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POPULAR ELECTRONICS

AUGUST 1966

50 CENTS

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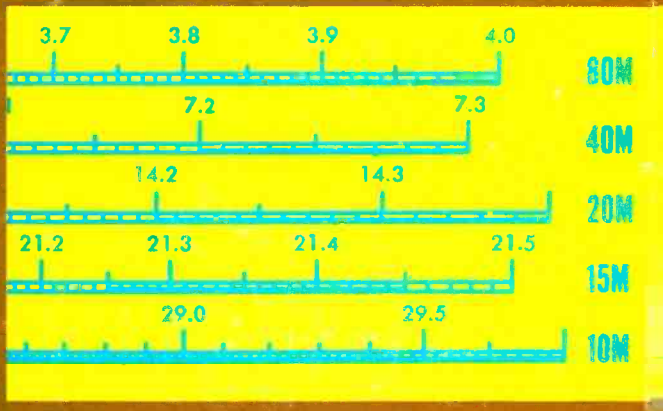
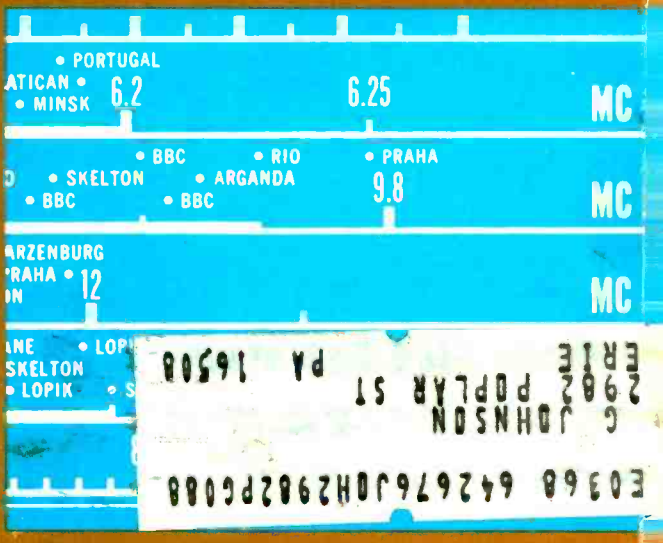
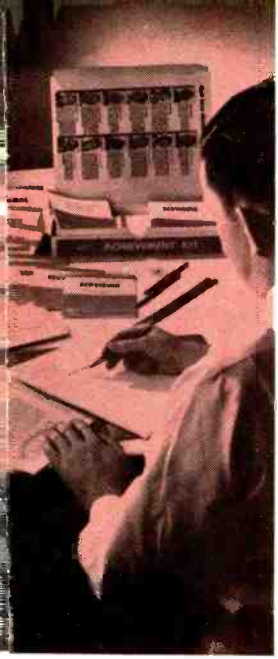
- **Build** Modulation Percentage Checker
- **The** Dit Makers
- **CB-1966** as seen by KOD3631
- **Directory** of Ham Radio Equipment
- **Report** on Sensational Drake SW-4 Receiver
- **Build** Tape Recorder Echo Chamber







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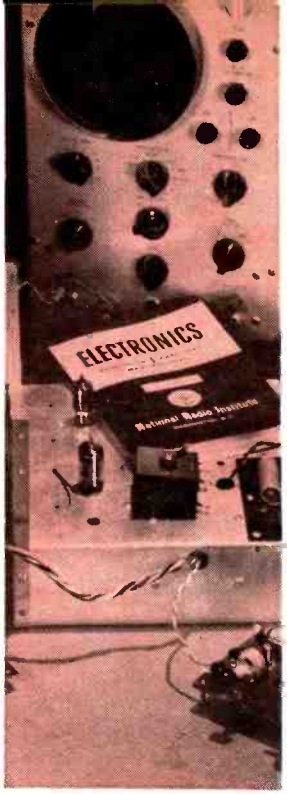

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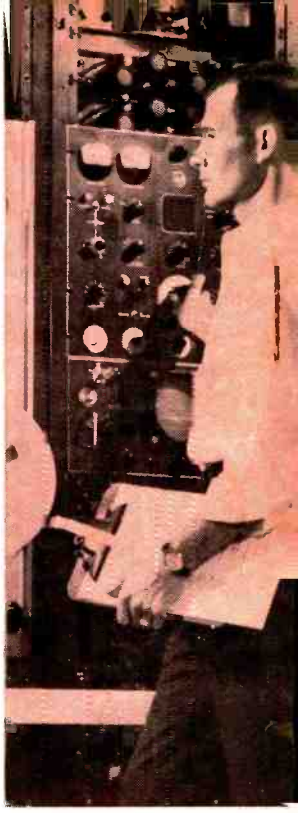

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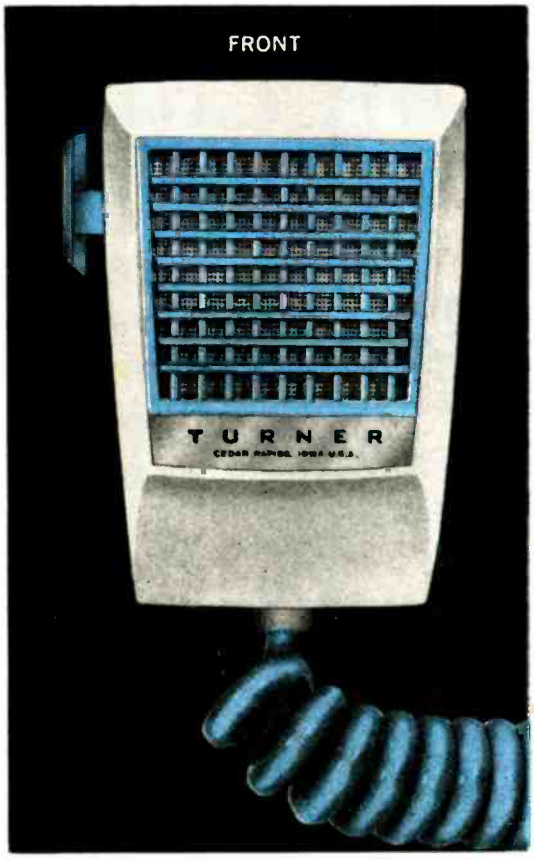

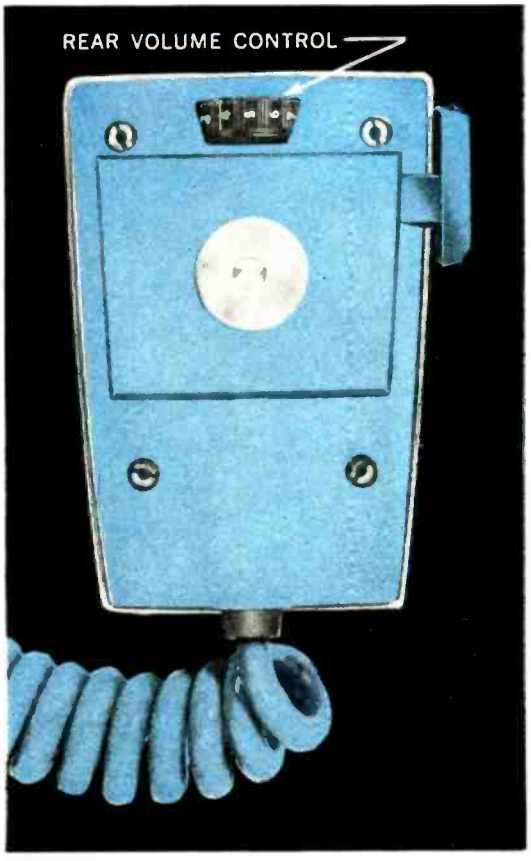

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VOLUME 25 **AUGUST, 1966** NUMBER 2

SPECIAL CITIZENS BAND FEATURES

SPECIAL AMATEUR RADIO FEATURES

ELECTRONIC CONSTRUCTION PROJECTS

COMMUNICATIONS

ELECTRONIC FEATURES AND NEW DEVELOPMENTS

DEPARTMENTS

POPULAR ELECTRONICS is indexed in the Readers' Guide to Periodical Literature

This month's cover photo by Bruce Pendleton. Partial dial scales shown are those of Heathkit HR-10 (top), Browning "Eagle" (center), and Hallicrafters S-200 (bottom).

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LETTERS
FROM OUR READERS

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"CAMPER'S SPECIAL" ON FORTY

I built the "Camper's Special" (August, 1965) and put it on the air, with results beyond my expectations. In the last few days I have made three contacts with stations in Illinois and Louisiana as far as 700 miles from here. But I'm using 40 meters instead of the 80 meters for which the transmitter was designed. My home-brew, three-transistor receiver would not work on 80, so I just put a 40-meter crystal in the Camper's Special and loaded it into a 40-meter doublet. Reports have indicated a strong and clear signal. I am having more fun with this small transmitter than with my big 160-watt job.

JOHN E. MOORE, WAØJJL
Springfield, Mo.

HOT "PEPPER"

My friend and I, both engineering majors at Stony Brook, constructed "Pepper," the r.f. amplifier (May, 1966), and we were amazed by the results. Normally, reception in the dorms is poor, even with an outside antenna. Now, despite the author's opposite intention, we are able to pick up our favorite rock-'n'-roll stations from New York City. We have found that almost any transistor will do the job well and a 9-volt radio battery works fine.

DONALD R. BLAKE
Stony Brook, N.Y.

It doesn't work. With the car engine off, Pepper lowers the signal strength. With the engine running, all I get is a loud buzz.

JOHN CORZINE
Columbus, Miss.

Pepper really pulls in the stations when the engine is OFF, but when the engine is running, all I can hear is ignition noise, generator whine, etc.

ERNIE GODBOUT, K1AUL
Woonsocket, R. I.

I took the radio out of the car and soldered the 12-volt lead to the on-off switch. I discovered that no ground connection was needed, as Pepper was apparently grounded through the antenna cable shield. However, when I turned it on, I noticed no improvement at all; in fact, the local stations were not quite as good as they had been. Then I decided to take a little ride. As soon as I started the engine—WOW—I could hear each plug firing loud and clear. The noise drowned out the radio stations completely but pro-

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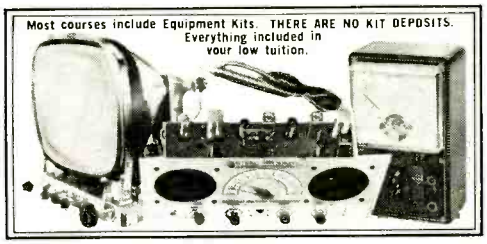

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LETTERS (Continued from page 6)

duced a deafening roar in time with the engine. What did I do wrong?

A. ROSENTHAL
Santa Monica, Calif.

It looks like we broke even on this one—with about the same number of unhappy results as happy ones. The gismo does work, but it needs debugging. Most car radios have an antenna trimming capacitor which

critically tunes the relatively short car antennas. This capacitor should be readjusted on the high end of the band for maximum volume after Pepper is installed. As for the noise problem, shielding and grounding is essential. Don't rely on the antenna lead-in shield for this purpose, as the shield itself could be "hot" with noise. Pepper should be built into a metal box and the box grounded to the car.

COLPITTSILLATOR AND MARCONIO?

When I saw your article entitled "Old World Standards Breaking Through" (April, 1966), my first impression—and hope—was that this article was part of a well-planned and perfectly executed April fool joke. Then came the May issue, which all but eliminated my hopes for a prolonged sanity in electronics. In the June issue . . . I see the end of reason and the beginning of a mad rush to do away with the traditional names of inventions and rename them after their inventors. I can picture the situation now. There will be no more oscillators, no more transistors, and no more radios. In their places, we will find Colpittsillators, Bardeenabrattainistors, and Marconios. Try to imagine telling someone how you used your Colpittsillator to test the Bardeenabrattainistorized a.f. section of your Marconio, only to find that it wouldn't respond to frequencies under two hundred hertz!

FREDERIC D. BARBER, JR.
Brookfield, Wis.

Just for your Edisonification, Fred, our loaded mailbags also convey strong thoughts in favor of hertz, but most of the comments can be summed up in one word . . . "nertz"!

POLIO COULDN'T STOP EDUARDO CANELA

Your attention is invited to the enclosed newspaper clipping showing Eduardo Canela,

CIRCLE NO. 25 ON READER SERVICE PAGE

3 more features —all new

Here is RCA's new WR-50B RF Signal Generator—wired or kit. It looks just like the old WR-50A, but the resemblance ends there. It has all the features you liked in the older model...plus 3 new ones you'll find in red below:

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RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.

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The Most Trusted Name in Electronics

LETTERS (*Continued from page 8*)

a 15-year-old student at the Daet Parochial School in Daet, and his science fair entry which won first prize. Eddie was stricken with polio at the age of three and fought a long hard battle to overcome physical handicaps.

The United States spends billions of dollars abroad to enhance its position, but sometimes the things which cost the least bring the greatest and most lasting returns. Copies of POPULAR ELECTRONICS, two to three months old, sell on the Manila newsstands for three to four pesos a copy. Considering that the average wage here is four pesos a day, the price of your magazine *is* quite high, but as many as fifty people get to read one copy.

EDMUND FORSYTHE
Putol Kawit, Cavite
Philippine Republic

Thanks for the clipping, Ed. Success stories, particularly about people who have had to overcome seemingly insurmountable handicaps, are most gratifying. All magazines have a certain amount of pass-along readership, but 50 is quite high. We can't help but feel that with the aid of skills gained from magazines such as ours, and science fair activities, a person's earning ability can be enhanced considerably.

PARTS PROCUREMENT PROBLEM SOLVED

You turned out to be my best friend in my hour of need by publishing the letter in your September, 1965, issue about the trouble I had

getting parts to build your projects. Many of your other readers responded by sending me very valuable parts. I sent them Turkish presents in return.

YUSUF TOLKUM
Bursa, Turkey

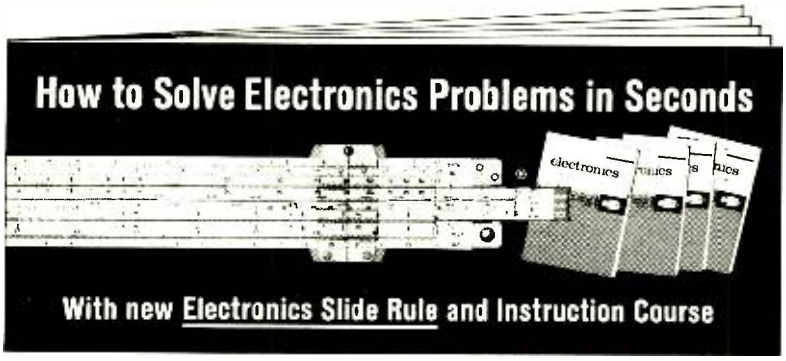
Glad it worked out okay for you, Yusuf.

HOW'S THAT AGAIN?

I see from the *Letters* in the June, 1966, issue that many readers still do not know the difference between "cycles" and "hertz." This is, of course, because cycles usually was used incorrectly—"cycles" for "cycles per second." Hertz cannot help but be used correctly. I also note that you, Mr. Letters Editor, have fallen into the common pitfall of confusing "imply" and "infer." Imply should be used for the active process, A implies B

Why solve electronics problems the old-fashioned pencil and paper way?

This free booklet shows a faster way.



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WAYNE LEMONS, Radio-Electronics

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OLIVER P. FERRELL, Editor, Popular Electronics

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JOSEPH J. DeFRANCE, Head of Electrical Technology Dept., New York City Community College

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CIRCLE NO. 41 ON READER SERVICE PAGE

LETTERS (*Continued from page* 10)

(to C), while infer is the passive process, C infers that A meant B. That is, imply is used by or of the originator, infer by or of the recipient of some statement. So that you should have said, "the 'old' frequency designators did imply cps." Hertz does not *imply* (you said infer) "per second," it explicitly *means* "per second," by definition. I hope that the next time you use imply or infer you will have firmly in mind the distinction between them.

PHILIP N. BRIDGES
Ashton, Md.

Philip, the next time we will neither infer nor imply; we will just say what we mean.

P.E. IN BORNEO

I am at present fighting in the jungles of Borneo. Perhaps the fact that I still read your magazine regularly proves I am an Electronics Enthusiast? I do not get much time for operating/buying/building but I manage as best I can. Have been buying and enjoying POPULAR ELECTRONICS regularly since 1958. Keep up your high standards!

