. If the unit still doesn't flash, replace Q2 and, if necessary, Q1 in that order. ■

S&E BUILDS THE MITCHELL UNIFLASH...

. . . an electronic light gizmo for the portrait specialist

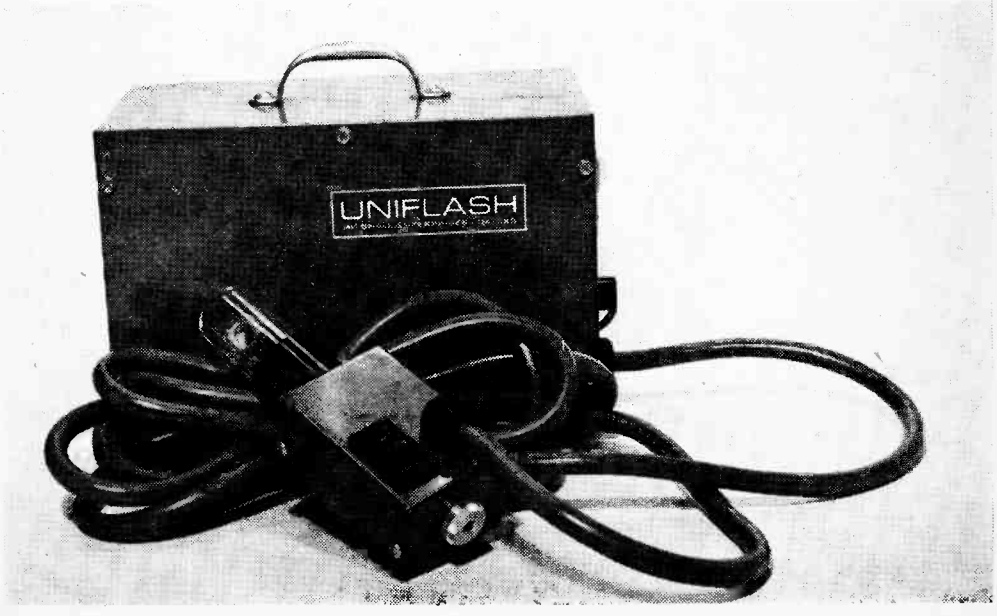
MITCHELL'S Uniflash is a 200 watt-second electronic flash that uses only a bare-bulb flashtube (no reflector) and an AC power supply. Essentially, it's a studio-type unit intended primarily for the portrait specialist.

As shown in our photos, Uniflash consists of two cord-connected units: an AC power supply, and a lamphead assembly which can be mounted on a lighting stand or on a camera tripod. The power supply is a wopper and is the main reason the Uniflash is a "studio" flash. It contains a voltage tripler that steps up the line voltage to 450 volts and two series-connected 3900-μF storage capacitors for the flashtube energy. Since the effective capacity of series-connected capacitors of the same value is half the value of one capacitor, the watt-second energy (from $WS = \frac{1}{2} CV^2$) is approximately 200.

The lamphead assembly contains a socket for the plug-in flashtube, a few components for triggering the flashtube, and an AC socket for the camera sync-cable. Unlike other electronic flash units, the sync-socket isn't polarized; this means that the sync-cable from the camera can connect to the socket either way. However, both sides of the sync terminals are isolated from the Uniflash's voltage bus and ground by 2 megohms from either terminal, so there's full safety in the sync-cable connection regardless of polarity.

Circuitry. The Uniflash circuit is about as straight-from-the-book as is possible, consisting of the absolute minimum circuitry needed to fire the flashtube. At the input is a line-powered voltage tripler that develops approximately 450 VDC. The output voltage of the tripler is fed to two series-connected storage capacitors. The reason for the series-capacitor connection is to allow the capacitors to fit into a cabinet of reasonable size.

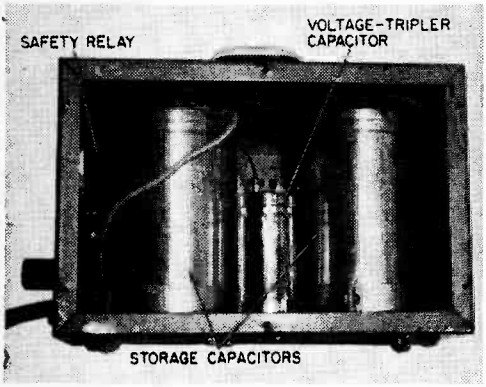
Since each capacitor is 3900 μF at 250 V, the series connection results in approximately 2000 μF at 500 V. A single ca-



S&E BUILDS THE MITCHELL UNIFLASH...

pacitor rated 2000 μF at 500 V would be so tall the cabinet would be unnecessarily bulky; and while the two series-connected capacitors take up more bulk space than a single capacitor, the space is spread in a low profile and results in a smaller cabinet.

The capacitor energy is applied to the flashtube via a two-conductor cable. The tube's trigger coil is built into the base of



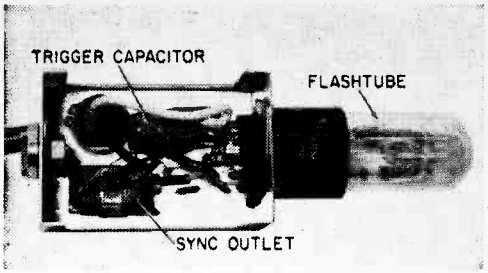
Power-supply cabinet is jam-packed with high-value capacitors; big ones are 3900 uF!

the flashtube so only an AC outlet (for the sync cable from the camera) and a trigger capacitor are required in the lamphead assembly. In total, it's a very simple and basic circuit, but one that works well.

Though not actually part of the flash circuitry, Uniflash includes a relay-controlled power switch for safety reasons. Voltage-tripler circuits have an unusual safety hazard, namely, that if the line cord is removed from the outlet and the power switch is *on*, it's possible for the voltage across one of the tripler capacitors to appear across the power plug.

To prevent this hazard, Uniflash uses a relay to apply and disconnect the AC power source. The power switch turns only the power relay *on*. If the line cord is disconnected or the power switch is turned *off*, the relay drops out and disconnects the line cord from the voltage-tripler power supply.

Building It. Kit assembly isn't difficult (there is, after all, but a handful of components). There isn't any parts jam in the



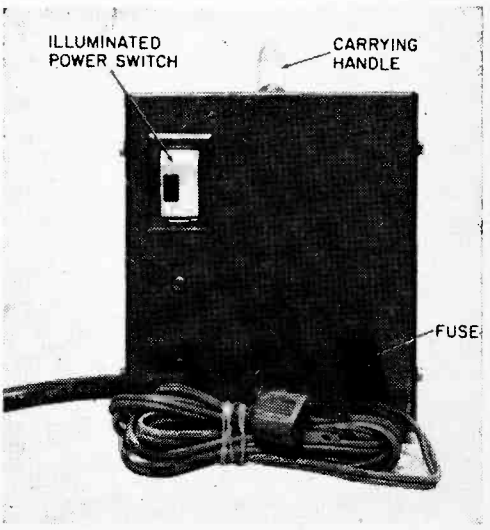
Lamphead includes non-polarized sync-outlet; trigger transformer is part of flashtube.

power supply or lamphead, so the only real care must be taken when checking the components in the event of a wiring error. Keep in mind that the 2900-μF capacitors store enough energy to lay a careless technician flat on his back, so super caution's the word.

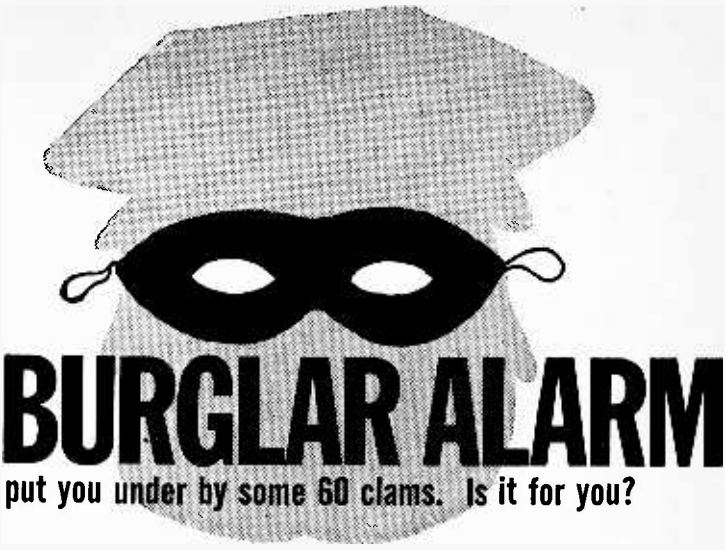
If anything at all is wrong, discharge the storage capacitors through 5000-ohm, 5-watt resistors and then short the terminals for a few minutes before you stick your hands or fingers into the power supply. This shorting-out is necessary because a storage capacitor can bounce back after having been discharged through a resistor. On the other hand, you can't throw a short across the capacitors without first using a resistor discharge since the surge current through the shorting wire will literally weld the short to the terminals.

If you've made no wiring errors—and assembly is so easy there should be none—simply plug in the flash tube, apply the AC

(Continued on page 97)



Rear of completed Uniflash. Fuse at lower right is intended to protect entire circuit.



S & E
tests a do-it-yourself

HOME BURGLAR ALARM

API's 208 will put you under by some 60 clams. Is it for you?

AMONG problems, home security must rank among today's top ten. Advertisements for "security" equipment abound in the pages of newspapers and national magazines. Unfortunately, most of this equipment is either worthless, too expensive for what it does, or too difficult for the average homeowner to use.

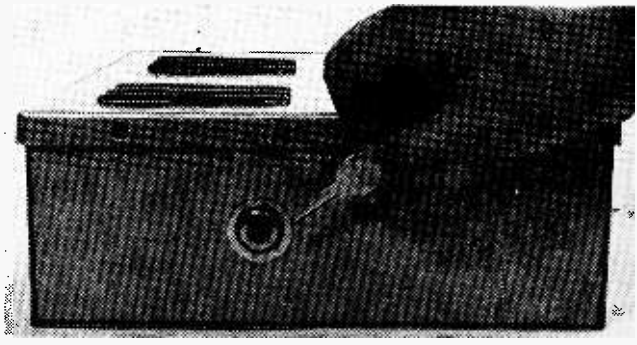
When you come right down to it, the best buy in home security equipment is professional equipment such as that sold and/or installed by professional installers and supply houses. A good example is Alarm Products International's Model 208 Time Delay Open Circuit Burglar Alarm.

The Model 208 system is specifically intended for the small homeowner or apartment dweller who isn't in a position to mount exterior alarm bells and key-type entrance locks (perhaps because the landlord frowns on anyone drilling holes in his doors). The system is housed in an 11- x 15- x 4-in. steel box that contains a 6-volt lantern-type power-supply battery, an 8-in. alarm bell, a time-delay controller, a time-delay timing adjust, a key-type master switch, and a connecting block.

What Gives. The time-delay controller provides two independent protection circuits. One is the time-delayed alarm circuit for the entrance doors. Any normally open switch, such as a two-piece magnetic switch, is mounted on the entrance and connected to the 208's time-delay contacts. When the user sets the alarm with the master key, the time-delay controller allows up to 90 seconds for the user to get out the door. After this minute-and-a-half interval, the alarm is automatically armed.

If the door is opened, closing the switch, the time delay allows up to 90 seconds for the user to turn the master switch *off*. And if the alarm isn't turned *off*, the time delay closes the bell circuit and locks up, making the bell sound continuously regardless of whether the door is closed or the wiring cut.

The second protection circuit is the more



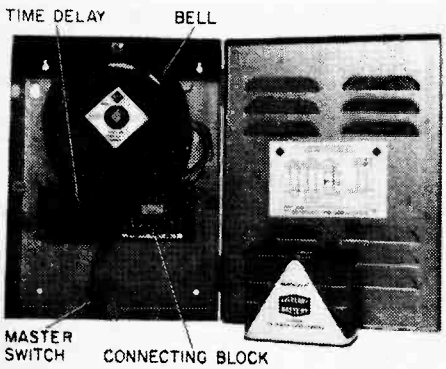
Key-type master switch on API's 208 provides only means of turning unit on or off. Once tripped, alarm will continue to sound, even if all external wiring is cut. Only master key can silence alarm.

HOME BURGLAR ALARM

or less common instantaneous alarm, which can be used for either intruder- or fire-protection. Any number of normally open intruder or heat detectors can be connected in parallel with the 208's instantaneous alarm terminals. As soon as a detector is tripped by either forcing a door or window, or by excessive heat, the alarm bell is instantly locked *on*. Again, the alarm bell can only be silenced by turning the master key switch to *off*.

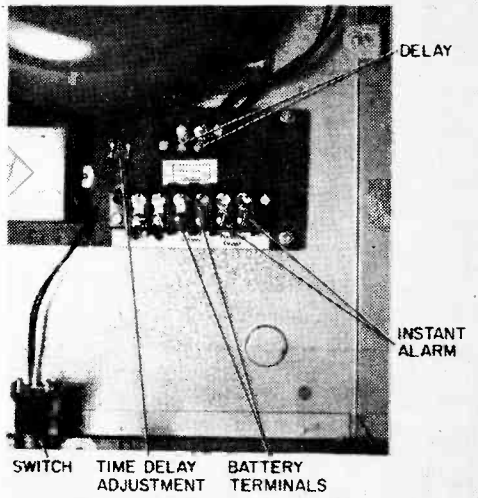
In the evening, before retiring, the entire alarm system is set *on* by simply turning the master switch to *on*.

Double Protection. The 208's internal equipment is normally protected by both the swing-away front panel and an internal steel plate. (The plate has been removed in our photo for clarity.) Once the alarm is tripped, either by the time delayed door circuit or the instantaneous circuit, the alarm bell locks up to the battery. Result is the bell will keep ringing even if the connecting wires are cut, the alarm is torn from the wall, or the entire unit is dunked in a tub of water. Nothing can stop the alarm from sounding other than the master key. And because of the double-panel construction, even squirting shaving cream right through the bell louvre cannot silence the alarm.



Completely self-contained, API 208 houses everything except detector switches in steel case. Protective steel panel has been removed here to reveal details of interior.

The time-delay controller is solid-state and requires just a few microamperes of battery current even when the alarm is armed. The battery will, therefore, last its normal shelf life while standing-by for protection. As a rule of thumb, the lantern battery should be replaced about once a year, unless it runs down sounding warning of an intruder or a fire.



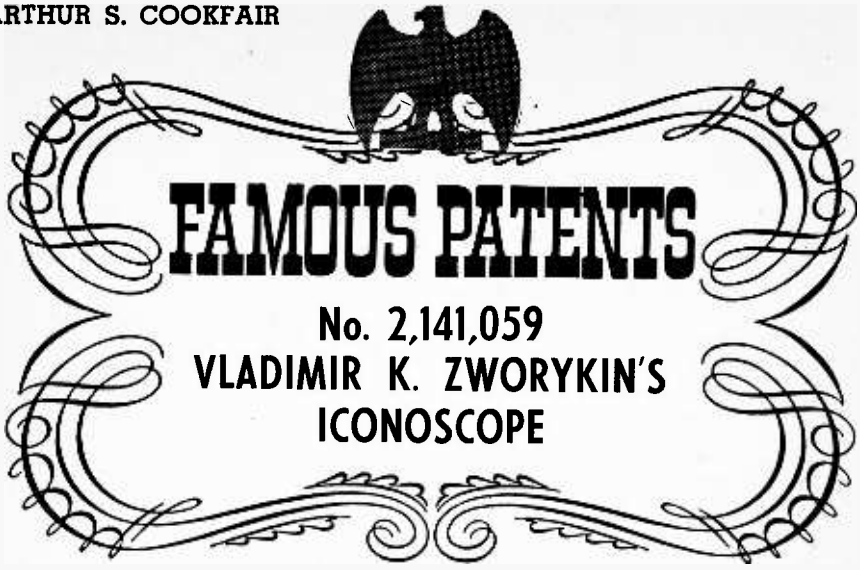
All circuit connections are made to barrier-type terminal strip within unit. Time delay adjust pot determines interval between time door is opened and alarm sounds off.

Summing Up. The A.P.I. Model 208 Burglar Alarm performs as well as can be expected of professional-type equipment. It stands head and shoulders above "hobby circuit" alarms and ultrasonic alarms that cover small areas at high cost, and which trip when a child gets up for a glass of water.

The A.P.I. Model 208 alarm is available only from professional equipment suppliers and installers. Price of the alarm unit, less intruder and fire detectors and battery, is about $60.00. For additional information, see your local A.P.I. dealer or write Alarm Products International, Dept. TC, 24-02 40th Ave., Long Island City, N.Y. 11101.

A Home Protector Kit consisting of the 208 alarm unit, three magnetic door/window switches, and two heat detectors is available prepaid for $69.95 from Custom Components Div., Box 153, Malverne, N.Y. 11565. (Additional switches and heat detectors are $3.55 each.) ■

By ARTHUR S. COOKFAIR



WHO invented television?

If a "Mr. Television" award were to be given to the inventor of television, the nominees for the title would be many indeed. Seldom has a modern invention evolved from the efforts of so many far-sighted inventors over so long a period of time. The list of nominees, to mention just a few, would certainly include.

- G. R. Carey, a Boston inventor who designed the first crude television in 1875, using a screen consisting of a mosaic of selenium cells, each individually wired to a corresponding electric bulb:
- Paul Nipkow, who, in 1884, received a German patent on a TV system based on a mechanical scanning disc (years before the age of electronics):
- K. F. Braun, who perfected the cathode ray tube in 1897 and paved the way for electronic methods of television;
- Russian physicist Boris Rosing and English scientist A. A. Campbell-Swinton, who independently developed electronic scanning systems based on the cathode ray tube, in 1907;
- J. L. Baird, Scottish inventor whose genius developed the mechanical scanning systems of Nipkow to their highest degree of perfection and who devised a color television system in the 1920s;
- Philo T. Farnsworth, American inventor whose research during the 1920s and 1930s resulted in the granting of more than 100 patents, many on inventions basic to modern TV.

High on any list of candidates for the "Mr. Television" award would be the name of Vladimir Kosma Zworykin, pioneer of modern television and inventor of the TV camera's "electronic eye"—the *Iconoscope*.

Born in Mourom, Russia in 1889, Vladimir Zworykin received his early education in his native land, graduating from the Petrograd Institute of Technology in 1912 with a degree in electrical eng neering. Later the same year the young scientist traveled to France to begin his graduate studies in X-ray research. His studies were cut short by the onset of World War I and he returned to Russia, where he served as a radio officer in Signal Corps of the Russian Army. In 1919, at the end of the war, he emigrated to the United States and became a naturalized citizen in 1924.

During his studies at the Petrograd Institute, Zworykin worked under Professor Boris Rosing—one of the rare scientists of the day who believed that television was more than just a science fiction dream. Under the influence of Professor Rosing, Zworykin became convinced that the key to television was not in the mechanical system of Nipkow, but in a yet-to-be discovered *electronic* system based on cathode-ray tubes.

Shortly after his arrival in the United States, Zworykin moved to Pittsburgh where, as a research scientist with Westing-

FAMOUS PATENTS

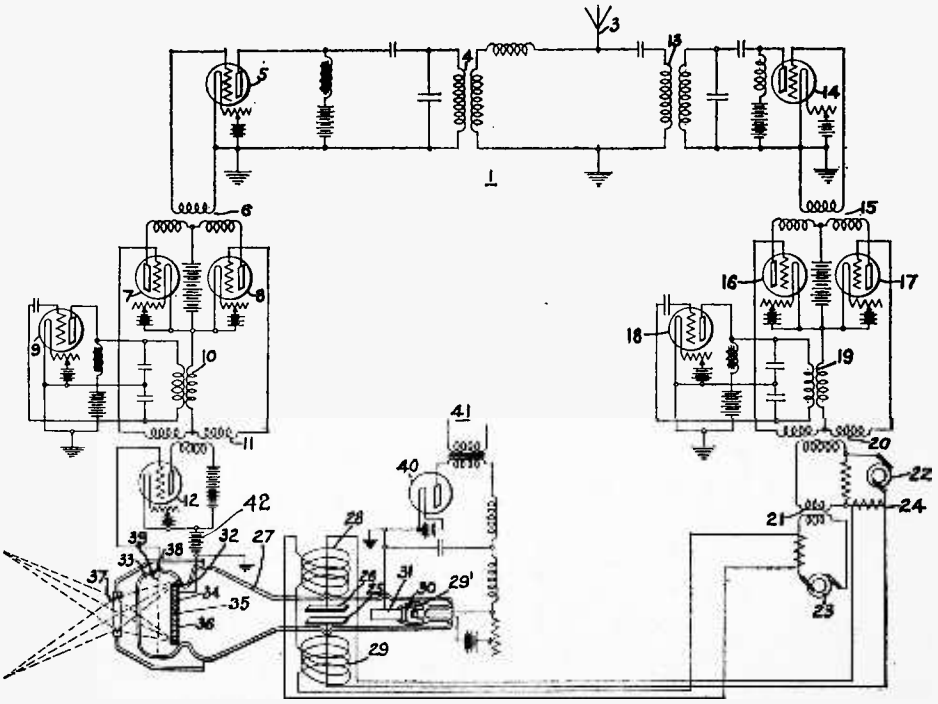
house Electric and Manufacturing Company, he was able to begin his investigations in electronic television. By 1923 he had developed a complete electronic television system.

Zworykin's system incorporated the first practical television camera—developed from the cathode-ray tube. He named it the "Iconoscope", from the Greek words "Eikon" meaning image, and "Skopon", meaning to watch. In the original Iconoscope, the image to be telecast was focused on a composite plate within the cathode-ray tube. The plate consisted of a mosaic of photo-electric material and a thin layer of aluminum on opposite faces of an insulating material (aluminum oxide). Zworykin used potassium hydride as the photo-electric material. (Later research led to the substitution of more efficient photo-electrics, such as caesium-silver compositions, and other insulating layers such as mica.) In operation, each segment of the mosaic consists of a tiny dot of photo-electric material which forms one plate of a miniature condenser, the other plate being the thin sheet of aluminum. As the image to be telecast is focused through the TV camera lens onto the photo-electric mosaic, a pattern of charges corresponding to the visual image is created. The pattern is "scanned" by a beam of electrons from the electron gun in the neck of the tube.

Zworykin applied for a patent on his television system—including the Iconoscope—in 1923. Other television researchers claimed similar inventions and a series of legal proceedings followed, to determine the true inventor. After fifteen years of legal proceedings, Zworykin was determined to be the first inventor and his patent was allowed to issue. U.S. Patent No. 2,141,059 covering his fundamental discoveries of the early 1920s was finally granted on *December 20, 1938.*

The Iconoscope—key to the early development of television—has been replaced to a large degree by more efficient camera tubes. However, it is still used for a number

(Continued on page 97)



On December 29, 1923, V.K. Zworykin applied for a patent on a complete and operable television system employing his iconoscope. This schematic accompanied his request.

Verrry Interrresting... diss

VOODOO RADIO

HAITI might just be the strangest country anywhere on the DX scene. Its three best-known stations are 4VB (*La Voix de la Révolution Duvaliériste*), Radio Lumiere (4VU), and 4VEH. As it happens, 4VB is spokesman for the regime headed by "Papa Doc" Duvalier, not only the bloodiest dictator in all Latin America but also reputedly a voodoo priest. Both 4VU and 4VEH, in contrast, are Christian missionary stations. Despite their differences, all three have gotten along together very well during the past few years with one major exception.

But let's start at the beginning—with 4VB. This one has become famous for French and Creole folk songs praising Papa Doc, on-the-spot broadcasts of "live" executions, and constantly switching frequencies. However, during an unsuccessful invasion of the republic (apparently launched from the Bahamas) on May 20, 1968, *La Voix* appeared on 6103 kHz. It has since varied not more than a few kHz from that spot, though it is logged outside Haiti only on rare occasions. Explanation is an erratic and short schedule. When it *is* on, 4VB's sign-off often comes as early as 1800 EST (which is around sunset in Port-au-Prince).

In fact, with the exception of those two missionary stations (both financed and controlled by non-Haitians), all Haitian broadcast activities have steadily declined

by C. M. Stanbury, II

VOODOO RADIO

since 1968. But this of course makes Haitian loggings all the rarer.

Rebel Radio. Prior to the attempted invasion, R. New York Worldwide aired a series of rebel programs to Haiti in French and Creole under the alias *La Voix de l'Union Haitienne Internationale* (0600-0630 EST on 15265 kHz). The broadcasts continued for a time even after the invaders had been routed, though there was some jamming, presumably from 4VB, in the form of distorted Latin American music.

A few months after this counter broadcasting commenced, the rebel programs from R. New York Worldwide ceased. Whether this was due to the jamming, the general stagnation in Haitian broadcasting, or an overall reduction in Caribbean clandestine radio activities remains to be seen. In any event, 4VB does go down in history as perhaps the only Latin American broadcast station outside of Cuba to ever be used as a deliberate jammer.

As for the four privately owned (commercial) Haitian stations currently active on the SWBC bands, they, like 4VB, seem to also be on reduced schedules with only limited nighttime broadcasts. (See our chart for details on call letters, frequencies, etc.) At last check, however, all four were verifying those few DX reports they do receive.

Station 4VEH. It was also the Bahaman-based invasion that caused the one brief rift between Papa Doc and those missionary stations or, to be more precise, between the Port-au-Prince government and 4VEH at Cap-Haitien. Because of their Bahaman starting point, the invaders landed in Northwest Haiti, very close to Cap-Haitien.

S&E'S GUIDE TO VOODOO RADIO

kHz	Call	Station	Location	Time (EST)
1035	4VEF	"4VEH"	Cap-Haitien	0500, 2000
1145	4VAB	R.Caraibes	Port-au-Prince	1900-2000
2410	4VU	R.Lumière	Les Cayes	0500, evening
2450	4VSO	"4VEH"	Cap-Haitien	0500, 2000
4940	4VM	Radiodiffusion Haitienne	Port-au-Prince	0600
5040		R.Valparaiso	Port-de-Paix	1900-2000
6035	4VAB	R.Caraibes	Port-au-Prince	1900-2000
6103	4VB	La Voix de la Révolution Duvaliériste	Port-au-Prince	1800
6195	4VHW	R.Haiti	Port-au-Prince	0600
9770	4VEH	"4VEH"	Cap-Haitien	0700, 1830
11835	4VEJ	"4VEH"	Cap-Haitien	0700, 1830

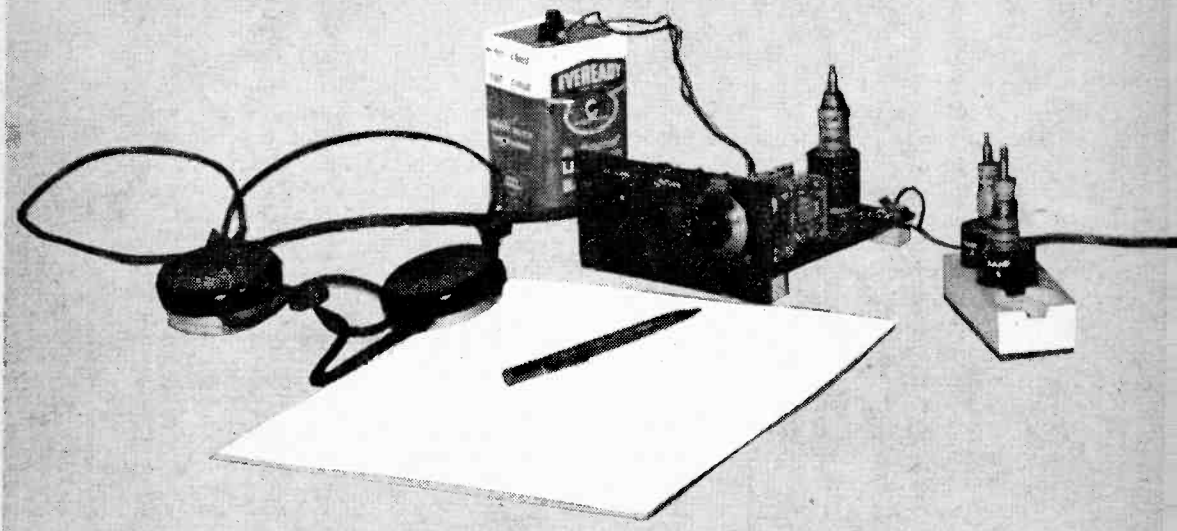
Though monitoring reports (on 6120 kHz) indicated that 4VEH carried on with normal programming during this conflict, Papa Doc decided that 4VEH had somehow helped the invaders and put them off the air for a time. However in a month or so the "misunderstanding" was resolved and 4VEH returned to the air.

While 4VEH at times enjoys a worldwide audience on such frequencies as 9770 and 11835 kHz, in the U.S. and Canada it's more easily heard on 1035 kHz in the standard BCB and 2450 kHz in 120-Meter territory. Best time to try for either of these channels is at 0500 sign-on and again around 2000 EST. It should be noted that while the whole Cap-Haitien operation is known as 4VEH, each transmitter is also assigned its own set of call letters. For example, the rig on 2450 kHz identifies as 4VSO, while the one on 1035 is known as 4VEF.

(Continued on page 96)

QSL from Haitian station 4VEH, transmitting in 31-Meter band. Station calls itself the evangelical voice of Haiti; card contains quote (in Spanish) from Psalm 119.

All-Solid-state IC LOW BANDER



Dip all the way down to a low, low 80 kHz with a regen receiver that's as mod as its IC innards!

by Charles Green W6FFQ

FROM the earliest days of radio the long wave band of the spectrum has been used for weather forecasts, naval and commercial CW communications, and aircraft beacons. Since many CW transmissions in the LF band are hand-keyed, listening to them is an ideal way to improve your ability to copy CW. SWLs can find a new interest in logging aircraft beacons and other LF stations.

Our easy-to-build, integrated circuit (IC), low frequency (LF), regen receiver tunes from 80 kHz to 420 kHz covering the most active portion of the long-wave band. Two plug-in coils cover the span of LF frequencies; a third plug-in coil covers the standard BCB to provide a dual-purpose receiver.

The output of this all-solid-state receiver is of sufficient level to drive either high- or low-impedance headphones or a small speaker. Construction has been simplified and the 6-volt lantern-type battery provides power for a long period of oper-

LOW BANDER

ating time before requiring replacement.

How It Works. Signals gathered by the antenna are fed to the receiver via input jack J1 to the primary winding of L1, the plug-in coil. The secondary of this coil is tuned by C2 and coupled to the input of one half of IC1 via C3. The signal is detected and fed to the input on the second half of IC1 via C6. Regeneration is effected through the tickler winding via C4 by feeding a portion of the signal being amplified in the first half of IC1, taken off at interstage pin 4. Potentiometer R1 is shunted across the tickler and limits the amount of signal fed back into the tickler.

The resulting signals from the first half of the IC are coupled as audio signals to the second half of the IC via C6 and gain control R3, where they are amplified further to drive output power transistor Q1. Output of Q1, which is a low-impedance transistor, will match speakers of 8 to 45 ohms or low- or high-impedance headphones without matching transformer.

We've powered the IC/Vamp LF receiver from a 6-volt lantern type battery that has a greater current output capacity than D or A cells, and therefore will operate the receiver for longer periods of time before having to be replaced. Diode D1 has been included to protect the IC and transistor Q1 from damage that could occur if battery polarity should accidentally be reversed. If by chance you have an AC-operated power supply that will deliver 6 volts regulated output, it can be used in place of the battery specified.

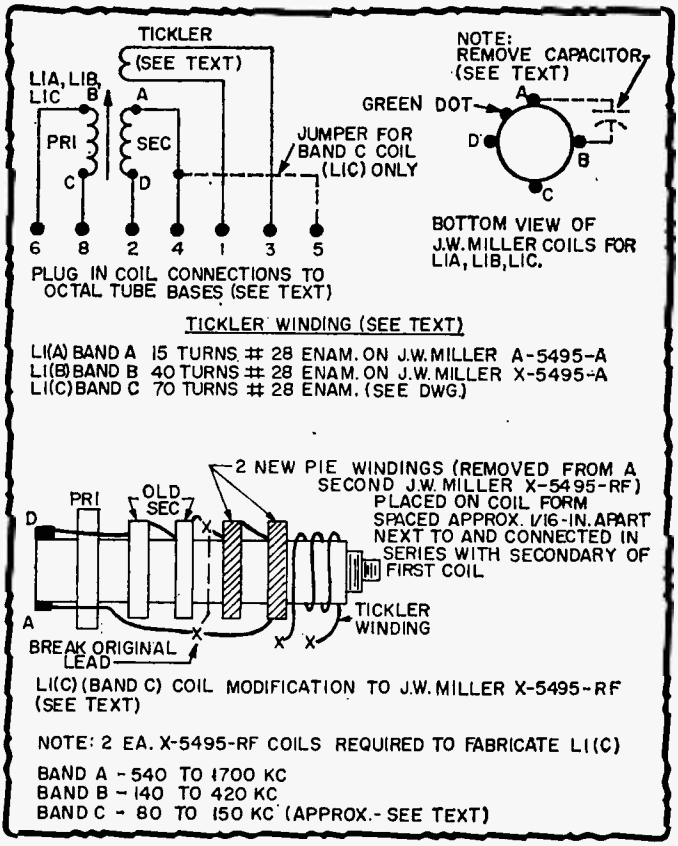
Building It. Since LF circuits are notably unsusceptible to stray capacitance and leakage that may be created by interconnecting leads, our IC/Vamp LF receiver isn't critical to physical layout. You should, however. employ normal good wiring practices in building it. We suggest you follow our layout as shown in the photos to simplify construction.