L. R. SIMPSON, Lt. R.A.
c/o GPO, London, England

FOREIGN-LANGUAGE BROADCASTS

I was pleased to see the schedule of foreign-language broadcasts in the June issue. I hope that you will see fit to continue this

service. The column will be especially helpful to those of us who are interested in increasing our language proficiency.

VERNON F. RAAEN, W4YGI
Oak Ridge, Tenn.

The listing of foreign-language broadcasts schedules is a very useful addition to your DX department.

WARREN MEINHARDT, WPE9HXV
Champaign, Ill.

Keep up "Foreign-Language Broadcasts to N.A."!

M. T. MORRIS, WPE5PE
Tyler, Texas

It looks like the foreign-language broadcast schedule is a hit—the above responses are typical of the many postcards and letters we have received. Therefore, we will continue to run this feature from time to time. Our thanks to all those who wrote in about it. -30-

CIRCLE NO. 24 ON READER SERVICE PAGE→

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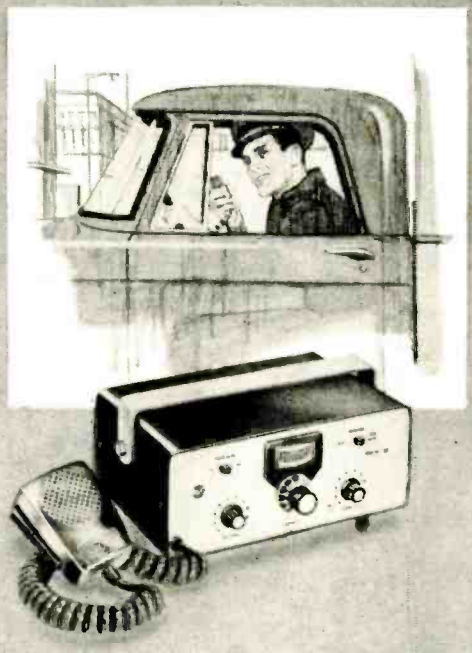

The all-solid-state MARK 10

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- Compact, lightweight. Fits easily under dash of any car or truck. Only 3⅜" high, 5¾" deep, 8½" wide. Weighs less than 4½ pounds.
- 12 crystal-controlled transmit and receive channels with illuminated channel selector.
- Combination "S" Meter and relative RF Output Meter.
- Operates from 12-volts DC power source (positive or negative ground).
- Crystal-controlled double conversion, superheterodyne receiver provides frequency accuracies greater than 0.004%.
- Separate AGC amplifier eliminates blasting and overloading, minimizes fading.
- Six-stage IF bandpass filter for maximum selectivity without ringing.
- Low-distortion, series-type noise limiter with automatic threshold adjustment.
- Receiver power regulated for maximum stability.
- Acoustically designed cabinet with audio characteristics shaped for maximum intelligibility.
- External speaker jack (de-activates internal speaker).

Mark 10: $189.95*

*Optional distributor resale price.

See them at your Authorized RCA CB Radio Distributor. Look for stores displaying this symbol.

CB

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.

RCA **The Most Trusted Name in Electronics**

SHURE MICROPHONES

for maximum voice punch!

BASE STATIONS

ALL-NEW... ADJUSTABLE HEIGHT

Model

444

for Ham and CB Use

Gets the message through where other mikes can't. "Shaped" frequency response cuts off below 300 cps, above 3000 cps—with specially developed "rising" characteristic from 1000 to 3000 . . . cuts through QRM, assures top intelligibility and maximum range. Touch-to-talk switch (with built-in switch provision for instant change to VOX or normal operation). Adjustable height stand minimizes operator fatigue. Dozens of other features. Only $25.50 net.

MOBILES

FOR "SOLID" 10-4's

Model

201

for CB Use

The low-cost hand-microphone with the "pro" features. "Shaped" response curve patterned after professional mobile and SSB amateur response curves. Virtually indestructible "Armo-Dur" case . . . shock-, corrosion-, and weather-proof. Long-life switch guaranteed full year. Kink-proof, peel-proof cord. "Lifetime" hang-up bracket. Only $10.80 net.

NEW! MODEL 202

LOW COST NOISE-CANCELLING MICROPHONE

Similar in outward appearance, size and construction to the Shure 201 (above)—but offers superior noise discrimination for crisp, clear, natural voice reproduction in applications with high background noise. Only $12.00 net.

LITERATURE: SHURE BROTHERS, INC., 222 HARTREY AVE., EVANSTON, ILL.

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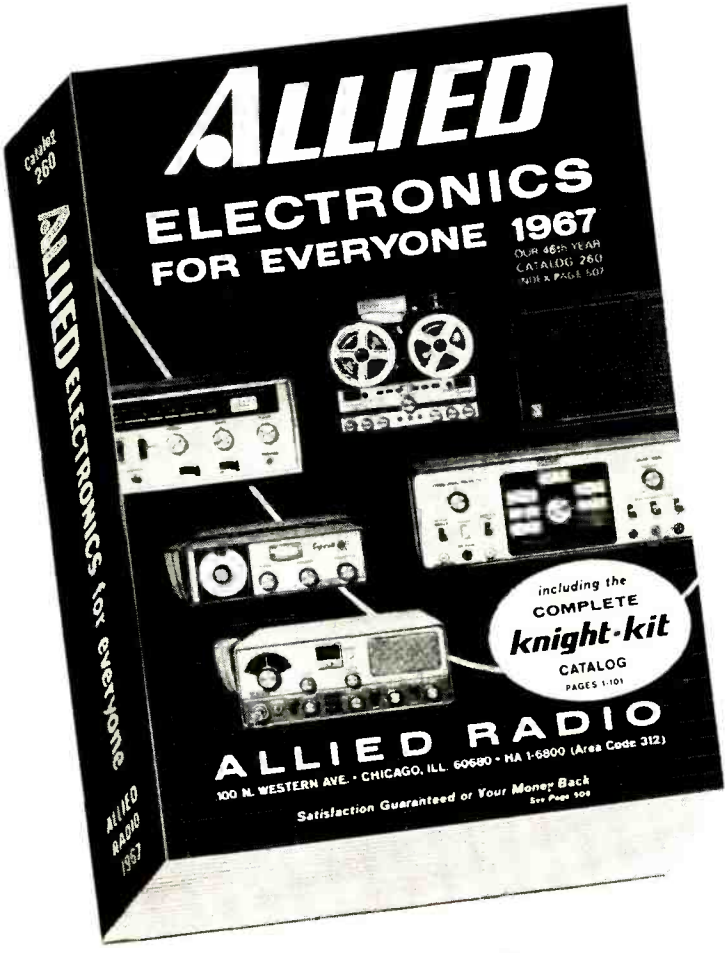

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RCA TRANSISTOR MANUAL, SC-12

Chock full of useful information for anyone who has anything to do with trasistors, the well-known RCA manual has now been expanded more than 20 percent over the preceding edition. It contains new easy-to-understand text on semiconductor devices and applications not previously covered, a "streamlined" data section with more extensive data on active transistors, up-to-date transistor selection charts, information on military-specification types and on mounting hardware, and a revised circuits section including descriptive write-ups of circuit functions and operation.

Published by Radio Corporation of America, Electronic Components and Devices, Harrison, N.J. 07029. Soft cover. 480 pages. $1.50.

MODERN TECHNICAL WRITING
Second Edition

by Theodore A. Sherman

Although this updated book covers several essential aspects of modern technical writing, it does not come to grips with the most important phase of the subject: how to prepare a technical manual to military specifications. Nor does it fully cover technical manuals prepared to commercial standards. But it does contain a wealth of information on grammar, reports (substantially enlarged over the first edition) and proposals (an entirely new chapter), and business correspondence, in addition to a general introduction to technical writing.

Published by Prentice-Hall, Inc., Englewood Cliffs, N. J. Hard cover. 418 pages. $10.00.

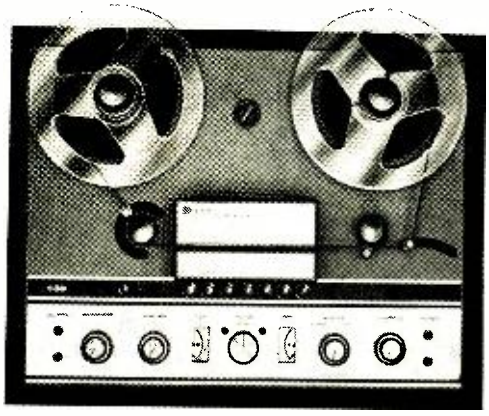
KNOW YOUR SQUARE WAVE AND PULSE GENERATORS

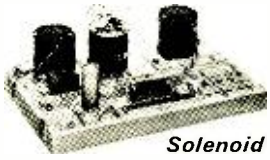
by Robert G. Middleton

After explaining the basic principles of square-wave and pulse generation, this text describes—in step-by-step detail—the circuitry of various service- and laboratory-type instruments. Throughout the book there are examples of how to perform various tests with these instruments (square-wave testing of amplifiers, pulse-ringing tests on flybacks and yokes, etc.). In the final chapter, each section of a high-quality lab-type pulse generator is thoroughly analyzed with the aid of circuit diagrams and waveform illustrations.

Published by Howard W. Sams & Co., Inc., 4300 W. 62 St., Indianapolis, Ind. 46206. Soft cover. 144 pages. $2.50. -30-

How To Get A $570 Stereo Recorder For $400





3 Motors . . . Solenoid Operated . . . Die-cast Main-plate, Flywheel & Capstan Shaft Housing

All-Solid-State Electronics . . . Record 4-Track, Stereo-Mono, Sound-On-Sound, Sound-With-Sound & Echo

Build The New Heathkit®/Magnecord®1020!

You Save $170!

Thanks to Heath, you can now save $170 on the new Magnecord 1020 professional 4-Track Transistor Stereo Tape Recorder by building it yourself. And the only difference between this Heathkit version and the original is the $170 you save (think of all the tape you can buy with that!)

Professional Recording Facilities

You can record "live" from microphones, or from auxiliary sources like tuners, phonographs, TV's, etc., and playback . . . in 4-track stereo or mono at either 7½ or 3¾ ips. And you can make sound-on-sound, and sound-with-sound (mixing) recordings, or create interesting echo effects.

Professional Tape Transport

The tape transport is powered by 3 separate motors . . . a hysteresis synchronous capstan motor for constant, accurate speed, and two split-capacitor types to drive the reels. And with the push button controls, you can change operation instantly with just a touch of a button. Compliance arms insure correct tape tension.

The fail-safe brakes, tape gate and pressure roller are solenoid operated for instant, gentle stops. And when the tape runs out, an automatic switch shuts off all motors and retracts the pressure roller.

3 Professional Tape Heads

Selectable ¼ track ease, record and play. Removable shields afford double protection against external magnetic fields. Snap-mounted head covers provide easy access for cleaning and de-magnetizing. And for quick, accurate editing, there are center-line marks.

Other Professional Features

All parts mount on a thick, die-cast mainplate that won't warp, reduces wear, provides rigid support and alignment. Two V. U. meters for visual monitoring of signal levels from tape or source. Front panel inputs and outputs for microphones and headphones. Digital counter with push-button reset. Low impedance emitter-follower outputs deliver 500 millivolts or more to amplifier inputs. Individual gain controls for each channel. And a 21 transistor, 4 diode circuit for cool, instant operation, and long life.

Famous Heathkit Know-How Speeds Assembly

Simple step-by-step instructions and giant pictorials guide you every step of the way. And to make construction even easier, the connecting wires and shielded cables are precut, stripped and marked . . . even the connectors are installed where necessary; just plug them in! You just wire two circuit boards and mount the transport components. Total assembly time is around 25 hours!

Order yours now!

Kit AD-16, deck & electronics, 45 lbs. **$399.50**

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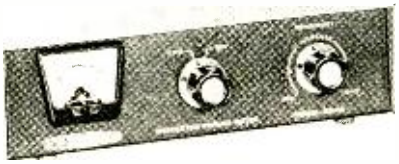
CIRCLE NO. 12 ON READER SERVICE PAGE

NEW PRODUCTS

Additional information on products covered in this section is available from the manufacturers. Each new product is identified by a code number. To obtain further details on any of them, simply fill in and mail the coupon on page 15.

REFLECTED POWER METER

Styled to match the *Heath* SB-Series equipment, the new HM-15 reflected power meter enables the ham operator to obtain peak efficiency from his transmitting equipment. It can be used with transmitters having peak power outputs as high as 1 kW, and can be used throughout the wavelength range of 160 to 6 meters. The Heath HM-15 measures



standing-wave ratios (SWR) from 1:1 to over 3:1 on 50- or 75-ohm transmission lines. It is calibrated both in SWR and percent of reflected power.

Circle No. 75 on Reader Service Page 15

LOW-COST SPEAKERS

True high fidelity at budget prices is claimed for two 12" component loudspeakers, the MC12 and MT12, which *Electro-Voice* has added to its "Michigan" line. Both have a dual cone (as does the "Michigan" MC8 introduced some years ago), but the MT12 also has a ring diaphragm tweeter and annular horn for increased efficiency in the higher frequencies. Frequency response: 40 to 14,000 Hz for the MC12; 40 to 18,000 Hz for the MT12. Nominal impedance in each case is 8 ohms.

Circle No. 76 on Reader Service Page 15

AUTOMATIC BATTERY SELECTOR

Easily installed in about ten minutes, the "Sure Power Pack" by *Topaz, Inc.* protects the batteries in two-battery vehicles, boats, and aircraft. The transistorized unit keeps the primary battery and the auxiliary battery disconnected from each other when the engine is stopped, assuring no depletion of the primary battery by accessories connected to the auxiliary battery. As soon as the engine is started, both batteries are automatically connected to the generator to bring them up to full charge. The "Sure Power Pack" is intended for 12-volt negative-ground vehicles only.

Circle No. 77 on Reader Service Page 15

SINE/SQUARE-WAVE GENERATOR

Both sine- and square-wave outputs are read from a one-scale frequency dial on the Model 636 dual-waveform generator which has been added to *Precise Electronics'* "Green Line" of test instruments. (The "Green Line" features front panels of easy-on-the-eyes green.) Model 636 provides a complete source of sine- and square-wave signals from 20 Hz to 200 kHz, for a wide range of audio and video testing, servicing, and experimental work. Other features include a smooth, dual-function output control; negligible distortion and high stability of sine-wave output; negligible square-wave tilt and fast rise time at all square-wave frequencies; and extensive shielding for minimum radiation pickup.

Circle No. 78 on Reader Service Page 15

HOME STEREO TAPE CARTRIDGE PLAYER

The new *Lear Jet* Stereo 8 tape cartridge player, Model HSA-900, works in conjunction with existing home stereo systems, utilizing the speakers, amplifiers, and audio controls of the system to produce full stereo playback. Employing the Stereo 8 eight-track continuous loop cartridge, the unit features completely automatic 8-track operation. Each Stereo 8 cartridge provides up to one hour and 20 minutes of continuous stereophonic music. Furnished with preamplifiers, the Model HSA-900 is a solid-state player (it incorporates 6 transistors and 3 diodes) and operates on standard 117-volt a.c.

Circle No. 79 on Reader Service Page 15

"PERSONAL POWER PACK"

You can go on that picnic and still see that crucial baseball game on TV—if you have a portable TV set, and a "Personal Power Pack" put out by the *Exide Industrial Marketing Division* of the Electric Storage Battery Company. Of course, the Power Pack can also be used for more mundane purposes.

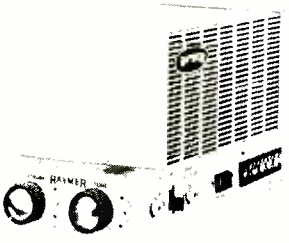
PRODUCTS (*Continued from page 22*)

such as powering tools and appliances. It consists of a 12-volt, sealed, maintenance-free lead-acid battery and an automatic charger in a stylish carrying case with adjustable shoulder strap.

Circle No. 80 on Reader Service Page 15

LOW-POWER AMPLIFIER

Wherever low-power output is desired, *Trutone Electronics'* Model 4P5C amplifier can be used. It is suitable for paging, background music, public address, stereo conversion, etc. Two inputs are provided with a switch arrangement for selecting either mike/tape/high-gain phono or radio-tuner/crystal-phono program sources. Outputs are for 8 ohms and 25- or 70-volt lines. The Model 4P5C employs one 12AX7 tube, one EL84, and two silicon rectifiers.



Circle No. 81 on Reader Service Page 15

CODE PRACTICE OSCILLATOR

A solid-state code practice oscillator is available from *Electronic Products Company* in three forms: completely wired; as a beginner's kit (circuit board only wired); and as an advanced kit (nothing wired). In all cases, a single earphone (15-ohm impedance) and two "D" cell batteries are furnished with the unit. The CPO can be operated with a speaker, a light, or high- or low-impedance phones. Its simplified two-transistor circuit has excellent stability from —40° F to +150° F.

Circle No. 82 on Reader Service Page 15

A.C.-D.C. BUZZER

Experimenters, hobbyists, or students might be interested in the Type 302 low-cost a.c.-d.c. buzzer announced by *Caringella Electronics*. The 302 can be used in a number of warning and signaling applications, as well as in games and toys. Operating voltage is 1.5 to 3 volts a.c. or d.c. Power can be furnished by flashlight batteries or taken from the center-tap of a 6.3-volt filament transformer winding. A booklet containing 20 different construction projects is provided with the buzzer.

Circle No. 83 on Reader Service Page 15

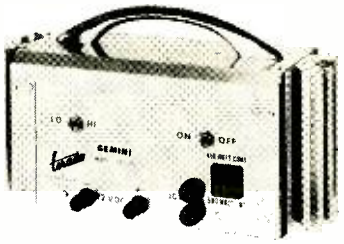
CONTROLLED-IMPEDANCE SPEAKER

Designed specifically for use with a solid-state amplifier, the S-8 air-suspension speaker system is the first in *H. H. Scott's* new CI (Controlled Impedance) Series to be announced. Rated at 8 ohms, the S-8 employs a 10" woofer of the air-suspension type and a 5" midrange/tweeter unit. The fact that the system maintains nearly constant impedance throughout its frequency range is claimed to insure optimum performance of the amplifier-speaker combination.

Circle No. 84 on Reader Service Page 15

SOLID-STATE POWER INVERTER

Boasting a capacity of 450 to 500 watts, the *Terado* "Gemini" Model 50-128 power inverter will change the regular storage battery current of your car or boat to 117 volts filtered a.c. The "Gemini" can operate soldering irons,



electric drills, lights (fluorescent or incandescent), portable TV sets, radios, hedge clippers, can openers, electric shavers, and what have you. Completely transistorized, it is housed in a heavy-gauge copper-clad case with carrying handle.

Circle No. 85 on Reader Service Page 15

COMMUNICATIONS HEADPHONE

Superex Electronics Corp. has introduced a new communications headphone, the Model CO-S "Communicator." The lightweight unit consists of an adjustable covered headband, foam-filled, washable, replaceable ear cushions, and dynamic elements for clear, crisp reproduction of the entire communications range, plus a standard phone plug with a 7' 2-conductor cable. Frequency response is 100 to 10,000 hertz; impedance of the "Communicator," 4 to 16 ohms.

Circle No. 86 on Reader Service Page 15

CARDIOID MICROPHONE

Seven basic acoustical and functional features are incorporated in *Turner Microphone Company's* Model 777 "Jet Star." They are: (1) excellent noise rejection; (2) ease of usage, either hand-held or on a stand; (3) clearly marked rotary-type on-off switch; (4) rolled-off bass response; (5) rugged all-metal die-cast case; (6) wide-range frequency response; and (7) naturally low impedance (150 ohm only—balanced line).

Circle No. 87 on Reader Service Page 15

Faulty, fragile, filament failures.

Phooey.

Yes, phooey to filament failures and costly tube replacements. CB radios should be solid state to take the bumps and knocks of mobile use.

That's why *all* Amphenol Citizens Radios are solid state. We don't believe in thin filaments that heat up and short or snap. Or in fragile glass enclosures. Or in tubes at all, when transistors have more than ten times the life and warm up instantly. That's why Amphenol has the broadest line of solid state equipment available today.

Take the new Spokesman 650 for example. This ten crystal-controlled channel receiver is complete with spot button, S and RF meter, squelch control, 23 channel RF tuner, solid state switching (no relay, making it possible to provide communications even at 25°F below zero), and most important, Amphenol dependability.

Remember, when you want the reliability of solid state circuitry, think of the industry's broadest line, Amphenol. See your local Amphenol distributor for more information on Amphenol solid state, and the Spokesman 650, or write us direct.

AMPHENOL DISTRIBUTOR DIVISION
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CIRCLE NO. 2 ON READER SERVICE PAGE

PARTS
METHODS
IDEAS
GADGETS
DEVICES

TIPS & TECHNIQUES

NEED A HELPER? HIRE A TRANSFORMER!

Got one of those old hermetically sealed type audio or power transformers sitting around doing nothing? Why not turn it into a versatile soldering iron stand and put it to work? Just turn the transformer over on its back and stick a couple of alligator clips on opposite terminal lugs, as shown, soldering the clips securely. Employed as a stand, the transformer will hold your iron when it's not in use; serving as a helper, the clips on the transformer will hold small parts during your soldering operations, and will even hold the solder for you while you solder. A small piece of felt glued to the bottom of the transformer will protect your workbench surface, and also keep the stand from slipping.

—Mark H. Bonham

SWITCH PROTECTOR MAY BE LIFE PROTECTOR

Here's an accident-proof switch protector that'll keep you from leaning or brushing against an equipment switch you just can't afford to turn on—accidentally. Take a small empty tin or plastic container—a salted peanut can, spray-paint can, or coffee can will do, and drill a hole the size of the switch shank through the bottom of the can. Remove the switch mounting nut and slip the can opening over the switch shank. Then replace and tighten the nut. Now the switch can still be turned on and off—but never accidentally. For more drama, you can place a cover with a warning note on the can. *—Charles C. Brock*

SOUPED-UP TV CHEATER CORD

If you service TV or hi-fi/stereo equipment in the home, you often need more light than

NEW! H.E.L.P.

FOR SALESMEN, HOUSEWIVES, VACATIONERS, ETC.

CITI-FONE II

EMERGENCY CONVENIENCE

2-Way Radio Communication...

5¾" x 4⅜" x 1½" FITS IN GLOVE COMPARTMENT

CITI-FONE II is designed for use with your car radio and modification or dismounting of the radio is not required. The standard car antenna (with matching accessory) can be used.

$49.95 Complete *with crystals for one channel*

SOLID STATE
9 transistors—2 diodes
5 watts input — 100% modulation. Operates directly from cars' 12 volt system.

TO BE USED IN ACCORDANCE WITH PART 95 F.C.C. RULES AND REGULATIONS

Mail Today for Complete Information!

Please send further information on "Citi-Fone II".

NAME_____

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STATE_____ ZONE_____

THE IDEAL way to utilize your existing receiver for entertainment or for two-way radio communications with superior performance at a cost far below conventional units

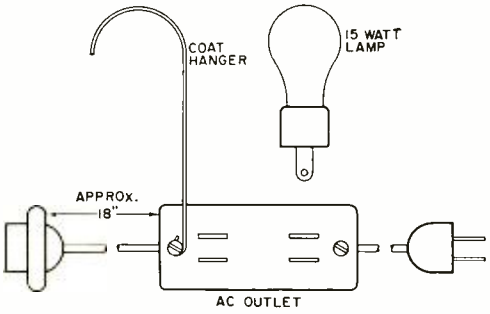
ANOTHER FIRST for 21470 Coolidge Oak Park, Michigan 48237

MULTI-ELMAC COMPANY

CIRCLE NO. 20 ON READER SERVICE PAGE

TIPS (*Continued from page 26*)

is readily available. Here's a simple way to get as much as you need by converting your cheater cord to serve as a lamp socket while functioning also as a receptacle for your soldering iron. Install a duplex a.c. receptacle in the cord about 18 inches from the female terminal as shown. Then attach the hook



portion from a wire coat hanger to the receptacle. (You may have to heat the tip of the wire before it will bend to form a pigtail for mounting.) Now you can plug in a night light socket and a small bulb (7½ to 15 watts) —and your soldering iron, too.

—Homer L. Davidson

"GIVE ME A LEVER LONG ENOUGH . . . AND I'LL MOVE THE WORLD"

You may not need to move the world . . . but an extension lever on that hard-to-get-at toggle switch can come in mighty handy in an emergency. A piece of rigid tubing—copper, brass, aluminum—or the sleeve from an old ballpoint pen slipped over the switch lever will provide greater convenience when you're reaching for and throwing that switch in a hurry.

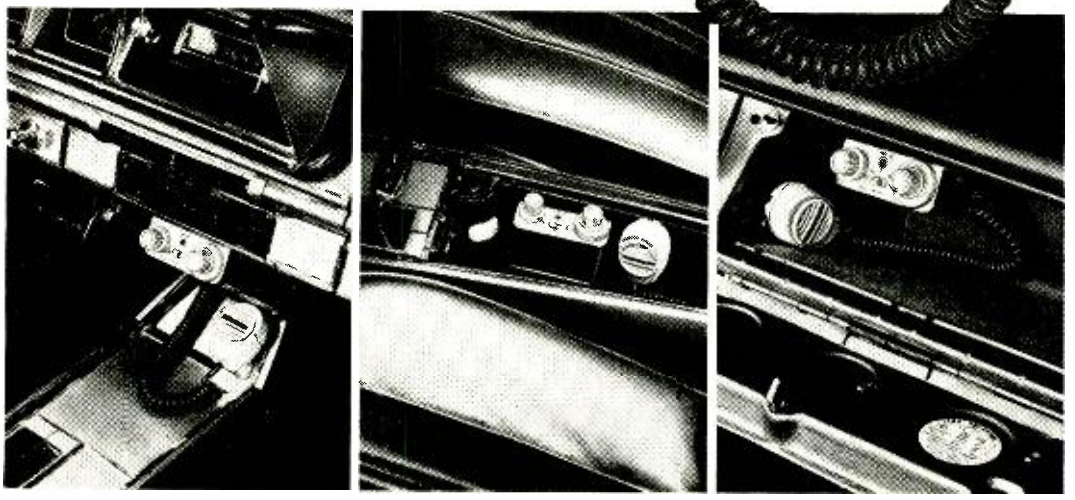
—Glen F. Stillwell

ELECTRIC TIMER TURNS OFF SOLDERING IRON

Ever forget to unplug that soldering iron before turning in for the night? You can prevent this from ever happening again—and also remove the possibility of a fire—by operating your soldering iron through an electric timer. If the timer cuts off before you're through, simply reset it again. If you forget to unplug the iron, the timer acts like a backup to turn it off for you.

—Wilfred Beaver

the International MO-23 citizens radio transceiver hides...



under the dash ..... in the console ..... in the glove compartment

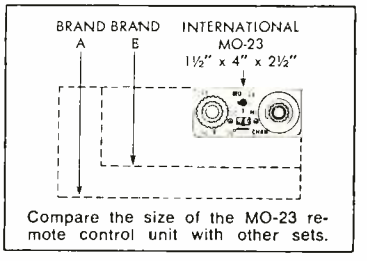
The MO-23 remote control unit is so small it will rest on the palm of your hand (1½" H x 4" W x 2½" D). You can install the MO-23 under the car dash . . . in the glove or console compartment. Compare this versatile mobile two-way radio with other makes. See for yourself how little space this unit really requires. Technically speaking, the MO-23 combines the best advantages of tubes and silicon transistors.

CHECK THESE FEATURES:

- 23 Crystal Controlled Channels
- Miniature Solid State Remote Control
- Illuminated Channel Selector
- Transmit/Receive Trunk Unit
- Transistor Power Supply

Ask your dealer to show you the International MO-23. We think it's a great new transceiver. You will too!

WATCH FOR INTERNATIONAL "FLYING SHOWROOM '66".
WELCOME ABOARD!



Compare the size of the MO-23 remote control unit with other sets.

FCC Citizens Radio license required. All use must conform with Part 95, FCC Rules and Regulations.

INTERNATIONAL
CRYSTAL MFG. CO., INC.
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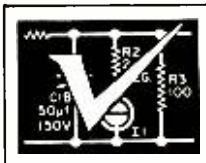
CIRCLE NO. 15 ON READER SERVICE PAGE



OPERATION ASSIST

Through this column we try to make it possible for readers needing information on outdated, obscure, and unusual radio-electronics gear to get help from other *P.E. readers. Here's how it works: Check the list below. If you can help anyone with a schematic or other information,* write him directly—*he'll appreciate it. If* you *need help, send a postcard to Operation Assist,* POPULAR ELECTRONICS, *One Park Avenue, New York, N.Y. 10016. Give maker's name, model number, year of manufacture, bands covered, tubes used, etc. State specifically what you want, i.e., schematic, source for parts, etc. Be sure to print or type everything legibly, including your name and address. Because we get so many inquiries, none of them can be acknowledged.* POPULAR ELECTRONICS *reserves the right to publish only those items not available from normal sources.*

Atwater Kent Model 20 receiver, ser. 225995, circa 1928; tunes BC; has 5-01A tubes. Schematic and information on battery connections needed. (Charles T. Kelly, P.O. Box 4030, Yuma, Ariz.)

Learadio Model AMR-12C receiver, ser. 3; tunes 2800 to 6700 kHz. Schematic and operating manual needed. (Gordon Cheesman, 114 Leominster Rd., Lunenburg, Mass. 01462)

Clark Model PA-30 amplifier. Schematic needed. (Edd Hajek, 155 N. Hickory St., Platteville, Wis. 53818)

RCA "Radiola 18" receiver. Model AR-936, circa 1920; tunes 550 to 1400 kHz; has 7 tubes. Schematic, operating manual and source for parts needed. (R.L. Faulkner, 122 Owen Ave., Lansdowne, Pa. 19050)

Hickok Model OBQ-1 VTM, circa 1950. Schematic and operating manual and S-44 meter needed. Book entitled **"Coils"** by Russell Summerville, published by "73" magazine, Peterborough, N.H., wanted. (Robert T. Kohler, 11449 W. Hidalgo St., Rt. #1, Box 132C, Tolleson, Ariz. 85353)

BC-441B transceiver, made by Hallicrafters; tunes between 160 and 80 meters. Schematic needed. (James W. Winney, 2d Lt., CAP, 2220 Park Ave., Lincoln, Nebr.)

TIX-882 field-effect transistor made by Texas Instruments needed. (Frank Tyro, Box 50, Ronan, Mont.)

Zenith receiver, ser. S 537723; tunes 1.5 MHz to 18 MHz and BC on 3 bands; has 12 tubes. Schematic and technical data needed. (Billy Adams, Lake Bronson, Minn.)

King Model 80 receiver, ser. 2334. Schematic and source for parts needed. (Stanley Bazylar, 8477 11 Mile Rd., Warren, Mich. 48093)

Silver Model 906 signal generator. Schematic and parts list needed. (Richard Fry, Box 104, E. Orwell, Ohio 44034)

Khun Model 316C audio equalizer. Schematic and operating manual needed. (Doug Hewitt, 11511 Gravelly Lake Dr., Tacoma, Wash. 98499)

TCK-4 transmitter and rectifier power unit, surplus, ser. 676. Schematic and operating manual needed. (Ronald Fick, 1903 Hart Ave., Dodge City, Kan. 67801)

Majestic receiver, ser. D 32020, type 10M792; tunes s.w.; has 7 tubes. Schematic needed. (J. René Paré, 31 De Gaspé, Quebec 3, P.Q., Canada)

EICO Model 470 oscilloscope. Operating manual and trouble-shooting information needed. (Walter Burgwin, 217 Martha Pl., Ashtabula, Ohio 44004)

(*Continued on page* 32)

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CIRCLE NO. 10 ON READER SERVICE PAGE

ASSIST (*Continued from page* 30)

Hickok Model 51X multitester, circa 1940. Operating manual and tube charts needed. **American Bosch** Model 20J receiver. Schematic needed. (John Roman, 690 Ware St., Palmer, Mass. 01069)

Webster-Chicago Model 180-1 wire recorder, circa 1940; has 5 tubes. Recording wire, .0036" stainless steel, needed. (David Osier, Box 5, Clearlake, Wash. 98235)

Zenith Model 12S267 receiver; tunes BC, s.w. and l.w.; has 12 tubes and cathode "eye." Set with or without cabinet, schematic, and operating manual wanted. (L. Waren, 208 W. Benton Ave., Naperville, Ill. 60540)

Philco Model 070 signal generator. Schematic needed. (Haisey Kudebeh, 27512 Linda Vista, Barstow, Calif.)