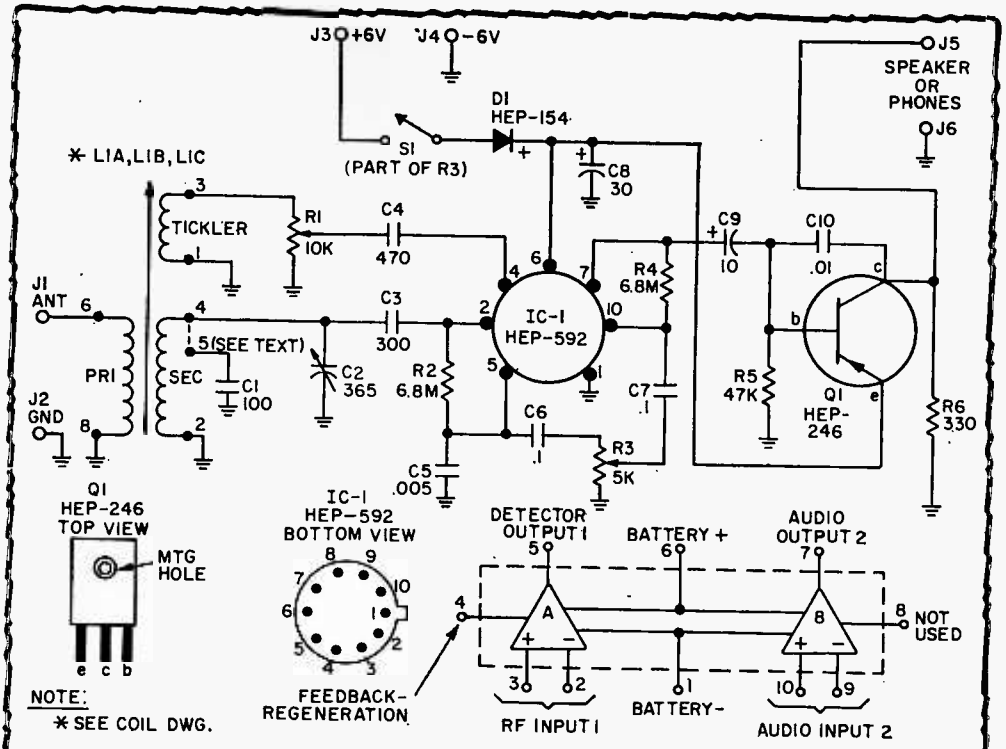
All components, except for tuning capacitor C2, audio level control R3, regeneration control R1, and the socket for plug-in coil L1, are mounted on a 2⅛ x 2¾-in. piece of perfboard. We used push pins to provide easy soldering of connections as well as for better mounting support plus a means to allow easy replacement of a part should it become necessary. The chassis base and front panel are made from ⅛-in. thick tempered hardboard (Masonite).

Wooden blocks, ½-in. square running full width, are cemented to the front and rear edges on the bottom of the main chassis hardboard sheet. These serve as feet to raise the entire assembly. Exact dimensions for the hardboard chassis base and front panel are given in the Parts List.

After drilling the front-panel holes for mounting R1, R3, and the tuning dial,

In making coils detailed here, remember all windings run in same direction.





IC/VAMP LF RECEIVER PARTS LIST

B1—6-V lantern battery (Eveready 510 S or equiv.)
C1—100-pF, 75-V ceramic capacitor (Lafayette 33E69022 or equiv.)
C2—365-pF variable capacitor (J.W. Miller 2111 or equiv.)
C3—300-pF, 150-V ceramic capacitor (Lafayette 33E21791 or equiv.)
C4—470-pF, 1000-V ceramic capacitor (Lafayette 32E01779 or equiv.)
C5—0.005-uF, 75-V ceramic capacitor (Lafayette 33E69048 or equiv.)
C6 C7—O.1-uF, 75-V ceramic capacitor (Lafayette 33E69089 or equiv.)
C8—30-uF, 16-V electrolytic capacitor (Lafayette 34E85505 or equiv.)
C9—10-uF, 16-V electrolytic capocitor (Lafayette 34E85463 or equiv.)
C10—0.01-uF, 75-V ceramic capacitor (Lafayette 33E69055 or equiv.)
D1—50-PIV, 1-A silicon diode (Motorola HEP-154)
IC1—Dual integrated circuit (Motorola HEP-592)
J1, J2, J3, J4, J5, J6—Fahenstock clips (Lafayette 33E71028 or equiv.)
L1A—540-1700 kHz coil (J.W. Miller A-5495-A antenna coil)
L1B—140-420 kHz coil (J.W. Miller X-5495-A antenna coil)
L1C—80-150 kHz coil (fabricated from 2 coils, J.W. Miller X-5495-RF—see text)
Q1—Pnp silicon transistor (Motorola HEP-246)
R1—10,000-ohm, linear taper potentiometer (Lafayette 33E12626 or equiv.)
R2, R4—6.8 megohm, ½-watt resistor
R3—5000-ohm, audio taper potentiometer AF gain control with spst switch S1 (Lafayette 32E22510 or equiv.)
R5—47,000-ohm, ½-watt resistor
R6—330-ohm, ½-watt resistor
S1—Spst switch (part of R3)
S01—Octal saddle socket for plug-in coils (Lafayette 32E20951 or equiv.)
1—1½-in. dia. vernier dial (Lafayette 99E60311 or equiv.)
1—5 x 5 x ⅛-in. piece tempered hardboard (Masonite or equiv.)
1—5 x 2½ x ⅛-in. piece tempered hardboard (Masonite or equiv.)
1—1½ x 2 x 1/16-in. sheet aluminum for bracket
1—2¾ x 2 3/16-in. piece perfboard for circuit board (Lafayette 19E83139 or equiv.)

Misc.—Knobs, perfboard and push-in terminals, ¼-in. spacers, ½-in. square wood strips, solder lugs, plastic sleeving, hookup wire, hardware, octal tube bases for plug-in coils, rub-on letters (Datak or equiv.) etc.

mount the dial on it. Next drill holes in the chassis base for mounting the plug-in socket for L1, the perfboard and antenna, battery and speaker terminals. Then cement the wooden blocks to the bottom of the chassis and cement the front panel to the wooden block on the front edge.

Put this aside to allow the cement to dry and make a 1½ x 1½-in. mounting bracket from scrap aluminum with a ½-in. foot,

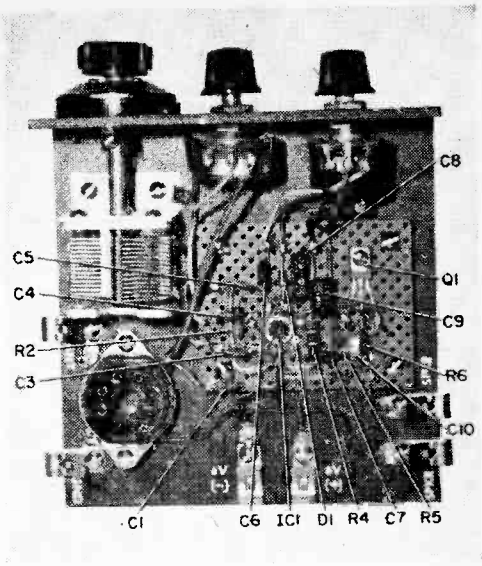
LOW BANDER

bent at a right angle to the main support. Drill the bracket to fix mounting holes on the front of C2 and the holes in the ½-in. foot, to match those drilled in the chassis base for mounting the bracket. Make holes in the foot oversized to allow slight alignment adjustments to ensure freedom of dial rotation when tuning capacitor is fastened to dial.

When cement has thoroughly dried, mount the capacitor loosely to the chassis and tighten set screw locking capacitor shaft to dial drive. Rotate dial through its complete excursion to check for binding. If satisfactory, tighten bracket to chassis.

If cement requires more drying time, go on to the perfboard assembly before adjusting dial and tuning capacitor positioning. Insert push pins as shown in photos, mount parts on them, and solder them in place. Great care should be taken not to apply too much heat to the leads of IC1 and Q1. We suggest you use an alligator clip on each of the leads of the solid-state units to act as a heat sink while soldering these units onto the perfboard. The IC is sunk into a hole in the perfboard, bottom-side up, with its leads fanned out to surrounding push pins.

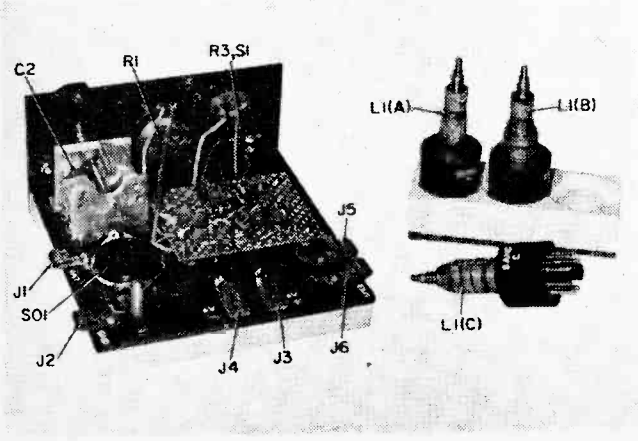
Except for Q1, which is fastened top-side down with a short bolt and nut that also acts as a heat sink, all parts are self-supporting on their leads. Interconnecting leads should be as short and direct as possible. You may want to place them on the bottom of the perfboard and solder to tabs of the push pins. This makes a neat subassembly.



This bird's eye view shows where all parts are located on perfbaard. Base connections for IC1 and Q1 are shown in schematic.

Use ¼-in. spacers to raise the perfboard from the chassis base and ½-in. spacers to raise the socket for L1. You may have to bend or cut off some part of the socket lugs to keep socket clearance within the ½-in. spacing afforded by its mounting spacers.

Be a Coil Maker. The only construction work left is the making of the plug-in coil L1 [there are actually three—L1 (A), L1 (B), and L1 (C)]. Coils are fabricated from standard commercially-wound coils to which tickler windings are added by slipping them over the top of the coil form. Tickler for coil L1 (A) covering the BCB (540 to 1700 kHz) is 15 turns of #28 enameled



In addition to showing neat coil rack described in text, we've located all other parts not mounted on perfboard. Though layout isn't critical this one conserves space and makes for an efficient low-band receiver, so why not use it? You'll be pleasantly surprized at how well it works.

wire wound in the same direction as the other windings of the coil. Coil L1 (B) (140 to 420 kHz) tickler is 40 turns of #28 enameled wire, added with same precautions on direction of winding mentioned above.

Coil L1 (C) has other modifications in addition to the tickler, which, in this case, is 70 turns of #28 enameled wire. You'll need two of the Miller X-5495A RF coils specified in the Parts List. The second one is your source of supply for the two additional pi-windings needed to modify the coil you must fabricate for L1 (C). Be sure the additional windings are added so that the direction of the turns is the same for the additional windings as are the windings of the coil being modified. This same caution should be heeded for the tickler coils you'll wind for these coils.

One other modification is required: remove the capacitor installed by the manufacturer between connections A and B on each of the coils. Also, on L1 (C) *only*, add a jumper from pin 4 to pin 5 on the octal tube base in which the coil is mounted. Adjust all coil alignment screws so that they extend about ¼-in. above the top of the coil form.

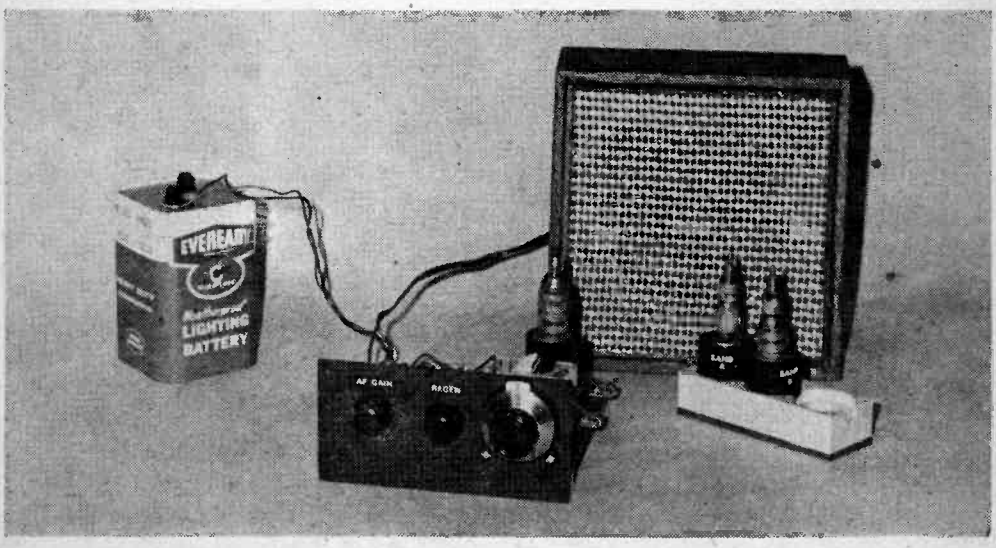
All three coils are each mounted in a separate octal tube base to facilitate plugging them into the receiver. Solder heavy bare copper wire to each of the coil's connectors, leaving the wires long enough to extend through relevant tube base pins. After soldering them to the coil, insert these wires in their respective pins in the base and push this coil assembly as far down into the base as possible to ensure a rugged coil mount.

Clean out all old cement and pieces of glass from the tube base, and clear all of the pins of solder. When a coil has been properly placed in its tube base, solder the lead wires to the tube pins and cut off excess lead wire and solder so that the completed assembly can be easily inserted in an octal socket. See details on the coil modifications in the accompanying drawing.

You may want to make the attractive, useful stand shown in the photo to hold the plug-in coils when not in use. It's easy to make. Drill three holes, ¾-in. in diameter, in a 1½ x 3⅞ x ¾-in. wood block and countersink them to a depth of ¼-in. with a 1⅛-in. diameter hole. Cement a piece of ⅛-in. hardboard over side not countersunk and you have your coil stand. You may have to ream the holes slightly if the coils fit too snugly.

Checkout and Operation. Before connecting the battery, check all wiring and double check for correct polarity of diode and electrolytic capacitors. One thing to bear in mind is that for best LF reception you need a long antenna mounted as high as possible. The exact length isn't nearly as critical for LF reception as for uhf and vhf reception. Also, for best reception you need a good

(Continued on page 98)



From opening photo and a quick glance at schematic you might guess the Low Bander will only operate phones. Actually we drove speaker at a fair audio level.

HAM TRAFFIC
DE W7DQS

by MARSHALL LINCOLN

The Noose Is Getting Tighter

WHEN you sit down to your ham rig for an evening of operating, do you now get the feeling that there's a loop of rope around your neck, and somebody far away is pulling on it?

I sure do, especially after our "friends" on the Potomac, the good ol' Friendly Candy Company, dropped one of the biggest bombshells of the century on the whole radio industry, including ham radio. Then they followed it up with a second attack aimed specifically at certain ham radio technical advancements.

The big blast, as you probably realized, was the new super stupendous increase in license charges. The second blast was one which has gone unnoticed by everyone except one particular group of hams involved —and they're boiling mad, with good reason, for it betrays much they have accomplished in recent years while the FCC was setting on its thumbs.

To take first things first, the new schedule of license charges, and the so-called "reasoning" behind them, reads like something right out of the secret files of a power-mad dictator. Most hams probably aren't aware of the whole scheme which the FCC has hatched up, and so they don't realize what a monster is breating fire down our necks. They are inclined to think of the $9.00 charge for a ham license application or renewal as an irritation, but little more.

However, the implications of the new set of FCC charges which covers the industry like a cast-iron bed sheet present a real threat to hams. Anything which restricts the electronic industry has side effects which hurt ham radio, and these new license charges will restrict the electronics industry —and threaten its future—like a gang of Chicago hoodlums turned loose at a ladies garden party.

Arrogant and Defiant. If you can get hold of a copy of the full FCC proposal, which touches all facets of radio and TV activity, and study it in detail, you will come right up out of your chair and go through the roof. You will be downright stunned by the arrogant, defiant attitude toward all radio communications activity displayed in this barrage of bilge known officially as Docket 18802, Notice of Proposed Rule Making.

To get the full impact of what the Feds are doing to us, we must briefly review what has happened.

Back in 1963, the FCC concocted a schedule of charges for various licenses. Before that, there was no charge for ham tickets, commercial operator's licenses, and pilot's radio licenses, among many others. The FCC always has called these "license fees," but I maintain they actually are additional TAXES. The Feds don't like to hear that word, because there's a little item in the U. S. Constitution that says only Congress can levy taxes, and these license charges certainly didn't come from Congress.

Object of the original set of license charges was to recover part of the cost of operating the FCC from the individuals, groups and industries which use the FCC's services, rather than have all taxpayers foot the entire bill. There are arguments you can make on both sides of that issue, but the Feds only listened to the arguments which supported their side.

Two Big Flaws. The original set of license charges might not have been so bad, except for two items: First, the money paid for radio licenses does not go into the FCC's operating budget. Rather, the FCC deposits

this money in the U. S. Treasury general fund. Then the FCC goes to Congress each years to ask for whatever money it feels it needs to operate. There has been no indication that the amount of money paid each year by all types of radiomen ever was considered in setting the FCC budget.

And second, the license charges have no relationship to the amount of work the FCC does in each radio service. For example, it seems to me that if hams pay in a certain amount of money for their licenses, they are entitled to have a proportionate amount of the FCC's time and energy spent on services for hams, such as license exams and monitoring and enforcement efforts. Has this been done? Haw—in a pig's eye!

So, you see the original license charges were merely a scheme for the Federal government to collect additional money from the electronics industry, both hobby and professional. The entire cost of operating the FCC still is paid by that good ol' No. 1 sucker, the U. S. taxpayer.

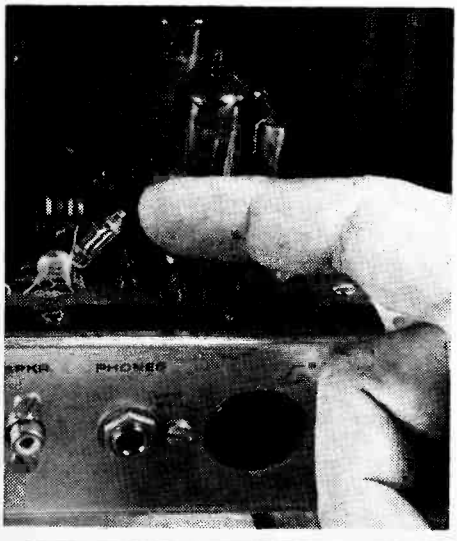
Now, though, after having gotten away with this racket for nearly seven years, Uncle has hatched a new scheme, and it's a dilly! The idea now is to collect the *entire* cost of operating the FCC from the radio and TV industry! And the way they decided to do it is really a hair-raiser!

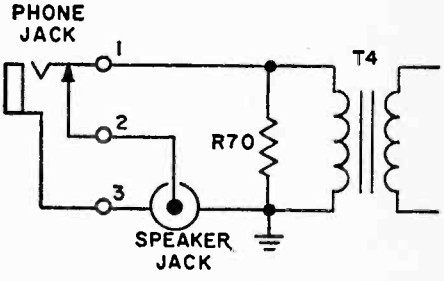
FCC "Work" Doesn't Count. The new charges are not based basically on the amount of work which the FCC would spend on that particular type of radio service, but rather on the "value to the user" of that type of radio usage! In other

(Continued on page 99)

More From Heathkit's HW-16 Novice Transceiver

When it first appeared, the Heathkit HW-16 novice CW transceiver was described in Ham Traffic as a handy and well-designed piece of gear for the beginning ham. That's still true, but there're a few modifications you can make to improve it still more. First, rewire the audio output connections so they are hooked up as shown in this wiring diagram. This will allow you to have full audio volume in your headphones, no matter whether you have a speaker plugged in. When wired according to Heath's directions, you lose audio in your phones unless you have a speaker connected, even though the speaker is muted. Second, after you get your general ticket, you'll want to do most of your transmitting on the same frequency as the station you're working, so disconnect one lead of the neon bulb used in the oscillator which provides the keyed tone in the receiver when you're sending (see photo). This will allow you to hear your own transmitted note in the receiver, which always is good CW operating practice. The neon bulb oscillator is handy when working as a novice, because you often must transmit on a frequency different from the station you're working, but after that is over, it can be a nuisance. By leaving one of the bulb's leads connected, you can easily restore the neon bulb oscillator if you want to. You'll also find it handy to remove and discard the RCA phono jack used for an antenna connector, and replace it with a conventional SO-239-





type female coax connector, which will match the standard coax plugs ordinarily used for antenna feed lines. Also, adding a metal panel, drilled with lots of small holes for ventilation, to cover the open back of the cabinet would be a good idea, for safety, for RF shielding, for protection of the exposed components, and to keep out at least a little dust. Drill holes in the flange around the rear of the cabinet, and attach the rear panel with sheet metal screws.

VT Control

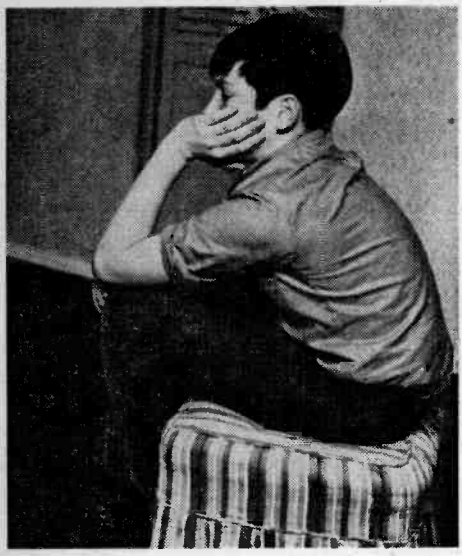
Below—here's television timer in all its glory. Parents are sure to lock it 'n' pocket key.

Father informs his prepossessed offspring that there will be no daddling with timer. But kids seem unaware of him.

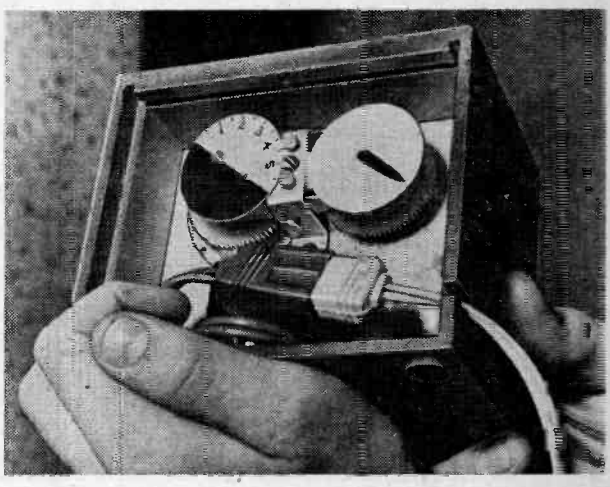
THE Pied Piper of Hamelin burst upon America's living-room scene some 22 years ago, tootling his fantasy song loudest to the family's young. To this day his loyal following still hums his tune with glassy-eyed attention.

Saturday morning activity around your home tells our tale. You're sure to see the brood plopped before the boob tube fantasizing along with, say, animated gorillas saving the whole world from lesser animal life. And every seven minutes, when this glass-and-aquadag Pied Piper clobbers your kiddies with hard-sell, watch as they mimic the barker down to his very convincing . . . "be the first on your block!!" routine. Certainly the TV doesn't influence a young person during all of his daily activities, but its opiate effect is clearly mirrored in him as he passes through a store and spies a product heavily hawked in his direction.

for BT Addicts



Left—engaged with TV's afternoon academe, young folk mime Rodin's The Thinker. Bottom—timer top hides TV plug.



Television addiction worries many parents. They now believe that the answer lies in a little black box which sits atop the TV set. D. G. Noiles, an enterprising mechanical engineer living in Connecticut, set upon his Yankee ingenuity to try his hand at correcting the nationwide Johnny-sits-'n'-stares problem. He concluded that the amount of time a child spends before the TV can be pre-decided by parents and controlled automatically by his device.

The TV's wired into the box, set for the specified amount of viewing time, then locked. When your little bugger's viewing time has been used up, the monitor will switch *off* the set, and it can't go *on* again until the next day. The idea, if not new, is certainly novel. As the box forces the child to improve his viewing discretion, he'll need less View Time control for Boob Tube addiction. ■

Dad holds key to TV timer. Little miss's miffed 'cause now she's got more time for homework, other un-TV doings.

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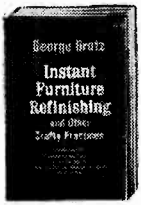

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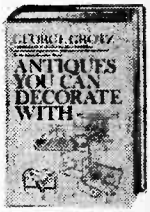

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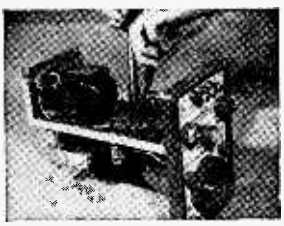
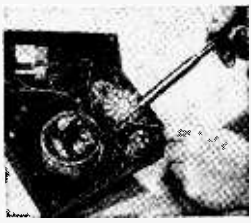
Construction of Oscilloscope.



Construction of Multimeter.



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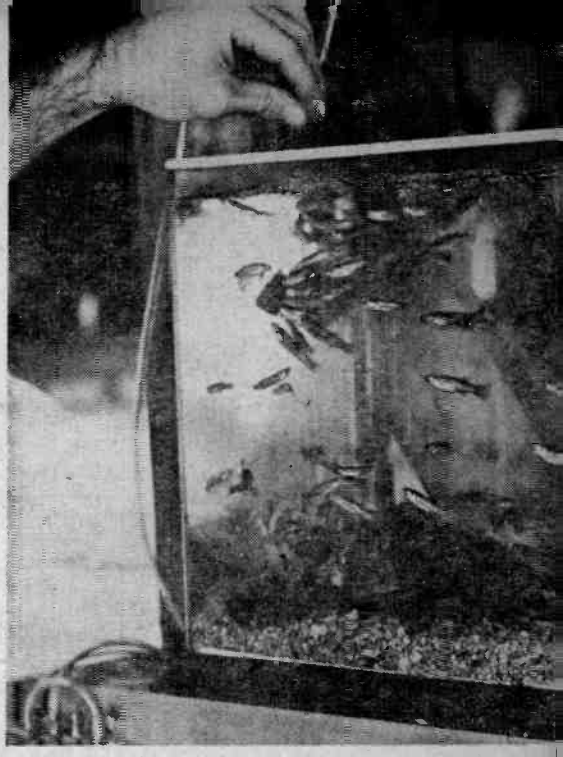
I must go down to the sea again, the dirty polluted sea!

THE quiet atmosphere that reigns at the Long Island University's Mitchel Campus Marine Laboratory located in East Meadow, New York, would never suggest the important work in oceanography that goes on there, and how the future of our existence depends on what studies and results will be found there. Nor does the public know how important every trip is that the little Lucayo, the lab's oceangoing 56-foot research ship makes, as it slips quietly out of its berth at Oyster Bay. The 29-ton vessel collects data and samples on the marine life that surrounds the area.

We are all becoming aware of the dangers of water pollution. Many rivers and

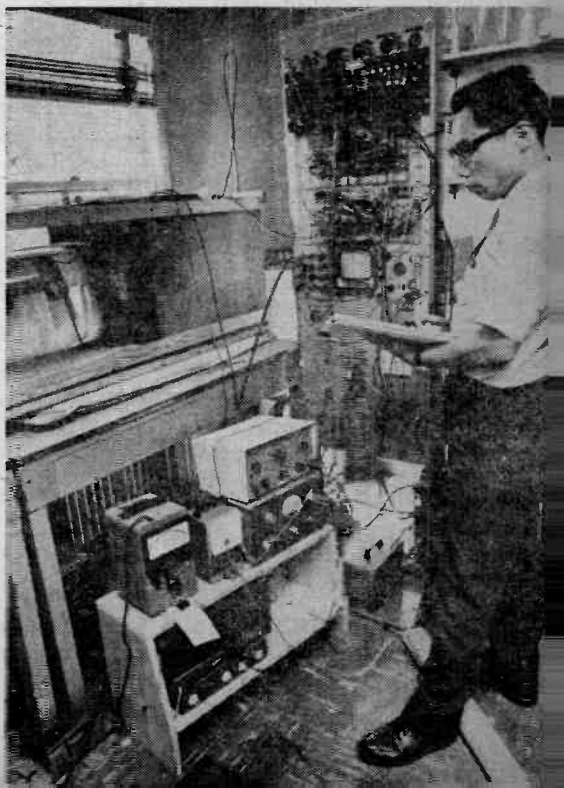
Aboard the Long Island University's Marine Science Boat Lucayo scientists check the offshore waters near Oyster Bay, Long Island. The ship, built as a charter vessel for Bahama Island hopping, was donated to the Marine School for research purposes. With diesel engine and sail, this little craft is ideal for cruising close to shore or for deep-water testing. Prof. Uzzo (right) prepares a device for sampling water at shallow depths. Called the Van Dorn water sampler, it is one of the most frequently used instruments in marine biological studies. A student (left) aboard the Lucayo reads and records temperatures of water samples taken at the surface and at various depths. Measurements are very critical because water pressure below surface must be compensated for, or readings are meaningless.



It is important to maintain sea conditions in the laboratory while investigating fish and performing experiments. Here, a marine scientist takes the water temperature of one of the experimental tanks. Their rigid control techniques make amateur aquarium purification practices seem very crude.

lakes now beyond the pollution stage and entering the poisonous stage are infecting the sea and its waterways and bays. The marine organisms (nekton, plankton, and benthos), those that swim, float, and those that live on the bottom of the water, are slowly being poisoned by man.

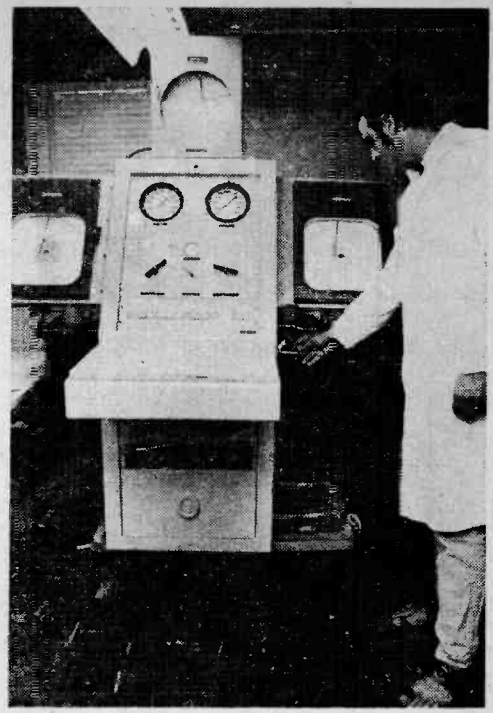
The average person gives little thought to how important sea and other water life is to our survival. Taking for granted all that comes from the sea, there is small concern about when it may run out. Man pours waste into the rivers and lakes, polluting the main arteries of the ocean and some day will kill every living creature in the sea. It may seem impossible now, but there are



Dr. Masaru Fukiya (above and right) is a scientist from Japan visiting the Mitchel Lab. In a way he is close to home since he uses a Sony tape [illegible] and other electronic equipment to study the behavior of fish that have minute electrodes attached to their body surfaces and fins.

polluted sea!

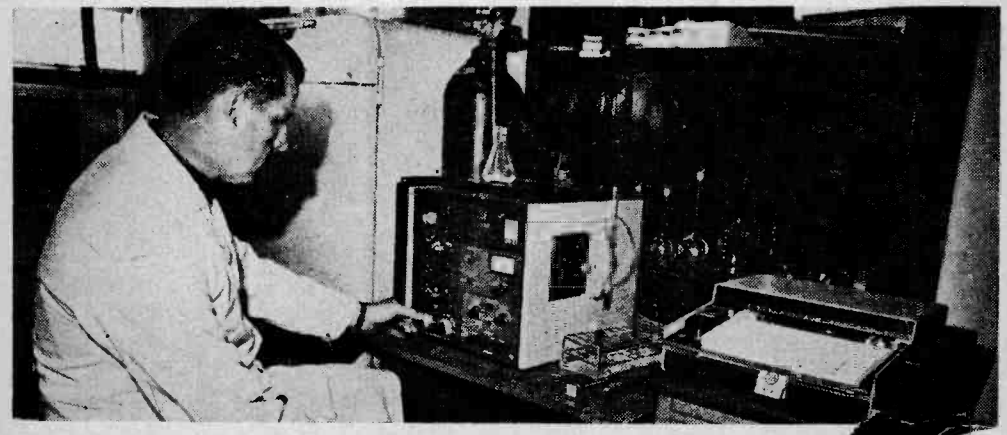
One way to check marine growth is to use radioactive "tags" in the food cycle. Then, electronic circuits measure isotope emissions.