Webcor Model EP-2404 tape recorder. Schematic and motor needed. (Lester Young, Jr., Rt. 8, Johnson City, Tenn. 37601)

Zenith "Transoceanic" receiver, Model 49CZ668-343016, circa 1949; tunes BC and s.w. on 6 bands; has 5 tubes. Schematic and operating manual needed. (Bill Jacobus, 3966 Grosvenor Rd., Cleveland, Ohio 44118)

Fairbanks Morse receiver, chassis 8A, circa 1940; tunes 550 kHz to 50 MHz; has 8 tubes. Schematic, parts list, operating manual, cabinet, and knobs needed. **Triangle Electric** Model 1010 receiver; tunes 550 kHz to 20 MHz on 3 bands; has 10 tubes. Schematic, parts list, operating manual, and knobs needed. (L. D. Smith, 254 N. Smart St., Greenwood, Ind. 46142)

Regency Model ATC-1 short-wave converter. **Lysco** Model 381 converter. Schematics and operating manuals needed. (Stan Putra, 1429 Lawndale, Racine, Wis. 53403)

E.C.C. (British) Model 951A receiver; tunes 9085 kHz; has one 3Q4 tube. Schematic and operating manual needed. (Allen Molyneux, Box 206, Pinedale, Wyo. 82941)

Atwater Kent Model 40 receiver, ser. 296635S; tunes BC. Schematic and power supply needed. (James Andrews, 3704 Avondale Dr., Ft. Wayne, Ind. 46806)

Silvertone 20" TV receiver, circa 1950. Schematic and operating manual needed. (Gordon Pratt, 4131 N. 44 Pl., Phoenix, Ariz. 85018)

Seeburg "Master" amplifier, type MA1-L6; 117 volts, 60 cycles; has 5 tubes. (Verl E. Dennis, Brandonville, W. Va.)

Temco Model 75GA transmitter, circa 1946. Schematic and all other technical data needed. (Joseph W. Morgan, 10691 Ramney Ave., Garden Grove, Calif. 92640)

RCA Model 6-C-5 clock radio, ser. U-047295; tunes 540 to 1600 kHz; 115 volts a.c., 60 cycles, 35 watts. Schematic needed. (Alan Atchison, 5231 N.E. 19 Ave., Fort Lauderdale, Fla. 33308)

T4/FRC transmitter made by Aircraft Accessories Corp.; tunes 1.8 to 30 MHz. Schematic and operating manual needed. (W. Barry Newsome, 2001 Kirby Rd., Falls Church, Va. 22043)

Atwater Kent Model 55 receiver. Schematic and source for tubes needed. (E. A. Armstrong, 1300 E. 8, Apt. N-1, Odessa, Tex.)

Simpson Model 266 VTVM, circa 1958. Schematic and operating manual needed. (Frank J. Longobardi, 2001 W. Orangethorpe Ave., Fullerton, Calif. 92633)

RAX-1 receiver, surplus, type CG-46116, circa 1945; tunes 1.5 to 9.0 MHz. **Browning** Model RJ-20A tuner; 105 to 125 volts, 60 cycles, 80 watts. Schematics needed. **Supreme** Model 589 tube and battery tester. Schematic and parts list needed. (Glen H. Spain, 227 Suffolk Dr., Tucson, Ariz. 85704)

Hallicrafters Model S-77A receiver; tunes CW on 4 bands; has 9 tubes. Schematic and alignment data needed. (Jim Carrig, Box 57, Limeridge, Wis. 53942)

Philco Model 16 receiver, circa 1940; tunes 530 kHz to 23 MHz on 5 bands; has 11 tubes. Schematic and tone control needed. (Michael Winkler, 315 Russet Ln., Highland Park, Ill. 60035)

Atwater Kent Model 20 receiver, ser. 301575, circa 1928; has 5 tubes. Schematic and battery voltage data needed. (Henry G. Rotklein, 2605 Huntleigh Dr., Oklahoma City, Okla. 73120)

Zenith Model 9-S-365 receiver. Schematic and operating manual needed. (Larry Young, 8 Janice Ln., Stoneham, Mass. 02180)

(*Continued on page* 38)

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This has resulted in a gold mine of new business for licensed service technicians. A typical mobile radio service contract pays an average of about $100 a month. It's possible for one trained technician to maintain eight to ten such mobile systems. Some men cover as many as fifteen systems, each with perhaps a dozen units.

Coming Impact of UHF

This demand for licensed operators and service technicians will be boosted again in the next 5 years by the mushrooming of UHF television. To the 500 or so VHF television stations now in operation, several times that many UHF stations may be added by the licensing of UHF channels and the sale of 10 million all-channel sets per year.

Opportunities in Plants

And there are other exciting opportunities in aerospace industries, electronics manufacturers, telephone companies, and plants operated by electronic automation. Inside industrial plants like these, it's the licensed technician who is always considered first for promotion and in-plant training programs. The reason is simple. Passing the Federal government's FCC exam and getting your license is widely accepted proof that you know the fundamentals of electronics.

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G. O. Allen

G. O. Allen
President

ASSIST (*Continued from page 32*)

Vocaline Model RC-425 12-volt Class B CB transceiver. Schematic, operating manual, and operating frequency information needed. (Bruce Nall, 3330 W. 29, Topeka, Kan. 66614)

Superior Model 100 multimeter. Operating manual needed. (Arthur Kossman, 3021 Mt. Pleasant, St. Louis, Mo. 63111)

RCA Model 9Q25E receiver; tunes s.w. and BC; has 6 tubes and magic eye. Schematic needed. (Paul George, Boy's Village, Smithville, Ohio)

TBM-8 transmitter, modulator CAY-50065-A, transmitter CAY 52170, made by Westinghouse. Operating manual and power supply needed. (Chaminade High School Radio Club, Chaminade H.S., Mineola, N.Y.)

Silvertone Model 4789 receiver, chassis 101.482. **Airline** Model 14BR-913A or 24BR-913A receiver. Parts needed. (Garnet W. Frank, Rt. 1, Potsdam, N.Y. 13676)

Pilot Radio FM "Pilotuner." Schematic needed. (Bo Yeargan, 120 Westmore, Rome, Ga.)

Scott Radio Laboratories Model SLR-H receiver, ser. 4478; tunes s.w. from 0.53 to 15.6 MHz; has 12 tubes. Schematic and alignment data needed. (Martin Lydon, 4600 Wissahican Ave., Rockville, Md.)

"Command" CB transceiver kit; has 5Y3, 6AU8, 6AQ5A, 12AX7, and 6AN8 tubes. (Donald A. Peterson, 6535 N. Monticello, Chicago, Ill. 60645)

Sparton Model 7-46 receiver-phono combination; tunes BC and s.w.; has 7 tubes. Schematic and operating manual needed. (Bob Hilgemann, Box 256, Elgin, Iowa 52141)

Philco Model 20 receiver, circa 1928; tunes BC; has 7 tubes. Schematic, parts list, and tube location chart needed. (Fred Rice, 7913 Gilbert St., Philadelphia, Pa. 19150)

EICO Model 400 oscilloscope. Schematic and operating manual needed. (John J. Barnaik, Jr., 177 E. Budge St., Phoenixville, Pa. 19460)

Heath Model DX-35 transmitter. Operating manual needed. (R. W. Yerbury, 3186 Hillsdale Dr., Granger, Utah 84119)

Mitchell Model 1415 or 1416 "Wireless Intercommunicator." Schematic needed. (John Widen, 2423 Circle Dr., Lakeland, Fla. 33803)

Radio City Products Model 807 tube and set tester. Instruction manual needed. (Hans Hingst, 6721-A E. 8 St., Anchorage, Alaska)

"Saxon" Model 755 tape recorder, made by Jupiter Mfg. of Japan; 4 tracks and 3 speeds; completely transistorized. Schematic and/or operating manual needed. (James H. Lynch, 1045 Garden St., E. Palo Alto, Calif.)

"DeJong" receiver, made by DeAdco Products, circa 1940; tunes 550 kHz to 4400 kHz on 3 bands. Tube layout chart needed. **Atwater Kent** Model 45 receiver, circa 1926; tunes 550 to 1600 kHz; has 8 tubes. Power pack needed. (Paul Locatelli, 327 Iroquois St., Lauriium, Mich. 49913)

Harman-Kardon "Citation V" amplifier. Metal cover cage needed. (W. Q. Cochran, Church Rd., Box 35, R.D. 1, Hatfield, Pa. 19440)

Wards "Airline" Model 62-150 receiver, circa 1937. Schematic, operating manual, and source for parts needed. (Daniel Tiffany, 36747 Greenbush, Wayne, Mich. 48184)

Farnsworth-Capehart Model 319AM TV receiver; has 21 tubes. Schematic and parts list needed. (William B. Farnsworth, 1304 Elm St., W. Springfield, Mass. 01089)

CRU 46151 receiver, made by RCA, circa 1942; tunes 195 to 9050 kHz. Schematic needed. (David Hire, Rt. 1, Clemmons, N.C. 27012)

RCA Model 224D receiver/transmitter used by Army Signal Corps. Schematic and operating manual needed. (Jan Tarsala, 1201 Grand Vista Way, Monterey Park, Calif. 91754)

Magnavox Model CR2-100 receiver/phono combination, circa 1948; tunes BC; has 7 tubes. Schematic needed. (Kenneth Kepler, 418 Pendegast St., Woodland, Calif. 95695)

Heathkit Model 0-5 oscilloscope. Schematic and operating manual needed. (Bob Yerman, 1283 Howland Wilson Rd., Warren, Ohio)

—30—

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CIRCLE NO. 5 ON READER SERVICE PAGE

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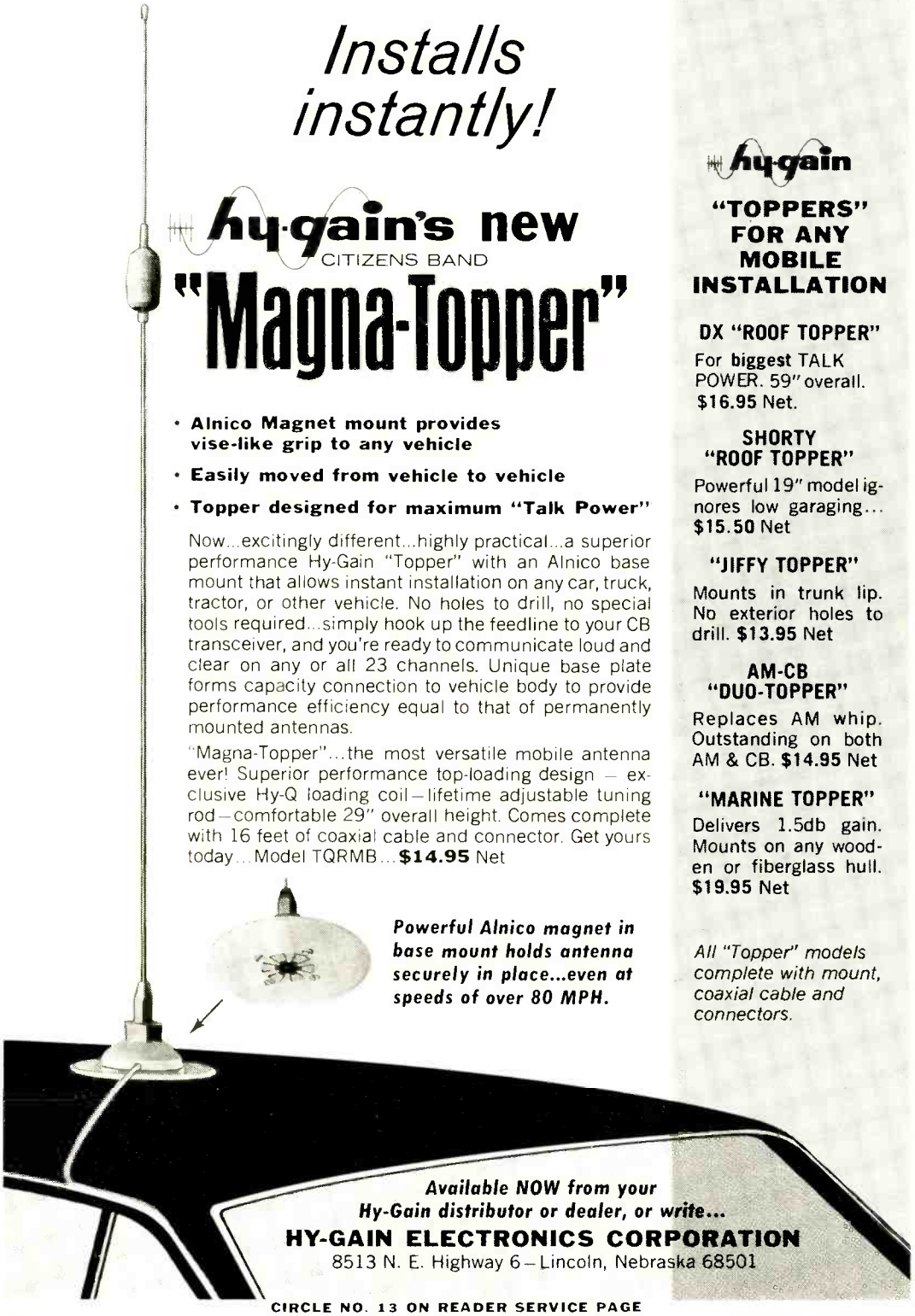

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CIRCLE NO. 13 ON READER SERVICE PAGE

BUILD THE MODBOX

End guesswork with this plug-in adapter— now you can instantly check percent and quality of modulation

By GEORGE J. WHALEN

ASK ANY amateur or CB operator about the efficiency, power input, or stability of his AM phone transmitter and you'll likely be in for fifteen minutes of enlightening statistics about final amplifier plate current, grid excitation levels, and field strength measurements. Then, ask him what his average percentage of modulation is. In all probability, you'll be met with a blank stare and an answer something like: "Oh, about a hundred percent . . . I guess."

You can hardly blame him for not knowing much about his modulation, simply because most transmitters have no provisions for checking either quality or percent of modulation.

The "Modbox" takes the guesswork out of monitoring modulation. It is a simple, inexpensive modulation analyzer, designed for easy addition to any plate-

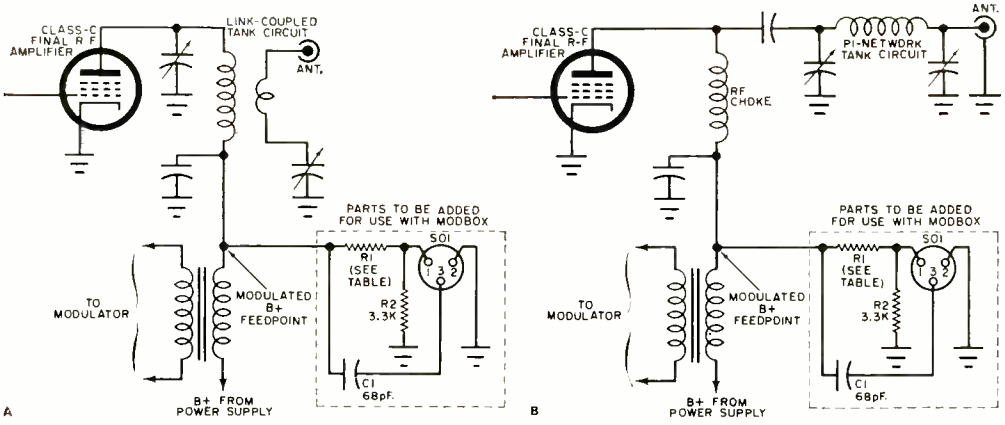


Fig. 1. Voltage divider R1 and R2, and harmonic frequency coupler C1 are installed in the final r.f. amplifier to obtain a sampling of harmonics and B-plus voltage without upsetting transmitter operation.

modulated AM transmitter or transceiver running up to 200 watts input. It provides three important monitoring features: first, it reads your average percentage of modulation; second, it flashes a warning whenever overmodulation or serious distortion is occurring in your final amplifier; and third, it lets you hear the audio applied to the final amplifier, for an on-the-spot listening test. This three-way quality check is the best insurance policy you can get against splatter, hum feedback, distortion, and loss of contacts due to poor modulation.

How It Works. A ratio voltmeter circuit is used to measure percentage of modulation, a peak-reading neon lamp "voltmeter" to detect overmodulation and audio distortion, and a direct audio monitoring circuit to couple audio out of your rig to a pair of headphones for a listening quality check.

The ratio voltmeter circuit makes it possible to measure both a.c. and d.c. voltages and the relative amounts of each voltage present with respect to the other. From these readings it is an easy matter to determine percent of modulation.

For safety's sake, the ratio voltmeter used in the Modbox operates from a resistive voltage divider installed in your transmitter's final amplifier as shown in Fig. 1. In this manner, high voltages are kept off the Modbox cable. The divider resistors have negligible effect on the transmitter and may be installed without violating any FCC regulations.

To better understand the operation of the ratio voltmeter circuit, imagine that the transmitter is in operation, but without modulation. Unmodulated B+ appears across *R1* and *R2*, and is divided down to a low voltage across *R2*, on the order of about 10 volts. This low voltage is connected by cable (through pin 1) to the Modbox (Fig. 2) where it appears across *CALIBRATION* potentiometer *R5*, but is blocked from the meter circuit by capacitor *C2*. When *PUSH TO CAL* switch *S1* is depressed, a path is created for d.c. to flow, through resistor *R3*, to d.c. milliammeter *M1*, and *R5* can be adjusted to obtain a full-scale reading of 1 mA. After this adjustment is completed, *S1* is released. The ratio voltme-

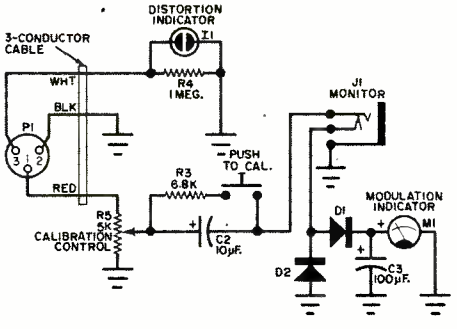


Fig. 2. Modulation indicator tells how much a.c. signal is present with respect to unmodulated d.c., to provide a percent modulation figure. Distortion indicator I1 lights up in the presence of harmonic frequencies which are generated by overmodulation.

ter is now calibrated for the unmodulated d.c. plate voltage in the final amplifier, and is ready to accurately measure a.c. modulation voltages with reference to this d.c. voltage.

When you speak into the microphone, your rig's modulator applies an a.c. modulating voltage to the final amplifier, superimposed on the d.c. plate voltage. This combination of voltage is also divided down by *R1* and *R2*, and appears across *R5*. Since *S1* is open, d.c. is blocked from the meter circuit, but the a.c. modulating voltage is coupled to rectifier diodes *D1* and *D2* and the meter by *C2*. Rectified audio voltages are filtered by *C3* and *M1* indicates the relative effective value of the a.c. modulating voltage. For 100% modulation, *M1* will give a reading of 0.7 mA. Readings exceeding 0.7 mA indicate overmodulation, which could result in "splatter" and distortion.

The distortion-indicating circuit is coupled to the modulated B+ by *C1* (Fig. 1) and because of the small amount of capacitance (68 pF) does not readily see audio voltages at frequencies in the range of 300 to 3000 Hz. However, when a condition of overmodulation exists, high-frequency harmonics are usually generated in the final amplifier on the order of 10,000 to 30,000 Hz, which are more easily passed by *C1*. When the harmonic voltages appear across *R4* and exceed a peak of about 65 volts, the neon lamp (*I1*) flashes and provides a visual indication.

A listening quality check of the audio can be made simply by plugging a pair of 2000-ohm headphones into jack *J1*. The rectifier and meter circuit is disconnected when the phones are plugged in. Potentiometer *R5* can be used as a volume control to adjust the sound level in the headphones.

Construction. Layout and type of cabinet used are matters of choice and are not critical. The few parts required for the entire circuit could be made to fit into your present rig, if you have the space on the front panel for *M1*. However, you will get more mileage out of the Modbox if it is a separate unit; you can plug it into different transmitters as needed.

A 5" x 2¼" x 2¼" aluminum utility box can be used. The holes should be located and drilled as shown in Fig. 3.

PARTS LIST

C1—68-pF, 3000-WVDC, ceramic capacitor
C2—10-μF, 25-WVDC, electrolytic capacitor
C3—100-μF, 6-WVDC, electrolytic capacitor
D1, D2—1N2070 silicon rectifier (or equivalent)
I1—NE-51 neon lamp
J1—Single closed-circuit phone jack (Switchcraft 12A or equivalent)
M1—Miniature 0-1 mA d.c. milliammeter (Lafayette 99 R 5052 or equivalent)
P1—Miniature male shielded cable connector (Amphenol MPM3L or equivalent)
R1—See Table 2
R2—3300-ohm, ½-watt resistor
R3—6800-ohm, ½-watt resistor
R4—1-megohm, ½-watt resistor
R5—5000-ohm, ½-watt linear taper potentiometer (Mallory U-14 or equivalent)
S1—S.p.s.t. normally-open push-button switch (Switchcraft 201 or equivalent)
SO1—Miniature female shielded chassis connector (Amphenol PCG-3 or equivalent)
1—5" x 2¼" x 2¼" aluminum utility box (Premier AMC 1004 or equivalent)
Misc.—⅜"-i.d. and 5/16"-i.d. grommets, 3-conductor cable, terminal strip, knob, screw, nut, wire, solder, etc.

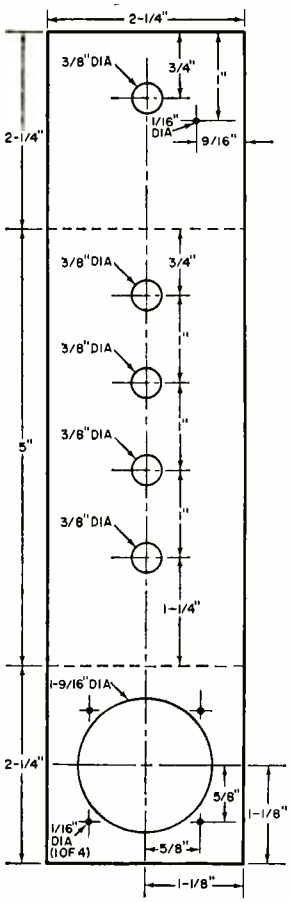


Fig. 3. Type of box used and layout are not critical, but make the four bolt holes for the meter a bit oversized to permit rotating the meter if necessary to keep it straight. If you have enough room on your transmitter, you can mount all the parts directly on it, and thus do away with the cable and the box.

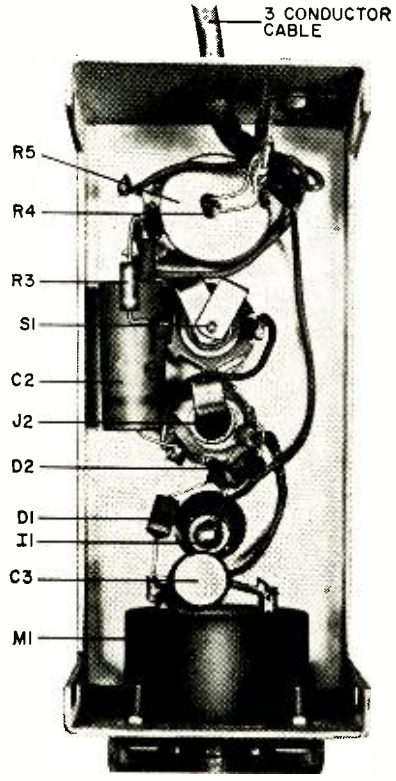


Fig. 4. Mount the parts in any convenient manner, but observe polarity of the meter, diodes, and electrolytic capacitors. Use a clamp to hold the cable.

The meter hole should be made to conform to the meter used. Mark the positions of the four meter-mounting screw holes and drill them somewhat oversize to permit slight rotation of the meter, if necessary, to mount it straight.

Appearance counts in home-brew gear just as much as it does in commercial equipment. So, if you want a really professional-looking job, smooth all burrs, polish the box with fine steel wool, paint, and apply decals. A final coat of clear acrylic lacquer will protect the unit from normal wear and tear. Four tiny rubber feet cemented to the bottom half of the box will enhance the appearance of the unit and protect your furniture.

When the chassis work and appearance details have been completed, assemble the three-conductor cable and connector *P1*. Cable length is not critical, but it should be just long enough to make a neat hookup to your transmitter. If you have to cut the shaft of *R5* down to size, do so without subjecting the control head to stress. The neon lamp is held in place with a $\frac{3}{8}$"-i.d. grommet.

Mount the meter after you have completed the wiring. Be sure to observe polarity of the meter, diodes, and electrolytic capacitors. And avoid overheating the diodes when soldering.

Calibration. No calibration is necessary as the meter readings are relative to the setting of *R5* for an unmodulated signal. However, if you would like to double-check your work, you can put together the test setup shown in Fig. 5. The VOM should be a 20,000 ohms-per-volt meter, capable of good accuracy on the low-voltage a.c. and d.c. ranges. Do not substitute a peak-to-peak VTVM for the VOM since this procedure calls for a meter capable of reading r.m.s. rather than peak a.c. voltages.

Connect the test setup to the Modbox, but do not connect the primary of the transformer to the 117-volt a.c. source just yet. Set the VOM to read d.c. volts and adjust *R6* until the VOM reads 6.3 volts d.c. Next, depress switch *S1* and adjust the Modbox *CALIBRATION* potentiometer (*R5*) until meter *M1* shows 1 mA. Readjust *R6* if necessary, to obtain the 6.3-volt d.c. reading on the VOM. Then, without disturbing any adjustments, release *S1*, set the VOM to read a.c. volts, and connect the calibrator to 117 volts a.c. The VOM should read 6.3 volts a.c., and Modbox meter *M1* should indicate 0.7 mA—corresponding to a 100% modulation reading.

If *M1* reads higher than 0.7 mA, decrease the value of the 6800-ohm resistor (*R3*) and repeat the calibration check. If *M1* reads lower than 0.7 mA, increase the value of *R3* and repeat the calibration check. One precaution: the a.c. voltage from the transformer must be no more and no less than 6.3 volts for this calibration procedure.

If you want to convert your meter to a direct-reading modulation meter, transfer the readings from the accompanying calibration chart (Table 1) onto the meter face, using a fine-pointed pen or colored pencil. If you are just interested in knowing how close your average modulation percentage comes to 100%, mark a line on the meter scale just beyond the 0.7-mA division and write in "100%"

above it. Then, carefully fill in the scale divisions between 0.7 and 1 mA in color, so that readings exceeding the 100% mark will stand out at a glance. If you wish, you can type out a small chart and cement it to the side of the case.

Transmitter Hookup. Select a suitable place in the transmitter, preferably as close to the final amplifier as possible, and mount *J1*. Next, compare your transmitter's schematic diagram with the two typical final amplifier circuits shown in Fig. 1, and locate the modulated B+ feed-point in your circuit. Once you've located the connection point, determine the d.c. plate voltage appearing at that point, either by measuring it directly or from the transmitter schematic. The plate voltage in your transmitter determines the value of divider resistor *R1*. See Table 2.

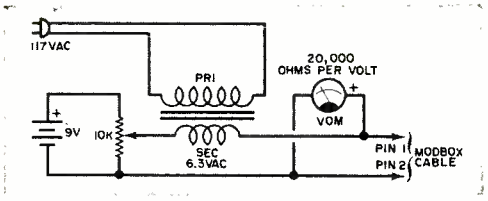


Fig. 5. Simple test setup for calibration purposes can be put together with a 9-volt d.c. and a 6.3-volt a.c. source. However, the Modbox is essentially foolproof, and does not require a calibrator.

Install *R1*, *R2*, and *C1* in your final amplifier circuit, and keep the leads as short as possible. Insulate any lead which might come in contact with the chassis. Pay particular attention to the grounding of *R2*, and pin 2 of *SO1*. After these components have been installed, connect the Modbox to the transmitter by plugging *P1* into *SO1*, and perform a quick continuity check on the interconnecting cable. Be sure that the Modbox's case shows continuity with the transmitter's chassis. Check all wiring carefully, button up the Modbox—and your transmitter—and you're ready to try it out on the air.

On The Air. It's a good idea to run your transmitter into a dummy load to make your adjustments and to avoid cluttering up the airways with extraneous sounds prior to going on the air, especially after a modification or repair has been made. Warm up the rig, cover the microphone or run the modulation control down to zero to prevent modulation of the carrier, depress the *PUSH TO CAL* switch (*S1*) on the Modbox and simultaneously adjust the *CALIBRATION* potentiometer (*R5*) until the meter indicates 1 mA. Release *S1* and speak into the microphone at a normal level. If your rig has a modulation gain control, bring the level up while speaking, observing the meter as it "kicks" in response to your speech. Bring the mod-

(*Continued on page* 106)

MODBOX METER CALIBRATION CHART	
METER READING (d.c. mA)	**% MODULATION**
0	0
0.07	10
0.14	20
0.21	30
0.28	40
0.35	50
0.42	60
0.49	70
0.56	80
0.63	90
0.70	100
0.71 to 1.0	Overmodulation

Table 1. You can obtain direct meter readings of percent modulation by inscribing these figures on the meter dial, or you can paste this table on the side of the box. If you are just interested in knowing how close you can get to 100% modulation, without overmodulating, paint that portion of the dial above 0.71 mA in red, or any suitable color.

VALUE OF RESISTOR R1		
FINAL R.F. AMPLIFIER D.C. PLATE VOLTAGE	**OHMS**	**WATTS**
150	36,000	2
175	43,000	2
250	62,000	2
325	82,000	4
400	100,000	4
475	120,000	4
550	130,000	5
625	150,000	6
700	180,000	6

Table 2. Value of R1 depends upon the final amplifier's plate voltage. If necessary, you can parallel a couple of resistors to obtain needed wattage and resistance. Don't go below the wattage indicated.

"HELLO, COMPUTER? I HAVE HOMEWORK FOR US TO DO."

PEOPLE with problems to be solved by a computer usually must give them to a programmer who codes the problems for the machine and passes the coded material on to a computer operator. By the time the answers come back, hours or days may have passed. Not so with the IBM 1710 computer. It is providing instant voice answers to students who call it on the telephone for help in doing their homework.

Six students are participating in a joint study conducted by the Catholic Schools Diocese of Brooklyn and the International Business Machines Corporation to see how well they can communicate with a computer from their homes using a push-button telephone attachment. By pushing the proper buttons, the students can tell the computer to add, subtract, multiply, divide, find a square root, etc. The IBM 1710, located 50 miles away in Yorktown Heights, N. Y., confirms what it has been told to do and immediately gives correct answers from its prerecorded vocabulary.

The computer doesn't tell the students *how* to do their homework, but it provides them with the equivalent of a versatile desk calculator right in their own homes. With routine but time-consuming operations taken care of by the computer, the students have time to do more problems and get more practice in setting them up.

The spoken answers to the problems come from special audio response units operating under the control of the IBM 1710. Since the six students began using the experimental calculating service in March, they have been putting it to work on algebra, physics, trigonometry, bookkeeping and accounting. -30-

Student uses push-button attachment alongside her telephone to give homework problem to IBM 1710 data processing system located some 50 miles away.

Experimental computer system performs the necessary mathematics to solve the problem and provides instant voice answer from prerecorded vocabulary.

CB'ERS ARE WONDERING ABOUT—

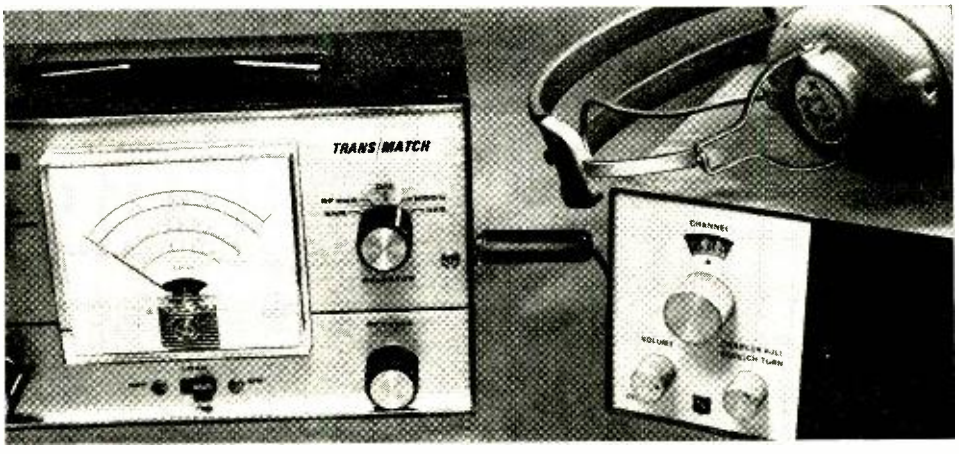
Some of the thoughts that are rattling around in the noggins of many of the country's nearly 900,000 CB'ers

By KOD3631

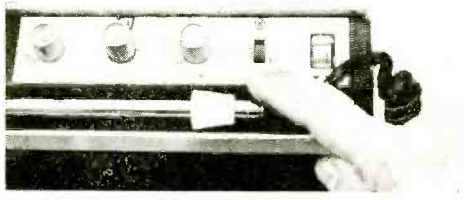
TODAY'S CB'ERS worry and wonder about a wide variety of subjects: the FCC, new equipment, the FCC, repairs on rigs, the FCC . . . well, you get the idea. What they worry about most is the number of stations jamming onto the channels. And they've got good reason to. There is an average of 2.8 transceivers for each CB license issued, and as of the end of May, 1966, there were some 857,000 CB licenses afloat, with new applications flooding into the FCC at an average of 23,000 per month. What with 23 channels allocated for CB'ers, that means an average of 117,370 stations *per channel!* The interference problem potential is frightening!