At the lab a student performs simulated deep sea experiments up to 3000-ft depths. The control panel looks like NASA designed it.

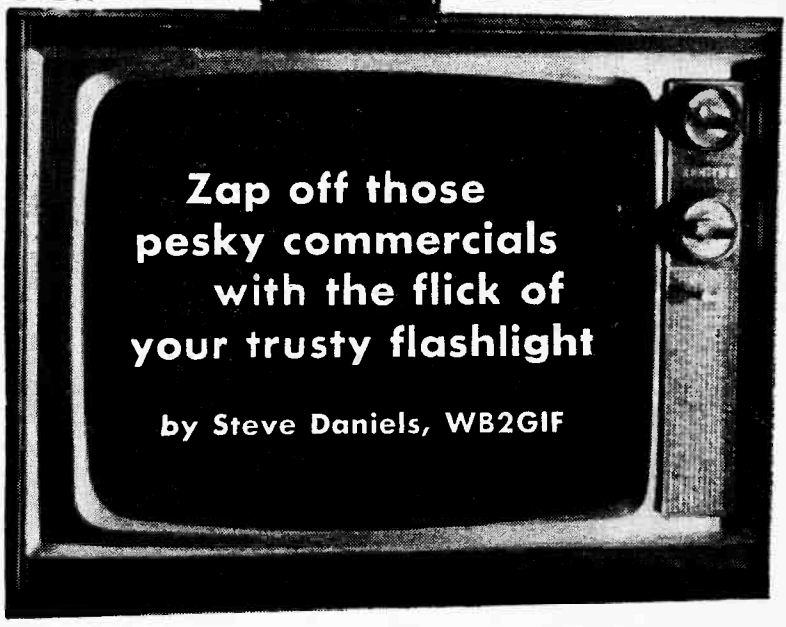
lakes and rivers that are not only unhabitable for fish and marine life, but even man cannot go near them for fear of being poisoned. As one graduate student put it, "The sea was once thought to be the future conveyor of the needs of our growing population, but now it is no longer what potential the sea may have for the future, but saving what is left from destruction."

Here at the Mitchel Field Lab students and scientists are doing what they can to prevent our age from being robbed of the riches that lie in the treasure houses of the waters around this planet. But they will also need the help of an aware public as well as more funds. ■



One of the scientists at the Marine Lab operates a gas chromotography instrume[nt]. It can be used to identify many of the insecticides that pollute our waterways and [...]

Flash Switch



Are you one of the multitude of TV listeners and lookers who's ready to reach for a baseball bat every time your intelligence is insulted by one of those great commercials conceived by the Madison Avenue Boys? Do you suffer whenever you're told that Utra Swipe Toothpaste gives you sex appeal? Have you had your fill of White Knights, White Tornadoes, and White Enzymes? Then you're ready and eager to use our *FlashSwitch*.

What is it? A solid-state switcher that lets you relax in your favorite easy chair and, with the flick of a flashlight, silence your set whenever an offending commercial starts to sound off. A second flash restores the program when you're ready to listen again.

Sure, over the years a number of different types of sound silencers, or commercial silencers, if you prefer, have been foisted on the TViewer. But then, we're all interested in applying and trying new circuits and ideas.

In poring over the latest Radio Shack catalog recently we ran across their bargain package of three *on/off* Dynaquad control rectifiers for $1.19 per package. Never one to pass up a bargain, we pondered on how to use these solid-state switching transistors in a novel application. Why not a photocell-operated, bi-stable switcher to kill TV commercials?

How It Switches. No doubt you wondered what in the world is the above-mentioned Dynaquad? Basically a Dynaquad is a bi-stable semiconductor that has three or more functions within its four or more semiconductor layers. It can be switched from *off* to *on* or

Flash Switch

from *on* to *off*. Essentially it's similar to a triac, a 4-layer *pnpn* device that, by having the two *pn pn* structures arranged in opposite directions, provides for its bidirectional electrical characteristics. It turns *on* and latches in the *on* state when it's base-biased negatively and can be turned *off* when base-biased positively.

We've employed two photoconductive cells to produce the bias voltages for switching. A sensitive relay in the collector circuit is energized when light from a flashlight illuminates PC1, which develops positive bias to stop conduction, thus de-energizing K1 and connecting the speaker's voice coil. By shining the flashlight beam into PC2, negative bias is developed. Transistor Q1 now conducts, K1 is energized, and the voice coil is disconnected from the output transformer.

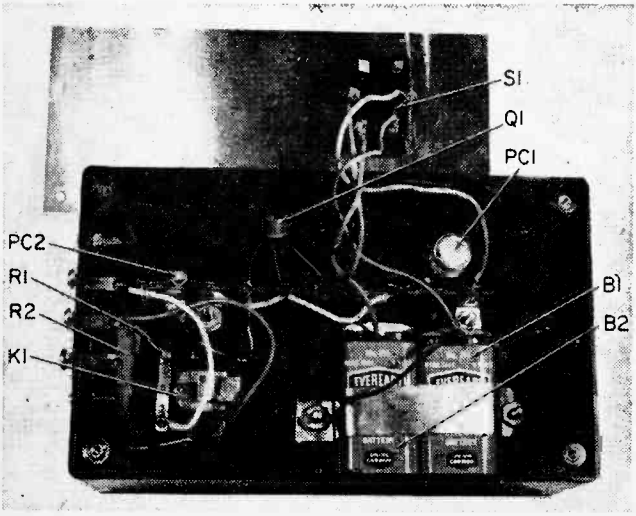
Each time the flashlight is flashed into the relevant photocells, the speaker is either disconnected or connected, depending on which photocell is illuminated. Note that we used a relay with spdt contacts that switches the output transformer to a 20-ohm load resistor whenever the speaker voice coil is disconnected. Without this load resistor the amplifier can be permanently damaged whenever the voice coil of the speaker is disconnected, particularly if the audio amplifiier is transistorized.

Note also that we connected the relay contacts so that when the relay is not energized the speaker is connected to the output transformer. This avoids the necessity of having to excite a photocell whenever you do want to listen. Or, if trouble should develop in the switcher, you still will be able to listen to the set without having to operate by-pass switches or go into a major rewiring to remove *FlashSwitch* from the circuit.

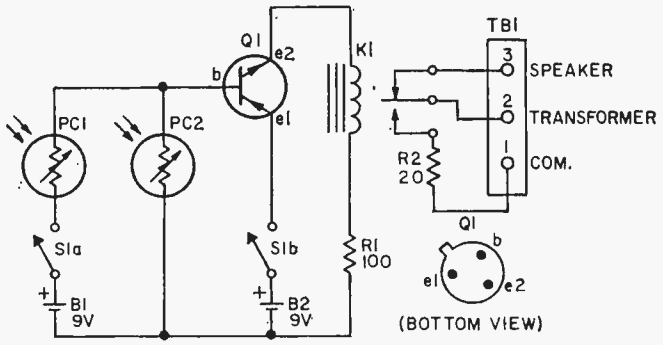
Making It. We housed *FlashSwitch* in a black plastic utility box with a removable solid metal cover, in order to reduce to a minimum stray reflections within the box that could spuriously excite the photocells. To further ensure light shielding, we used a black plastic tube to direct light beams to PC2 (the plastic barrel from a standard phone plug will do nicely). Photocell PC1 is about ½-in. in diameter and is mounted near the surface of the metal panel. We used a rubber grommet with a hole about ⅜-in. inside diameter to shield PC1.

Most of the parts are mounted on an 8-lug tie strip, except for the power switch S1, relay K1, and the two 9-volt transistor radio batteries B1 and B2, which are mounted directly on the housing as shown in the photos.

In order to separate PC1 and PC2 as far as possible and still keep the size of *FlashSwitch* reasonably small, we placed them at the extremes (right and left) of the tie strip. It's necessary to separate the two cells in order to be able to direct the flashlight beam first to one and then to the other individually so that *on* and *off* switching can be effected. Because this separation is important for successful operation we suggest you follow the layout shown in the photos even though the circuit isn't critical.



Now you see what's inside our TV-commercial zapper. Only critical positioning to worry about is how and where photocells PC1 and PC2 are located. Keep them as far apart within confines of black-box housing as po[ssible. Screw] on plastic handle [from pho]ne plug shields PC2 [from] stray light.



PARTS LIST FOR FLASH SWITCH

B1, B2—9-V transistor radio battery (Eveready 216 or equiv.)
K1—DC relay, 7mA at 12 VDC, coil resistance 1000 ohm (Sigma UF-1000-G-SIL or equiv.)
Q1—Dynaquad switching transistor (Radio Shack 276-553, no equiv. available)
PC1—Cadmium selenide photocell (Clairex CL504L or equiv.)
PC2—Cadmium selenide photocell (Clairex CL904 or equiv.)
R1—100-ohm, ½-watt resistor
R2—20-ohm, 5-watt resistor
S1—Dpdt toggle switch (Radio Shack 275-666 or equiv.)
TB1—3 point screw terminal board (Radio Shack 274-345 or equiv.)
1—3¾ x 6¼ x 2-in. black plastic molded utility box with removable aluminum cover (Radio Shack 270-627 or equiv.)
2—Battery Holder, Keystone 203P or equiv. optional—see text)
Misc.—Bolts, nuts, solder lugs, wire, solder, 8-point tie strip, grommets, plastic sleeving or cap from standard phone plug, etc.

Though we made a simple battery-holding clamp from a ½-in. wide strip of scrap aluminum, you may want to be more professional. Therefore we've listed a commercial battery holder in the Parts List.

Testing It. Since the operation of *FlashSwitch* is dependent on screening out all light except the flashlight rays shined directly at either PC1 or PC2, you will have to test it fully assembled.

Turn *on* S1 and shine a flashlight into PC2. The relay should pull in and hold even after turning *off* the flashlight. If the relay doesn't pull in when the light ray strikes PC2, in all probability the Dynaquad (Q1) is defective. After all, at this price they can't be individually tested before shipment. In fact, it might be a good idea to try out all the ones you bought. You may find one or more better than the one you happened to wire in the first time.

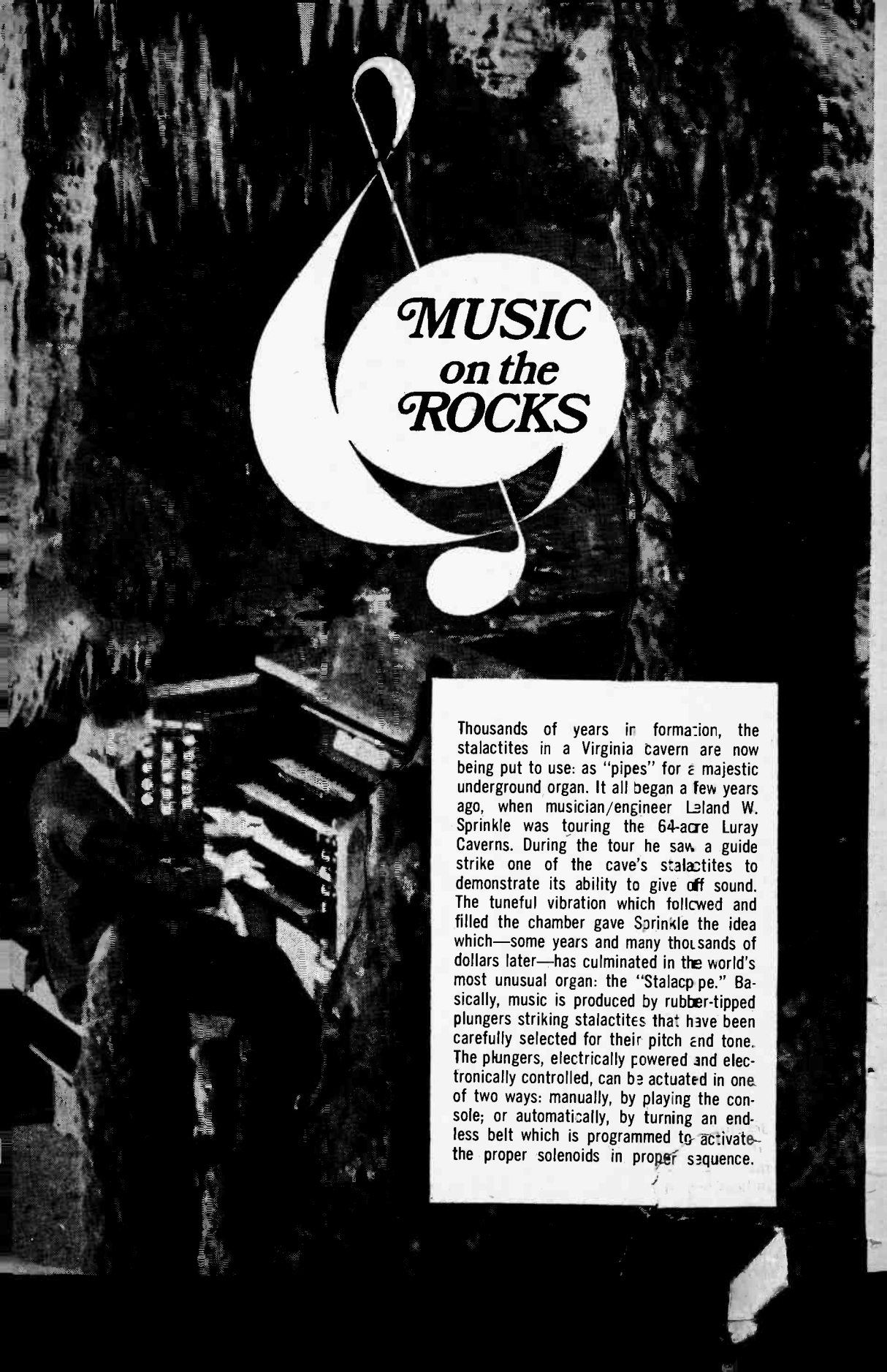
Once you get relay K1 to pull in when PC2 is exposed to the flashlight, shine the ray on PC1. The relay should drop out. If it doesn't, back to the routine of trying another Dynaquad! Now that you have both photocells energizing and de-energizing relay K1, see how far away you can get with the flashlight and still operate the unit. It should work well up to 15 feet away.

Turn *off* or de-energization of K1 is less sensitive than turn *on*. You may have to enlarge the hole in the grommet shielding it to let in more light for maximum sensitivity.

Installing FlashSwitch. In order to hook up *FlashSwitch* to your TV all that's necessary is to break one of the leads between the speaker voice coil and the set's output transformer, as shown in the schematic. Make certain that the transformer is connected to *FlashSwitch* terminals 2 and 3. This is necessary to ensure that the load resistor built into *Flash Switch* will always be connected to the transformer whenever the speaker is switched *off*.

Enjoying It. Now that your *FlashSwitch* is completed and hooked up to your TV set, sit back and relax. With your trusty flashlight in hand, you can forevermore enjoy the programs without those annoying commercials dinning in your ears.

If you find *FlashSwitch* is hard to turn *off*, interchange the batteries. After starting off with new batteries having equal voltage it's possible that lower emitter e1 voltage on Q1 will make it harder to turn *off*, if, by chance, B2's voltage drops faster than B1's in normal use. Reversing the battery in position B1 for B2 may restore ease of switching *off*. If not, use a fresh battery for B2. ■



MUSIC on the ROCKS

Thousands of years in formation, the stalactites in a Virginia cavern are now being put to use as "pipes" for a majestic underground organ. It all began a few years ago, when musician/engineer Leland W. Sprinkle was touring the 64-acre Luray Caverns. During the tour he saw a guide strike one of the cave's stalactites to demonstrate its ability to give off sound. The tuneful vibration which followed and filled the chamber gave Sprinkle the idea which—some years and many thousands of dollars later—has culminated in the world's most unusual organ: the "Stalacpipe." Basically, music is produced by rubber-tipped plungers striking stalactites that have been carefully selected for their pitch and tone. The plungers, electrically powered and electronically controlled, can be actuated in one of two ways: manually, by playing the console; or automatically, by turning an endless belt which is programmed to activate the proper solenoids in proper sequence.

Mechanical and Electrical failure can be predicted by

THE SOUND OF SILENCE

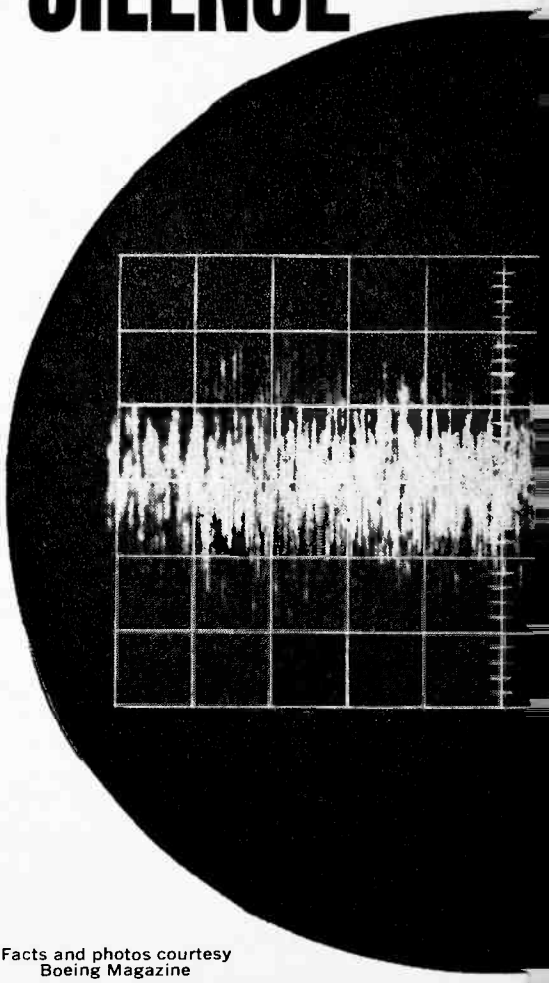
PERHAPS fortunately, nature provided man with only limited hearing—roughly in the region of between 16 cycles and 20,000 cycles per second. Thus man does not hear the rattle of air molecules bumping into each other in a breeze or the rumble of a growing tree. Yet there are such sounds, in fact a complex universe of sounds above and below man's range of hearing. It is a wonder that more human eavesdropping has not taken place in these heretofore supposedly silent regions.

Work now under way in Boeing's aerospace laboratories clearly indicates that tuning in on this cacaphony of silence may be of tremendous benefit to both man and machine. The Boeing work is the brainchild of Harvey Balderston, a research specialist in Boeing's failure analysis laboratory. Balderston reasoned that it might be possible to hear tiny mechanical defects if some way could be found to screen out unwanted noise.

Slowdown. By recording only extremely high frequencies and then slowing them down to the range of human hearing, Balderston *did* screen out unwanted noise. A bearing with only a tiny scratch on its surface sounds like a lively xylophone solo when recorded and played back at a slow speed. A worn hydraulic valve nearing failure sounds like a flushing toilet. Every operating part, according to Balderston, has its own unique, high-frequency beat, hiss, or tinkle which changes as it wiggles and waggles and wears out.

Balderston has listened to the sounds of life itself. He found that an artificial heart valve in a human patient had an acoustic pattern different from a real heart valve. His work with hydraulic fluid flow indicates there is a distinct possibility equipment may some day be developed to listen to the sound of blood flowing through a patient's body, much the way a doctor now listens to a heartbeat with a stethoscope.

A likely early use of failure detectors would be to tune in on automobile problems. Relatively inexpensive equipment could be developed to attach briefly to a transmission, engine, or other automobile power equipment. The mechanic then could listen for indications of trouble. Auto makers already



Facts and photos courtesy Boeing Magazine

SOUND OF SILENCE

have shown interest in developing this kind of diagnostic equipment.

The Sound of Failure. Balderston is currently at the equipment-designing stage of his work, piecing together hardware that could detect the beginning stages of failure in structural, mechanical, hydraulic, or electrical/electronic systems during normal operation. Balderston has discovered several important rules for listening to the silent sounds of failure in the course of his research: 1—all failures are either the result of structural defects or chemical contamination; 2—a defect in one part of a system sets everything in that system to vibrating; and 3—the energy level of the frequencies associated with a failing part is ten thousand to a million or more times higher than normal resonant frequencies. For example, the noise energy level of bubbles from leakage has been found to be an astronomical three billion times higher (over 90 dB) than the level in a good valve.

With this and a few other rules of thumb to go by, Balderston expects to perfect equipment that will quickly and automatically isolate trouble in aircraft and other mechanical systems long before there is any other indication of trouble. A programmed card would be inserted in the test equipment to check bearing surfaces, for example. All bearings could be checked at once, and a meter would indicate the relative amount of wear. More important, red-line emergency condition could be pre-set on the card, and if detected noise exceeded a certain level, a warning light would flash, indicating that one of the bearings should be replaced. As visualized by Balderston, the test equipment could be made small enough to be hand-held and, with a change only of the programmed card, one piece of equipment could be used to check any number of systems, whether mechanical, electrical, or structural.

Balderston listens in on bearing failure. Wired for sound, bearing sings worried song.

Adding oil to ball bearing just might improve operation; sounds tell for sure.

It's the Level! Sounds audible to man would not be required for checking most systems. But when the sounds of failure are brought into the range of human hearing, they provide dramatic evidence of the secrets being discovered. Especially surprising is the noise of crack-resistant metal trying to sew itself into a strong lattice-like structure to stop a crack from spreading. Slowed to human hearing range, this sound is a series of bell-like tinkles not unlike falling splinters of glass.

"It is the sound of molecules falling into stronger structural units," Balderston explained.

Perhaps the most spectacular proof of the new failure detection system came about quite by accident. Demonstrating his technique to a group of Boeing officials, Balderston set out to show how a deliberately damaged bearing registered a much higher resonant frequency than a new bearing. However, to Balderston's surprise, just the reverse happened. The new bearing had a higher frequency reading than the damaged bearing. Disassembly showed the new bearing had a deep gall across its face, a flaw actually more severe than that inflicted on the test bearing.

Such are the secrets whispered by the sounds of silence. ■

VOLUME 52, PART 4

WHITE'S RADIO LOG

An up-to-date Directory of North American AM, FM, and TV Stations, including special sections on World-Wide Shortwave Stations and Emergency Stations for Selected Areas

WHITE'S RADIO LOG CONTENTS FOR 1969-1970

WHITE'S

RADIO LOG

U. S. FM Stations by States

Listing indicates stations on the air up to May 1, 1970

Location	Call	MHz
ALABAMA		
Abbeville	WARI-FM	94.3
Albertville	WQSB	105.1
Alexander City	WRFS-FM	106.1
Andalusia	WNBX	98.1
Anniston	WHMA-FM	100.5
Athens	WJOF	104.3
Atmore	WATM-FM	104.1
Auburn	WFRI	97.7
Bay Minette	WWSM	105.5
Birmingham	WAPI-FM	94.5
	WBRC-FM	106.9
	WCRT-FM	96.5
	WOJC	93.7
	WENN-FM	107.7
	WVSU-FM	91.1
Carrollton	WWAG	94.1
Clanton	WFZZ	97.7
Cullman	WFMH-FM	101.1
	WKLN	92.1
Decatur	WDRM	102.1
	WRSA	96.9
Dotham	WOOF-FM	99.7
	WTVY-FM	95.5
Enterprise	WIRB-FM	96.9
Eufala	WULA-FM	92.7
Fairhope	WABF-FM	92.1
Florence	WQLT	107.3
Gadsden	WLJM	103.7
Geneva	WGEA-FM	93.5
Guntersville	WTWX	95.9
Hamilton	WERH-FM	92.1
Homewood	WJLN	104.7
Huntsville	WAHR	99.1
	WNOA	92.9
Jackson	WHOD-FM	104.9
Mobile	WKRG-FM	99.9
	WLPR	96.1
Monroeville	WMFC-FM	98.5
Montgomery	WFMI	98.9
	WAJM	103.3
	WCOV-FM	97.3
	WHHY-FM	101.9
Muscle Shoals	WLAY-FM	105.5
Oneonta	WKLD	97.7
Ozark	WOAB	104.9
Roanoke	WELR-FM	95.3
Scottsboro	WCNA-FM	98.3
Selma	WTUN	100.1
Sheffield	WRCK-FM	106.3
Sylacauga	WMLS-FM	98.3
Tuscumbia	WVNA	100.3
Tuscaloosa	WUOA	95.7
	WACT-FM	105.5
ALASKA		
Anchorage	KNIK	105.5
	KHAR-FM	103.9
	KWKO	102.1
	KYAK-FM	101.3
College	KUAC	104.7
ARIZONA		
Flagstaff	KAFF-FM	92.9
Globe	KWJB-FM	100.3
Mesa	KBUZ-FM	104.7
	KMNO-FM	93.3
Phoenix	KRFM	95.5
	KFCA	91.5
	KMEO-FM	96.9
	KOOL-FM	94.5
	KNIX-FM	102.5
	KOY-FM	92.5
	KTAR-FM	98.7
	KYEW	93.3
	KHEP-FM	101.5
Scottsdale	KDOT-FM	104.7
Show Low	KVWM	93.5
Tempe	KUPD-FM	97.9
Tucson	KFMM	99.5
	KCEE-FM	96.1
	KVOA-FM	93.7
Tucson	KWFM	92.9
ARKANSAS		
Arkedelphia	KSWH	88.1
Beytheville	KLCN-FM	96.1
Brinkley	KBRI-FM	102.3
Camden	KWEH	97.1
Conway	KASC	91.5
	KVEE-FM	105.1
Crossett	KAGH-FM	104.9
Dardanelle	KCAB-FM	102.3
El Dorado	KRIL	99.3
	KELD-FM	103.1
Fayetteville	KKEG	92.1
	KNWA	103.9
Forrest City	KBFC	93.5
Ft. Smith	KFPW-FM	94.9
	KMAG	99.1
	KTCS-FM	99.9
Harrison	KHOZ-FM	102.9
Hot Springs	KBHS-FM	96.7
	KGUS	97.5
Jacksonville	KGMR-FM	100.3
Jonesboro	KBTM-FM	101.9
	KASU	91.9
Little Rock	KARK	103.7
	KAAY-FM	98.5
	KMYO-FM	95.7
	KRAA	94.1
Magnolia	KFMV	107.9
Mammoth Springs	KAMS	95.1
Mena	KENA-FM	101.7
Monticello	KHBM-FM	93.5
Newport	KNBY-FM	105.5
Osceola	KOSE-FM	98.1
Pine Bluff	KADL-FM	94.9
	KOTN-FM	92.3
Pochontas	KPOC-FM	103.9
Siloam Springs	KUOA-FM	105.7
Springdale	KSPR-FM	104.9
Texarkana	KADO	107.1
	KOSY-FM	102.5
Wynne	KWYN-FM	92.7
CALIFORNIA		
Alameda	KJAZ	92.7
Anaheim	KEZR-FM	95.9
Angwin	KANG	89.9
Apple Valley	KAVR-FM	102.3
Areata	KHSC	90.5
Auburn	KAFI	101.1
Avalon	KBIG-FM	104.3
Bakersfield	KERN-FM	94.1
	KBBY	107.9
	KGFM	101.5
Berkeley	KPFA	94.1
	KIFM	96.5
	KALX	90.7
	KPFB	89.3
	KPAT-FM	102.9
Bijou	KHUR	99.9
Buena Park	KBPK	90.1
Carlsbad	KARL-FM	95.9
Cathedral City	KWXY-FM	103.1
Chico	KCBM	93.7
	KCHO	91.1
Claremont	KSPC	88.7
Coachella	KCHV-FM	93.7
Concord	KVHS	91.1
Davis	KDVS	91.5
Delano	KDNO	98.5
El Cajon	KECR	93.3
El Centro	KNEU	98.5
Escandido	KOWN-FM	92.1
Eureka	KINS-FM	96.3
Fremont	KFMR	104.9
Fresno	KARM-FM	101.9
	KFIG	94.5
	KFRE-FM	93.7
	KKNU	102.7
	KMJ-FM	97.9
	KYNO-FM	95.5
Garden Grove	KTBT	94.3
Gilroy	KPER	94.3
Glendale	KUTE	101.9
Hemet	KHSJ-FM	105.5
Inglewood	KTYM-FM	103.9
Irvine	KUCL	89.9
La Canada	KUNF	88.9
Livermore	KYTE	101.7
Lodi	KXKX	97.7
Lompoe	KLOM-FM	92.7
Long Beach	KJLH	102.3
	KLON	88.1
	KNOB	97.9
	KPEN	97.7
	KFJC	89.7
Los Angeles	KABC-FM	95.5
	KBBI	107.5
	KBCA	105.1
	KCBH	98.7
	KFAC-FM	92.3
	KFOX-FM	100.3
	KGBS-FM	97.1
	KHJ-FM	101.1
	KMET	94.7
	KNX-FM	93.1
	KOST	103.5
	KPFK	90.7
	KPOL-FM	93.9
	KRHM	102.7
	KRKD-FM	96.3
	KUSC	91.5
	KWST	105.9
	KXLU	88.9
	KHOF	99.5
Los Angeles-Avalon	KBIG-FM	104.3
Los Banos	KLBS-FM	95.9
Los Gatos	KLGS	95.3
Marysville	KRFD	99.9
Menduecino	KMFB-FM	92.7
Merced	KAMB	101.5
Modesto	KBEE-FM	103.3
	KTRB-FM	104.1
	KDHS	90.5
Mojave	KOOL-FM	97.7
Monterey	KWAY	96.9
Newport Beach	KOCM	103.1
Northridge	KEOC-FM	88.5
Oceanside	KUDE-FM	102.1
Ontario	KSOM-FM	93.5
Oxnard	KPMJ	104.7
Pacific Grove	KOCN	104.9
Palm Springs	KGEC	104.7
Pasadena	KPCS	89.3
	KPPC-FM	106.7
Patterson	KOSO	93.1
Redding	KEWB	104.3
Redondo Beach	KKOP	93.5
Redlands	KCAL-FM	96.7
	KUOR-FM	91.1
Ridgecrest	KLOA-FM	105.5
Riverside	KBBL	99.1
	KACE-FM	92.7
	KOUO	97.5
	KUCR	88.1
	KLLU	89.7
	KPIP	93.5
Roseville	KCTC	96.1
Sacramento	KERS	90.7
	KFBK-FM	92.5
	KEBR	100.5
	KHIQ	105.1
	KJML	106.5
	KSFM	96.9
	KXOA-FM	107.9
	KZAP	98.5
Salinas	KSBW-FM	102.5
	KRSA-FM	100.7
	KERR	103.9
San Bernardino	KVCR	91.9
	KOLA	99.9
	KRCS	95.1
San Diego	KOGO-FM	94.1
	KBKB	101.5
	KEBS-FM	89.5
	KFMB-FM	100.7
	KFMX	96.5
	KITT	105.3
	KDIG	98.1
	KLRO	94.9
	KPRI	106.5
	KSDS	88.3
	KBBW	102.9
	KSDO-FM	103.7
	KSEA	97.3
San Fernando	KVFM	94.3
	KSFV	106.3
San Francisco	KALW	91.7
	KCBS-FM	98.9
	KDFC	102.1
	KEAR	97.3
	KFOG	104.5
	KFMS	106.1
	KGO-FM	107.
	KIOI	101.3
	KNBR-FM	99.7
	KMPX	106.5
	KOIT	93.3
	KQEO-FM	88.5
	KRON-FM	96.5
	KSAN	94.9
	KCMA	90.5
	KBRG	103.3
	KABL-FM	98.1
	KKHI-FM	95.7
San Jose	KSJO-FM	92.3
	KBAY	100.3
	KRPM	98.5
	KSJS	90.7
	KPLX	106.5
San Luis Obispo	KATY-FM	96.1
	KCPR	91.3
	KSBY-FM	93.3
San Mateo	KCSM	90.9
	KVEZ	107.7
	KZSU	90.1
San Rafael	KTIM	100.9
Santa Ana	KWIZ-FM	96.7
	KYMS	106.3
Santa Barbara	KCSB-FM	91.5
	KOB-FM	93.7
	KGUD-FM	99.9
	KMUZ	103.3
	KTMS-FM	97.5
Santa Clara	KSCU	90.1
	KREP	105.7
Santa Cruz	KSCO-FM	99.1
Santa Maria	KXFM	99.1
	KSMA-FM	102.5
Santa Monica	KCRW	89.9
	KSRF	103.1
Sierra Madre	KMAX	107.1
Stockton	KUOP	91.3
	KJAX	99.3
	KSTN-FM	107.3
	KWG-FM	105.7
Tahoe Valley	KTHO-FM	103.1
Thousand Oaks	KNJO	92.7
Torrance	KNHS	89.7
Tracy	KSRT	100.9
Truckee	KNLT	101.7
Tulare	KBOS	94.9
	KNNU	106.7
Twenty-Nine Palms	KQYN	95.7
Ukiah	KUKI-FM	93.5
	KLIL	94.3
Vacaville	KVFS	95.3
Ventura	KBBY	95.1
Ventura-Oxnard	KVEN-FM	100.7
Visalia	KONG-FM	92.9
Walnut Creek	KDFM	92.1
West Covina	KBOB	98.3
Woodland	KRBT	102.5
COLORADO		
Alamosa	KASF	90.9
	KGIW-FM	93.5
Aspen	KSPN	97.7
Boulder	KRNW	97.3
Colorado Springs	KRCC	91.5
	KKFM	96.5
	KSHS	90.5
	KVOR-FM	92.9
	KPIK-FM	94.3
	KRDO-FM	95.1
	KRYT-FM	101.9
Cortez	KZFM	94.1
Denver	KADX	105.1
	KFML-FM	98.5
	KLIR-FM	100.3
	KLZ-FM	106.7
	KHOW-FM	95.7
	KDEN-FM	99.5
	KOA-FM	103.5
	KOSI-FM	101.1
	KBPI	105.9
Ft. Collins	KCSU-FM	90.9
	KFMF	93.3
Ft. Morgan	KFTM-FM	101.7
Grand Junction	KREX-FM	92.3
Greeley	KCBL-FM	91.5
	KGRE	92.3
Gunnison	KWSB-FM	91.9
Lakewood	KJAE	107.5
Longmount	KLMO-FM	104.3
Loveland	KLOV-FM	102.3
Manitou Springs	KCMS-FM	102.7
Morrison	KWBI	91.1
Pueblo	KVMN	98.9
Rocky Ford	KAVI-FM	95.9
CONNECTICUT		
Bridgeport	WJZZ	99.9
	WPKN	89.5
Brookfield	WINE-FM	95.1
Danbury	WLAD-FM	98.3
Fairfield	WSHU	91.1
Groton	WSUB-FM	105.5
Hamden	WKCI	101.3
Hartford	WHCN-FM	105.9
	WORC-FM	102.9
	WCCC-FM	106.9
	WLVH	93.7
	WRTC-FM	89.3
	WTIC-FM	96.5
	WWUH	91.3
Hartford-Meriden	WBMI-FM	95.7
Middletown	WESU	88.1
	WIHS	104.9
New Britain	WRCH-FM	100.5
New Haven	WNHC-FM	99.1
	WYBC-FM	94.3
New London	WTYD	100.9
Norwalk	WDRN	95.9
Norwich	WICH-FM	97.7
Stamford	WSTC-FM	96.7
Storrs	WHUS-FM	91.7
Wallingford	WWEB-FM	90.1
Waterbury	WATR-FM	92.5
	WWCO-FM	104.1
W. Hartford	WWUH	91.3
Westport	WMMM	107.9
DELAWARE		
Dover	WDOV-FM	94.7
Georgetown	WSEA	93.5
Wilmington	WMPH	91.7
	WJBR	99.5
	WSTW	97.3
D. C.		
Washington	WASH	97.1
	WAMU-FM	88.5
	WETA-FM	90.9
	WFAN-FM	100.3
	WGAY	99.5