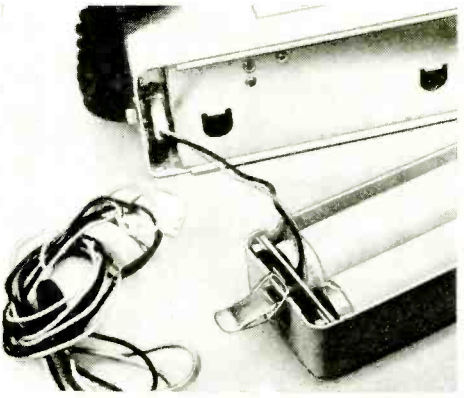
One thing which should make many crowded channel worriers rest easier is the availability of rigs offering single-sideband (SSB) transmission. Without going into an eloquent technical dissertation, the basic advantages are that you get better range as compared to a standard AM CB unit, and you take up only *half* of the usual channel space. In fact, two single-sideband stations can operate simultaneously on the same channel while only a few blocks apart, and not even be aware of each other. Single sideband offers the prospect of turning the present 23 channels into 46.

However, SSB rigs are not compatible with the hundreds of thousands of non-SSB CB transceivers already on the air. Since SSB is new to CB, very little of the existing equipment is capable of communicating with an SSB station. One of the major advantages of CB is being able to rely upon it in an emergency, especially when you're 10 miles into the middle of nowhere. Until there are sufficient SSB base stations to offer this aid, SSB mobiles will have limited efficiency. CB'ers are wondering when, if ever, the SSB bug will catch hold and

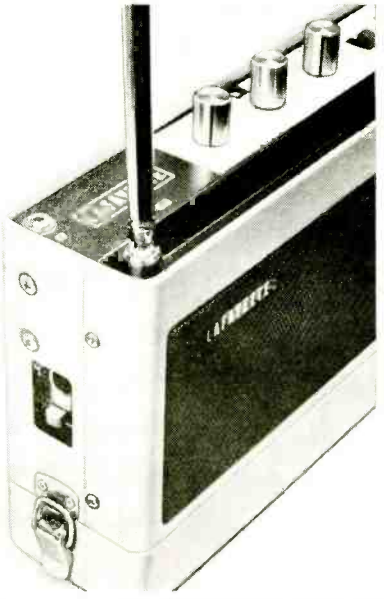


Multiple-purpose test instruments. One of the many recently introduced multiple-purpose testers is the EICO 715 "Trans/Match." Besides measuring power output in watts, serving as a field strength meter, and checking SWR when inserted in the transmission line between transceiver and antenna, the "715" will also read percentage of modulation. In this photo, a Squires-Sanders "23'er" is being tested. Headphones plugged into the side of the "715" permit an on-the-air type aural check of quality.





CB portables hit new stride. Walkie-talkies have graduated from the kiddie-style 100-milliwatt units to hand-held 1- and 2-watt transceivers and 2-watt or bigger shoulder packs. Squelch and noise limiting are "musts" in these portables, as is a selection of channels. The shoulder-slung portable in these photos is Lafayette's HA-450. It has 6 channels, provisions for connecting external antenna, headphone jack, meter switching to check battery condition, and 2.5 watts input. When tested by the POPULAR ELECTRONICS staff, the HA-450 maintained contact with a base station at a distance of 4-5 miles before being swamped by QRM. Switching to another channel showed that 8-9 miles could be expected from it under average conditions.



open up the doors for a CB service which can be twice as good as it is now.

New and Old Features. CB'ers are pondering, too, over some of the new CB gear. For eons they have been fed the same old features (squelch, noise limiters, S-meter, etc., etc.). They were beginning to wonder where the important features were that they really need-

ed. It was a matter of the manufacturers offering good features, but overdoing it. But now CB'ers find, much to their joy, that there are truly better things on the way—what you might call good things over*due*!

Look at some of the new sets. Mechanical filters to improve selectivity are becoming common. One unit has complete push-button control, another has tip-touch-tabs. Modular stations are coming on strong, and one base station even has a front panel switch to enable you to change back and forth between a beam antenna and a ground plane. One transceiver has a panel meter which automatically switches back and forth between an S-meter and a r.f. output meter while you operate. Walkie-talkies are getting more powerful, and a few even have different-size antennas for operating indoors and outdoors.

A feature that many operators could do *without* is still found in a few rigs. It's the usually hidden switch which changes the transmitter input power from 5 watts to 100 milliwatts. The implication is that you can run the thing at 100 milliwatts and legally work "skip" and conduct "ham radio" type operations under the FCC's Part 15 regulations. While this may be technically possible, the FCC says that these rigs are clearly illegal because in order for a transceiver to be operated under Part 15, it *cannot* be capable of running more than 100 milliwatts on 27 MHz—regardless of switching.

The manufacturers should employ the very obvious selling point of being able to use 100-milliwatt low power for local CB contacts to cut down on interference. It seems a shame to knock out a channel for miles around with 5 watts to speak to your mobile unit only 5 blocks away. One of the cardinal rules of good radio communications practice is not to use more transmitter power than you need to establish communications.

CB'ers are also curious about how small mobile antennas are going to get. The latest antennas for mobile units are the shortened "loaded" types—the full-length 108″ whip has gone the way of the Stanley Steamer. Somewhere there must be a law of diminishing returns—when the antennas will shorten themselves right out of communications efficiency. But how far is that point from today's antennas?

They get shorter and shorter. It's difficult to believe that the ultra-short center-loaded whips now being sold for mobile use can really get out. POPULAR ELECTRONICS tried out this 18″ whip from Antenna Specialists by mounting it in the exact center of a Tempest convertible trunk lid. Using the 16′ section of coax cable supplied with the antenna, the SWR was adjusted to 1.2:1. Consistent 100% readability range using this undersized antenna (Model MS-130) was 9-10 miles on transmit and 12-14 miles on receive. The limiting factor was found to be not the mobile antenna but the pickup of the base station antenna—there was just too much QRM. It took about two hours to install this antenna—most of the time was spent in carefully routing the cable under the door tread.

HELP and the FCC. Something else on the minds of many CB operators is the proposed Highway Emergency Locating Plan (HELP). As you probably know by now, this is a program whereby countless police stations, hospitals, auto emergency units, and other special service organizations will monitor a couple of CB channels on a 24-hour basis. The whole idea was whipped up and presented

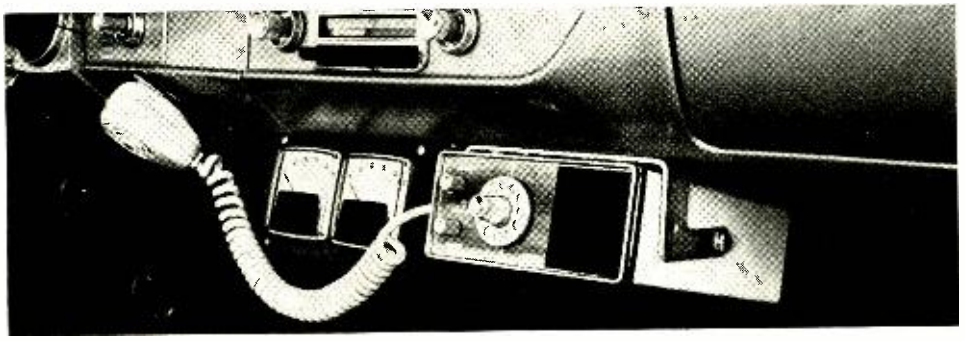
to the FCC over a year ago; to date, the silence has been deafening. Oh, yes, once the FCC people did issue a press release which said that they were still thinking it over; but this or a similar program which has so many obvious merits could certainly be put right into use unless there were some underlying (and unseen) negative factors.

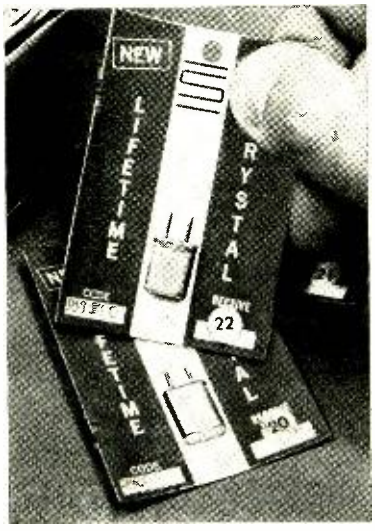
One thing against the HELP program is a large group of police officers. They feel that the program will be invaded by all manner of well-intentioned but untrained microphone-button jockeys who will create more havoc for motorists than the problems which faced them at the time they first called for help. Could be, but everyone wonders when CB will be given the chance it deserves to prove itself in a national public service program.

Many CB'ers are concerned with the FCC's attitude toward the CB service, especially in the realm of enforcement. In some areas of the country, CB'ers live in constant fear of the FCC monitor as if he were a huge, awesome vulture waiting to swoop down and swallow all local operators. In other areas, bedlam rules the CB channels.

In general, the FCC monitors are rather impersonal fellows—they send warning notices to all stations found violating the Rules, be they notorious troublemakers or some poor unfortunate who made his first slip. Some CB'ers live a stone's throw from one of the FCC monitor stations and, naturally, those operators are watched more closely than the majority of CB operators, who live out of ground-wave range and can be monitored only by a mobile monitor or via skip reception. Those who operate according to Part 95 of the FCC's Rules have nothing ot fear, but

(*Continued on page* 90)





Compact mobiles for compact cars. Typical of today's mobile CB transceiver is the Regency "Ranger." In this POPULAR ELECTRONICS staff member's car, the most convenient spot under the dash was already occupied by two meters monitoring the transistorized ignition system. So, a compact solid-state multiple-channel CB rig was called for. Note that the mike cord and controls "face" the driver. The "Ranger" is delivered with channel 11 crystals installed, leaving 10 more crystal positions open. The buyer gets a small plastic number with the purchase of a receive crystal and slips this onto the rotary dial channel selector. Looking inside the "Ranger," note the printed circuit wiring and the Collins mechanical filter for optimizing selectivity.

ANNUAL REPORT ON

A MANUFACTURER-BY-MANUFACTURER ANALYSIS OF THE CB MARKETPLACE—HIGHLIGHTING NEW EQUIPMENT, PRICE OR MODEL CHANGES, ETC.

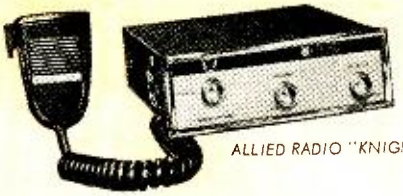
PREPARED BY THE
POPULAR ELECTRONICS
EDITORIAL STAFF

A REMARKABLE DISPLAY of new CB equipment will be placed on sale during the months of August, September, and October. There will be so much new equipment around that your Editors can't help but be reminded of the sudden burst of equipment activity in 1962-63. Scores of new 5-watt transceivers are now being prepared for marketing. Solid-state transceivers are rapidly gaining the major share of the mobile market, and are making inroads as base station units. A variety of new attachments and operating conveniences are being sold and more are likely to appear before the end of this year.

The 1966 "Annual Report on CB Equipment" has been prepared by soliciting information from every CB equipment manufacturer. Those companies manufacturing 5-watt transceivers are represented in the following pages. However, while every effort has been made to have this Report complete and comprehensive, a few manufacturers were unable to supply pertinent information by press time. (The Editors are not responsible for price and/or model changes made after the preparation of this Report on June 1, 1966.)

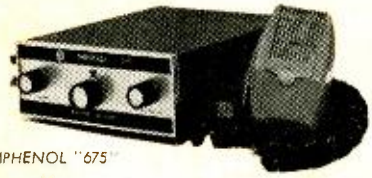
An innovation has been made in this Report. It is the large dot (●) which often appears on the left-hand edge of the text material, indicating that the item discussed is new, restyled, or has been changed in price since our 1965 Report.

ALLIED RADIO CORP. (100 N. Western Ave., Chicago, Ill. 60680): Typifying the immense amount of action in the CB marketplace, Allied Radio has revamped a large percentage of its famous Knight and Knight-Kit line of CB gear. In the ● Knight lineup is a new 5-channel crystal-controlled transceiver called the "KN-2520" ($79.95) and a 23-channel ● "KN-2522" ($99.95). These two units are for 12-volt d.c. operation. The "KN-● 2565B" ($169) has been updated and now contains a "Range-Expander" modulation circuit and provisions for p.a. This is a universally powered transceiver. Also ● new in the wired Knight line is the "KN-2590" ($69.95). This universally powered unit is set up for 8 channels. Switching over to the Knight-Kit lineup, the "C-540" ($44.95) base station is being continued (with universal power it is $49.95). The "C-560" base station ($84.95) is continued (with universal power, $89.95). The latter units have 6 crystal-controlled transmit/receive channels plus a tunable receiver. Also featured is an overmodulation indicator and automatic S-meter switching to read transmit power output. The very popular "Safari I" ($129.95) is retained in the Knight-Kit



ALLIED RADIO "KNIGHT KN-2520"

B & K "COBRA V"



AMPHENOL "675"

BROWNING "RAVEN"

line. This is a 23-channel transceiver, universally powered with dual-conversion receiver, switched S-meter, overmodulation indicator and p.a. output. Joining the kit line this fall are two new ones. The
- "Safari II" ($59.95) will be a 5-channel unit for 12-volt operation that is completely solid state. An a.c. base station power supply will be $19.95. This unit is also adaptable to portable use, and rechargeable batteries and carrying case are available as options. Maintaining much of the compact size, the solid-state
- "Safari III" ($84.50) kit will be for 23 channels and will also be initially designed for 12-volt d.c. operation. Allied Radio is continuing a number of important accessories and a look at its catalog is a must.

AMPHENOL CORPORATION (2875 S. 25th Ave., Broadview, Ill. 60153): Three new CB transceivers will be introduced this fall to augment the very popular line of Amphenol solid-state mobile and base stations. Of particular interest is the
- 2-channel Model 80 ($129.95) walkie-talkie that has received FCC type approval. The Model 80 has a power switch for maximum battery conversion. In the "Hi" mode, the input is 3 watts; and in the "Lo" mode, the input is 0.75 watt. A new 10-channel mobile unit called the
- Model 675 ($169.95) has a double-conversion receiver with ceramic filter i.f. stages. For the space-conscious CB'er,
- there is the new Model 725 ($109.95) measuring only 6" x 6½" x 1⅞". This unit has 8 crystal-controlled channels. In addition to the three new ones, Amphenol is continuing the Model 650 ($229.95), Model 625 ($189.95), Model 510-B ($199.95), and Model C-75 ($114.50). Also available is the 524 selective-calling adapter ($79.95) and the "Porta-Paks" for the 510-B and 625 or 650.

B & K MANUFACTURING CO. (1801 West Belle Plaine, Chicago, Ill. 60613: The "CAM-88" ($214.95) featuring "Dyna-Boost" is being continued. New from
- B & K is the "Cobra V" ($99.95), a solid-state unit with 5 crystal-controlled channels, for 12-volt d.c. operation only. The small size of the "Cobra V" is handsomely set off by the walnut grain paneling.

BROWNING LABORATORIES, INC. (1269 Union Ave., Laconia, N.H. 03246): The premier base station, the "Eagle" ($359) continues to rack up considerable interest. This two-unit station has just about every feature a CB'er would want, including variable selectivity, built-in VSWR meter, "spot" frequency, speech clipping, r.f. gain control on the front panel, etc. For the mobile station,
- Browning offers the "Raven" ($269). Featured here is a built-in Rayistor speech compressor, a theft deterring mounting, and a triple diode noise limiter. Both the "Eagle" and "Raven" are 23-channel units. The "Drake" has been phased out of production.

DEMCO "SATELITE"

E.C.I. "COURIER TR-23S"

BURSTEIN-APPLEBEE CO. (1012 McGee St., Kansas City, Mo. 64106): Two new CB units are being offered as price-breaking "spring/summer" specials. The BA-8 ($69.95) can be set for 8-channel transmit/receive or for use as a 23-channel tunable receiver. It is universally powered. The BA-23 ($99.95) has a tunable double-conversion receiver and 23-channel crystal control transmit (1 crystal supplied). The power supply is transistorized for 117 volts a.c. and 12 volts d.c. The BA-22 has been discontinued.

CONCORD ELECTRONICS CORP. (1935 Armacost Ave., Los Angeles, Calif. 90025): Introduced this past year was the 1-watt walkie-talkie, Model TG-132B. This unit has adjustable squelch and is delivered with channel 9 and 14 crystals. External power and antenna adapters are packed with the walkie-talkie.

DEMCO ELECTRONICS (Bristol, Ind. 46507): Just introduced is the "Chalet" ($124.50), a 12-volt mobile rig with 6 crystal-controlled channels. It is all solid state. For base station operation, the "Chalet" can be plugged into a Model DMT-110 ($34.50); for 6-volt d.c. operation, it can be plugged into a Model DMT-612 ($44.50). A remodeled version of the "Ravelle" ($124.50) goes on sale this month. This tube-type transceiver has 5 internal crystal positions plus new panel sockets for receive and transmit crystals. It also has p.a. output provisions. A brand-new model of the "Satelite" (price n.a.) is to be released shortly. This 3-piece CB base station (receiver, transmitter, and speaker are separate units) features several innovations—including a panel-mounted switch for antenna changeover, ground plane to beam; instant-on operation; 24 channels; etc.

E.C.I. ELECTRONICS COMMUNICATIONS, INC. (56 Hamilton Ave., White Plains, N.Y. 10601): In addition to the well-known "Courier 23" ($189.50), e.c.i. is now selling three new solid-state transceivers particularly designed for mobile operation. First of the three is the "Courier TR-6" ($129) set up for 6-channel crystal-controlled operation. Next is the "Courier TR-12" ($139) for 12-channel operation, featuring an illuminated S-r.f. meter. Top of the new line is the "Courier TR-23S" ($169) for 23-channel operation. Each of these units has a panel-mounted modulation indicator and is protected against d.c. power reversal and overloading.

EICO ELECTRONIC INSTRUMENT CO., INC. (131-01 39th Ave., Flushing, N.Y. 11352): As promised in last year's report, EICO did announce a 12-channel tube-type transceiver available *wired only*. It is the "Sentinel 12" Model 712 ($99.95). This unit features a 5-watt/100-milliwatt switch, 3 i.f. stages, spotting switch, and fully tunable receiver. Top of the EICO line is the "Sentinel-Pro" ($169.95). This

unit is also available *wired only* and is a reworked version of the "Sentinel 23"; the new model has a built-in speech clipper (called "Range Plus"), fingertip pi-network output controls, p.a. provisions, etc. Both of these EICO transceivers are universally powered.

FANON ELECTRONIC INDUSTRIES, INC. (439 Frelinghuysen Ave., Newark, N.J. 07114): A new walkie-talkie from this manufacturer is the "Chieftain" ($109.95). This is a 2-watt input unit with provisions for 2-channel operation. Metering is switched between r.f. output and battery condition. An optional extra is a 5-tone selective-calling system ($21.95). The "Pathfinder" ($53.50) is being continued. This unit has only ½-watt input, but can be used in conjunction with the selective-calling system.

GC ELECTRONICS CO. (400 South Wyman St., Rockford, Ill. 61101): This company has discontinued transceiver production, although some "Globe Master" and "President" models are available in a few stores at drastically reduced prices. Current production is aimed at a line of CB accessories.

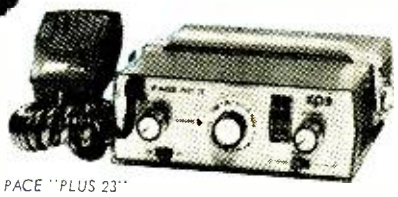
GENERAL RADIOTELEPHONE CO. (3501 West Burbank Blvd., Burbank, Calif. 91505): The big "G" is continuing the successful line of gear introduced last year. The only addition is the Model MC-7 ($199.50) which is somewhat similar to the popular "Super" MC-8 (same price), except that the MC-7 has power supply provisions to go on 6 volts d.c., as well as 12 volts d.c. and 117 volts a.c. Both are 24-channel units (including the CAP channel at 26.620 MHz) and have p.a. or "bull horn" switching. The awesome "SB-72" ($399.50) is the top of the big "G" line and can go single-sideband (48-channel possibilities), or 24-channel double-sideband straight AM; a Collins Radio mechanical filter is used for sideband selection. On the low end of line is the VS-6 ($99.50), universally powered, with 5 crystal-controlled channels. The "Silent Service" ($39.95) selective calling adapter (66 possible codes) can be used with all big "G" transceivers except the SB-72.

HALLICRAFTERS (5th and Kostner Ave., Chicago, Ill. 60624): Four brand-new products have just been announced by this famous communications equipment manufacturer. First is a 1-watt walkie-talkie called the CB-8 ($99.95). This unit has squelch, 2 channels, and rechargeable nickel-cadmium batteries. The CB-17 ($99.95) has been introduced as a tube-type 6-channel transceiver with provisions to accept all of the usual Hallicrafters accessories (S-meter, receiver "VFO", noise eliminator, encoder/decoder, etc.) For $50 more, the CB'er can pick up the new CB-19 ($149.95), an 8-channel unit with variable tuning in the receiver. The S-meter and spotting switch are built in. Like the CB-17, the CB-19 is universally powered; however,

LAFAYETTE HB-444/25A

OLSON "SPOTTER 23"

E. F. JOHNSON "MESSENGER 350"



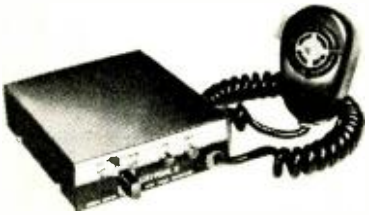
PACE "PLUS 23"

the CB-19 has dual conversion in the receiver section. Last of the new ones, but not least, is the 5-channel solid-state
- CB-20 ($99.95). This is a mobile unit with extra shielding and noise suppression circuitry. Speaking of mobile operation, Hallicrafters is continuing the CB-12 ($179.95), a 12-channel solid-state transceiver with a dual conversion receiver. For base station use, a pedestal power supply, Model P-12 ($34.95), is offered. Top of the Hallicrafters line is the CB-14 ($259.95) for mobile operation, or for base station use with the P-14 pedestal power supply ($39.95). This unit has 23 channels.

HEATH COMPANY (Benton Harbor, Mich. 49023): Heavy emphasis is being placed on the popular GW-14 ($89.95, kit, and $124.95, wired) at the top of the line. This solid-state transceiver has provisions for 23-channel crystal-controlled operation. The GW-14 is designed for 12-volt mobile operation, but a new 6- to 12-volt converter—Model GWA-14-4 ($14.95)—is offered the VW or Porsche owner. For base station operation, the Model GWA-14-1 ($14.95) 117-volt a.c. power supply is used. Heath sells the crystals for the GW-14 at discount prices when they are ordered with the transceiver. Continued in the line are the GW-12A ($34.95) for single-channel base station operation and the GW-12D ($39.95) which is universally powered. The GW-22 series is available in a variety of configurations—with and without selective calling—from $47.95 to $74.95. A deluxe base station, GW-42 ($99.95), featuring selective calling, is still available. In the walkie-talkie line-up is the 1-watt GW-25A ($69.95). Heath is also considering a new walkie-talkie with a 2-watt input
- rating. It will be the GRS-65 ($99.95, assembled) and will be for single-channel operation.

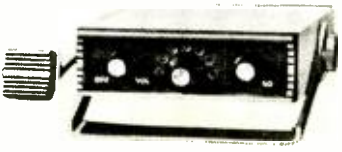
INTERNATIONAL CRYSTAL MFG. CO. INC. (18 N. Lee, Oklahoma City, Okla.): The Model 440 ($245) is being continued, as well as the Model 50AN ($172.50) and Model 59N ($172.50). The Model 440 is set up for 23 channels, the 50AN for 3, and the 59N for 12. All of these units are tube types. New this year are
- the Model MO ($199.50) and Model
- MO-23 ($245). These latter units are hybrids, mixing tubes and transistors, and are designed for mobile operation. The Model MO is set for 6 channels and the Model MO-23 for 23 channels. Both units feature control-head remote operation.

E. F. JOHNSON CO. (Waseca, Minn.): Probably the most resounding impact on the CB market in the past 12 months was made by the E. F. Johnson Co. through
- the introduction of its "Messenger 350" ($299.95). This solid-state transceiver insures CB single-sideband communications under the worst possible QRM and QRN conditions. The "350" has 2 crystal-controlled channels, each of which can be subdivided and transmissions

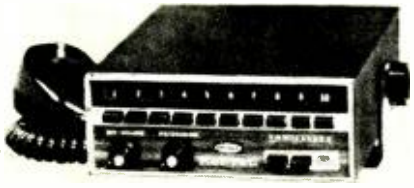


MULTI-ELMAC "CITI-FONE II"

PEARCE-SIMPSON "DIRECTOR"



POLYTRONICS "POLY PUP"



RAYTHEON "TWR-ELEVEN"

made on either the upper or lower sidebands, thus providing 4 possible communications channels. Primarily a mobile rig, the "350" can be used as a base station with a 117-volt accessory power supply. Power input to the "350" is 10 watts (PEP) and provisions are made for i.f. noise silencing and p.a. switchover. At this writing, Johnson has no plans to drop its CB 5-watt input AM equipment. The "Messenger" ($99.95), "Messenger Two" ($149.95), "Messenger III" ($189.95), and "Personal Messenger" ($129.50) are all being continued. Announced within the past few months was a new member of the family, the "Messenger 100" ($129.95). This is a solid-state unit for 5-channel operation featuring built-in speech compression and i.f. noise clipping on "receive." A base station 117-volt a.c. power supply pedestal is available as an optional accessory. In the way of accessories, Johnson has a novel "Power Pack" ($69.95) for hand-carried operation of the "Messenger III," "Messenger 100," and "Messenger 350." The "Power Pack" provides 8 hours of operation and is designed to accept either a 22" center-loaded or 48" base-loaded whip antenna. A battery recharger will recharge the nickel-cadmium cells in 12-16 hours. In addition to the selective-calling system ("Tone Alert") being continued by Johnson, other accessories include a "CB Matchbox" ($15.95), "Antenna Meter" ($14.95), "Voltage Regulator" ($17.95) for dropping 24-32 volts to 13 volts, and "In-Converter" ($22.95). AT PRESS TIME: A new 23-channel solid-state unit has been announced, the "Messenger 323" (about $300), which will be top of the line in AM equipment.

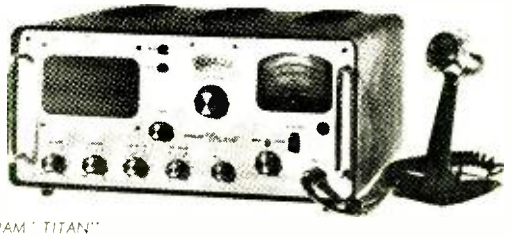
KAAR ELECTRONICS CORP. (2250 Charleston Rd., Mountain View, Calif. 94041): A new member of the Canadian Marconi Company group, Kaar is retaining the time-proven D333B ($229.95) with its 8 channels and tunable receiver. The "Skyhawk" ($219.95) is being upgraded into a "Mark II" version, and scheduled for release this month is a new solid-state transceiver, the "Skylark 336" ($179.95). The "Skylark" will be rugged and designed for industrial use. It will have 11 channels. All Kaar transceivers have a special 2-year guarantee on components.

LAFAYETTE RADIO ELECTRONICS CORP. (111 Jericho Turnpike, Syosset, L.I., N.Y. 11791): As one of two major manufacturers/suppliers of CB gear, Lafayette has a number of things planned for the next few months. Since the last report in POPULAR ELECTRONICS (the August 1965 issue) the "Comstat 9" ($59.95) has been introduced. This 9-channel crystal-controlled receive/transmit unit is sold as a kit. Extra crystal socket positions are panel-mounted, and a switch on the rear deck can change the input from 5 watts to 100 milliwatts. A wired version of the "Comstat 9,"

WORLD RADIO LABS "RUSTLER"

SONAR T-2

SQUIRES SANDERS "SSS"



TRAM "TITAN"

called the "Comstat 19" ($69.95), is also available. Both units can be universally powered through the use of optional accessories. For 25-channel operation (Lafayette has set aside 2 extra crystal positions for the proposed HELP frequencies) at a modest price, the "Comstat
- 25" ($139.95) may fill the bill. This transceiver has a dual-conversion receiver, frequency-synthesis, "Range Boost" modulation, and p.a. facilities. The "Comstat 25" also has the 100-milliwatt switch and is a hybrid circuit with universal power. Next step up the line in these mostly tube-type transceivers is the re-
- modeled HB-444/25A ($179.95). Here again the possibility of 25 CB channels is part of the package, plus a new circuit that automatically switches the S-meter to read relative power output when transmitting. The 100-milliwatt switch is retained as in the above units, but "P.A. Volume" is a separate control on the front panel. For 25-channel mobile oper-
- ation, Lafayette is introducing the "HB-525" ($149.95). This transceiver has a 455-kHz mechanical filter for maximum receiver selectivity. The "Range Boost" circuitry is built in, and the solid-state design makes for a compact unit. A 6-volt and a 117-volt power supply will be available. The popular 12-channel mobile rig called the "HB-555" ($99.95) is being continued, as is the "HB-600" ($219.95). The latter unit is the top of the Lafayette line. It is universally powered and contains a special r.f. noise-limiting circuit (pat. pending). The "HB-600" is all solid state with p.a. and "Range Boost" provisions. Lafayette has a wide variety of walkie-talkies for Part 95 operation. Two of the best are: the
- "HA-300B" (less than $80) which is a new one featuring 2 watts input, 3 channels, and "Range Boost" modulation; and the "HA-450" ($99.95) with 2.5 watts input and 6-channel operation.

METROTEK ELECTRONICS, INC. (7900 Pendleton Pike, Indianapolis, Ind. 46226): This subsidiary of Regency Electronics, Inc., has revamped its line of moderately priced equipment. Starting at the top of
- the line, the "Colt 23" ($129.95) has a 23-channel crystal-controlled transmitter with tunable receiver. The receiver features dual conversion. Next in line is the "Pacer II" ($99.95) with 10 transmit and 11 receive channels plus a tunable receiver. A crystal socket on the panel permits the 11th transmit channel selection.
- The "Mustang II" ($79.95) has 7 transmit and 8 receive crystal-controlled channels, plus a tunable receiver. A panel crystal socket is provided. All three of the Metrotek receivers have "Spotter" facilities, built-in speech clipping, and are universally powered.

MIDLAND INTERNATIONAL CORP. (1909 Vernon St., N. Kansas City, Mo. 64116): This importer has a wide variety of walkie-talkie transceivers with power input ratings of 100 milliwatts and up. It is

difficult to single out any one from all the others, but CB'ers might particularly note the "Model 13-130" ($69.95) which is a 3-channel walkie-talkie with 1 watt input and the "Model 13-133B" ($79.95), a 2-channel unit with 2 watts input. New from Midland is a 5-watt base station called the "Model 13-150" ($99.95). This transceiver is completely solid state and set up for 8 crystal-controlled channels.

MULTI-ELMAC CO. (21470 Coolidge, Oak Park, Mich. 48237): The "Citi-Fone 99" ($99.95) introduced within the past year has attracted attention. This unit has 8 crystal-controlled channels, S-meter, high level modulation, and is universally powered. Big brother of the "99" is the "Citi-Fone SS" ($169.50), crystal-controlled on all 23 channels. Both of these units are tube type, but the brand-new "Citi-Fone II" ($49.95) is completely solid state. The "II" represents an unusual approach in CB equipment and is one of the lowest cost units on the market. It is for 2 channels and the receiver is not really a receiver, but a converter, so that a standard AM auto receiver serves as the second i.f. strip. The "II" is extremely small and for 12-volt d.c. operation only.