Location	Call	MHz
	WGMS-FM	103.5
	WGTB	90.1
	WMAL-FM	107.3
	WMOD	98.7

FLORIDA

Apopka	WTLN-FM	95.3
Atlantic Beach	WAQB-FM	104.9
Belle Glade	WSWN-FM	93.5
Blountstown	WRTV	102.3
Boca Ratan	WWOG	99.9
Boynton Beach	WHRS	91.7
Bradenton	WBRD-FM	103.3
Clear Water	WTAN-FM	95.7
	WQXM	97.9
Cocoa	WEZY-FM	99.3
Cocoa Beach	WCKS	101.1
	WKPE-FM	104.1
Coral Gables	WYOR	105.1
	WVUM	90.5
Crestview	WAAZ-FM	104.9
Daytona Beach	WNDB-FM	94.5
	WMFJ-FM	101.9
DeLand	WOOO-FM	105.9
Dunnellon	WTRS-FM	102.3
Ft. Lauderdale	WFTL-FM	100.7
	WIXX-FM	105.9
	WMJR	100.7
	WSRF-FM	103.5
Ft. Meyers	WINK-FM	96.9
	WHEW	101.9
	WSOR	95.3
Ft. Pierce	WARN-FM	98.7
	WOVV	95.5
Ft. Walton Beach		
	WFTW-FM	103.7
Gainesville	WRUF-FM	103.7
	WGVL	105.5
Hialeah	WHMS	92.1
Immokalee	WCOF-FM	95.9
Jacksonville	WJAX-FM	95.1
	WAQB	104.9
	WQIK-FM	99.1
	WIVY-FM	92.5
	WKTZ-FM	96.1
Key West	WFYN-FM	92.5
Lake City	WTDL-FM	94.3
Lakeland	WVFM	94.1
Leesburg	WLBE-FM	106.7
Marianna	WTOT-FM	100.9
Melbourne	WYRL	102.3
Miami	WKAT	93.1
	WJHR	96.3
	WGOS-FM	93.9
	WIOD-FM	97.3
	WTHS-FM	91.7
	WEDR	99.1
	WWPB	101.5
Miami Beach	WOCN-FM	94.9
Milton	WXBM-FM	102.3
Mt. Dora	WORJ-FM	107.7
Naples	WNFM	94.5
New Port Richey	WGUL-FM	105.5
Ocala	WMOP-FM	93.7
Okeechobee	WLMC	103.1
Orlando	WDBO-FM	92.3
	WHOO-FM	96.5
	WKIS-FM	100.3
	WWQS	105.1
Palm Beach	WMUM	97.9
	WPBA-FM	107.1
Panama City	WMAI-FM	107.9
	WPAP-FM	92.5
Pensacola	WPEX-FM	94.1
	WCOA-FM	102.7
	WONF	101.5
Plantation Key	WXOS	100.3
Pompano Beach	WRBD-FM	102.7
Quincy	WCNH-FM	101.7
St. Augustine	WFOY-FM	97.7
St. Petersburg	WGNB	101.5
	WTCX	99.5
	WWBA-FM	107.3
Sarasota	WSAF-FM	102.5
	WSPB-FM	106.3
Sebring	WJAN	105.5
Stuart	WMCF	92.7
Tallahassee	WGLF	104.1
	WFSU-FM	91.5
	WBGM-FM	98.9
	WOMA	94.9
Tampa	WDAE-FM	100.7
	WFLA-FM	93.3
Tampa	WLCY-FM	94.9
	WPKM	104.7
	WUSF	89.7
Titusville	WRMF-FM	98.3
West Palm Beach		
	WEAT-FM	104.5
	WPBF	107.9
Winter Haven	WXKL	97.5
Winter Park	WPRK	91.5
	WLOQ	103.1

GEORGIA

Albany	WGPC-FM	104.5
	WJIZ	96.3
Americus	WDEC-FM	94.3
Athens	WNGO	95.5
	WDOL-FM	104.7
Atlanta	WABE	90.1
	WPLO-FM	103.3
	WGKA-FM	92.9
	WKLS	96.1
	WREK	91.1
	WSB-FM	98.5
	WLTA-FM	99.7
Auburn	WFRI	97.7
Augusta	WAUG-FM	105.7
	WACG-FM	90.7
	WBBQ-FM	104.3
	WGUS-FM	102.3
	WZZW	103.1
Bainbridge	WMGR-FM	97.3
Brunswick	WGIG-FM	100.7
	WYNR-FM	101.5
Buford	WGCO	102.3
Canton	WCHK-FM	105.5
Carrollton	WBTR-FM	92.1
Cochran	WVMG-FM	96.7
Columbus	WRBL-FM	102.9
	WGBA-FM	107.3
	WWRH	104.9
Cordele	WFAV	98.3
Cornelia	WCON-FM	99.3
Dawson	WDWD	92.1
Decatur	WAVO-FM	94.9
Dublin	WXLI-FM	92.7
Gainsville	WDUN-FM	106.7
	WWQT	97.1
Griffin	WKEU-FM	97.7
Hawkinsville	WCEH-FM	103.9
Jackson	WJGA-FM	92.1
Jesup	WLOP-FM	105.5
La Grange	WLAG-FM	104.1
Macon	WDEN-FM	105.3
	WMAZ-FM	99.1
Manchester	WFDR-FM	93.3
Marietta	WBIE-FM	101.5
Milledgeville	WMVG-FM	102.3
Moultrie	WMTM-FM	93.9
Newnan	WCOH-FM	96.7
Perry	WPGA-FM	100.9
Rome	WRGA-FM	102.3
	WROM-FM	97.7
Rossville	WRIP-FM	105.5
Savannah	WTOC-FM	94.1
	WEAS-FM	93.1
	WXLM	97.3
Smyrna	WQXI-FM	94.1
Statesboro	WMCD	100.1
Swainsboro	WJAT-FM	98.3
Toccoa	WLET-FM	106.1
Vidalia	WVOP-FM	97.7
Valdosta	WGOV-FM	92.9
Warner Robins	WRBN-FM	101.7
Washington	WLOV-FM	100.1
W. Point	WCJM	100.9

HAWAII

Hilo	KKEA	97.9
Honolulu	KAIM-FM	95.5
	KFOA	94.7
	KGMB-FM	93.1
	KHVH-FM	93.9
	KPOI-FM	97.5
	KTUH	90.5
Kailua	KKAI	96.3

IDAHO

Boise	KBOI-FM	97.9
	KBBK-FM	92.3
Caldwell	KBXL-FM	94.1
Idaho Falls	KID-FM	96.1
	KGVO-FM	99.1
Jerome	KFMA	92.7
Lewiston	KOZE-FM	96.7
Moscow	KUID	91.7
	KUOI-FM	89.3
Nampa	KCRH	91.5
Pocatello	KBGL	88.7
	KSNN-FM	93.7

ILLINOIS

Alton	WOKZ-FM	100.3
Anna	WRAJ-FM	92.7
Arlington Heights	WEXI	92.7
Aurora	WKKD-FM	95.9
	WAUR	107.9
Belvidere	WKWL	104.9
Benton	WVFC	98.3
Bloomington	WBNQ	101.5
Canton	WBYS-FM	98.5
Carbondale	WSIU	91.9
	WCIL-FM	101.5
Carmi	WROY-FM	97.3
Centralia	WILY-FM	95.3
Champaign	WDWS-FM	97.5
	WLRW	94.5
Charleston	WEIC-FM	92.1
Chicago	WBBM-FM	96.3
	WREZ	91.5
	WCYC	88.7
	WHPK-FM	88.3
	WLS-FM	94.7
	WDHF	95.5
	WEFM	99.5
	WSDM	97.9
	WFMF	100.3
	WNUS-FM	107.5
	WFMT	98.7
	WKFM	103.5
	WMAQ-FM	101.1
	WMBI-FM	90.1
	WNIB	97.1
	WXRT	93.1
	WUD-FM	104.3
	WWEL	93.9
	WCBW	104.9
	WTAS	102.3
	WDAN-FM	102.1
	WIAI	99.1
	WSOY-FM	102.9
	WNIU	89.5
	WLBK-FM	92.5
	WIXN-FM	101.7
	WDGC-FM	88.3
	WVFV	103.9
	WDQN-FM	95.9
	WMRY	101.1
	WSIE	88.7
	WCRA-FM	95.7
	WEPS	88.1
	WELG	103.9
	WRMN-FM	94.3
	WRSE-FM	88.7
	WXFM	105.9
	WTPC	89.7
	WEAW-FM	105.1
	WNUR	89.3
	WFIW-FM	104.9
	WHFH	88.5
	WELL-FM	98.5
	WVKC	90.5
	WGIL-FM	94.9
	WELF	107.1
	WGHS	88.5
	WGNU-FM	106.5
	WGRN	89.3
	WEBQ-FM	99.9
	WDUK	99.3
	WEEF-FM	103.1
	WHSD	88.5
	WEAI	100.5
	WJBM-FM	104.1
	WJOL-FM	96.7
	WAJP	93.5
	WKAK	99.9
	WKOC	88.3
	WKEI-FM	92.1
	WLTL	88.1
	WLNR-FM	106.3
	WLPO-FM	99.3
	WAKO-FM	103.1
	WLCC	88.7
	WSMI-FM	106.1
	WLUV-FM	96.7
	WWKS	91.3
	WKAI-FM	100.1
	WLBH-FM	96.9
	WGLC-FM	100.9
	WMDR	96.9
	WVPC-FM	97.7
	WRMI-FM	104.7
	WMHS	91.5
	WSAB	94.9
	WVMC-FM	101.1
	WMIX-FM	94.1
	WQNC	89.1
	WGLT	91.7
	WGLD-FM	102.7
	WSEI	92.9
	WOLI	98.3
	WPRS-FM	98.3
	WRHS	88.1
	WMTH	88.5
	WSIV-FM	95.3
	WMBD-FM	93.3
	WCBU	88.3
	WIVC	106.9
	WGSY	100.9
	WBBA-FM	97.7
	WPOK-FM	103.1
	WGEM-FM	105.1
	WTAD-FM	99.5
	WTAY-FM	101.7
	WROK-FM	97.5
	WHBF-FM	98.9
	WVIK	90.9
	WSHV	104.9
	WRSV	101.9
	WRWC	103.1
	WTAX-FM	103.7
	WFMB	104.5
	WVEM	101.9
	WVJM	94.3
	WIZZ-FM	97.7
	WGGM	95.1
	WTIM-FM	92.7
	WITT	93.5
	WILL-FM	90.9
	WPGU	107.1
	WTWC	103.9
	WGFA-FM	94.1
	WEFA	102.3
	WETN	88.1
	WRVI	95.3
	WNTH	88.1
	WTSK	105.5

INDIANA

Angola	WAFM	100.1
Auburn	WIFF-FM	105.5
Bloomington	WFIU	103.7
	WTTV-FM	92.3
Bluffton	WCRD	100.1
Boonville	WBNL-FM	107.1
Columbia City	WFDT	106.3
Columbus	WCSI-FM	101.5
Connersville	WCNB-FM	100.3
Crawfordsville	WNDY	106.3
Decatur	WADM-FM	92.7
Elkhart	WCMR-FM	104.7
	WFIM	100.7
	WXAX	104.7
Elwood	WBMP	101.7
Evansville	WIKY-FM	104.1
	WEVC	91.5
	WJMS-FM	99.7
	WPSR	90.7
	WVHI	105.3
Fort Wayne	WPTH	95.1
	WCMX	101.7
	WKJG-FM	97.3
Franklin	WFCI	89.3
	WIFN	95.9
Frankfort	WILO-FM	99.7
Gary	WGVE	88.1
Gaston	WDHS	91.1
Goshen	WGCS	91.1
Greencastle	WGRE	91.7
	WXTA	94.3
Greenfield	WSMJ	99.5
Greensburg	WTRE-FM	107.3
Hammond	WYCA	92.3
Hartford City	WHCI	91.9
	WWHC	104.9
Howe	WHWE	89.7
Huntington	WVSH	91.9
	WHLT-FM	103.1
Indianapolis	WAJC	104.5
	WBDG	90.9
	WICR	88.7
	WFBM-FM	94.7
	WFMS	95.5
	WGEE-FM	103.3
	WIAN	90.1
	WIFE-FM	107.9
	WNAP	93.1
	WTLC	105.7
Jasper	WITZ-FM	104.7
Kendallville	WAWK-FM	93.3
Knox	WKVI-FM	99.3
Kokomo	WFKO	100.5
	WKMO	93.5
Lafayette	WASK-FM	105.3
	WAZY-FM	96.7
	WXUS	92.7
La Porte	WLOI-FM	96.7
Lebanon	WNON	100.9
Linton	WBTO-FM	93.5
Logansport	WSAL-FM	102.9
Madison	WORK-FM	98.7
Marion	WMRI-FM	106.9
	WBST	90.7
Martinsville	WCBK-FM	102.3
Michigan City	WMCB-FM	95.9
Monticello	WVTL	95.3
Muncie	WLBC-FM	104.1
	WWHI	91.5
New Albany	WNAS	88.1
New Castle	WCTW-FM	102.5
	WYSN	91.1
N. Manchester	WBKE-FM	89.5
North Vernon	WOCH-FM	106.1
Peru	WARU-FM	98.3
Plainfield	WJMK	98.3
Plymouth	WTCA-FM	94.3
Princeton	WRAY-FM	98.1
Richmond	WGLM	96.1
	WECI	91.5
	WKBV-FM	101.3
Rochester	WROI	92.1
Salem	WSLM-FM	98.9
Scottsburg	WMPI	100.9
Seymour	WJOD	93.7
Shelbyville	WSVL-FM	97.1
South Bend	WETL	91.9
	WHME	103.1
	WNDU-FM	92.9
	WRBR	103.9
	WSBT-FM	101.5
Terre Haute	WTHI-FM	99.9
	WBOW-FM	107.5
	WPFR	102.7
	WVTS	100.7
	WISU	89.7
Wabash	WKUZ	95.9
Warsaw	WRSW-FM	107.3
Washington	WFML	106.5
West Lafayette	WBAA-FM	99.1
W. Terre Haute	WWVR	105.5
Valparaiso	WAKE-FM	105.5
	WVUR	89.5
Vincennes	WAOV-FM	96.7
Winchester	WIUC	98.3

IOWA

Algona	KLGA-FM	92.7
Ames	KASI-FM	107.1
	WOI-FM	90.1
	KLEM	104.1
	KPGY	91.9
Atlantic	KJAN-FM	103.7

WHITE'S RADIO LOG

Location	Call	MHz
Boone	KFGQ-FM	99.3
Burlington	KBUR-FM	107.3
Carroll	KCIM-FM	93.7
Cedar Falls	KTCF	88.1
Cedar Rapids	KHAK-FM	98.1
	KCOE-FM	90.5
	KWMR	88.9
	WMT-FM	96.5
Clarion	KRIT	96.9
Clinton	KROS-FM	96.1
Council Bluffs	KRCB-FM	98.5
Creston	KSIB-FM	101.7
Davenport	WOC-FM	103.7
	KALA	90.1
	KWNT-FM	106.5
Denison	KDNS-FM	107.1
Des Moines	KDPS	88.1
	KDMI-FM	97.3
	WHO-FM	100.3
	KFMG	94.9
	KRNT-FM	102.5
	KWDM	93.3
Dubuque	WDBQ-FM	105.3
	KEMD	92.9
Estherville	KILR-FM	95.9
Fairfield	KVPC	89.5
Ft. Dodge	KWMT-FM	94.5
Grinnell	KDIC	107.1
Humboldt	KHBT	97.7
Iowa City	KSUI	91.7
	KXIC-FM	100.7
Iowa Falls	KIFG-FM	85.3
LeMars	KLEM-FM	99.5
Maquoketa	KMAQ-FM	95.3
Marshalltown	KFJB-FM	101.7
Mason City	KLSS	106.1
Mt. Vernon	KRNL-FM	89.7
Muscatine	KWPC-FM	99.7
Newton	KCOB-FM	95.9
Oskaloosa	KBOE-FM	104.9
Pella	KCUI	89.1
Sioux Center	KDCR	91.3
Sioux City	KDVR	97.9
	KTFC	103.3
Spencer	KICD-FM	107.7
Storm Lake	KAYL-FM	101.5
Waterloo	KNWS-FM	101.9
	KWWL-FM	107.9
	KXEL-FM	105.7
Waukon	KNEI-FM	103.9
Waverly	KWAR	89.1
Webster City	KWAW	95.9

KANSAS

Abilene	KABI-FM	98.3
Baldwin	KNBU	88.9
Dodge City	KGNO-FM	95.5
Emporia	KSTE	88.7
	KVOE-FM	104.9
Garden City	KUPK-FM	97.3
Great Bend	KBJC	91.9
Hutchinson	KSKU	102.1
Independence	KIND-FM	101.7
Junction City	KJCK-FM	94.5
Kansas City	KUDL-FM	98.1
	KCKN-FM	94.1
Larned	KANS-FM	96.7
Lawrence	KANU	91.5
	KLWN-FM	105.9
Leavenworth	KCLO-FM	98.9
Liberal	KJRL	99.3
Manhattan	KSDB-FM	88.1
Newton	KJRG-FM	92.3
Ottawa	KTJO-FM	88.1
	KOFO-FM	95.7
Parsons	KPPS-FM	91.1
Pratt	KWNS-FM	93.1
Russell	KRSL-FM	95.9
Salina	KAFM	99.9
Scott City	KFLA-FM	94.5
Topeka	KTOP	100.3
	KEWI-FM	107.7
	WIBW-FM	97.3
Wichita	KFH-FM	97.9
	KARD	107.3
	KEYN-FM	103.7
	KQTY	101.3
	KMUW	89.1
Winfield	KSWC	88.3

KENTUCKY

Albany	WANY-FM	106.3
Ashland	WCMI-FM	93.7
Beattyville	WLJC	102.3
Benton	WCBL-FM	102.3
Bowling Green	WLBJ-FM	96.7
Campbellsville	WTCO-FM	103.9
Carrollton	WVCM	100.1
Central City	WNES-FM	101.9
Columbia	WAIN-FM	93.5
Corbin	WCTT-FM	107.1
	WYGO-FM	99.3
Cythiana	WCYN-FM	102.3
Danville	WMGE	107.1
Elizabethtown	WQXE	106.3
Erlanger	WHKK	100.9
Falmouth	WWJS	95.3
Ft. Campbell	WABD-FM	107.9
Ft. Knox	WSAC-FM	105.5
Frankfort	WKYW	104.9
Fulton	WFUL-FM	104.9
Georgetown	WRVG	90.1
Glasgow	WGGC	95.1
Grayson	WGOH-FM	102.3
Hardinsburg	WHIC-FM	94.3
Harrodsburg	WHBN-FM	99.3
Hazard	WKIC-FM	101.1
Henderson	WSON-FM	99.5
	WUAZ	103.1
Hopkinsville	WHOP-FM	98.7
	WKOF	100.3
Jamestown	WJRS-FM	103.1
Leitchfield	WMTL-FM	104.9
Lexington	WBKY	91.3
	WLAP-FM	94.5
	WLEX	98.1
	WVLK-FM	92.9
London	WFTG-FM	103.9
Louisville	WFPK	91.9
	WFPL	89.3
	WHAS-FM	97.5
	WKLO-FM	99.7
	WKRX	106.9
	WLRS	102.3
Madisonville	WFMW-FM	93.9
Manchester	WWXL-FM	103.1
Mayfield	WNGO-FM	94.7
Maysville	WFTM-FM	95.9
Monticello	WFLW-FM	101.7
Morehead	WMOR-FM	92.1
	WMKY-FM	91.1
Morganfield	WMSK-FM	95.3
Mt. Sterling	WMST-FM	105.5
Munfordville	WLOC-FM	102.3
Murray	WAWW	103.7
	WKMS-FM	91.3
Owensboro	WOMI-FM	92.5
	WSTO	96.1
Puducah	WPAD-FM	96.9
	WKYX-FM	93.3
Paintsville	WSIP-FM	98.9
Paris	WPDE-FM	96.7
Pikeville	WPKE-FM	92.1
Prestonburg	WDOC-FM	95.5
	WPRT-FM	105.5
	WUKP	89.1
Princeton	WPKY-FM	104.9
Richmond	WEKU-FM	88.9
Russellville	WRUS-FM	101.1
St. Mathews	WSTM	103.1
Scottsville	WLCK-FM	99.3
Somerset	WSEK	96.7
	WSCC	90.7
Stanford	WRSL-FM	95.9
Versailles	WWLV	100.9
Whitesburg	WTCW-FM	103.9

LOUISIANA

Alexandria	KALB-FM	96.9
	KDBS-FM	100.3
Baton Rouge	WJBO-FM	102.5
	WAFB-FM	98.1
	WQXY-FM	100.7
	WYNK-FM	101.5
DeRidder	KLDA-FM	101.7
Golden Meadow	KLEB-FM	94.3
Hammond	WTGI	103.3
Houma	KCIL	107.1
	KHOM	104.1
Jennings	KJEF-FM	92.7
Jonesboro	KTOC-FM	104.9
Lafayette	KRVS-FM	88.3
	KPEL-FM	99.9
	KSMB	94.5
Lake Charles	KPLC-FM	99.5
	KIKS-FM	96.1
	WCKW	92.3
La Place	KAPB-FM	97.7
Marksville	KMLB-FM	104.1
Monroe	KNOE-FM	101.9
	KREB	106.1
Morgan City	KMRC-FM	96.7
Natchitoches	KNOC-FM	97.7
New Iberia	KNIR-FM	99.1
New Orleans	WBEH	89.3
	WDSU-FM	93.3
	WJMR-FM	97.1
	WNOE-FM	101.1
	WRNO	99.5
	WWOM-FM	98.5
	WWL-FM	101.9
	WWMT	95.7
Opelousas	KSLO-FM	107.1
Ruston	KRUS-FM	107.1
Shreveport	KRMD-FM	101.1
	KBCL-FM	96.5
	KEEL-FM	93.7
	KWKH-FM	94.5
	WVSL-FM	105.3
Slidell	KTIB-FM	106.3
Thibodaux	KVPI-FM	93.9
Ville Platte		
W. Monroe	KYEA	98.3
Winnfield	KVCL-FM	92.1
Winnsboro	KCRF-FM	95.9

MAINE

Augusta	WFAU-FM	101.3
Bangor	WABI-FM	97.1
	WMEH-FM	90.9
Brunswick	WBOR	91.1
	WCME-FM	98.9
Caribou	WFST-FM	97.7
Ellsworth	WDEA-FM	95.7
Lewiston	WCOU-FM	93.9
	WRJR	91.5
Orono	WMEB-FM	91.9
Portland	WLOB-FM	97.9
	WPOR-FM	101.9
	WGAN-FM	102.9
Rockland	WRKD-FM	93.5
Skowhegan	WGHM-FM	107.1
Waterville	WTVL-FM	98.3

MARYLAND

Annapolis	WNAV-FM	99.1
	WXTC	107.9
Baltimore	WBJC	91.5
	WCAO-FM	102.7
	WFMM-FM	93.1
	WRBS	95.1
	WBAL-FM	97.9
	WITH-FM	104.3
	WLPL-FM	92.3
	WMAR-FM	106.5
	WTOW-FM	101.9
Bethesda	WJMD	94.7
	WHFS	102.3
Bradbury Heights	WPGC	95.5
Cambridge	WCEM-FM	106.3
Catonsville	WBMD-FM	105.7
Cumberland	WCUM-FM	102.9
	WKGO	106.1
Frederick	WFRE	99.9
Frostburg	WFRB-FM	105.3
Glen Burnie	WISZ-FM	95.9
Hagerstown	WJEJ-FM	104.7
	WARK-FM	106.9
Halfway	WHAG-FM	96.7
Havre de Grace	WASA-FM	103.7
Oakland	WBUZ	95.5
	WMSG-FM	92.1
Salisbury	WBOC-FM	104.7
	WICO-FM	94.3
Tacoma Park	WGTS-FM	91.9
Waldorf	WSMD-FM	104.1
Westminster	WTTR-FM	100.7

MASSACHUSETTS

Amherst	WAMF	89.6
	WFCR	88.5
	WMUA	91.1
Andover	WPAA	91.7
Boston	WBUR	90.9
	WBCN	104.1
	WBZ-FM	106.7
	WCOP-FM	100.7
	WEEI-FM	103.3
	WERS	88.9
	WHDH-FM	94.6
	WJB	96.9
	WROR	98.5
Brockton	WBET-FM	97.7
Brookline	WBOS	92.9
Cambridge	WGBH-FM	89.7
	WHRB-FM	95.3
	WTBS	88.1
Fitchburg	WFMP	104.5
Framingham	WKOX-FM	105.7
Gloucester	WVCA-FM	104.9
Greenfield	WHAI-FM	98.3
Haverhill	WHAV-FM	92.5
Hyannis	WCOD-FM	106.1
Lawrence	WCCM-FM	93.7
Lowell	WLLH-FM	99.5
	WLTI	91.5
Lynn	WLYN-FM	101.7
Medford	WHIL-FM	107.9
New Bedford	WBSM-FM	97.3
	WNBH-FM	98.1
N. Adams	WMNB-FM	100.1
Northampton	WHMP-FM	99.3
Pittsfield	WQRB	105.5
	WBRK-FM	101.7
Plymouth	WPLM-FM	99.1
Southbridge	WESO-FM	100.1
S. Hadley	WMHC	88.5
Springfield	WHYN-FM	93.1
	WAIC	91.9
	WCRX	102.1
	WSCB	88.9
	WMAS-FM	94.7
Taunton	WRLM	93.3
Waltham	WBRS	91.7
	WCRB-FM	102.5
W. Yarmouth	WOCB-FM	94.9
Williamstown	WCFM	91.3
Winchester	WHSR-FM	91.9
Worcester	WAAF	107.3
	WICN	90.5
	WSRS	96.1

MICHIGAN

Adrian	WLEN	103.9
	WVAC	88.1
Alma	WFYC-FM	104.9
Alpena	WHSB	107.7
	WATZ-FM	93.5
Ann Arbor	WUOM	91.7
	WNRZ	102.9
	WPAG-FM	107.1
Bad Axe	WLEW-FM	92.1
Battle Creek	WKFR-FM	103.3
Bay City	WBCM-FM	96.1
	WGER-FM	102.5
Benton Hrbr.	WHFB-FM	99.9
Big Rapids	WBRN-FM	100.9
Birmingham	WHFI	94.7
Cadillac	WWTV-FM	92.9
Charlotte	WCER-FM	92.7
Cheboygan	WCBY-FM	105.1
Clare	WCRM-FM	95.3
Coldwater	WANG-FM	98.5
Dearborn	WKNR-FM	100.3
Detroit	WDET-FM	101.9
	WBFG	98.7
	WCHD	105.9
	WABX	99.5
	WDEE-FM	93.1
	WDTR	90.9
	WGPR	107.5
	WMUZ	103.5
	WMZK	97.9
	WJR-FM	96.3
	WOMC	104.3
	WQRS-FM	105.1
	WWJ-FM	97.1
	WWWW	106.7
	WXYZ-FM	101.1
	WCAR-FM	92.3
E. Lansing	WKAR-FM	90.5
	WFMK	99.1
	WITL-FM	100.7
	WVIC-FM	94.9
Flint	WFBE	95.1
	WGMZ-FM	107.9
	WMRP-FM	105.5
Grand Haven	WGHN-FM	92.1
Grand Rapids	WFUR-FM	102.9
	WJAV-FM	93.7
	WLAV-FM	96.9
	WYON	101.3
	WOOD-FM	105.7 (s)
	WVGR	104.1
	WXTO-FM	97.9
	WZZM-FM	95.7
Greenville	WPLB-FM	107.3
Hancock	WMPL-FM	93.5
Hastings	WBCH-FM	100.1
Highland Pk.	WHPR	88.1
Holland	WJBL-FM	94.5
	WHTC-FM	96.1
Houghton	WGGL-FM	91.1
Houghton Lake	WJGS	98.5
Interlochen	WIAA	88.3
Jackson	WBBC	94.1
	WKHM-FM	106.1
Kalamazoo	WMUK	102.1
	WSEO-FM	106.5
Lansing	WJIM-FM	97.5
	WILS-FM	101.7
Lapeer	WTHM-FM	103.1
Marquette	WNMR	90.1
	WWMT	95.7
Marshall	WALM-FM	104.9
Midland	WQDC-FM	99.7
Monroe	WVMO	98.3
Mount Clemens	WBRB-FM	102.7
Mount Pleasant	WCMU	90.1
	WCEN-FM	94.5
Muskegon	WMUS-FM	106.9
Niles	WNIL-FM	95.3
Oak Park	WLDM	95.5
Owosso	WOAP-FM	103.9
Petoskey	WJML	98.9
	WMBM-FM	96.7
Port Huron	WHLS-FM	107.1
Royal Oak	WOAK	89.3
	WOMC	104.3
Saginaw	WSAM-FM	98.1
	WSBM	106.3
	WWWS	107.1
St. Johns	WRBJ-FM	92.1
St. Joseph	WSJM-FM	107.1
Sandusky	WMIC-FM	97.7
Southfield	WSHJ	88.3
Spring Arbor	WSAE	89.3
Sturgis	WSTR-FM	99.3
Traverse City	WLDR-FM	101.9
	WCCW-FM	92.1
	WTCM-FM	103.5
Waterford	WTSD	106.3
Warren	WPHS	91.5
Ypsilanti	WEMU	88.1

MINNESOTA

Alexandria	KXRA-FM	92.7
Austin	KAUS-FM	99.9
Anoka	KTWN	107.9
Bemidji	KBSB	91.9
Benson	KBMO-FM	93.5
Blue Earth	KBEW-FM	100.9
Brainerd	KLIZ-FM	95.7

Location	Call	MHz
Breckenridge	KKWB	104.9
Collegeville	KSJR-FM	90.1
Duluth	WDIO-FM	94.9
	WUMD	89.1
Faribault	KDHL-FM	95.9
Fergus Falls	KBRF-FM	103.3
Fosston	KEHG-FM	107.1
Golden Valley	KQRS-FM	92.5
Hibbing	WMFG-FM	106.3
Hutchinson	KDUZ-FM	107.1
International Falls	KICC	91.5
Litchfield	KLFD-FM	95.3
Mankato	KMSU	90.5
	KEYC-FM	99.1
	KYSM-FM	103.5
Marshall	KMHL-FM	100.1
Minneapolis-St. Paul		
	KBEM-FM	88.5
	WCCO-FM	102.9
	KSTP-FM	94.5
	KEEY-FM	102.1
	KTIS-FM	98.5
	WLOL-FM	99.5
	KNOF	95.3
	KTCR-FM	97.1
	WPBC-FM	101.3
	WAYL	93.7
	WCTS-FM	100.3
Moorhead	KVOX-FM	99.9
	KCCM-FM	91.1
	KQWB-FM	98.7
New Brighton	KSJN-FM	91.1
New Ulm	KNUJ-FM	93.1
Northfield	WCAL-FM	89.3
Owatonna	KRFO-FM	104.9
Park Rapids	KPRM-FM	103.7
Pipestone	KLOH-FM	98.7
Red Wing	KCUE-FM	105.5
Richfield	WPBC-FM	101.3
Rochester	KROC-FM	106.9
	KNCV	101.7
	KNXR	97.5
	KOLM-FM	96.7
St. Cloud	KFAM-FM	104.7
	WJON-FM	101.7
	KVSC	88.5
St. Louis Park	KRSI-FM	104.1
St. Peter	KRBI-FM	105.5
Virginia	WHLB-FM	107.1
Wadena	KKWS	105.9
Wilmar	KWLM-FM	102.5
Worthington	KWOA-FM	95.1

MISSISSIPPI

Biloxi	WBIL	106.3
Cleveland	WDSK-FM	92.7
Columbia	WFFF-FM	96.7
Columbus	WMBC-FM	103.1
Corinth	WALP	90.5
	WKCU-FM	94.3
	WWTX	95.3
Forest	WQST	92.5
	WDMS	100.7
Greenville	WBAQ	97.9
	WDMS	100.7
Greenwood	WSWG	99.1
Gulfport	WROA-FM	107.1
	WTAM	102.3
Hattiesburg	WHSY-FM	104.5
	WFOR-FM	103.7
Hazelhurst	WMDC-FM	100.9
Houston	WCPC-FM	93.3
Indianola	WNLA-FM	105.5
Jackson	WJDX-FM	102.9
	KFXM	95.5
	WJMI	99.7
	WSLI-FM	96.3
	WWHO	94.7
Kosciusko	WKOZ-FM	105.1
Laurel	WNSL-FM	100.3
Louisville	WLSM-FM	107.1
Magee	WSJC-FM	107.5
McComb	WCCA	94.1
Meridian	WMMI	88.1
	WDAL-FM	101.3
	WOKK-FM	97.1
Moss Point	WCIS-FM	104.9
Natchez	WQNZ	95.1
New Albany	WNUA-FM	103.5
Oxford	WOOR	97.5
Pascagoula	WPMP-FM	99.1
Poplarville	WRPM-FM	107.9
Pontotoc	WSEL-FM	96.7
Starkville	WSMU-FM	106.3
Tupelo	WELO-FM	98.5
Vicksburg	WQMV	98.2
	WKYV-FM	106.7
Yazoo City	WJNS-FM	92.1

MISSOURI

Aurora	KSWM-FM	100.1
Bolivar	KLTB	106.3
Buffalo	KBFL	90.3
Cape Girardeau	KGMO-FM	100.7
	KZYM-FM	102.9
Carrollton	KAOL-FM	101.1
Clayton	KFUO-FM	99.1
	KHRU	88.1
Columbia	KWWC-FM	90.5
	KBIA-FM	91.3
	KTGR-FM	96.7
	KSHE	94.7
Crestwood	KDEX-FM	102.3
Dexter		
El Dorado Springs	KESM-FM	107.1
	KGRC	92.9
Hannibal	KHKA	88.9
Hillsboro	KBTC-FM	99.3
Houston	KJFF	106.9
Jefferson City	KOBC	91.1
Joplin	KSYN	92.5
	KFMU	94.9
Kansas City	KBEY	104.3
	KTSR	90.1
	WDAF-FM	102.1
	KCUR FM	89.3
	KLJC	88.5
	KMBR-FM	99.7
	KPRS-FM	103.3
	KXTR	96.5
	KWKI	93.3
Kennett	KBOA-FM	98.9
Kirksville	KRXL	103.5
Lexington	KLEX-FM	106.3
Marshall	KMFL-FM	102.9
	KNOS	91.7
Mexico	KWWR-FM	95.7
Moberly	KRES	104.7
	KMTS	90.1
Osage Beach	KRMS-FM	93.5
Point Lookout	KSOZ	88.1
Poplar Bluff	KWOC-FM	94.5
Rolla	KCLU-FM	94.3
	KMSM	88.5
St. Charles	KCLC	88.9
Ste. Genevieve	KSGM-FM	105.7
St. Joseph	KUSN-FM	105.1
St. Louis	KFCM	93.7
	KBMJ-FM	90.7
	KACO	107.7
	KADI	96.5
	WIL-FM	92.3
	KMOX-FM	103.3
	KDNA	102.5
	KRCH	98.1
	KSLH	91.5
Sedalia	KSIS-FM	92.1
Sikeston	KMPL-FM	97.7
Springfield	KTTS-FM	94.7
	KTXR	101.5
	KWFC	97.3
	KWTO-FM	98.7
Union	KLPW-FM	101.7
Warrensburg	KCMW	90.9
Waynesville	KFBD-FM	97.7
	KYSD	102.3
West Plains	KWPM-FM	93.9

MONTANA

Belgrade	KGVW-FM	96.7
Billings	KURL-FM	97.1
	KOYN-FM	93.3
Bozeman	KGLT	90.1
Glendive	KIVE-FM	96.5
Great Falls	KOPR-FM	106.3
Hamilton	KLYQ-FM	95.9
Missoula	KUFM	88.1
	KYSS-FM	100.1
Plentywood	KPWD	100.1

NEBRASKA

Aurora	KROA	103.1
Beatrice	KWBE-FM	92.9
Columbus	KJSK-FM	101.1
	KTTT-FM	93.5
Hastings	KICS-FM	93.5
	KCNT	88.1
Holdrege	KUVR-FM	97.7
Kearney	KOVF-FM	91.3
Kearney-Holdrege	KRNY-FM	98.9
Lexington	KRVN-FM	93.1
Lincoln	KFMQ	95.3
	KLIN-FM	107.3
	KRNU	90.3
	KUCV	91.3
	KWHG	102.7
Omaha	KFAB-FM	99.9
	KGBI-FM	100.7
	KIOS-FM	91.5
	KOIL-FM	96.1
	KOZN	94.1
	WOW-FM	92.3
Scottsbluff	KNEB-FM	94.1
York	KAWL-FM	104.9

NEVADA

Carson City	KRWL-FM	97.3
Fallon	KVLV-FM	99.3
Henderson	KCNA	94.1
Las Vegas	KORK-FM	97.1
	KRGN	101.9
	KLUC-FM	98.5
	KVEG-FM	92.3
Reno	KNEV	95.5
	KUNR	88.1
	KSRN	104.5
Sparks	KFON	98.3

NEW HAMPSHIRE

Berlin	WMOU-FM	103.7
Claremont	WTSV-FM	106.1
Conway	WBNC-FM	93.5
Dover	WDNH	97.5
Durham	WUNH	90.3
Exeter	WPEA	90.1
Laconia	WLNH-FM	98.3
Keene	WKNE-FM	103.7
Manchester	WKBR-FM	95.5
	WHNS	101.1
Mt. Washington	WMTW-FM	94.9
Nashua	WOTW-FM	106.3
Portsmouth	WPFM	100.3

NEW JERSEY

Asbury Park	WJLK-FM	94.3
Atlantic City	WFPG-FM	96.9
	WMGM	103.7
	WRNJ	95.1
Bridgeton	WSNJ-FM	107.7
Camden	WKDN-FM	106.9
Cape May	WRIO-FM	101.7
Dover	WDHA-FM	105.5
E. Orange	WFMU	91.1
Eatontown	WHTG-FM	106.3
Egg Harbor	WRDR	104.9
Franklin	WLVP	102.3
Franklin Lakes	WRRH	88.7
Glassboro	WGLS-FM	89.7
Hackettstown	WNTI	91.9
Hanover	WHPH	90.3
Long Branch	WRLB	107.1
Millville	WMVB-FM	97.3
Newark	WHBI	105.9
	WFME	94.7
	WVNJ-FM	100.3
	WBGO	88.3
Newton	WIXL-FM	103.7
New Brunswk.	WCTC-FM	98.3
Point Pleasant	WADB	95.9
Paterson	WPAT-FM	93.1
Princeton	WPRB	103.3
South Orange	WSOU	89.5
Toms River	WOBM	92.7
Trenton	WBSH	101.5
	WCHR	94.5
	WTOA	97.5
	WTSR	89.7
Vineland	WDVL-FM	92.1
Wildwood	WCMC-FM	100.7
Zarephath	WAWZ-FM	99.1

NEW MEXICO

Albuquerque	KANW	89.1
	KBNM	99.5
	KDEF-FM	94.1
	KRST	92.3
	KHFM	96.3
	KMAP	100.3
	KOB-FM	93.3
	KUNM	90.1
Artesia	KSVP-FM	92.9
Carlsbad	KBAD-FM	92.1
Clovis	KTQM-FM	99.9
	KMTY-FM	99.1
Farmington	KRAZ	96.9
Hobbs	KLDG-FM	95.7
Los Alamos	KRSN-FM	98.5
Las Cruces	KGRD-FM	103.9
Las Vegas	KEDP	91.1
Lovington	KLEA-FM	101.7
Portales	KENW-FM	88.9
Roswell	KBIM-FM	94.9
Sante Fe	KAFE-FM	97.3
	KSNM	95.5
Taos	KKIT-FM	99.3
Tucumcari	KTNM-FM	92.7
University Park	KRWG	90.7

NEW YORK

Albany	WAMC	90.3
	WDKC	106.5
	WHRL	103.1
	WROW-FM	95.5
Auburn	WRLX	106.9
Babylon	WBAB-FM	102.3
Binghamton	WNBF-FM	98.1
	WHRW	90.5
	WKOP-FM	99.1
Baldwinsville	WSEN-FM	92.1
Brooklyn	WYNE	91.5
Brookville	WCWP	88.1
Buffalo	WBEN-FM	102.5
	WADV	106.5
	WDCX	99.5
	WBFO	88.7
	WBUF	92.9
	WEBR-FM	94.5
	WGR-FM	96.9
	WWOL-FM	104.1
	WYSL-FM	103.3
	WBNY-FM	96.1
Canton	WSLU	96.7
Central Square	WCSQ	89.3
Cherry Valley	WJIV	101.9
Clinton	WHCL-FM	88.7
Corning	WCLI-FM	106.1
Cortland	WKRT-FM	90.9
Depew	WBLK-FM	93.7
	WOIR	105.1
DeRuyter	WFLR-FM	95.9
Dundee	WELV-FM	99.3
Ellenville	WECW	88.1
Elmira	WEHH-FM	94.3
	WENY-FM	92.7
Endicott	WMRV	105.5
Floral Park	WSHS	90.3
Fulton	WOSC-FM	104.7
Garden City	WLIR	92.7
Geneseo	WGSU	89.3
Glen Falls	WWSC-FM	95.9
	WXQL	107.1
Gouverneur	WIGS-FM	92.7
Hempstead	WHLI-FM	98.3
	WVHC	88.7
Hornell	WHHO-FM	105.3
Horseheads	WIQT-FM	100.9
Hudson	WHUC-FM	93.5
Hyde Park	WHVW-FM	97.7
Ithaca	WHCU-FM	97.3
	WICB	91.7
	WEIV	103.7
	WVBR-FM	93.5
Jamestown	WJTN-FM	93.3
	WKSN-FM	101.7
Johnstown	WIZR-FM	104.9
Kenmore	WYSL-FM	103.3
Kingston	WGHQ-FM	94.3
Lake Ronkonkoma	WSHR	99.7
Lake Success	WTFM	103.5
Liberty	WVOS-FM	95.9
Loudonville	WVCR-FM	89.1
Middletown	WALL-FM	92.7
Mt. Kisco	WRNW	107.1
	WVIP-FM	106.3
Newburgh	WFMN	103.1
New Rochelle	WVOX-FM	93.5
New York	WABC-FM	95.5
	WBAI	99.5
	WCBS-FM	101.1
	WEVD-FM	97.9
	WFUV	90.7
	WHOM-FM	92.3
	WKCR-FM	89.9
	WLIB-FM	107.5
	WNCN	104.3
	WNEW-FM	102.7
	WNBC-FM	97.1
	WNYC-FM	93.9
	WNYE	91.5
	WOR-FM	98.7
	WPIX-FM	101.9
	WQXR-FM	96.3
	WRFM	105.1
	WRVR	106.7
Niagara Falls	WHLD-FM	98.5
Norwich	WCHN-FM	93.9
Olean	WHDL-FM	95.7
Oneonta	WGNR	103.9
	WRHO-FM	89.5
Oswego	WOSE	104.9
	WRVO	89.9
Plattsburg	WEAV-FM	99.9
Patchogue	WALK-FM	97.5(s)
	WPAC-FM	106.1
	WLNA-FM	100.7
Peekskill	WDLC-FM	96.7
Port Jervis	WTSC-FM	91.1
Potsdam	WPDM-FM	99.3
Poughkeepsie	WSPK	104.7
	WEOK-FM	101.5
Riverhead	WHRF-FM	103.9
Rochester	WHFM	98.9
	WBFB	92.5
	WCMF	96.5
	WIRQ	90.9
	WNYR-FM	101.3
	WROC-FM	97.9
	WRUR	88.5
	WVOR	100.5
Rome	WKAL-FM	95.9
Sag Harbor	WLNG-GM	92.1
Saratoga Springs	WKAI-FM	102.3
Schenectady	WGFM	99.5
Seneca Falls	WSFW-FM	99.3
Smithtown	WCTO	94.3
South Bristol	WMIV	95.1
Springville	WSPE	88.1
Syracuse	WAER	88.1
	WDDS-FM	93.1
	WMHR	102.9
	WONO	107.9
	WSYR-FM	94.5
Troy	WFLY	92.3
	WRPI	91.5
	WRUN-FM	104.3
	WIBQ-FM	94.9
	WQUR	96.9
	WZOW	107.3
Watertown	WNCQ	97.5
Wethersfield Township	WBIV	107.7
White Plains	WFAS-FM	103.9

NORTH CAROLINA

Ahoskie	WRCS-FM	99.3

WHITE'S

RADIO LOG

Location	Call	MHz
Albermarle	WABZ-FM	100.9
Asheboro	WGWR-FM	92.3
Ashville	WLOS-FM	99.9
Bridgeton	WVWB-FM	97.7
Black Mountain	WMIT	106.9
Burgaw	WPGF-FM	99.9
Burlington-Graham		
	WBAG-FM	93.9
	WBBB-FM	101.1
Chapel Hill	WUNC	91.5
Charlotte	WBT-FM	107.9
	WRNA	95.1
	WSOC-FM	103.7
	WYFM	104.7
Clinton	WRRZ-FM	107.1
Concord	WPEG	97.9
Dunn	WQTI	103.1
Durham	WDNC-FM	105.1
	WSRC-FM	107.1
Eden	WEAF	94.5
Elkin	WIFM-FM	100.9
Farmington	KRAZ	96.9
Fayetteville	WQSM	98.1
Forest City	WBBO-FM	93.3
	WAGY-FM	105.3
Franklin	WFSC-FM	96.7
Gastonia	WGNC-FM	101.9
Goldsboro	WEQR	96.9
Greensboro	WMDE	98.7
	WQFS	90.7
	WQMG	97.1
	WUAG	89.9
Greenville	WNCT-FM	107.7
Grifton	WITN-FM	93.3
Henderson	WHNC-FM	92.5
Hendersonville	WHKP-FM	102 5
Hickory	WHKY-FM	102.9
	WXRC	95.7
High Point	WHPE-FM	95.5
	WMFR-FM	99.5
	WNOS-FM	100.3
Jacksonville	WRCM	92.1
	WXQB-FM	105.5
Kannapolis	WRKB-FM	99.7
Kinston	WRNS	95.1
Laurinburg	WSTS	96.5
Lexington	WLXN	94.1
Lumberton	WTSB-FM	95.7
	WISK	102.3
Morganton	WMNC-FM	92.1
Murfreesboro	WWDR-FM	98.3
North Wilkesboro		
	WKBC-FM	97.3
Raleigh	WKIX-FM	96.1
	WKNC-FM	88.1
	WPTF-FM	94.7
	WRAL-FM	101.5
	WSHA	88.9
Reidsville	WWMO	102.1
Rocky Mount	WEED-FM	92.1
	WFMA	100.7
Roxboro	WRXO-FM	96.7
Salisbury	WSTP-FM	106.5
Sanford	WWGP-FM	105.5
Shelby	WOHS-FM	96.1
Statesville	WFMX	105.7
	WDBM-FM	96.9
Tabor City	WKSM	104.9
Tarboro	WCPS-FM	104.3
Thomasville	WTNC-FM	98.3
Washington	WITN-FM	93.3
Whiteville	WENC-FM	99.1
Williamston	WIAM-FM	103.7
Wilmington	WPRV	93.9
	WAAV	101.7
	WHSL-FM	97.3
	WMFD-FM	100.9
Wilson	WVOT-FM	106.1
Winston-Salem	WAAA-FM	107 5
	WFOD-FM	88.5
	WGPL	93.1
	WSJS-FM	104.1

NORTH DAKOTA

Bismarck	KFYR-FM	92.9
	KBMR-FM	94.5
Devils Lake	KDLR-FM	96.7
Fargo	KFNW-FM	97.9
	WDAY-FM	93.7
	KDSU	91.9
Grand Forks	KYBC	94.7
Jamestown	KSJN	99.3
Minot	KCJB-FM	97.1
	KMOT-FM	93.7

OHIO

Akron	WAKR-FM	97.5
	WAPS	89 1
	WAUP	88.1
Alliance	WCUE-FM	96.5
	WFAH-FM	101.7
	WRMU	91.1
Archbold	WHFD	95.9
Ashland	WNCO-FM	101.3
	WRDL	89.5
Ashtabula	WREO-FM	97.1
Athens	WOUB-FM	91.3
	WATH-FM	105.5
Batavia	WCNE	88.7
Bellaire	WOMP-FM	100.5
Bellefontaine	WOGM	98.3
Berea	WBWC	88.3
Bowling Green	WAWR-FM	93.5
	WBGU	88.1
Bryan	WWMS	100.9
Bucyrus	WBCO-FM	92.7
Cambridge	WILE-FM	96.7
Canton	WHBC-FM	94.1
	WNYN-FM	106.9
	WTOF	98.1
Cedarville	WCDR-FM	90.1
Celina	WMER	94.3
	WCSM-FM	96.7
Chillicothe	WBEX-FM	93.3
Cincinnati	WAEF	98.5
	WCPO-FM	105.1
	WEBN-FM	102.7
	WAKW	93.3
	WGUC	90.9
	WKRC-FM	101.9
	WASI	94.1
	WZIP-FM	92.5
Circleville	WNRE	107.1
Cleveland	WBOE	90.3
	WCRF-FM	103.3
	WCLV	95.5
	WDOK	102.1
	WERE-FM	98.5
	WGAR-FM	99.5
	WCJW	104.1
	WKYC-FM	105.7
	WMMS	100.7
	WNOB	107.9
	WRUW-FM	91.1
	WXEN	106.5
	WZAK	93.1
Cleveland Hts.	WCUY-FM	92.3
Columbus	WCBE	90.5
	WBNS-FM	97.1
	WBUK	96.3
	WCOL-FM	92.3
	WMNI-FM	99.7
	WNCI	97.9
	WOSU-FM	89.7
	WSPO	94.7
Conneaut	WFIZ	105.5
Coshocton	WTNS-FM	99.3
Dayton	WHIO-FM	99.1
	WONE-FM	104.7
	WDAO	107.7
	WSMR	89.3
DeGraff	WDEQ-FM	91.1
Delaware	WSLN	88.7
Dover	WJER-FM	101.7
E. Liverpool	WRTS	104.3
Eaton	WCTM	92.9
Elyria	WBEA	107.3
Fairfield	WCNW-FM	94.9
Findlay	WFIN-FM	94.9
Fostoria	WFOB-FM	96.7
Fremont	WFRO-FM	99.1
Gallipolis	WJEH-FM	101.5
Granville	WDUB	90.9
Greenville	WDRK-FM	106.5
Hamilton	WQMS	96.7
	WHOH	105.5
Hillsboro	WSRW-FM	106.7
Holland	WPOS-FM	102.3
Kent	WKSU	89.7
	WKNT-FM	100.1
Kenton	WKTN-FM	98.3
Kettering	WVUD-FM	99.9
Lancaster	WHOK-FM	95.5
Lima	WIMA-FM	102.1
	WTGN	97.7
Logan	WLGN-FM	98.3
London	WLNO	106.3
Mansfield	WVNO	106.1
	WCLW-FM	105.3
Marietta	WCMO	89.3
	WMOA-FM	94.3
Marion	WMRN-FM	106.9
Medina	WDBN	94.9
Miamisburg	WFCJ	93.9
Middletown	WPFB-FM	105.9
Milford	WLYK-FM	107.1
Mt. Vernon	WMVO-FM	93.7
New Concord	WMCO	90.7
Newark	WCLT-FM	100.3
New Philadelphia	WNPQ	95.5
Norwalk	WLKR-FM	95.3
Oberlin	WOBC	88.7
Oxford	WMUB	88.5
	WOXR	97.7
Piqua	WPTW-FM	95.7
Port Clinton	WRWR-FM	94.5
Portsmouth	WPAY-FM	104.1
	WNXT-FM	99.3
Reading	WRCJ	89.3
Salem	WSOM-FM	105.1
Sandusky	WLEC-FM	102.7
Sidney	WMVR-FM	105.5
Springfield	WBLY-FM	102.9
	WEEC	100.7
	WUSO	89.1
Steubenville	WSTV-FM	103.5
Struthers	WKTL	90.7
Sylvania	WGLN	105.5
Tiffin	WTTF-FM	103.7
Toledo	WSPD-FM	101.5
	WCWA-FM	104.7
	WKLR	99.9
	WMHE	92.5
University Heights	WJCR	88.9
	WUJC	88.9
Urbana	WCOM-FM	101.7
	WUHS	91.7
Van Wert	WERT-FM	98.9
Wapakoneta	WERM	92.1
Washington Court House		
	WCHO-FM	105.5
Westerville	WOBN	91.5
	WBBY	103.9
Wilberforce	WCSU-FM	88.9
Wooster	WWST-FM	104.5
	WCWS	91.9
Worthington-Columbus		
	WNCI	97.9
Xenia	WHBM-FM	103.9
	WBZI	95.3
Yellow Springs	WYSO	91.5
Youngstown	WKBN-FM	98.9
	WBBW-FM	93.3
	WRED	101.1
	WYSU	88.5
Zanesville	WHIZ-FM	102 5

OKLAHOMA

Ada	KTEN-FM	93.3
Bartlesville	KYEM	100.1
Bethany	KGOY	104.9
Chickasha	KNDR	105.5
Clinton	KWOE-FM	106.9
Durant	KSEO-FM	107.3
Edmund	KWHP	97.7
	KCSC	90.1
Enid	KCRC-FM	96.9
Eufaula	KCES	102.3
Henryetta	KHEN-FM	99.5
Lawton	KLAW	101.5
McAlester	KNEO-FM	101.3
Midwest City	KTEA-FM	92.5
Muskogee	KMMM-FM	106.9
Nowata	KNFB	94.3
Oklahoma City	KOKH	88.9
	KBYE-FM	98.9
	KEBC	94.7
	KJAK	100.5
	KJEM-FM	102.7
	KOCY-FM	96.1
	KOFM	104 1
	KFNB	101.1
Ponca City	KLOR-FM	99.3
Poteau	KLCO-FM	98.3
	KINB	107.3
Pryor	KKMA	104.5
Shawnee	KBGC	89.9
Stillwater	KOSU-FM	91.7
	KSPI-FM	93.9
	KVRO	105.5
Tahlequah	KTLQ-FM	101.7
Tulsa	KAKC-FM	92.9
	KRMG-FM	95.5
	KMOD	97.5
	KORU	103.3
	KRAV	96.5
	KWGS	89.5
Weatherford	KCCE	95.3

OREGON

Aguadilla	WIVA-FM	100.5
Albany	KWIL-FM	107.9
Ashland	KSOR	90.1
Corvallis	KFLY-FM	101.5
	KBVR	90.1
Dalles City	KCIV	104.5
Eugene	KRVM	91.9
	KORE-FM	93.1
	KFMY	97.9
	KLCC	90.3
	KPNW-FM	99.1
	KWAX	91.1
	KBMC	94.5
	KZEL-FM	96.1
Grants Pass	KGPO	96.9
Medford	KBOY-FM	95.3
Oretech	KTEC	88.3
Portland	KBOO	90.7
	KINK	101.9
	KJIB	99.5
	KLIQ-FM	92.3
	KOAP	91.5
	KOIN-FM	101.1
	KPDQ-FM	93.7
	KPAM-FM	97 1
	KPOK	98.5
	KQFM	100.3
	KPPC	89.5
	KXL-FM	95.5

PENNSYLVANIA

Allentown	WFMZ	100.7
	WAEB-FM	104.1
Altoona	WMUH	89.7
	WVAM-FM	100.1
	WFBG-FM	98.1
Beaver Falls	WBVP-FM	106.7
	WGEV	88.3
Bedford	WAKM	100.9
Bellwood	WHGM	103.9
Bethlehem	WGPA-FM	95.1
Bloomsburg	WHLM-FM	106.5
Boyertown	WBYO	107.5
Braddock	WLOA-FM	96.9
Butler	WBUT-FM	97.7
Carbondale	WCDL-FM	94.3
Carlisle	WHYL-FM	102.3
Chambersburg	WCHA-FM	95.1 (s)
Charleroi	WESA-FM	98.3
Clearfield	WCPA-FM	93.5
Oanville	WPGM-FM	96.7
DuBois	WCED-FM	102.1
Easton	WEST-FM	96.1
	WJRH	90.5
	WEEX-FM	99.9
Ebensburg	WEND-FM	99.1
Elizabethtown	WMSH-FM	106.7
Elwood City, Pa.	WFEM	92.1
Ephrata	WIOV	105.1
Erie	WWFM	99.9
	WWGO-FM	103.7
Gettysburg	WGET-FM	107.7
Greencastle	WKSL	94.3
Greensburg	WOKU-FM	107.1
Greenville	WGRP-FM	107.1
Grove City	WEDA-FM	95.1
	WSAJ-FM	89.5
Harrisburg	WHP-FM	97.3
	WMSP	94.9
	WSFM	99.3
	WTPA-FM	104.1
Havertown	WHHS	89.3
Hazleton	WAZL-FM	97.9
Huntingdon	WHUN-FM	106.3
Indiana	WQMU	103.1
	WIUP-FM	91.3
Jenkintown	WIBF-FM	103.9
Johnstown	WARD-FM	92.1
	WJAC-FM	95.5
Lancaster	WGAL-FM	101.3
	WDAC	94.5
	WLAN-FM	96.9
Lebanon	WLBR-FM	100.1
Lewisburg	WVBU-FM	90.5
Lewistown	WMRF-FM	95.9
Linesville	WVCC	101.7
Lock Haven	WBPZ-FM	92.1
Mansfield	WNTE	89.5
Martinsburg	WJSM-FM	92.7
Meadville	WARC	90.3
	WMGW-FM	100.3
Media	WXUR-FM	100.3
Mercer	WWIZ	103.9
Milton	WMLP-FM	100.9
Montrose	WPEL-FM	96.5
New Kensington-Tarentum	WYDD	100.7
New Wilmington	WKPS	88.9
North East	WHYP-FM	100.9
Oil City	WDJR	98 5
Palmyra	WCTX	92.1
Philadelphia	WCAU-FM	98.1
	WDAS-FM	105.3
	WRCP-FM	104.5
	WFIL-FM	102.1
	WDVR	101.1
	WFLN	95.7
	WUHY-FM	90.9
	WIFI	92.5
	WMMR	93 3
	WPBS	98.9
	WPEN-FM	102.9
	WPNA	94.1
	WPWT	91.7
	WQAL	106.1
	WRTI-FM	90.1
	WWDB	96 5
	WXPN	88.9
Pittsburgh	KDKA-FM	92.9
	WAMO-FM	105.9
	WEEP-FM	107.9
	WTAE-M	96.1
	KQV-FM	102.5
	WDUQ	91.5
	WJAS-FM	99.7
	WKJF	93.7
	WPIT-FM	101.5
	WWSW-FM	94.5
	WYDO	104.7
Pottsville	WAVT-FM	101.9
Reading	WRFY-FM	102.5
	WXAC	91.3
Red Lion	WGCB-FM	96.1
Ridgeway	WKBI-FM	94.3
Scranton	WGBI-FM	101.3
	WEJL-FM	107.1
	WUSV	88.9
	WWDL	104.9
Selinsgrove	WQSU	91.5
Shamokin	WISL-FM	95.3
Sharon	WPIC-FM	102.9
Somerset	WVSC-FM	97.7
South Williamsport	WMPT-FM	99.3
State College	WMAJ-FM	103.1
	WDFM	91.1
	WQWK	96.7

Location	Call	MHz
Stroudsburg	WVPO-FM	93.5
Sunbury	WKOK-FM	94.1
Tamaqua	WSVB	105.5
Telford	WBMR	89.7
Towanda	WTTC-FM	95.3
Tyrone	WGMR-FM	102.3
Union City	WBVB	106.3
Uniontown	WPQR-FM	99.3
University Park	WDFM	91.1
Warren	WRRN	92.3
Washington	WJPA-FM	95.3
Waynesboro	WAYZ-FM	101.5
Wellsboro	WGCR-FM	97.7
Wilkes-Barre	WBRE-FM	98.5
	WRKC	88.5
	WYZZ	92.9
Williamsport	WLYC-FM	105.1
	WRAK-FM	102.7
York	WNOW-FM	105.7
	WSBA-FM	103.3
York-Hanover	WYCR	98.5

RHODE ISLAND

Kingston	WRIU	91.1
Providence	WPJB-FM	105.1
	WBRU	95.5
	WDOM	91.3
	WICE-FM	107.7
	WHIM-FM	94.1
	WLKW-FM	101.5
	WPRO-FM	92.3
Westerly	WERI-FM	103.7
Woonsocket	WWON-FM	106.3

SOUTH CAROLINA

Aiken	WLOW-FM	95.9
	WAKN-FM	99.3
Anderson	WCAC	101.1
	WANS-FM	107.3
Bamberg	WWBD-FM	92.7
Barnwell	WBAW-FM	101.7
Batesburg	WBLR-FM	92.1
Beaufort	WBEU-FM	98.7
Charleston	WCSC-FM	96.9
	WTMA-FM	95.1
Chester	WCMJ	99.3
Clemson	WSBF-FM	89.3
Columbia	WCOS-FM	97.9
	WNOK-FM	104.7
	WUSC-FM	89.9
Conway	WLAT-FM	104.1
Darlington	WDAR-FM	105.5
Dillon	WDSC-FM	92.9
Due West	WARP	91.7
Easley	WELP-FM	103.9
Florence	WSTN	103.1
Greenville	WESC-FM	92.5
	WFBC-FM	93.7
	WMUU-FM	94.5
Greenwood	WCRS-FM	96.7
Kingstree	WDKD-FM	100.1
Lancaster	WLCM-FM	107.1
Moncks Corner	WWMC	105.5
Myrtle Beach	WMYR-FM	92.1
	WTGR-FM	101.7
N. Charleston	WKTM	102.5
Orangeburg	WDIX-FM	106.7
Rock Hill	WRHI-FM	98.3
Seneca	WBFM	98.1
Spartanburg	WSPA-FM	98.9
Sumter	WFIG-FM	101.3
Walterboro	WALD-FM	100.9

SOUTH DAKOTA

Brookings	KBRK-FM	101.7
	KESD	88.3
Hot Springs	KOBH-FM	96.7
Madison	KJAM-FM	103.1
Rapid City	WVSR	97.9
Sioux Falls	KELO-FM	92.5
	KCHF-FM	93.5
	KNWC-FM	96.5
	KSOO-FM	97.3
Springfield	KSTI-FM	88.5
Vermillion	KUSD-FM	89.9
	KVRF	102.3
Watertown	KDLO-FM	95.3
	KWAT-FM	96.1

TENNESSEE

Bristol	WOPI-FM	96.9
Brownsville	WBHT-FM	95.3
Chattanooga	WDOD-FM	96.5
	WDYN	89.7
	WKES	88.9
	WLOM	100.5
	WDEF-FM	92.3
Cleveland	WCLE-FM	100.7
Clinton	WYSH-FM	104.9
Collegedale	WSMC	90.7
Columbia	WYFY-FM	101.7
Cookeville	WHUB-FM	98.3
	WPTN-FM	94.3
Covington	WKBL-FM	93.5
Crossville	WAEW-FM	99.3
Dickson	WDKN-FM	102.3
Dyersburg	WTRO-FM	100.1
Elizabethton	WLSN	99.3
Fayetteville	WYTM-FM	105.5
Franklin	WIZO-FM	100.1
Gallatin	WFMG	104.5
Greeneville	WOFM	94.9
Henderson	WFHC-FM	91.5
Humboldt	WIRJ-FM	102.3
Jackson	WTJS-FM	104.1
	WDEB-FM	100.1
Johnson City	WJCW-FM	101.5
Kingsport	WKPT-FM	98.5
Knoxville	WBIR-FM	103.5
	WEZK	97.5
	WIVK-FM	107.7
	WKCS	91.1
	WUOT	91.9
Lawrenceburg	WDXE-FM	95.9
Lebanon	WFMO	91.3
	WCOR-FM	107.3
Lenoir City	WLIL-FM	93.5
Lewisberg	WJJM-FM	94.3
Lexington	WDXL-FM	99.3
Livingston	WLIV-FM	95.9
Manchester	WMSR-FM	99.7
Marshall	KMHL-FM	100.1
Martin	WCMT-FM	101.7
McKenzie	WKTA	106.9
McMinnville	WHNR	103.9
Memphis	WMC-FM	99.7
	WCBC	91.1
	WHBQ-FM	105.9
	WMPS-FM	97.1
	WREC-FM	102.7
	WTCV	101.5
	KWAM-FM	101.1
Milan	WKBJ-FM	92.3
Morristown	WMTN-FM	95.9
Murfreesboro	WMTS-FM	96.3
	WMOT	89.5
Nashville	WLAC-FM	105.9
	WKDA-FM	104.3
	WPLN	90.3
	WNAZ-FM	88.9
	WSET	92.9
	WSIX-FM	97.9
	WSM-FM	95.5
Oak Ridge	WATO-FM	94.3
Oneida	WBNT-FM	105.5
Paris	WTPR-FM	105.5
Sevierville	WSEV-FM	102.1
Savannah	WORM-FM	101.7
Shelbyville	WHAL-FM	102.9
Smithville	WJLE	101.7
Sparta	WSMT-FM	105.5
Springfield	WDBL-FM	94.3
Sweetwater	WDEH-FM	95.3
Tullahoma	WJIG-FM	93.3

TEXAS

Abernathy	KWGO-FM	99.5
Abilene	KACC-FM	91.1
	KFMN	99.3
	KWKC-FM	105.1
Amarillo	KGNC-FM	93.1
	KDJW-FM	94.1
Austin	KHFI-FM	98.3
	KASE	100.7
	KMFA	89.5
	KOKE-FM	95.5
	KTBC-FM	93.7
	KUT-FM	90.7
Beaumont	KAYD	97.5
	KBPO	94.1
	KTRM-FM	95.1
	KJET-FM	107.7
	KTCN-FM	106.3
Belton	KFNE	95.3
Big Spring	KWHI-FM	106.3
Brenham	KFRN-FM	99.3
Brownwood	KORA-FM	98.3
Bryan	KLYX	102.1
Clear Lake City	KFAD	94.9
Cleburne	WTAW-FM	92.1
College Station	KNRO	106.9
Conroe	KZFM	95.5
Corpus Christi	KIOU	96.5
	KSIX-FM	93.9
Crockett	KIVY-FM	92.7
Dalhart	KXIT-FM	95.9
Dallas	KIXL-FM	104.5
	KCCD	102.9
	KNUS	98.7
	KRLD-FM	92.5
	WFAA-FM	97.9
	WRR-FM	101.1
	KVTT	91.7
	KXXK	105.3
	KBOX-FM	100.3
Del Rio	KDLK-FM	94.3
Denison-Sherman	KDSX-FM	101.7
	KGCC	89.7
Denton	KDNT-FM	106.1
	KNTU	89.5
DiBoll	KSPL-FM	95.5
Dumas	KDDD-FM	95.3
El Campo	KULP-FM	96.9
El Paso	KTEP	88.5
	KINT-FM	97.5
	KIZZ-FM	102.1
	KSET-FM	94.7
	KTSM-FM	99.9
Ft. Worth	WBAP-FM	96.3
	KBUY-FM	93.9
	KCWM	99.5
	KFWT-FM	102.1
	KNOK-FM	107.5
	KTCU-FM	89.1
	KWXI	97.1
Gainesville	KGAF-FM	94.5
Galveston	KGBC-FM	106.5
Harlingen	KELT	94.5
Henderson	KGRI-FM	100.1
Hereford	KPAN-FM	106.3
Highland Park-Dallas	KVIL-FM	103.7
Hillsboro	KHBR-FM	102.5
Houston	KHCB-FM	105.7
	KILT-FM	100.3
	KFMK	97.9
	KODA-FM	99.1
	KPFT	90.1
	KLEF	94.5
	KQUE	102.9
	KRBE	104.1
	KXYZ-FM	96.5
	KTRH-FM	101.1
	KUHF	88.7
	KBNO	93.7
Huntsville	KSAM-FM	101.7
Jacksonville	KOOI	106.5
Jacksonville	KEBE-FM	106.5
Jasper	KTXJ-FM	102.3
Killeen	KLEN-FM	93.3
	KNCT-FM	91.3
Kingsville	KPUP	97.7
	KTAI	91.9
Lake Jackson	KLJT	107.3
Lamesa	KELE	100.3
Longview	KHER	105.7
Lubbock	KSEL-FM	93.7
	KBFM	96.3
	KLBK-FM	94.5
	KTXT-FM	91.9
Marshall	KMHT-FM	97.3
McAllen	KQXX	98.5
McKinney	KAWB	95.3
Midland	KNFM	92.3
Mt. Pleasant	KIMP-FM	100.7
Muleshoe	KMUL-FM	103.1
Nacogdoches	KSFA-FM	92.1
	KEFM	103.3
New Boston	KNBO	95.9
New Braunfels	KNBT	92.1
Odessa	KQIP	96.7
	KOCV	91.3
	KOYL-FM	97.9
Orange	KOBS-FM	105.5
Palestine	KLIS	94.3
Paris	KPLT-FM	99.3
Pasadena	KLVL-FM	92.5
	KIKK-FM	95.7
Plainview	KHBL	88.1
	KPLA	93.7
Port Arthur	KCAW-FM	93.3
	KPAC-FM	98.5
Robstown	KROB-FM	99.9
Rosenberg	KFRD-FM	104.9
San Angelo	KWLW	93.9
	KIXY	94.7
	KSJT	97.5
San Antonio	KISS	99.5
	KBER-FM	100.3
	KEEZ	97.3
	KAKI-FM	98.1
	KITY	92.9
	KMFM	96.1
	KCOR-FM	101.9
	KITE-FM	104.5
	KSYM-FM	90.3
	KTFM	102.7
Seguin	KWED-FM	105.3
Sherman	KSHN	96.7
Sinton	KTOD-FM	101.3
	KCTA-FM	103.3
Spearman	KBMF-FM	98.3
Stephenville	KWWM	98.3
Temple	KYLE-FM	104.9
Terrell Hills	KBUC-FM	106.3
Texarkana	KTAL-FM	98.1
Tyler	KZAK-FM	93.1
	KNUE	101.5
Victoria	KTXN-FM	98.7
Waco	KEFC	95.5
	KWTX-FM	97.5
	KWBU	89.9
	WACO-FM	99.9
Wichita Falls	KLUR	99.9
	KNTO	95.1

UTAH

Cedar City	KCDR-FM	88.1
Centerville	KSTU	105.5
Ephraim	KEPH	88.9
Logan	KUSU-FM	91.5
Ogden	KBOC	101.9
	KWCR-FM	88.1
Parowan	KPWN	90.9
Provo	KBYU-FM	88.9
	KFMC	96.1
Salt Lake City	KCPX-FM	98.7
	KQMU	94.1
	KRSP-FM	103.5
	KSL-FM	100.3
	KSOP-FM	104.3
	KUER	90.1
	KWHO-FM	93.3
	KWIC	97.1
Spanish Fork	KONI-FM	106.3

VERMONT

Burlington	WJOY-FM	98.9
	WRUV	90.1
	WVNY	92.9
Middlebury	WRMC-FM	91.7
Northfield	WNUB-FM	89.1
Randolph Center	WVTC	90.7
Rutland	WHWB-FM	98.1
St. Albans	WWSR-FM	102.3
White River Junction	WNHV-FM	95.7

VIRGINIA

Abingdon	WBBI-FM	92.7
Altavista	WKDE-FM	105.5
Arlington	WAVA-FM	105.1
Ashland	WIVE-FM	100.1
Blacksburg	WVVV	104.9
	WUVT-FM	90.7
Charlottesville	WINA-FM	95.3
	WTJU	91.3
Chesapeake	WFOS	90.5
Chester	WDYL	92.1
Covington	WKEY-FM	100.9
Crewe	WSVS-FM	104.7
Danville	WBTM-FM	103.3
Farmville	WFLO-FM	95.7
Fredericksburg	WFVA-FM	101.5
	WFLS-FM	93.3
Galax	WBOB-FM	98.1
Gate City	WGAT-FM	104.9
Gretna	WMNA-FM	103.3
Grundy	WNRG-FM	97.7
Hampton	WVEC-FM	101.3
	WHOV	88.3
Harrisonburg	WEMC	91.7
	WMRA	91.1
	WSVA-FM	100.7
Lexington	WLUR	91.5
Lynchburg	WWOD-FM	100.1
	WLLL-FM	98.3
Manassas	WEZR	106.7
Marion	WMEV-FM	93.9
	WOLD-FM	102.3
Martinsville	WMVA-FM	96.3
Newport News	WGH-FM	97.3
Norfolk	WMTI	91.5
	WCMS-FM	100.5
	WNOR-FM	98.7
	WRVC	102.5
	WTAR-FM	95.7
	WTID-FM	104.5
	WXPI	105.3
	WYFI-FM	99.7
Norton	WNVA-FM	106.3
Petersburg	WSSV-FM	99.3
Portsmouth	WAVY-FM	96.9
Pulaski	WPUV-FM	107.1
Radford	WRAD-FM	101.7
Richmond	WTVR-FM	98.1
	WEZS	103.7
	WRFK	91.1
	WRVA-FM	94.5
	WRNL-FM	102.1
Roanoke	WLRJ	92.3
	WPVR	94.9
	WSLS-FM	99.1
Salem	WJLM	93.5
South Boston	WHLF-FM	97.5
South Hill	WJWS-FM	105.5
Staunton	WSGM	93.5
Suffolk	WFOG	92.9
Tappahannock	WRAR-FM	105.5
Tasley	WESR-FM	103.3
Tazewell	WTZE-FM	100.1
Warrenton	WEER-FM	107.7
Warsaw	WNNT-FM	100.9
Williamsburg	WCWM	89.1
	WBCI-FM	96.5
Winchester	WRFL	92.5
	WEFG	102.5
Woodbridge	WXRA	105.9
Yorktown	WYCS	91.5

WASHINGTON

Aberdeen	WDUX	104.7
Bellevue	KFKF-FM	92.5
Bellingham	KVGM	92.9
	KERI	104.3
Bremerton	KBRO-FM	106.9
Centralia	KELA-FM	102.9
Cheney	KEWC-FM	89.1
College Place	KGTS	91.3
Edmonds	KBIQ	105.3
Ellensburg	KCWS-FM	91.5
Hoquiam	KGHO-FM	103.9
Kennewick	KONA-FM	105.3
Longview	KLYK	105.5
Lynden	KLYN-FM	106.5
Mercer Island	KMIH	90.1
Moses Lake	KWIQ-FM	100.3
Opportunity	KZUN-FM	96.1
Prosser	KACA	101.7
Pullman	KPUL-FM	104.9
Richland	KORD-FM	102.7
Seattle	KING-FM	98.1

WHITE'S RADIO LOG

Location	Call	MHz
	KBBX	98.9
	KBLE-FM	93.3
	KETO-FM	101.5
	KIRO-FM	100.7
	KISW	99.9
	KLSN	96.5
	KOL-FM	94.1
	KRAB	107.7
	KTW-FM	102.5
	KUOW	94.9
	KIXI-FM	95.7
Spokane	KREM-FM	92.9
	KCFA-FM	107.9
	KDNC FM	93.7
	KTWD	105.7
	KXLY-FM	99.9
	KHQ-FM	98.1
Tacoma	KCPS	90.9
	KLAY-FM	106.1
	KPLU	88.5
	KTNT-FM	97.3
	KTOY	91.7
	KTAC-FM	103.9
Wenatchee	KPQ-FM	102.1
Yakima	KNDX	104.1
	KMWX-FM	107.3
	KIT-FM	94.5

WEST VIRGINIA

Beckley	WBKW	99.5
Berkley Springs	WCST-FM	93.5
Bethany	WVBC	88.1
Bluefield	WHIS-FM	104.5
Buckhannon	WVWC	88.9
Charleston	WKAZ-FM	97.5
	WCHS-FM	96.1
	WKNA	98.5
	WTIO	102.7
	WVAF	99.9
Charlestown	WZFM	98.3
Huntington	WKEE-FM	100.5
	WMUL	88.1
	WVQM	103.3
Logan	WVOW-FM	101.9
Martinsburg	WEPM-FM	97.5
Morgantown	WAJR-FM	101.9
Oak Hill	WOAY-FM	94.1
Parkersburg	WTAP-FM	103.1
	WCEF-FM	99.3
St. Albans	WKLC-FM	105.1
Welch	WKJC	106.3
Wheeling	WKWK-FM	97.3
	WWVA-FM	98.7
	WTRF-FM	107.5

WISCONSIN

Appleton	WLFM	91.1
	WAPL-FM	105.7
Baraboo	WLVE	94.9
Beaver Dam	WBEV-FM	95.3
Beloit	WBCR-FM	88.1
Chilton	WHKW	89.3
Chippewa Falls	WCFW	105.5
Colfax	WHWC	88.3
Delafield	WHAD	90.7
Dodgeville	WDMP-FM	107.1
Eau Claire	WIAL	94.1
	WBIZ-FM	100.7
	WEAU-FM	104.5
Fond du Lac	WFON	107.1
Fort Atkinson	WFAW	107.3
Green Bay	WBAY-FM	101.1
	WDUZ-FM	98.3
Greenfield Twp.	WWCF	94.9
Hayward	WRLS-FM	92.1
Highland	WHHI	91.3
Highland Twp.	WHSA	89.9
Janesville	WJVL	99.9
Kaukauna	WVLE	104.9
Kenosha	WKZN	96.9
	WLIP-FM	95.1
La Crosse	WHLA	90.3
	WWLA	93.3
Madison	WHA-FM	88.7
	WIBA-FM	101.5
	WISM-FM	98.1
	WMFM	104.1(s)
	WRVB-FM	102.5
Manitowoc	WKUB	92.1
Marinette	WHMD	91.5
Marshfield	WDLB-FM	106.5
Medford	WGIM-FM	99.3
Menomonie	WZFM	98.3
	WDMW	92.1
	WVSS	89.5
Merrill	WLIN	100.7
Milwaukee	WXMT-FM	93.5
	WFMR	96.5
	WMIL-FM	99.7
	WISN-FM	97.3
	WRIT-FM	102.9
	WAWA-FM	102.1
	WQFM	93.3
	WTMJ-FM	94.5
	WBON	107.7
	WNUW	99.1
	WUWM	89.7
	WYMS	88.9
Monroe	WEKZ-FM	93.7
Neenah-Menasha	WDCC	99.3
Neillsville	WCCN-FM	107.5
New London	WLIH-FM	93.5
New Richmond	WIXK-FM	107.1
Oconto	WOCO-FM	107.1
Oshkosh	WMKC	96.7
	WRST-FM	88.1
	WOSH-FM	103.9
Park Falls	WNBI-FM	98.3
Platteville	WSUP	90.5
	WSWW-FM	99.3
Portage	WPDR-FM	100.1
Port Washington	WGLB-FM	100.1
Prairie du Chien	WPRE-FM	94.3
Racine	WRAC-FM	100.7
	WFNY	92.1
Reedsburg	WRDB-FM	104.9
Rhinelander	WOBT-FM	107.9
Rice Lake	WJMC-FM	96.3
Richland Center	WRCO-FM	100.9
Ripon	WCWC-FM	95.9
River Falls	WEVR-FM	106.3
	WRFW	88.7
Sauk City	WVLR	96.7
Shawano	WTCH-FM	100.1
Sparta	WCOW-FM	97.1
Stevens Point	WSPT-FM	97.9
	WSUS	89.9
Sturgeon Bay	WDOR-FM	95.9
Superior	WWJC-FM	105.1
	WSSU	91.3
Suring	WRVM	102.7
Tomah	WTMB-FM	98.9
Two Rivers	WQTC-FM	102.3
Viroqua	WGBM	102.3
Watertown	WTTN-FM	104.7
Waukesha	WAUK-FM	106.1
Waupaca	WDUX-FM	92.7
Wausau	WRIG-FM	101.9
	WHRM	91.9
Wauwatosa	WIFC	95.5
	WTOS	103.7
West Bend	WBKV-FM	92.5
Whitewater	WSUW	91.7
Wisc. Rapids	WWRW	103.3

WYOMING

Casper	KAWY	94.5
Cheyenne	KVWO-FM	106.3
	KFBC-FM	97.9
Laramie	KUWR	91.5

GUAM

Agana	KUAM-FM	93.9

PUERTO RICO

Arecibo	WCMN-FM	107.3
	WNIK-FM	106.5
Aguadilla	WABA-FM	100.3
Bayamon	WRSJ-FM	100.7
	WEYA	84.7
Caguas	WVJP-FM	103.3
Camuy	WCHQ-FM	102.9
Carolina	WVDZ-FM	107.7
	WOLA-FM	107.7
Corozal	WORD	92.5
Fajardo	WMDD-FM	94.7
Guayama	WXRE-FM	96.5
Isabela	WISA-FM	101.5
Mayaquez	WKJB-FM	99.1
	WORA-FM	97.5
	WDYE-FM	94.1
Ponce	WLEO-FM	101.9
	WPAB-FM	93.3
	WPRP-FM	105.1
San German	WRPC	95.1
San Juan	WIPR-FM	91.3
	WIAE-FM	102.5
	WITA-FM	107.7
	WKAQ-FM	104.7
	WKVM-FM	105.7
	WPRM	98.5
	WOBS-FM	99.9
Utuado	WUPR-FM	104.1

VIRGIN ISLANDS

Chalotte Amalie	WBNB-FM	97.9
	WESP	101.1
Christiansted	WIVI-FM	99.5

Canadian AM Stations by Location

Location	Call	kHz
Abbotsford, B.C.	CFVR	1240
Ajax, Ont.	CHOO	1390
Alma, Que.	CFGT	1270
Altona, Man.	CFAM	950
Amherst, N.S.	CKDH	900
Amos, Que.	CHAD	1340
Antigonsh, N.S.	CJFX	580
Barrie, Ont.	CKBB	950
Bathhurst, N.B.	CKBC	1360
Belleville, Ont.	CJBQ	800
Blind River, Ont.	CJNR	730
Brampton, Ont.	CHIC	790
Brandon, Man.	CKX	1150
Brantford, Ont.	CKPC	1380
Bridgewater, N.S.	CKBW	1000
Brockville, Ont.	CFJR	1450
Burns Lake, B.C.	CFLD	1400
Cabano, Que.	CJAF	1240
Calgary, Alta.	CBR	1010
	CFAC	960
	CFCN	1060
	CFVP	6030
	CHQR	810
	CKXL	1140
Callander, Ont.	CFCH	600
Cambell River, B.C.	CFWB	1490
Campbellton, N.B.	CKNB	950
Camrose, Alta.	CFCW	790
Castlegar, B.C.	CKQR	1230
Causapscal, Que.	CJBM	1450
Charlottetown, P.E.I.	CFCY	630
Chatham, Ont.	CFCO	630
Chicoutimi, Que.	CBJ	1580
	CJMT	1420
Chilliwack, B.C.	CHWK	1270
Churchill, Manitoba	CHFC	1230
Cobourg, Ontario	CHUC	1450
Collingwood, Ont.	CKCB	1400
Corner Brook, Nfld.	CBY	990
	CFCB	570
	CJSS	1220
Cornwall, Ontario	CFML	1110
Courtenay, B.C.	CFCP	1440
Cranbrook, B.C.	CKEK	570
Creston, B.C.	CFKC	1340
Dartmouth, N.S.	CFDR	790
Dauphin, Man.	CKDM	730
Dawson Creek, B.C.	CJDC	1350
Dolbeau, P.Q.	CHVD	1230
Drumheller, Alta.	CJDV	910
Drummondville, Que.	CHRD	1480
Dryden, Ont.	CKDR	900
Duncan, B.C.	CKAY	1500
Edmonton, Alta.	CBX	740
	CFRN	1260
	CHED	630
	CHFA	680
	CHQT	1110
	CJCA	930
	CKUA	580
Edmundston, N.B.	CJEM	570
Edson, Alta.	CJYR	970
Elliott Lake, Ont.	CKNR	1340
Estevan, Sask.	CJSL	1280
Flin Flon, Man.	CFAR	590
Fort Frances, Ont.	CFOB	800
Fort Nelson, B. C.	CFNL	590
Fort Simpson, N.W.T.	CFMR	1490
Fort St. John, B.C.	CKNL	560
Fort William, Ont.	CJLX	800
Fredericton, N.B.	CBZ	970
	CFNB	550
Frobisher Bay, N.W.T.	CFFB	1200
Galt, Ont.	CFTJ	1110
Gander, Nfld.	CBG	1450
Gander, Nfld.	CKGA	730
Granby, Que.	CHEF	1450
Grande Prairie, Alta.	CFGP	1050
Grand Bank, Nfld.	CJOX	710
Grand Falls, Nfld.	CBT	640
	CKCM	620
	CJCN	680
Grand Forks, B.C.	CKGF	1340
Gravelbourg, Sask.	CFRG	710
	CFGR	1230
Guelph, Ont.	CJOY	1460
Halifax, N.S.	CBH	660
	CHNS	960
	CHNX	6130
	CJCH	920
Hamilton, Ont.	CHAM	1280
	CHML	900
	CKOC	1150
Happy Vallley, Nfld.	CFGB	1340
Hauterive, Que.	CHLC	580
Hearst, Ont.	CFLH	1340
Huntsville, Ont.	CKAR	630
Hull, Que.	CKCH	970
Inuvik, N.W.T.	CHAK	860
Joliette, Que.	CJLM	1350
Jonquiere, Que.	CKRS	590
Kamloops, B.C.	CFJC	910
Kapuskasing, Ont.	CFLK	1230
	CKAP	580
Kelowna, B.C.	CKOV	630
Kenora, Ont.	CJRL	1220
Kentville, N.S.	CKEN	1490
Kingston, Ont.	CFRC	1490
	CKLC	1380
	CKWS	960
Kirkland Lake, Ont.	CJKL	560
Kitchener, Ont.	CHYM	1490
	CKKW	1320
Kitimat, B.C.	CKTK	1230
Lac Megantic, Que.	CFKL	1340
Langley, B.C.	CJJC	850
La Pocatiere, Que.	CHGB	1310
La Sarre, Que.	CKLS	1240
La Tuque, Que.	CFLM	1240
Leamington, Ont.	CHIR	730
	CHYR	710
Lethbridge, Alberta	CHEC	1090
	CJOC	1220
Levis, Que.	CFLS	1240
Lindsay, Ont.	CKLY	910
Lloydminster, Alta.	CKSA	1090
London, Ont.	CFPL	980
	CJQE	1290
	CKSL	1410
Marystown, Nfld.	CHCM	560
Matane, Que.	CKBL	1250
Medicine Hat, Alta.	CHAT	1270
Melfort, Sask.	CJVR	1420
Middleton, N.S.	CKAD	1350
Midland, Ontario	CKMP	1230
Moncton, N.B.	CBA	1070
	CBAF	1300
	CKCW	1220
Mont Laurier, P.Q.	CKML	610
Montmagny, Que	CKBM	1490
Montreal, Que.	CBF	690
	CBM	940
	CFCF	600
	CFMB	1410
	CJAD	800
	CJMS	1280
	CKAC	730
	CKLM	1570
	CKGM	980
Moose Jaw, Sask.	CHAB	800
Nanaimo, B.C.	CHUB	1570
Nelson, B.C.	CKKC	1390
New Carliste, Que.	CHNC	610
Newcastle, N.B.	CKMR	790
New Glasgow, N.S.	CKEC	1320
New Liskeard, Ont.	CJTT	1230
New Westminster, B.C.	CKNW	980
Niagara Falls, Ont.	CJRN	1600
North Battleford, Sask.	CJNB	1050
North Vancouver, B.C.	CKLG	730
Oakville, Ont.	CHWO	1250
Orillia, Ont.	CFOR	1570
Oshawa, Ont.	CKLB	1350
Osoyoos, B.C.	CKOO	1240
Ottawa, Ont.	CBO	910
	CBOF	1250
	CFRA	580
	CJRC	1150
	CKOY	1310
	CKPM	1440
Owen Sound, Ont.	CFOS	560
Parry Sound, Ont.	CKAR-I	1340
Peace River, Alta.	CKYL	610
Pembroke, Ont.	CHOV	1350
Pentieton, B.C.	CKOK	800
Peterborough, Ont.	CHEX	980
	CKPT	1420
Pointe Claire, Que.	CFOX	1470
Portage La Prairie, Man.	CFRY	920
Port Alberni, B.C.	CJAV	1240
Port Arthur, Ont.	CFPA	1230
	CKPR	580
Powell River, B.C.	CHQB	1280
Prince Albert, Sask.	CKBI	900
Prince George, B.C.	CKPG	550
Prince Rupert, B.C.	CFPR	860
	CHTK	560
Quebec, Que.	CBV	980
	CHRC	800
	CJRP	1060

Location	Call	kHz
	CKCV	1280
Quesnel, B.C.	CKCQ	570
Red Deer, Alta.	CKRD	850
Regina, Sask.	CBK	540
	CJME	1800
	CKCK	620
	CKRM	980
Revelstoke, B.C.	CKCR	1340
Richmond Hill, Ont.	CFGM	1310
Rimouski, Que.	CJBR	900
Rivière du Loup, Que.	CJFP	1400
Roberval, Que.	CHRL	910
Rosetown, Sask.	CKKR	1330
Rouyn, Que.	CKRN	1400
Ste Agathe des Monts, Que.	CJSA	1230
Ste-Anne-des-Monts, Que.	CKGN	1340
St. Anthony	CBNA	600
St. Boniface, Man.	CKSB	1050
St. Catharines, Ont.	CHSC	1220
	CKTB	610
St. Eleuthere, Que.	CHRT	1450
St. Hyacinthe, Que.	CKBS	1240
St. Jean, Que.	CHRS	1090
St. Jérome, Que.	CKJL	900
St. John's, Nfld.	CBN	640
	CJON	930
	CKZN	6160
	VOAR	1230
	VOCM	590
	VOWR	800
St. Thomas, Ont.	CHLO	680
Saint John, N.B.	CBD	1110
	CFBC	930
	CHSJ	1150
Salmon Arm, B.C.	CKXR	580
Sarnia, Ont.	CHOK	1070
	CKJD	1250
Saskatoon, Sask.	CFNS	1170
	CFQC	600
	CKOM	1250
Saulte Ste. Marie, Ont.	CJIC	1050
	CKCY	920
Schefferville	CBDR	1230
Sept-Iles, Que.	CKCN	560
Shaunavon, Sask.	CJSN	1490
Shawinigan, Que.	CKSM	1220
Sherbrooke, Que.	CHLT	630
	CJRS	1510
	CKTS	900
Simcoe, Ont.	CFRS	1560
Smiths Falls, Ont.	CJET	630
Smithers, B.C.	CFBV	1230
Sorel, Que.	CJSO	1320
Stratford, Ont.	CJCS	1240
Steinbach, Man.	CHSM	1250
Stephenville, Nfld.	CFSX	910
Sudbury, Ont.	CFBR	550
	CHNO	900
	CKSO	790
Summerside, P.E.I.	CJRW	1240
Swift Current, Sask.	CKSW	1400
Sydney, N.S.	CBI	1140
	CHER	950
	CJCB	1270
	CJCX	6010
Terrace, B.C.	CFTK	590
Thetford Mines, Que.	CKLD	1230
Thompson, Man.	CHTM	610
Tillsonburg, Ont.	CKOT	1510
Timmins, Ont.	CFCL	620
	CKGB	680
Toronto, Ont.	CBL	740
	CFRB	1010
	CFRX	6070
	CHFI	680
	CHIN	1540
	CHUM	1050
	CJBC	860
	CKEY	590
	CKFH	1430
Trail, B.C.	CJAT	610
Trois-Rivières, Que.	CHLN	550
	CJTR	1150
Truro, N.S.	CKCL	600
Val d'Or, Que.	CKVD	900
Valleyfield, Que.	CFLV	1370
Vancouver, B.C.	CBU	690
	CHQM	1320
	CJOR	600
	CKFX	6080
	CKLG	730
	CKVN	1410
	CKWX	1130
	CKZU	6160
Verdun, Que.	CKVL	850
Vernon, B.C.	CJIB	940
Victoria, B.C.	CFAX	1070
	CJVI	900
	CKDA	1220
Victoriaville, Que.	CFDA	1380
Ville Marie, Que.	CKVM	710
Ville St. Georges, Que.	CKRB	1460
Ville Vanier, Que.	CFOM	1340
Wawa, Ont.	CJWA	1240
Welland, Ont.	CHOW	1470
Weyburn, Sask.	CFSL	1190
Whitehorse, Y.T.	CFWH	570
Williams Lake, B.C.	CKWL	1240
Windsor, N.S.	CFAB	1450
Windsor, Ont.	CBE	1550
	CKLW	800
	CKWW	580
Wingham, Ont.	CKNX	920
Winnipeg, Man.	CBW	990
	CFRW	1470
	CJOB	680
	CKRC	630
	CKY	580
Woodstock, N.B.	CJCJ	920
Woodstock, Ont.	CKOX	1340
Yarmouth, N.S.	CJLS	1340
Yellowknife, N.W.T.	CFYK	1340
Yorkton, Sask.	CJGX	940

Canadian FM Stations by Location

Location	Call	kHz
Belleville, Ont.	CJBQ-FM	97.1
Brampton, Ont.	CHIC-FM	102.1
Brandon, Man.	CKX-FM	96.1
Brantford, Ont.	CKPC-FM	92.1
Calgary, Alta.	CHFM-FM	95.9
Clearwater, B.C.	CFFM-FM-2	92.7
Clinton, B.C.	CFFM-FM-4	106.5
Cornwall, Ontario	CJSS-FM	104.5
Edmonton, Alta.	CFRN-FM	100.3
	CJCA-FM	99.5
	CKUA-FM	98.1
Guelph, Ont.	CJOY-FM	106.1
Halifax, N.S.	CHNS-FM	96.1
Hamilton, Ont.	CKDS-FM	95.3
Kamloops, B.C.	CFFM-FM	98.3
Kelowna, B.C.	CJOV-FM	104.7
Kentville, N.S.	CKWM-FM	97.7
Kingston, Ont.	CFRC-FM	91.9
	CKLC-FM	98.3
	CKWS-FM	96.3
Kitchener, Ont.	CFCA-FM	105.3
	CHYM-FM	96.7
La Pocatière, Que.	CHGB-FM	102.9
Laval, Que.	CFGL-FM	105.7
Lethbridge, Alberta	CHEC-FM	100.9
London, Ont.	CFPL-FM	95.9
Maniwaki, Que.	CBFL-FM	98.9
Merritt, B.C.	CFFM-FM-3	103.9
Mount Timothy, B.C.	CFFM-FM-5	99.7
Montreal, Que.	CBF-FM	95.1
	CBM-FM	100.7
	CFQR-FM	92.5
	CJFM-FM	95.9
	CJMS-FM	94.3
	CKGM-FM	97.7
North Bay, Ont.	CKAT-FM	93.7
Oshawa, Ont.	CKQS-FM	94.9
Ottawa, Ont.	CBO-FM	103.3
	CFMO-FM	93.9
Penticton, B.C.	CKOK-FM	97.1
Peterborough, Ont.	CHEX-FM	101.5
Port Arthur, Ont.	CKPR-FM	94.3
Quebec, P.Q.	CHRC-FM	98.1
Red Deer, Alberta	CKRD-FM	98.9
Regina, Sask.	CFMQ-FM	92.1
Richibucto, N.B.	CBHM-FM	98.5
Rimouski, Que.	CBJR-FM	101.5
Saint John, N.B.	CFBC-FM	98.9
Saskatoon, Sask.	CFMC-FM	103.9
	CJUS-FM	89.7
Sault Ste. Marie, Ont.	CJIC-FM	100.5
	CKCY-FM	104.3
Savona, B.C.	CFFM-FM	101.9
Sherbrooke, Que.	CHLT-FM	102.7
Smiths Falls, Ont.	CJET-FM	101.1
St. Catharines, Ont.	CHSC-FM	105.7
	CKTB-FM	97.7
Sudbury, Ont.	CKSO-FM	92.7
Sydney, N.S.	CJCB-FM	94.9
Tillsonburg, Ont.	CKOT-FM	100.5
Timmins, Ont.	CKGB-FM	94.5
Toronto, Ont.	CBL-FM	94.1
	CHFI-FM	98.1
	CHIN-FM	100.7
	CHUM-FM	104.5
	CJRT-FM	91.1
	CKFM-FM	99.9
Trail, B.C.	CJAT-FM	106.7
Truro, N.S.	CKCL-FM	100.9
Vancouver, B.C.	CBU-FM	105.7
	CBUF-FM	97.7
	CHQM-FM	103.5
	CKLG-FM	99.3
Verdun, Que.	CKVL-FM	96.9
Victoria, B.C.	CFMS-FM	98.5
Windsor, Ont.	CKLW-FM	93.9
	CKWW-FM	88.7
Winnipeg, Man.	CBW-FM	98.3
	CFRW-FM	94.3
	CJOB-FM	97.5
	CKY-FM	92.1

White's World-Wide Shortwave Stations

Prepared by Don Jensen

We get letters.

"I've tried over and over to hear certain stations, but I can't. What's wrong? Do I need a new receiver?"

And we get letters.

"Your shortwave list is a bummer! I tuned for some of the stations but they aren't there. Shape up, huh!"

Whether inquiry or complaint, the root cause is the same. Some of you simply aren't hearing stations you think you should be hearing.

The complainers—happily, a relative handful—think they know why. It's our fault for giving them a bum steer. To them we'd argue that goofs in White's Worldwide Shortwave Stations list are few. And, when they occur, usually it is because the station has changed schedule or frequency after this column has been "locked up" by the printer.

To those who wonder if new listening equipment would solve their problems, we'd suggest that it won't help as much as you think. What is really needed, in most cases, is not a scapegoat—man or machine—but, rather, a better understanding of DXing.

The first thing to realize is that SWLing isn't like watching TV, where you check the program guide, switch the channel, and—*bingo*—there it is. White's SW list, for example, shows Radio Nepal on 11,970 kHz. at 0120 GMT. But it would be unrealistic to expect to hear this station on a regular, daily basis. Maybe you'll hear it the first time you try, but then again it may take ten tries, or a hundred.

Knowledge is the key to successful shortwave listening. Knowledge comes with experience. Learn what you can about radio frequency propagation. Learn what phenomena affect reception, when to expect optimum reception conditions, when log-

gings over certain global paths are unlikely or technically impossible. Your radio supply store should carry several books for Hams and SWLs that will explain the basics of radio frequency propagation. Pick up a copy and study it. Your own listening will show you when signals from various parts of the world fade in and out on the different shortwave bands.

For many beginning SWLs, language is a problem too. A little study of the major broadcasting languages can go a long way to help. A few key words in each language will allow you to identify many stations that don't air English programs. At the very least, learn the difference in "sound" between languages. Even if you don't understand a word, you can tell Spanish from Portuguese, German from Arabic.

Learn as much as you can about the stations and countries for which you're tuning. A reference notebook, with a page or so for notes on each "wanted" station, may help. Would you expect to hear Spanish programs from a Brazilian station? You'd be surprised how many hobby newcomers do. On which African stations would French programming be likely? Can you tell the difference between Latin American and West African music? Between the music of Mexico and Peru?

Every bit of data you store away may prove useful to you some day in your DX activities. In shortwave listening, savvy is about 80 per cent of the game. Equipment makes up the other 20 per cent.

A widespread misconception among listeners is that a new (and usually more expensive) receiver is all they need to jump their totals from 50 to 150 countries heard in short order. Moving too quickly from an inexpensive receiver to a $500 Super-G-Whiz can mean disappointment and bitter complaints that the new rig is no better than the old.

Learn to use your present receiving equipment to the best advantage. Even with an inexpensive, kit-built receiver, until you've heard at least 100 different countries, you haven't tapped its full potential. And you will have learned a lot about DXing along the way. There is nothing magical about a more sophisticated radio. It can shave the DX odds in your favor, true, but only if you have the knowhow to take advantage of its superior features. And this takes time.

Don't expect too much, too fast! Take the time to learn as much as you can about the hobby and about your own gear. If you haven't the patience and perseverance, this isn't the place for you. But if you do, you'll find DXing the shortwave bands rewarding, relaxing and fun!

Speaking of Letters. We recently received

Propagation Forecast for August/September 1970

Prepared by C. M. Stanbury II

LISTENER'S STANDARD TIME	ASIA (except Near East)	EUROPE, NEAR EAST & AFRICA (N. of the Sahara)	AFRICA (S. of the Sahara)	SOUTH PACIFIC	LATIN AMERICA
0000-0300	31	31, 41, (49)	31w, 60e	41, (60), (90)	49, 60, (90)
0300-0600	31, 41, (49w)	31 (poor)	19w, 31e	49, 60, 90, (75)	49, 60, (90)
0600-0900	31, (41), (49w)	(16), 19	19, (49w)	25, 31, 60	31, (49)
0900-1200	19, 25	16, 19	19, 25	25	(16), 25, (31)
1200-1500	19, 25	16, 19	19, 25	19	(16), 25, (31)
1500-1800	41	(19), 25, 31, (49)	41w, 60, 90e	19, 25	25, 31
1800-2100	16, 19, (41)	25, 31	25, 31e, 60, 90w	(16), 19	60, 90
2100-2400	19, (31w)	31, 41, 49	60, 90	25, (31w)	60, 90

one from a Michigander who signed it, "Super DXer." In all fairness, lest you condemn him for a certain lack of humility, he appended, parenthetically, "more or less."

So much for "Super DXer," but his signature brings to mind some of the other nicknames used by listeners past and present.

One SWL named Paul calls himself "The Big P." Wonder if he's related to another fellow known as "The Jolly Green DXer?" Then there's the "Hoosier Hotshot," and "Mighty Mike," neither of which will win any awards for originality.

A Wisconsin listener has adopted the rank of "Captain" and decorated his DX den in a nautical motif. His listening reports are headed, "From the Captain's log." Well-known medium waver Gordon Nelson of Watertown, Mass., is called "The Admiral," an obvious reference to the hero of Trafalgar, whose surname he bears. And veteran listener Lloyd Hahn, now retired in Florida, is still known as "Rooster" to old timers in the Newark News Radio Club.

Some months ago you may have seen an NBC-TV news interview with William Prater, an official of the United Mine Workers union. What you probably don't know is that Prater, a Tennesseean, once was known in hobby circles as the "Hillbilly DXer," with a log of several thousand stations heard.

But our favorite DX monicker belongs to a New York State listener, Carleton Lord. Many years ago he joined the ranks of nobility by proclaiming himself "Count de Veries." Think about that one!

This Issue's Shortwave Contributors

Everett Slosman (NY); Kim Elliot (Ind.); Carroll Patterson (Ga.); Rick Anderson (Ill.); Frank Peters (Ill.); Marlin Field (Mich.); Christopher Lobdell (Mass.); Dan Ferguson (Fla.); Gregg Calkin (Canada); Bill Sparks (Cal.); Edward Shaw (Cal.); Marvin Robbins (Nebr.); Sam Rowell (Wash.); Don Billingsley (Cal.); Del Hirst (Tex.); Alvin Sizer (Conn.); George Schnabel (NY); A. R. Niblack (Ind); David Williams (Ore.); Richard E. Wood (Hawaii); Dan Henderson (Md.); Leo Alster (NJ); Gerry Dexter (Wis.); Michael Macken (Mass.); Jim Young (Cal.); Bill Berghammer (NY); Bob Smith (Mich.); John Boessenecker (Cal.); Douglas Smith (Cal.); David Cross (Canada); Newark News Radio Club, 215 Market St., Newark, N.J.; North American SW Association, Box 989, Altoona, Penna.

kHz.	Call	Name	Location	GMT
2410	4VU	R. Lumiere	Cayes, Haiti	1100
2474	—	—	Hangchow, China	1300
2510	—	Korean Bc Svc	Seoul, Korea	1300
90-Meter Band—3200 to 3400 kHz				
3215	YVOE	Ondas Panamericanas	El Vigia, Venezuela	0500
3218	—	R. Clube Mozambique	Lorenco Marques, Mozambique	0430
3230	VRH8	R. Fiji	Suva, Fiji	0800
3232	—	RTV Malgache	Tananarive, Malagasy Rep.	0300
3245	VL8BK	R. Kerema	Kerema, Papua Territory	1050
3255	ELBC	Liberian Bc Co	Monrovia, Liberia	2240
3259	—	NHK	Sendai, Japan	0900
3265	ZFY	R. Demerara	Georgetown, Guyana	0950
3275	ZYK28	R. Olinda	Recife, Brazil	0300
3280	—	Windward Is. Bc Svc	St. Georges, Grenada	0100
3305	VL8BD	R. Western District	Daru, Papua Territory	0900
3316	—	R. Sierra Leone	Freetown, Sierra Leone	0700
3320	—	R. Pyongyang	Pyongyang, N. Korea	1400
3350	HIBD	L.V. de la Romana	Sto. Domingo, Dominican Rep.	0200
3385	—	R. Cayenne	Cayenne, Fr. Guiana	0030
3385	YVQI	R. Barcelona	Barcelona, Venezuela	0215
3386	CR4AA	R. Clube Cabo Verde	Praia, Cape Verde Is.	2245
3395	YVOK	R. Universidad	Merida, Venezuela	0245
3396	—	RTV Kaduna	Kaduna, Nigeria	0500
60-Meter Band—4750 to 5060 kHz				
4650	HCAK2	R. del Ecuador	Guayaquil, Ecuador	0000
4712	HCAV3	R. Luz y Vida	Loja, Ecuador	0600
4735	HCBK2	R. El Mundo	Guayaquil, Ecuador	0300
4753	—	R. Republik Indonesia	Makasar, Indonesia	1230
4767	HJDY	R. Catatumbo	Ocana, Colombia	0300
4770	ELWA	Sudan Interior Mission	Monrovia, Liberia	0700
4770	YVNW	R. Bolivar	C. Bolivar, Venezuela	0100
4777	—	RTV Gabonaise	Libreville, Gabon	0500
4790	HCVP2	R. Atalaya	Guayaquil, Ecuador	0500
4800	—	All India R.	Hyderabad, India	1530
4800	—	ORTF Relay	Brazzaville, Congo Rep.	2200
4807	—	R. Clube Sao Tome	Sao Tome	2115
4807	—	ORTF	St. Denis, Reunion Is.	0230
4815	—	RTV Voltaique	Ouagadougou, Upper Volta	0630
4820	CR6RZ	R. Angola	Luanda, Angola	0530
4820	HRVC	L.V. Evangelica	Tegucigalpa, Honduras	0330
4825	—	—	Ashkabad, USSR	0215
4825	HIFA	L.V. Fuerzas Armadas	Sto. Domingo, Dominican Rep.	0100
4828	—	Rhodesian Bc Co	Salisbury, Rhodesia	0400
4834	—	R. Mali	Bamako, Mali	0700
4839	—	R. Bukavu	Bukavu, Congo	0430
4845	—	R. Botswana	Gaberones, Botswana	0400
4850	—	R. Nat. Mauritanie	Nouakchott, Mauritania	2145
4855	—	R. Clube Mozambique	Lorenco Marques, Mozambique	0415
4855	YDK	R. Republik Indonesia	Palembang, Indonesia	1330
4865	—	Emisora Regional Acores	Ponta Delgada, Azores	2230
4865	PRC5	R. Clube Para	Belem, Brazil	0900
4885	—	V. of Kenya	Nairobi, Kenya	0400
4887	ZYG26	R. Pioneira	Teresina, Brazil	0930
4895	OAZ4T	R. Chanchamayo	La Merced, Peru	0700
4912	—	Gilbert/Ellice Bc Svc	Tarawa, Gilbert & Ellice Is.	0730
4915	—	V. of Kenya	Nairobi, Kenya	0330
4920	VLM4	Australian Bc. Corp.	Brisbane, Australia	0830

WHITE'S SHORTWAVE SECTION

kHz.	Call	Name	Location	GMT
4926	—	R. Ecuatorial	Bata, Rio Muni	0530
4930	HRVS	R. Catolica	Tegucigalpa, Honduras	1050
4932	—	Nigerian Bc Corp.	Benin City, Nigeria	0600
4940	—	—	Kiev, USSR	0330
4945	ZYE23	R. Educadora	Braganca, Brazil	0935
4950	—	R. Malaysia Sarawak	Kuching, Sarawak	1300
5015	—	Windward Is. Bc Svc	St. Georges, Grenada	2300
5035	—	R. Nat. Centafricaine	Bangui, Central African Rep.	2200
5040	—	Burma Bc Svc	Rangoon, Burma	1200
5085	—	R. Republik Indonesia	Medan, Indonesia	1200

49-Meter Band—5950 to 6200 kHz

5804	—	R. Sanaa	Sanaa, Yemen	0330
5935	YNW	R. Nacional Nicaragua	Managua, Nicaragua	0000
5950	YNRC	R. Zelaya	Bluefields, Nicaragua	0135
5955	TGNA	R. Culturol	Guatemala City, Guatemala	0300
5955	—	R. Berlin International	Berlin, E. Germany	0230
5960	CR6RZ	A Voz de Angola	Luanda, Angola	0500
5960	HRRH	L.V. de Occidente	Sta. Rosa Copan, Honduras	1200
5980	YSS	R. Nacional El Salvador	San Salvador, El Salvador	0000
5985	—	R. Tanzania	Dar es Salaam, Tanzania	0330
5985	LRS2	R. Splendid	Buenos Aires, Argentina	0130
5990	—	R. Sweden	Stockholm, Sweden	0015
5990	HCFA4	L.V. Manabi	Portovielo, Ecuador	1200
6005	CFCX	Canadian Marconi	Montreal, Canada	2300
6005	—	RIAS	Munich, Germany	0400
6010	CJCX	Cape Breton Bc.	Sydney, Canada	1130
6010	—	RAI	Rome, Italy	0100
6020	OAX4Q	R. Victoria	Lima, Peru	1130
6020	XEUW	Eco de Sotavento	Vera Cruz, Mexico	1200
6025	—	R. Portugal	Lisbon, Portugal	0230
6045	HOU3I	L.V. Baru	David, Panama	0300
6050	HRLP	R. America	Tegucigalpa, Honduras	0430
6055	—	R. Rep. Rwandaise	Kigali, Rwanda	0400
6060	—	RAI	Caltanisetta, Sicily	0800
6075	HJCT	R. Sutatenza	Bagota, Colombia	0100
6075	—	R. South Africa	Johannesburg, South Africa	0430
6080	—	RTV Algerienne	Algiers, Algeria	0700
6082	OAX4Z	R. Nacional	Lima, Peru	0230
6085	—	Bayerischer R.	Munich, Germany	0600
6090	XECMT	R. Mante	C. Mante, Mexico	1230
6090	VLI6	Australian Bc Corp	Sydney, Australia	1230
6095	—	R. Baghdad	Baghdad, Iraq	2000
6097	—	R. Mogadiscio	Mogadiscio, Somalia	0330
6100	—	R. Belgrade	Belgrade, Yugoslavia	2200
6105	XEQM	R. Yucatan	Merida, Mexico	0430
6130	—	R. Ghana	Accra, Ghana	2130
6135	—	R. Warsaw	Warsaw, Poland	1900
6140	—	L.V. Revolution	Bujumbura, Burundi	0430
6141	HCDE4	R. Vision Manta	Manta, Ecuador	0445
6155	—	Far East Network	Tokyo, Japan	1130
6155	—	Oesterreicher R.	Vienna, Austria	0800
6165	—	R. Zambia	Lusaka, Zambia	0500
6170	—	Philippine Bc Svc	Manila, Philippines	1050
6195	—	R. Bremen	Breman, Germany	0700
6210	—	R. Nordsee International	International Waters	2230
6250	—	R. Sta Isabel	Sta. Isabel, Eq. Guinea	2200

41-Meter Band—7100 to 7300 kHz

7035	—	R. Peking	Peking, China	2330
7050	—	R. Cairo	Cairo, Egypt	0300.
7065	—	R. Tirana	Tirana, Albania	0630
7115	—	RTV Marocaine	Seboa-Aioun, Morocco	0830
7120	—	BBC Relay	Tebrau, Malaysia	2200
7145	—	R. Warsaw	Warsaw, Poland	2200
7150	—	Springbok R.	Johannesburg, South Africa	0300
7170	—	R. Noumea	Noumea, New Caledonia	1000
7200	—	Sudan Bc Svc	Omdurman, Sudan	0430
7270	—	R. Republik Indonesia	Djakarta, Indonesia	1130
7275	—	Nigerian Bc Corp	Lagos, Nigeria	0600
7290	—	Trans World R.	Monte Carlo, Monaco	0900
7330	—	—	Kiev, USSR	0100
7345	—	R. Prague	Prague, Czechoslovakia	0130
7480	—	R. Peking	Peking, China	1300

31-Meter Band—9500 to 9775 kHz

9360	—	R. Nacional Espana	Madrid, Spain	0430
9380	—	—	Alma Ata, USSR	0200
9475	—	R. Cairo	Cairo, Egypt	2230
9492	—	R. Tirana	Tirana, Albania	2115
9505	YVXJ	R. Barquisimeto	Barquisimeto, Venezuela	0330
9505	—	Sudan Bc Svc	Omdurman, Sudan	1930
9510	—	R. Bucharest	Bucharest, Rumania	0445
9510	—	R. Kabul	Kabul, Afghanistan	1830
9510	—	BBC Relay	Ascension Is.	2230
9515	TAT	R. Ankara	Ankara, Turkey	2030
9520	VLT9	Australian Bc Corp	Port Moresby, Papua Territory	0630
9535	CR6RZ	R. Angola	Luanda, Angola	0500
9545	—	R. Ghana	Accra, Ghana	2200
9550	—	R. Sofia	Sofia, Bugaria	0445
9560	—	R. Japan	Tokyo, Japan	1600
9570	—	R. Qatar	Doha, Qatar	1730
9575	—	RAI	Rome, Italy	0130
9580	—	V. Philippines	Manila, Philippines	1000
9585	YDF6	V. Indonesia	Djakarta, Indonesia	1330
9595	—	Swiss Bc Corp	Berne, Switzerland	1830
9600	—	R. Tashkent	Tashkent, USSR	1200
9610	LLG	R. Norway	Oslo, Norway	0330
9615	—	RTV Marocaine	Rabat, Morocco	2200
9620	—	R. Belgrade	Belgrade, Yugoslavia	1730
9625	—	Kol Israel	Jerusalem, Israel	2100
9630	—	Vatican R.	Vatican City	1820
9645	TIFC	Faro del Caribe	San Bose, Costa Rica	0330
9655	JKH2	R. Japan	Tokyo, Japan	0730
9655	OAX9G	R. Nor Peruana	Chachapoyas, Peru	0345
9670	—	Syrian Bc Svc	Damascus, Syria	2030
9690	—	RAE	Buenos Aires, Argentina	0600
9700	—	R. Sofia	Sofia, Bulgaria	0030
9712	YVKP	R. Tropical	Caracas, Venezula	0200
9715	—	Cyprus Bc Corp	Nicosia, Cyprus	2030
9725	ETLF	R. V. Gospel	Addis Ababa, Ethiopia	0400
9735	—	Deutsche Welle Relay	Kigali, Rwanda	1515
9745	XYR67	R. Cultura	Sao Paulo, Brazil	0835
9760	—	R. Nacional Espana	Madrid, Spain	0300
9770	4VEH	Evangelistic V. of West Indies	Cap Haitien, Haiti	1230
9915	—	V. UN Command	Okinawa	1500
9976	—	Yemeni Royalist R.	Unknown	0510

25-Meter Band—11700 to 11975 kHz

11650	—	R. Pakistan	Dacca, E. Pakistan	1720
11705	—	R. Pakistan	Islamabad, W. Pakistan	0130
11705	—	R. Sweden	Stockholm, Sweden	0330

kHz.	Call	Name	Location	GMT
11710	—	RAE	Buenos Aires, Argentina	2330
11730	—	R. Nederland	Hilversum, Netherlands	2200
11735	—	RTV Morocaine	Tangier, Morocco	1800
11745	—	R. Cairo	Cairo, Egypt	0115
11754	LRX	R. El Mundo	Buenos Aires, Argentina	0200
11760	—	R. Havana Cuba	Havana, Cuba	0400
11780	—	R. Belgrano	Buenos Aires, Argentina	0200
11780	ZL3	R. New Zealand	Wellington, New Zealand	0700
11795	—	Deutsche Welle	Cologne, Germany	0200
11795	PRI39	R. Nacional	Rio de Janeiro, Brazil	0000
11800	—	R. Nacional Espana Relay	Tenerife, Canary Is.	2330
11820	—	Trans World R.	Bonaire Neth. Antilles	0330
11830	—	V. America Relay	Okinawa	2300
11835	CXA19	R. El Espectador	Montevideo, Uruguay	2330
11855	—	Saudi Arabian Bc Svc	Jeddah, Saudi Arabia	1800
11855	ETLF	R. V. Gospel	Addis Ababa, Ethiopia	0250
11860	LLJ	R. Norway	Oslo, Norway	2200
11866	—	RTV Congolaise	Lubumbashi, Congo	1900
11875	—	R. RSA	Johannesburg, South Africa	0300
11875	YNW	R. Nacional Nicaragua	Managua, Nicaragua	1300
11875	—	RAI	Rome, Italy	1800
11880	XERR	R. Comerciales	Mexico City, Mexico	0100
11890	DZE9	Far East Bc Corp	Manila, Philippines	0930
11900	CE1190	L.V. Chile	Valparaiso, Chile	0000
11920	—	RTV Ivoirienne	Abidjan, Ivory Coast	0700
11925	—	R. Tashkent	Tashkent, USRR	1200
11925	—	BBC Relay	Ascension Is.	0500
11949	ZPA5	R. Encarnacion	Encarnacion, Paraguay	0030
11950	—	VTVN	Soigon, Vietnam	1500
11970	—	R. Nepal	Katmandu, Nepal	0120
11970	—	R .Lebanon	Beirut, Lebanon	2030

19-Meter Band—15100 to 15450 kHz

kHz.	Call	Name	Location	GMT
15040	—	R. Euzkadi	Unknown	2030
15055	—	R. Cairo	Cairo, Egypt	1600
15060	—	R. Peking	Peking, China	0100
15080	—	R. Peking	Peking, China	2330
15115	ELWA	Sudan Interior Mission	Monrovia, Liberia	1400
15140	—	Windward Is. Bc Svc	St. Georges, Grenada	2330
15145	WNYW	R. New York Worldwide	New York, USA	2200
15160	—	R. Australia	Melbourne, Australia	2000
15165	OZF7	R. Denmark	Copenhagen, Denmark	1500
15185	—	Far East Bc Assoc.	Victoria, Seychelles	0330
15185	—	ORTF	Paris, France	1930
15235	—	R. Japan	Tokyo, Japan	0100
15250	—	R. Bucharest	Bucharest, Rumania	1300
15255	—	Vatican R.	Vatican City	1900
15273	CXA74	SODRE	Montevideo, Uruguay	0100
15285	—	R. Ghana	Accra, Ghana	1900
15285	—	V. America Relay	Colombo, Ceylon	1215
15290	—	Syrian Bc Svc	Damascus, Syria	1830
15315	ETLF	R.V. Gospel	Addis Ababa, Ethiopia	1500
15365	—	V. Nigeria	Lagos, Nigeria	1830
15400	—	BBC Relay	Ascension Is.	1930
15420	—	South East Asia R. V.	Manila, Philippines	0100
15435	—	Deutsche Welle Relay	Kigali, Rwanda	2030

16-Meter Band—17700 to 17900 kHz

kHz.	Call	Name	Location	GMT
17720	BED39	V. Free China	Taipei, Taiwan	0230
17755	—	R. Berlin International	Berlin, E. Germany	0200
17770	—	RAI	Rome, Italy	1415
17795	—	RAI	Rome, Italy	1500
17840	—	R. Prague	Prague, Czechoslovakia	1600
17875	—	Cyprus Bc Corp	Nicosia, Cyprus	1545
17880	—	Oesterreicher R.	Vienna, Austria	1630
17885	—	R. Havana Cuba	Havana, Cuba	1800
17945	—	R. Pakistan	Karachi, Pakistan	1430

13-Meter Band—21450 to 21750 kHz

kHz.	Call	Name	Location	GMT
21480	—	R. RSA	Johannesburg, South Africa	1900
21495	—	R. Portugal	Lisbon, Portugal	1800
21520	—	Swiss Bc Corp	Berne, Switzerland	1600
21585	—	R. Sweden	Stockholm, Sweden	1430
21740	—	R. Australia	Melbourne, Australia	0200
21745	—	R. Kuwait	Kuwait	1630

White's Emergency Radio Station Listings for PACIFIC NORTHWEST

SCIENCE AND ELECTRONICS furnishes this exclusive listing of Pacific Northwest emergency radio stations as an aid to our many readers now engaged in the fascinating and rapidly growing hobby of monitoring emergency radio communications. We have and will be publishing similar lists devoted to different metropolitan areas in forthcoming issues so that you'll be able to accumulate a sizable array of this difficult-to-obtain data. Refer to the index on page 81 for our 1969/1970 program of emergency radio station listings.

If you desire to obtain similar lists from other areas in the United States that have not been published in this magazine, then we suggest you write to Communications Research Bureau, Box 56, Commack, N.Y. 11725. They may have a list of emergency radio services that covers your locality. Include a stamped, self-addressed envelope with your request.

All frequencies are megahertz (MHz) unless otherwise noted. Symbols used are: CD—Civil Defence; FD—Fire Department; LG—Local Government; PD—Police Department; SD—Sheriff or County PD.

IDAHO STATE POLICE

Mobile channels:		42.54	154.71	154.86	154.89	155.07	159.21
Bases:							
Albion	KLI231	42.54					
	KIZ523			154.86			
Arco	KOB334	42.54					
Blackfoot	KJZ992	42.54					
Blad Mtn.	KOI389	42.54					
Boise	KOA368	42.54					
	KOB33			155.25			
	KOU73			158.79			
Bonners Ferry	KOB289	42.54					

WHITE'S EMERGENCY SECTION

Cascade	KJK786	42.54	
	KOI315	42.54	
Challis	KCN367	42.54	
Chinks Peak	KOB277	42.54	
	KOP42	155.25	
Coeur D'Alene	KOA302	42.54	
	KOR26	154.95	
	KOR27	158.91	
	KOU78	159.21	
	KPO34	158.91	
Delco	KIZ525	154.86	
Grangeville	KGP790	42.54	
	KOA323	42.54	
Hailey	KOK775	42.54	
Heutter	KOP43	155.07	
Hollister	KOE389	42.54	
	KIZ522	154.86	
	KOR79	158.79	
Idaho Falls	KFD568	42.54	
	KOS66	159.03	
Inkom	KOB636	42.54	
Jerome City	KOG499	42.54	
	KIZ526	154.86	
	KOR25	154.95	
Kamiah	KBJ664	42.54	
Kellogg	KOI235	42.54	
King Hill	KOH695	42.54	
	KIZ524	154.86	
Kooskia	KLD807	42.54	
Lewiston	KOB263	42.54	
	KCK78	154.95	
	KZR52	159.09	
Macks Inn	KBI817-8	42.54	
McCall	KJK785	42.54	
Mica Mtn.	KOG489	42.54	
Montpelier	KOA300	42.54	
Moscow	KBR221	42.54	
Nezperce	KOM474	42.54	
	KCM52	159.03	
	KZR51	154.65	
Orofino	KOA324	42.54	
Powell	KJU344	159.21	
Preston	KOB251	42.54	
Priest River	KOH644	42.54	
Rexburg	KOB471	42.54	
Rigby	KOA477	42.54	
Riggins	KJF779	42.54	
St. Anthony	KOA515	42.54	
St. Maries	KOB290	42.54	
Salmon	KOY80	155.25	
Sandpoint	KOA987	42.54	
Soda Springs	KOH762	42.54	
Strevell	KOE316	42.54	
Twin Falls	KOU72	158.79	
Wallace	KOG334	42.54	
portable bases	KOG577	42.54	
	KOR70	154.95	155.25
	KOR69	158.79	
	KOY86	154.95	

IDAHO COUNTY AGENCIES

Ada County	SD	KGP703	39.82	39.86
	SD	KOG991	39.82	39.86
	SD	KGP700	47.20	
	SD	KH164-5	159.09	
	SD	KOW62	159.09	
Bannock County	SD	mobiles	39.82	42.54
	LG	KGQ92	153.80	
Bingham County	SD	KOH242	39.82	39.86
Bonneville County	SD	KUA788	39.82	39.86
	SD	KBA749	39.82	
	SD	KFT625	47.46	
	SD	KBV27	458.75	
	LG	KHP95-7	72.54	
	LG	KCU95	158.88	
Canyon County	SD	KOH218	39.82	
Kootenai County	SD	mobiles	42.54	
	LG	KGU987-90	453.25	458.25
	LG	KJB960	453.25	
Latah County	SD	KOA525	39.82	
Nezperce County	SD	KOA803	39.82	
Shoshone County	SD	KDC310	39.82	
	SD	KFE50	155.01	
	SD	KOS90	156.21	
	SD	KFE51	158.73	
	LG	KUW92	155.04	
	LG	KRY90	155.04	
Twin Falls	SD	KOG982	39.82	

OREGON STATE POLICE

Mobile units	42.88	42.94
Bases:		
Albany	KPE73	154.86	
---	---	---	---
Arlington	KOA381	42.88	42.94
Ashland	KON939	42.88	42.94
Astoria	KOA418	42.88	42.94
Baker	KOA383	42.88	42.94
	KPD21	154.92	
	KPD20	156.03	
Bend	KOB321	42.88	42.94
	KPO92	154.86	
Burns	KOB311	42.88	42.94
Canyon City	KOB309	42.88	42.94
Carpenterville	KAS427	155.91	
Chehalem Mtn.	KON349	42.88	42.94
Clackamas	KAW775	42.88	42.94
Coquille	KOB307	42.88	42.94
	KPA87	159.03	
	KPA88	154.86	
Enterprise	KON823	42.88	42.94
Eugene	KJE228	42.88	42.94
	KOA693	42.88	42.94
Florence	KJW724	42.88	42.94
Gilchrist	KOL482	42.88	42.94
Gold Beach	KEP653	42.88	42.94
Government Camp	KOB202	42.88	42.94
Gronts Pass	KOA513	42.88	42.94
	KOM79	156.03	
	KPG32	154.89	
Hermiston	KCW25	154.92	
Klamath Falls	KOB308	42.88	42.94
LaGrande	KOA744	42.88	42.94
	KAW733	42.88	42.94
	KOS93	156.03	
	KOS94	154.92	
Lakeview	KJE229	42.88	42.94
Marys Peak	KDQ231	42.88	42.94
McMinnville	KOI284	42.88	42.94
Medford	KBG513	42.88	42.94
	KOM78	154.89	
Myrtle Creek	KAT565	42.88	42.94
Newport	KOA315	42.88	42.94
	KZR81	156.03	
	KZR82	154.89	
Odell Lake	KOA296	42.88	42.94
Ontario	KOP39	154.92	
Pendleton	KOA382	42.88	42.94
	KOK62	154.92	
	KOK63	156.03	
Portland	KOA745	42.88	42.94
	KBV43	154.80	
Prineville	KOL354	42.88	42.94
	KON896	42.88	42.94
	KPB44	156.03	
Roseburg	KOB310	42.88	42.94
	KOD47	154.86	
St. Helens	KON822	42.88	42.94
Salem	KDC261	42.88	42.94
	KOA598	42.88	42.94
	KDY26	154.86	
	KPE72	156.03	
The Dalles	KOA293	42.88	42.94
Tilomook	KOB877	42.88	42.94
	KPF28	154.80	
	KPF29	155.91	
Vale	KOA384	42.88	42.94
	KOP38	156.03	
Warm Spgs. Jct.	KOB728	42.88	42.94
Woodburn	KAT566	42.88	42.94
Wyeth	KON938	42.88	42.94
Portable bases	KOA485	42.88	42.94
	KRC86	154.86	
	KNQ31	155.91	
	KNQ32	154.82	

OREGON COUNTY AGENCIES

Clackamas Co.	SD	KOL973	155.43
	SD	KOI237	159.03
	SD	KPI79	158.85
	SD	KOP433	460.50
	LG	KOM481	45.44
Clatsop Co.	SD	KJW812	155.55
	SD	KFV939	155.79
	LG	KFV938	154.025
Columbia Co.	LG	KFZ893	155.715
Coos Co.	SD	mobiles	155.01
Deschutes Co.	SD	KOF545	155.25
	SD	KON29	453.05
	SD	KON30-1	458.05
	LG	KJW754	453.35
	LG	KZH96	458.35
Douglas Co.	SD	KJE992	155.70
	SD	KOD44	154.95
	SD	KOL484-5	155.70
	FD	KJY804	154.37
	FD	KOI622	154.37
Jackson Co.	SD	KOA585	155.61

	SD KJY854	155.61			
	SD KQO50	453.35			
	SD KQO51	458.35			
Josephine Co.	SD KNE38	154.83			
	SD KNE41	154.83			
	SD KJZ20	154.83			
	SD KJY648-9	159.09			
Klamath Co.	LG KON857	45.12			
Lane Co.	SD KFT659	39.82			
	SD KOG326	39.82			
Lincoln Co.	SD KOH635	45.10			
	LG KRZ32	155.055			
	LG KTO51	155.055			
	LG KFN498-9	155.835			
	LG KFX268	155.835			
Linn Co.	SD KCT224	154.71			
	SD KJR438	154.71			
	SD KEN97	453.05			
	SD KEN98	458.05			
Malheur Co.	SD KPL40	155.67			
	SD KOM646	158.91			
Marion Co.	SD KDG750	154.74			
	SD KIZ360	154.74			
	SD KOG233	154.74			
	SD KHI34	155.64			
	LG KDB397	158.94			
	FD KBQ750	153.77	154.16		
	FD KDG418	153.77	154.16		
Multnomah Co.	SD KEP665	154.83			
	SD KOA282	155.65			
	SD KJY673	158.835			
	SD KOL353	159.03			
	SD KOA50	72.98	73.18	75.98	
	SD KOE65	75.98			
	SD KYT38	75.98			
	SD KIU22	75.98			
	SD KIT80-1	159.09			
	SD KPD97	159.09			
	SD KIT82	159.09			
	SD KPO94-6	158.73	159.09		
	SD KEN91	158.73	159.09		
	SD KGV48	158.73			
	SD KIT80-2	158.73			
	SD KNP65	158.73			
	SD KOA49	158.73	159.09		
	SD KPO97	158.73			
	SD KRO83	158.73			
	SD KFL83	158.73			
	SD KRO76-7	72.98			
	LG KEM643	153.86			
	LG KDU492	153.86			
	LG KBC435	153.86			
	LG KCI727	153.86			
	LG KDR766	153.86			
	LG KOL926	153.86			
	FD KOK263	154.01	154.175	154.28	
Polk Co.	SD KCI55	155.67			
	LG KHP82	158.88			
Umatilla Co.	SD KOG323	39.82			
	LG KFG64	155.04			
	LG KDC933-4	155.76			
Wasco Co.	SD KAY935	39.82			
	SD KES97	453.40			
	SD KES98	458.40			
Washington Co.	SD KBR983	155.01	159.03		
	SD KLE757	453.40			
	SD KQR568	458.40			
Yamhill Co.	SD KLU309	460.50			
	LG KBI880	45.32			
	LG KOL924	45.32			
	LG KHJ20	72.82			
	LG KHJ21	75.42			
	FD KDO278	154.28			

WASHINGTON STATE POLICE

Mobile units:	154.68	154.77	154.875	155.475	155.52
			155.70	155.85	158.79
Bases:					
Baw Faw	KOA586		154.77	155.475	155.85
Bellingham	KCL766		155.475	158.79	
	KOA583		154.77	155.475	158.79
	KDX85		154.68	154.77	
Beverly	KOA584		154.77	155.475	158.79
Bremerton	KOA589		154.77	154.845	155.475
Bridgeport	KTC606		158.79		
	KON926		158.79		
	KPQ66		154.89	155.475	
Burch Mtn.	KOA587		154.77	154.845	155.475
			158.79		
Camas	KCL772		155.475	158.79	
Camp Murray	KFT598		158.79		
Chehalis	KOA586		154.77		
	KOE437		158.79		
	KEQ49		154.77	155.475	

Colfax	KCN699	154.77	155.475	
	KOM94	154.77		
Colville	KOG324	154.77	155.475	158.79
	KDX89	154.68	154.77	
Concrete	KCL767	155.475		
Creston	KDX88	154.77		
Creston Butte	KOA592	154.77	155.475	
Davenport	KCL777	155.475		
Dayton	KCL774	155.475	158.79	
Easton	KCL770	155.475		
Ellensburg	KOA584	154.77	155.475	
	KEQ48	154.77		
Enumclaw	KOA431	154.77	155.475	155.52
Ephrata	KOE443	154.77	155.475	158.79
Everett	KOA498	154.77	155.475	
	KEQ50	154.77		
Hoquiam	KOA590	154.77	155.475	
	KDU91	154.77		
Index	KCL768	155.475		
Ione	KCL778	155.475	158.79	
Issaquah	KOA389	154.77	155.475	155.58
		158.79		
Joe Butte	KOA467	154.77	155.475	158.79
Kalama	KOA582	154.77	155.475	158.79
Kelso	KOA582	154.77	155.475	
Kennewick	KOA417	154.77	155.475	155.52
		158.79		
Monroe	KLI925	155.79		
Morton	KLC771	155.475		
Mt. Vernon	KOE438	158.79		
Naselle Mt	KOA586	154.77	155.475	
Neilton	KCL773	155.475		
North Bend	KOA288	154.77	155.475	
	KDX84	154.77		
Okanogan	KOA439	154.77	155.475	
	KQE51	154.68	154.77	
	KPQ68	155.85	158.79	
Olympia	KOA499	154.77	155.475	158.79
	KOA590	154.77	155.475	158.79
Pt Angeles	KCL779	155.475	158.79	
	KOA588	154.77	155.475	158.79
	KDU92	154.68	154.77	
Pt Townsend	KLP864	154.74		
Richland	KJY851	154.77	155.475	
Ritzville	KCL776	155.475		
Seattle	KLL606	154.77	155.475	155.58
	KOA389	154.77	155.475	155.58
Shelton	KLI924	155.70		
Spokane	KOA592	42.54	154.77	155.475
		155.58	158.79	
	KDX87	154.77		
Steptoe	KCL775	155.475		
Sunnyside	KOK918	154.77	155.475	
Tocoma	KOA431	154.77	155.475	155.52
Vancouver	KOA345	154.77	155.475	158.79
		460.025		
	KDX83	154.68	154.77	
Walla Walla	KOA467	154.77	155.475	158.79
	KDX86	154.68	154.77	
Wenatchee	KOA587	154.77	155.475	
	KPQ67	155.85		
Yakima	KOA585	154.77	155.475	158.79
	KQB412	158.79		
Portable base	KCL780	156.475		
	KOH326	154.68	154.77	154.845
		155.58	155.85	

WASHINGTON COUNTY OPERATED AGENCIES

Benton Co.	SD KOM785	156.15	
	SD KPL81	453.20	
	SD KPL823	458.20	
	LG KBY241	154.10	
	LG KDL95	158.88	
	FD KQM789-91	154.175	154.445
	FD KSA21	154.415	
	FD KSB37-8	154.415	
	FD WAH66	154.415	
	FD KRQ52	458.75	
	FD KRQ53	453.75	
	FD KTX78	453.60	
	FD KTX79	458.60	
Chellan Co.	SD KJF833	155.37	
	SD KOL234	155.37	
	SD KOH680	155.37	
	LG KOV34	453.45	
	FD KEN48	453.15	
	FD KEN47	458.14	
Clallam Co.	LG KBV949	155.88	
	LG KOM211	155.88	
	LG KPN30-1	158.835	
Clark Co.	SD KCJ23	154.89	
	SD KLH912	155.31	
	SD KOA984	155.31	
	FD KON900	154.37	
	FD KJI442	154.37	
	FD KOK922	154.37	

WHITE'S EMERGENCY SECTION

	FD KCN237	154.37			
	FD KCS987	154.37			
	FD KOL793	154.37			
Cowlitz Co.	SD KGR218	156.21			
	SD KOB404	156.21			
	SD KYA94	155.37			
Franklin Co.	SD KOA527	156.15			
	SD KPO36	453.35			
	SD KPO35	458.35			
	FD KDB384	154.19			
	FD KFB929	154.25			
Grant Co.	SD KOB427	156.15			
	LG KLK505-9	154.085			
	FD KGL472	154.19			
Grays Harbor Co.	KOA398	39.82			
	SD KJW765	39.82			
	SD KJP81	453.40			
	FD KFO757	154.19	154.43	155.085	
Island Co.	SD KJV71-4	155.73			
	FD KDX392	154.43			
King Co.	SD KFF218	155.01			
	SD KOA772	155.19			
	SD KDC279	155.19			
	SD KON205	159.09			
	SD KBZ943	155.19	159.09		
	SD KLR452	460.275	460.325		
	SD KML44	465.325			
	LG KBU678	153.755			
	LG KDC281	153.755			
	LG KLY813	154.085			
	LG KJW426	453.10			
	LG KZF28-9	458.10			
	FD KOL644	153.95			
	FD KOF989	154.19			
	FD KBE822	154.25			
	FD KOK561	154.25			
	FD KOK987	154.25			
	FD KOL375	154.25			
	FD KOM473	154.25			
	FD KOM786	154.25			
Kitsap Co.	LG KGU94	153.92			
	LG KPO66	153.92			
	LG KDN796	158.88			
	LG KJC999	158.88			
	FD KFF228	154.37			
	FD KON461	154.37			
Kittitas Co.	SD KOB272	156.15			
	LG KFW61-2	155.10			
	LG KDT304-6	156.00			
	FD KO1782	154.43			
Lewis Co.	SD KDL844	39.82			
	LG KBW851-2	45.16	155.10	155.47	
	FD KON211	154.19			
Okanogan Co.	SD KFO754	155.37			
	SD KPC46	458.35			
	LG KFR36	155.10			
	LG KDB312-4	156.00			
Pierce Co.	SD KOB452	39.82	156.09		
	SD KOG321	156.09			
	CD KDL939	45.20			
	FD KDL938	154.43			
	FD KOB276	154.43			
	FD KOI948	154.43			
	FD KOK692	154.43			
San Juan Co.	SD KCY213	155.61			
Skagit Co.	SD KOA625	155.31			
	SD KBD77	155.31	155.73		
	FD KDU533	154.43			
Snohomish Co.	SD KOI647	159.21			
	SD KOT76	453.95			
	FD KOF609	154.43			
	FD KOK857	154.43			
	FD KJF939	154.43			
Spokane Co.	SD KF0787	39.82	39.94		
	PD KOW65	159.21			
	FD KOM819	154.43			
Thurston Co.	SD KGL589	39.82			
	SD KOH603	39.82			
	LG KCL204	155.145			
	LG KCW642	155.145			
	LG KLO348	453.975			
	FD KVL91	72.84			
	FD KEP614	154.19			
	FD KOL474	154.19			
	FD KCX427	154.43			
	FD KDA372	154.43			
	FD KFD670	154.43			
	FD KOM707	154.43			
	FD KQL869	154.43			
Walla Walla Co.	SD KOB598	39.82			
	FD KOK870	154.43			
	FD KDJ34	453.50			
	FD KDJ35	458.50			
Whetcom Co.	SD KOI662	155.61			
	FD KOI654	46.14			
	FD KBY736	154.43			
	FD KFD634	154.43			
Whitman Co.	SD KOB279	39.82	39.94		
	SD KDL23	155.13			
	FD KOM472	154.19			
Yakima Co.	SD KON322	156.15			
	SD KOA973	156.15			
	FD KTU74	153.77			
	FD KFD21	153.77			
	FD KOK410-1	154.19			

Voodoo Radio

Continued from page 58

Radio Lumiere. Even more intriguing is the relationship between Haiti's government and 4VU operated by the West Indies Mission at Los Cayes on the republic's Southwest penninsula. Though R. Lumiere describes some of its purposes as coping with "the ill winds of discontent sweeping over the world" and pursuading Haitians to desert their "voodoo gods," the station once lauded Papa Doc as follows:

"What is the attitude of the government of Haiti? The West Indies Mission enjoys the highest esteem in official circles now as it has in the past for the obvious concrete accomplishments in the lives of the peasant masses . . ."

Noting that it had not sought favors, R. Lumiere continued, "No date has been set for the expiration of our licenses, and we have been virtually allowed to choose our own frequencies, call letters, and operating hours. We pay no taxes or license fees, for we handle no paid advertisements."

Station 4VU may also hold the distinction of being the sole broadcaster to ever really consider building a station on notorious Navassa Island—a U.S. possession about 40 miles West of Haiti and, as many readers will recall, the fictional home of a widely publicized 1967 hoax station.

R.Lumiere's own hopes of building an FM relay on the island were short lived. One 4VU official took a motor launch out to Navassa and, as he later told an officer of the North American SW Association, he found it infested with snakes and "totally unsuitable" for a radio station.

But to return from the might-have-been to hard reality, R.Lumiere is almost always logged on 2410 kHz, where programs are in French and Creole. ■

PDQ Reactor

Continued from page 33

tact with the case. Finish up your perf boarding process by taking care not to roast the semiconductors and making sure you've wired the relay in properly.

The seeds of your labor are soon to bear fruit. A little more drilling n' filing whips the case's front panel into shape. If you don't feel like hassling through steel case ironmongery, try outboarding the meter, *Calibrate* pots R9 and R10, PB1 and *Time* pot R5 into an aluminum mini-box, interconnecting the cases with a suitable cable.

This arrangement also serves an important purpose if you're considering PDQ's use in a psychology lab or any other controlled-experiment environment. Now the person being tested sees only a neon lamp and a switch. There's no superfluous knobs to twiddle or distracting meter face to subconsciously try to "beat." If you go this route, mount the lamp holder and S1 onto the front of the case.

Let 'er Rip. By now you're chomping at PDQ's bit—but hold back for a moment. Calibrate the dern thing first! Adjust for meter zero by turning R10 with PB1 depressed. Now depress and quickly release S1; the meter should read near, or over, full scale. Adjust R9 so it reads exactly full scale. Press PB1 again and the meter'll zero. If it doesn't zero the first time, repeat the preceding operation.

Okay, you've waited long enough for the moment of truth. Sit comfortably in front of PDQ. Press S1 and hold it down until I1 extinguishes, then release S1 as quickly as possible. The author tested several people and found that readings averaged from 10 uA. (pretty slow) to 35 uA. with the listed values for R6 and C3.

Setting up the meter movement to read *seconds* requires that you can get your hands on a super-accurate power supply. First, you'll need to refer to a universal capacitor charging curve found in any good engineering text and set up a graph of *Voltage* across C3 versus *Time*. Then connect the accurate voltage supply between circuit common and Q3's gate terminal. Apply a voltage corresponding to several charging time constants (for C3). You'll wind up with a meter face that's calibrated in terms of time. ■

Famous Patents

Continued from page 56

of special purposes, such as in televising motion picture film.

Vladimir Zworykin became a member of the RCA research staff in 1929 and rose to the position of vice-president of RCA in 1947. His researches in various fields of science have led to the granting of more than 120 patents on inventions ranging from radio and television to guided missiles and automobiles.

Perhaps Dr. Zworykin's most important contribution to science and to the human race was his modification and development of the electron microscope into a practical instrument that could be used to study the world of viruses and protein molecules and advance man's knowledge of life itself.

Copies of Vladimir K. Zworykin's Iconoscope patent (which is part of a complete television system) are available for fifty cents each from the U.S. Patent Office, Washington, D.C. 20231. In ordering, give the number of the Patent—No. 2,141,059. ■

Mitchell Uniflash

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power, wait seven seconds for the capacitors to charge, and then *fire!* You must wait at least seven seconds to allow the capacitors to reach full charge; there is no built-in "ready light."

Checked with a strobemeter, Uniflash produced a guide number of 48 with ASA 50 film. Actually, since much of the illumination on the subject is bounce light because of the bare flashtube, the guide number will vary, depending on the flash-to-subject distance and the color of the room.

Summing Up. While a studio-type, bare-bulb electronic flash is not the universal light source, Uniflash packs a good light output. And it represents an easy answer to the need for bare-bulb, "natural light" lighting techniques.

Uniflash is available in kit ($79.95) or wired ($104.95) form. For additional information write Mitchell Enterprises, Dept. S, Box 19562, Dallas, Tex. 75219. Tell 'em you saw it in S/E.

Great Men of Science

Continued from page 38

An intensely practical man, he insisted that men should use heat as a servant. "Put heat to work!" he urged.

He himself invented the drip coffee pot plus the modern fireplace and flue. He invented the steam radiator, installed the world's first central heating systems in buildings used by scientists of France and England.

But the man who founded the science of thermodynamics was more than a scientist-inventor.

Born in Woburn, Mass., he sided with the British in the 1770s. Rumford ranks as one of the earliest professional secret agents, but the full extent of his trickery wasn't disclosed until 150 years after his death. While posing as a patriot he spent at least two years as a British spy.

There was no proof of his duplicity at the time. Still, he thought it wise to to go to England in 1776. Before his 22nd birthday he was elevated to the important post of Undersecretary in the Ministry for Carolina and Georgia.

At this early period he made many important experiments concerning the explosive force of gunpowder. He developed accurate ways to measure the impact of bullets, and founded the deadly science of ballistics.

Not content with high rank and a sheaf of scientific achievements, he tried to sell naval information to the French. Later he transferred his allegiance to Bavaria and rose to the post of prime minister. Made a Count of the Holy Roman Empire in 1791, he took the name Rumford in honor of a village in which he spent several happy years (today, what was Rumford is now Concord, N.H.).

U. S. officials offered him the superintendency of West Point when the military academy was being built—then withdrew the offer in embarrassment when British officials leaked word of his activity during the Revolution.

Undaunted, the scientist who had become a millionaire in an age when few amassed such a fortune, used part of his money to establish one of the world's great scientific bodies—England's famous Royal Institution.

In old age, the man who had fought against Washington and his rebels endowed a professorship at Harvard. No one knows why he did it. To unravel the mysteries of his intrigue-filled life would take decades of research. No other man so deeply involved in international affairs has done so much to make life comfortable for the masses by means of "our servant, heat." ■

IC Low-Bander

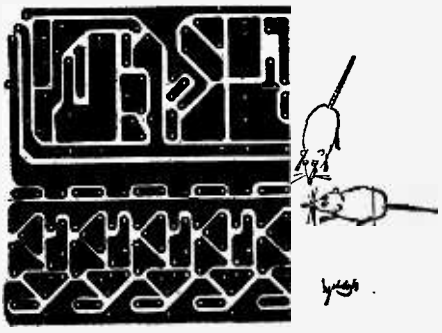
Continued from page 63

ground. Connect antenna and ground to clips J1 and J2, respectively, then a 6-volt battery to clips J3 and J4. Be sure polarity is correct and connect either a small PM speaker or headphones to clips J5 and J6.

Oh yes— plug in a coil L1 (A), covering the BCB, for initial checking because there are far more transmissions day and night in that band. Initially turn both volume and regeneration controls fully clockwise. As you tune through from one end of the dial to the other you should hear a chirp or squeal as you tune past each station. If no chirps or squeals are heard reverse connections to the tickler in the tube base.

Set the dial on a strong squeal and rotate regeneration control R1 counterclockwise until you reach a point where the squeal turns into either sweet music or sweet talk. At this point the volume control should be adjusted to suit your listening pleasure.

Duplicate the above operations for coils L1 (B) and L1 (C). You will gain experience as to where the controls should be set for best performance as you use the receiver. You'll be surprised and delighted at how well it works. ■



"Good luck!"

Ham Traffic

Continued from page 65

words, the actual amount of work done by the FCC has no relationship to what it will charge for any particular type of radio license! Not only that, but the number of times a radio user will renew his license in the future also is figured into the bite which the Friendly Candy Company will take out of his billfold.

For example, the various classes of commercial operator's licenses cost $3, $4 to $5. Uncle said he will leave those charges just as they are. However, he will increase from $2 to $10 the charge for a restricted radiotelephone operator's permit. This is the type of radio license which pilots and other radio users must have. There is no exam required for this pilot's radio ticket—just fill out a simple form and mail it in—that's all. Some clerk at the FCC types out a little card and mails it back to the pilot—and the ticket is good for life, with no renewal required.

However, for a commercial operator's license, which must be renewed, there is a lengthy technical exam to prepare, administer and grade.

Uncle's "reasoning" for increasing the charge to pilots but not to commercial operators is not based at all on the amount of work done by the FCC in issuing these licenses. Rather the idea is that the pilot's license lasts a lifetime, so they want to get more money from him the first time because they won't get another chance. The commercial operators must renew every five years, so they can hit their pocketbooks repeatedly! *And the FCC admits this in their notice of proposed rule making!*

Type Approval Taxes. Another example of wild Federal bureaucratic thinking is in the case of charges to be made for "type approval" of commercial equipment, such as two-way radio gear and even TV receivers. These charges will be based on the selling price of the equipment and the estimated number of units to be produced! These charges have no relationship to the *amount of work performed by the FCC* in inspecting this equipment! These charges are taxes, pure and simple—they can't possibly be called "fees." (And remember, only Congress, composed of our elected representatives, is supposed to have the power to tax.)

Charges to broadcast stations would be a certain percentage of their advertising rates for commercial announcements—nothing is said about how much work the FCC would do in regulating these stations—again, you see, another TAX.

Charges to cable TV systems would be based on the number of subscribers they have! Again, no relationship to whatever work the FCC performs for these portions of the industry. And again, another unconstitutional TAX.

How Are Hams Affected? But what does all this mean to ham radio? How does this arrogant attitude affect our future? Very bascially, it places our future in complete doubt. If the FCC is allowed to get away with these new charges and the principles they represent, then *the FCC will have the power to put out of business any type of radio communication for which it may acquire a dislike.* Simply by raising the charges so high that no one can afford it.

Look at it this way. Ham license taxes are to go up to $9, with no logical reasoning behind this increase. Supposedly the general public is now subsidizing ham radio by paying taxes to support the FCC. And why not? The general public benefits in many ways from the activities of ham radio operators, just as it benefits from all forms of radio communications. Yet the FCC wants us to pay $9 now. If they're allowed to get away with it, what's to prevent them from charging us $90 next year, or $900 the following year? The wording in the FCC's new schedule of charges makes this entirely possible.

Incidentally, there was another hooker in the FCC's plan. There was a shorter than normal time allowed for the filing of comments on the proposal, and the FCC said in advance that there would be no extension of time allowed! Now isn't that nice! They spend literally years thinking up this thing, then allow a very short time for everyone involved to digest it, and tell us all in advance that we can't possibly have any additional time for comments, regardless of our reasons for needing it! Real steam roller tactics, by an agency that is supposed to be "serving" us.

They deliberately made it impossible for national publications such as SCIENCE AND ELECTRONICS, and many others, to report the full story to you readers in enough time for you to band together to fight this unfair proposal! ■

Moving Coil Meter

Continued from page 42

Mount the coil assembly in place by stretching the rubber band over pieces G and I, centering it vertically within the height of the pole pieces of the magnet.

Now For The Pointer. Straighten out a 4¾-in. length of #18 gauge bare copper wire and then form it as shown in our drawing. The pointer is cemented in the slot in block J so that it rests near the zero end (left side) of the scale platform with the moving coil at rest with no current flowing. Piece F is used to make final zero rest position adjustments after a scale has been cemented into position.

Fasten two double solder lugs to block H; these are intermediary connecting points for the two wires from the moving coil. Form a helix like a hairspring with each of these leads so they will wind up as the coil assembly moves clockwise. Solder the end of the wire from the top helix to one of the top lugs and the bottom helix to one of the bottom lugs. Mount two Fahnestock clips or binding posts along the front edge of the meter baseboard and connect them to the solder lugs on H, using #18 solid, bare wire. Since meter polarity is determined by magnet polarity and the direction of current flow, depending on how the coil is wound, the correct polarity markings of the meter should be established at the time you calibrate the instrument.

Calibration. In order to calibrate this instrument, you'll need a potentiometer having roughly 200 ohms resistance, a 1½-volt battery, and a DC milliammeter, preferably a multi-range one available as part of a VOM.

Now you are ready for the calibration scale that's mounted on the platform C made during the framework construction. The scale is drawn on a piece of heavy white paper (U) which will be cemented to the platform after the calibration marks have been drawn. (Rub on numerals, such as Datak, make a neat scale.) Temporarily fasten this white paper (U) to platform C, draw an arc as shown in the photo, and place a mark on the left-hand side for a zero reference point.

Connect a 1½-volt battery, a 200-ohm potentiometer (used as a rheostat), a VOM set on DC milliamp ranges (or a milliammeter), and the moving coil meter you have just built, as shown in the calibration diagram.

Set the potentiometer for maximum resistance and at the start use the highest milliamp range of the VOM. If the pointer on your moving coil meter deflects to the left (below the established 0 point), reverse connections to it and then mark the binding posts + and −. Use the connection diagram to determine their polarity markings after connecting the meter so that the pointer moves to the right.

Slowly turn potentiometer to reduce resistance in the circuit and note the readings of the VOM milliamp range selected. Mark your moving coil meter with the same readings shown on the milliammeter. We divided the 0-100 scale into 10 mA divisions. In commercial manufacture of DC moving coil meters, spring tensions, spacing, and coil weight are carefully controlled so that these meters are linear. For this reason commercial milliammeters have uniform spacing between divisions. Our moving coil meter doesn't have such uniformity because of the variations in the rubber band used for suspension and tension, and because it's difficult to maintain accuracy of positioning the various pieces and to be assured of the strength of magnetic field developed by the magnet. Once you have established the calibration points they will be accurate.

Now that you have marked the scale in pencil you can remove it from the platform and apply the permanent markings. Then permanently fasten the scale in position and stand back to admire your work. If you used reasonable care in following the instructions, you'll have good reason to be proud of your handiwork and should expect a good grade and/or congratulations from your friends and teachers. ■

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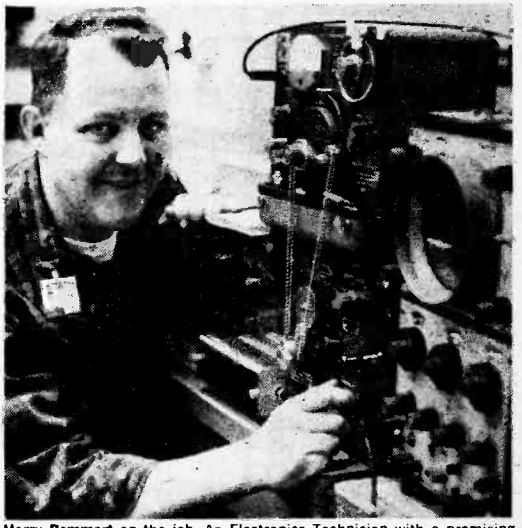

Harry Remmert on the job. An Electronics Technician with a promising future, he tells his own story on these pages.

By Harry Remmert

AFTER SEVEN YEARS in my present position, I was made painfully aware of the fact that I had gotten just about all the on-the-job training available. When I asked my supervisor for an increase in pay, he said, "In what way are you a more valuable employee now than when you received your last raise?" Fortunately, I did receive the raise that time, but I realized that my pay was approaching the maximum for a person with my limited training.

Education was the obvious answer, but I had enrolled in three different night school courses over the years and had not completed any of them. I'd be tired, or want to do something else on class night, and would miss so many classes that I'd fall behind, lose interest, and drop out.

The Advantages of Home Study

Therefore, it was easy to decide that home study was the answer for someone like me, who doesn't want to be tied down. With home study there is no schedule. I am the boss, and I set the pace. There is no cramming for exams because I decide when I am ready, and only then do I take the exam. I never miss a point in the lecture because it is right there in print for as many re-readings as I find necessary. If I feel tired, stay late at work, or just feel lazy, I can skip school for a night or two and never fall behind. The total absence of all pressure helps me to learn more than I'd be able to grasp if I were just cramming it in to meet an exam deadline schedule. For me, these points give home study courses an overwhelming advantage over scheduled classroom instruction.

Having decided on home study, why did I choose CIE? I had catalogs from six different schools offering home study courses. The CIE catalog arrived in less than one week (four days before I received any of the other catalogs). This indicated (correctly) that from CIE I could expect fast service on grades, questions, etc. I eliminated those schools which were slow in sending catalogs.

FCC License Warranty Important

The First Class FCC Warranty* was also an attractive point. I had seen "Q" and "A" manuals for the FCC exams,

*CIE backs its FCC License-preparation courses with this famous Warranty: graduates must be able to pass the applicable FCC License exam or their tuition will be refunded in full.

and the material had always seemed just a little beyond my grasp. Score another point for CIE.

Another thing is that CIE offered a complete package: FCC License and technical school diploma. Completion time was reasonably short, and I could attain something definite without dragging it out over an interminable number of years. Here I eliminated those schools which gave college credits instead of graduation diplomas. I work in the R and D department of a large company and it's been my observation that technical school graduates generally hold better positions than men with a few college credits. A college degree is one thing, but I'm 32 years old, and 10 or 15 years of part-time college just isn't for me. No, I wanted to *graduate* in a year or two, not just *start*.

If a school offers both resident and correspondence training, it's my feeling that the correspondence men are sort of on the outside of things. Because I wanted to be a full-fledged student instead of just a tagalong, CIE's exclusively home study program naturally attracted me.

Then, too, it's the men who know their theory who are moving ahead where I work. They can read schematics and understand circuit operation. I want to be a good theory man.

From the foregoing, you can see I did not select CIE in any haphazard fashion. I knew what I was looking for, and only CIE had all the things I wanted.

Two Pay Raises in Less Than a Year

Only eleven months after I enrolled with CIE, I passed the FCC exams for First Class Radiotelephone License with Radar Endorsement. I had a pay increase even before I got my license and *another* only ten months later. I'm getting to be known as a theory man around work, instead of one of the screwdriver mechanics.

These are the tangible results. But just as important are the things I've learned. I am smarter now than I had ever thought I would be. It feels good to know that I know what I know now. Schematics that used to confuse me completely are now easy for me to read and interpret. Yes, it is nice to be smarter, and that's probably the most satisfying result of my CIE experience.

Praise for Student Service

In closing, I'd like to get in a compliment for Mr. Chet Martin, who has faithfully seen to it that my supervisor knows I'm studying. I think Mr. Martin's monthly reports to my supervisor and generally flattering commentary have been in large part responsible for my pay increases. Mr. Martin has given me much more student service than "the contract calls for," and I certainly owe him a sincere debt of gratitude.

And finally, there is Mr. Tom Duffy, my instructor. I don't believe I've ever had the individual attention in any classroom that I've received from Mr. Duffy. He is clear, authoritative, and spared no time or effort to answer my every question. In Mr. Duffy, I've received everything I could have expected from a full-time private tutor.

I'm very, very satisfied with the whole CIE experience. Every penny I spent for my course was returned many times over, both in increased wages and in personal satisfaction.

Perhaps you too, like Harry Remmert, have realized that to get ahead in Electronics today, you need to know much more than the "screwdriver mechanics." They're limited to "thinking with their hands"...learning by taking things apart and putting them back together...soldering connections, testing circuits, and replacing components. Understandably, their pay is limited—and their future, too.

But for men like Harry Remmert, who have gotten the training they need in the fundamentals of Electronics, there are no such limitations. As "theory men," they think with their heads, not their hands. For trained technicians like this, the future is bright. Thousands of men are urgently needed in virtually every field of Electronics, from two-way mobile radio to computer testing and trouble-shooting. And with this demand, salaries have skyrocketed. Many technicians earn $8,000, $10,000, $12,000 or more a year.

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

FROM OUR MAIL BAG

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

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

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

PRINTED CIRCUITRY

At no increase in price, the "Edu-Kit" now Includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many Radio and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.

UNCONDITIONAL MONEY-BACK GUARANTEE

Please rush my Progressive Radio "Edu-Kit" to me, as indicated below:
Check one box to indicate choice of model

☐ Deluxe Model $31.95.
☐ New Expanded Model $34.95 (Same as Deluxe Model plus Television Servicing Course).

Check one box to indicate manner of payment
☐ I enclose full payment. Ship "Edu-Kit" post paid.
☐ I enclose $5 deposit. Ship "Edu-Kit" C.O.D. for balance plus postage.
☐ Send me FREE additional information describing "Edu-Kit."

Name .....

Address .....

City & State ..... Zip .....

PROGRESSIVE "EDU-KITS" INC.
1189 Broadway, Dept. 561NN, Hewlett, N. Y. 11557