OLSON ELECTRONICS, INC. (260 S. Forge St., Akron, Ohio 44308): Price of the "Side-Bander II" has been reduced ($189.98). This unit is one of the few CB rigs featuring double-sideband transmissions with reduced or partially suppressed carrier output. New from Olson is the "Spotter 23" ($109.98). This unit has a tunable receiver and provisions for 23-channel crystal-controlled operation. A panel socket for an "extra" transmit channel is part of the package. Both of the Olson units are tube-type and are universally powered. AT PRESS TIME: New 8- and 12-channel transceivers will be introduced in the late fall.

PACE COMMUNICATIONS CORP. (24049 S. Frampton Ave., Harbor City, Calif. 90710): The big news from Pace is the introduction of the "Plus 23" ($199). This unit has all 23 channels, dual-conversion receiver, all solid-state circuitry on printed circuit boards, high level modulation, p.a. output, and two selections of series gate noise limiting. Designed for 12 volts d.c., a snap-in power lead is available for changeover to base station operation. The "Pace I" ($129) appears for the first time in this report. This unit has 6 crystal-controlled channels and a dual-conversion receiver, and is for mobile 12-volt operation only. The "Pace II" ($169) is being continued in the line. This transceiver is set for 12 channels and has a base station power pack accessory. Another new one is the "Pace II-S" ($179), featuring a calibrated S-meter, but otherwise similar to the "Pace II." Both of the latter transceivers have two positions of noise limiting, p.a. output, and selective-calling accessories. The "Pace 5000" ($250) and "Pace 5000-P" ($320) are being continued. These are extremely rugged units featuring 6-channel operation and a wide selection of input voltages (6, 12, 24/28, or 32 volts for mobile, marine, or aircraft use). AT PRESS TIME: A new transceiver called the "Auto-Mate" ($69.95) has been announced. This unit will load a typical automobile cowl antenna—instead of requiring a special CB antenna. The "Auto-Mate" acts as a converter, using the auto radio as i.f. strip and detector.

PEARCE-SIMPSON, INC. (P.O. Box 800, Biscayne Annex, Miami, Fla. 33152): Just because the Pearce-Simpson people revel in Florida sunshine, don't think that they are standing still. Just announced as we go to press is a 6-channel solid-state unit called the "Companion III" ($139.90). This transceiver has "automatic" channel-changing with a touch-tap button. Two r.f. stages in the receiver, all-electronic switching, and p.a. output are built-in. At the top of the Pearce-Simpson line of new units is the "Director" ($299.90). All solid state, with 23 channels, this unit is claimed to have exceptional frequency stability through the use of special circuitry. Negative peak clipping and high level audio saturation put sock in the modulation. You can get a lot of the "Director" features in the new "Escort II" ($239.90) if you're satisfied with 11-channel operation vs 23 channels. Both the "Director" and "Escort" are for mobile use, but 117-volt a.c. power supplies are available. The "Guardian 23" ($269.90) contains circuitry similar to the above two units, but is a tube-type unit. It has 23 channels and a special panel r.f. gain control. The "Companion II" ($179.90) is $10 down

(*Continued on page 93*)

BUILD:

POWERHOUSE 2-TUBE SHORT-WAVE RECEIVER

By **CHARLES GREEN,**
W3IKH

DON'T LET
THE "2-TUBE" ANGLE
THROW YOU . . .
THIS RECEIVER
IS ACTUALLY
THE HOTTEST THING AROUND

HERE'S a short-wave receiver that's built like a brick house, yet fires up like a real powerhouse. True, it cannot claim style . . . but it sure can boast plenty of class. Far more important is the fact that it pulls in more stations—from all over the world—than many commercial short-wave receivers with a lot of fancy circuitry that adds nothing but complexity. This "little monster" covers frequencies from 500 kHz to 30 MHz in four bands! How about that?

Just imagine picking up your local broadcast stations, then switching to the marine band, then to the international short-wave bands, all the way down to the 10-meter amateur band! A simple bandspread tuning circuit is incorporated to provide maximum selectivity in the crowded bands, and provisions are included for either speaker or headset operation.

About the Circuit. The "little monster" is a transformer-operated regenerative receiver employing switchable coils (see Fig. 1). A twin triode (12AT7) op-

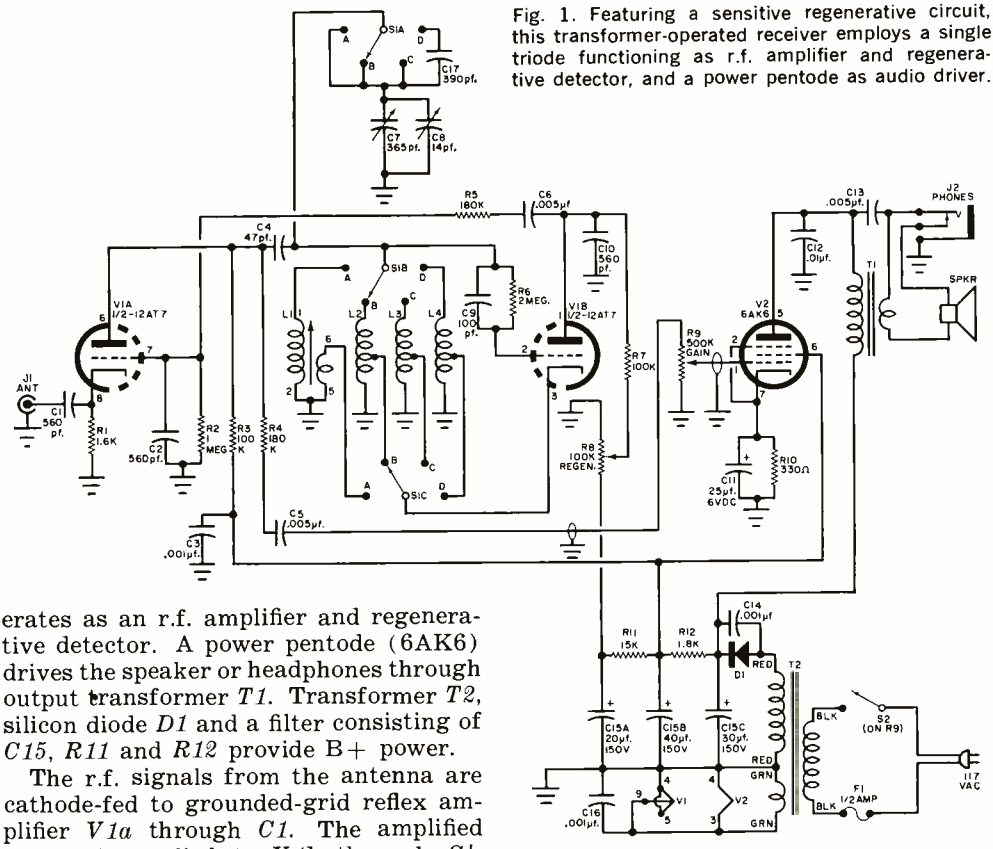


Fig. 1. Featuring a sensitive regenerative circuit, this transformer-operated receiver employs a single triode functioning as r.f. amplifier and regenerative detector, and a power pentode as audio driver.

erates as an r.f. amplifier and regenerative detector. A power pentode (6AK6) drives the speaker or headphones through output transformer *T1*. Transformer *T2*, silicon diode *D1* and a filter consisting of *C15*, *R11* and *R12* provide B+ power.

The r.f. signals from the antenna are cathode-fed to grounded-grid reflex amplifier *V1a* through *C1*. The amplified output is applied to *V1b* through *C4*. The detected audio is fed back to the grid of *V1a* through *C6-R5*, and after amplification is coupled to gain control *R9* thru *R4-C5* before it is applied to *V2*.

Switch *S1* selects the coils for the desired band while *R8* varies the regenera-

PARTS LIST

C1, C2, C10—560-pF, 400-volt ceramic disc capacitor
C3, C14, C16—0.001-μF, 400-volt ceramic disc capacitor
C4—47-pF, 400-volt ceramic tubular capacitor
C5, C6, C13—0.005-μF, 400-volt ceramic disc capacitor
C7—10-365 pF variable capacitor
C8—2-14 pF miniature variable capacitor (E.F. Johnson 160-107 or equivalent)
C9—100-pF, 400-volt ceramic tubular capacitor
C11—25-μF, 6-volt electrolytic miniature capacitor
C12—0.01-μF, 1000-volt ceramic disc capacitor
C15—20-30-40 μF, 150-volt electrolytic capacitor
C17—390-pF, 400-volt mica capacitor
D1—1N1697 diode
F1—½-ampere fuse (and fuse holder)
J1—Phono jack
J2—Closed-circuit phone jack
L1—Oscillator coil (J.W. Miller 71-OSC or equivalent)
L2, L3—B & W 3016 Miniductor coil
L4—B & W 3013 Miniductor coil
R1—1600-ohm, ½-watt resistor
R2—1-megohm, ½-watt resistor
R3, R7—100,000-ohm, ½-watt resistor
R4, R5—180,000-ohm, ½-watt resistor
R6—2-megohm, ½-watt resistor
R8—100,000-ohm potentiometer, linear taper
R9—500,000-ohm potentiometer, audio taper (with on-off switch S2)
R10—330-ohm, 1-watt resistor
R11—15,000-ohm, ½-watt resistor
R12—1800-ohm, 2-watt resistor
S1—3-pole, 4-position rotary switch
S2—S.p.s.t. switch (on R9)
T1—Output transformer: primary, 10,000 ohms; secondary, 4 ohms (Stancor A3879 or equivalent)
T2—Power transformer, 125 volts @ 15 mA and 6.3 volts @ 0.6 ampere (Stancor PS-8415 or equivalent)
V1—12AT7 tube
V2—6AK6 tube
SPKR—4", 3.2-ohm speaker
1—8" x 6" x 4½" aluminum box (LMB 146 or equivalent)
1—8" x 5½" x 1/16"-thick aluminum sheet
Misc.—Terminal strips, a.c. line cord, knobs, 7-pin and 9-pin tube sockets, etc.

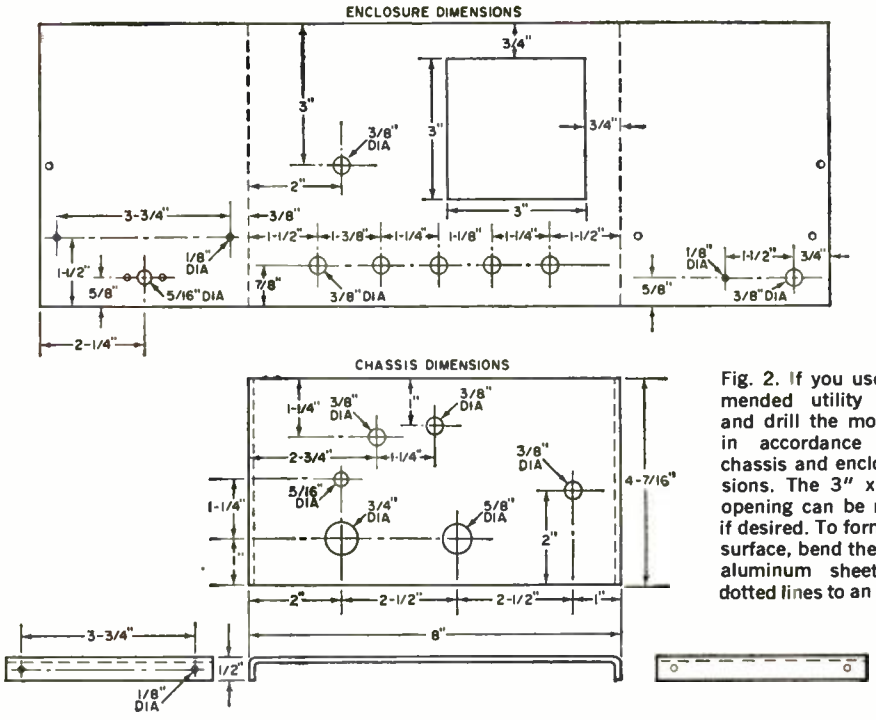


Fig. 2. If you use the recommended utility box, punch and drill the mounting holes in accordance with these chassis and enclosure dimensions. The 3" x 3" speaker opening can be made round, if desired. To form the chassis surface, bend the edges of the aluminum sheet along the dotted lines to an angle of 90°.

tion of the detector. Capacitor *C7* is the main tuning capacitor and *C8* provides bandspread tuning. Band A covers approximately 0.5 to 1.6 MHz; band B from 1.7 to 5 MHz; band C from 4.5 to 14 MHz; and band D from 13.5 to 30 MHz.

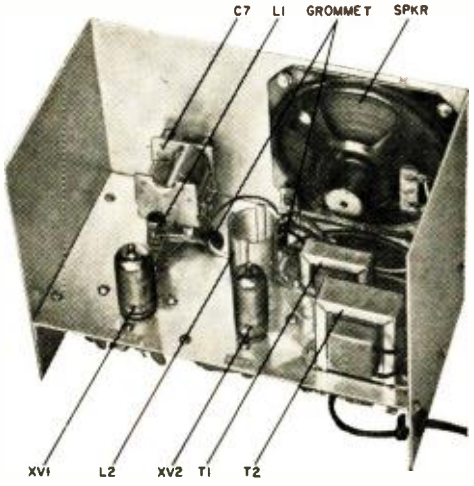


Fig. 3. Assemble major components on the chassis at the locations shown. Be sure to use four 3/8"-long spacers between capacitor C7 and front panel.

Construction. The receiver is assembled on a 1/16"-thick 4 7/16" x 8" aluminum plate mounted in a utility box (LMB 146) approximately two inches from the bottom of the box. The speaker, dial plate, and the tuning and operating controls are all mounted on the front panel of the utility box.

Mounting dimensions and drill sizes for the chassis and cabinet are given in Fig. 2. After drilling out and deburring the holes, install the tube sockets, rubber grommets, speaker and metal grille, transformers, coils, and the tuning capacitor at the locations shown in Fig. 3.

Coil details and terminal connections are given in Fig. 4. Note that the B & W coils must be cut down to a specified number of turns, and that in each case a #6 ground lug is attached to one end of the coil. To attach the lug to the coil, file the lug to get a sharp edge, heat it, and then insert it into the plastic coil form nearest the end of the coil, after soldering the coil terminal to the lug. Use the shortest lead possible. The ground lug is secured to the chassis with a #6 self-tapping screw.

You can now follow the pictorial diagram (Fig. 5) for the layout of com-

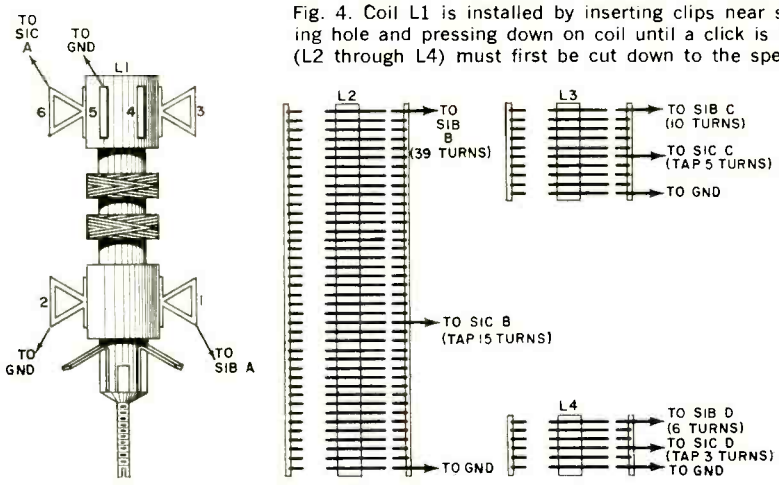


Fig. 4. Coil L1 is installed by inserting clips near screw end into mounting hole and pressing down on coil until a click is heard. The B & W coils (L2 through L4) must first be cut down to the specified number of turns.

ponents and circuit wiring. Be sure to dress the 6.3-volt filament wires close to the chassis while keeping them away from the coils. Keep all wiring as direct and as short as possible.

Use $\frac{3}{8}$"-long spacers to mount the tuning capacitor to the front panel, and make sure the lugs on the capacitor are not grounded to the chassis. After completing the assembly, install the template (Fig. 6) on the front panel over the tuning capacitor. Then install a tuning knob with pointer and the remaining control knobs.

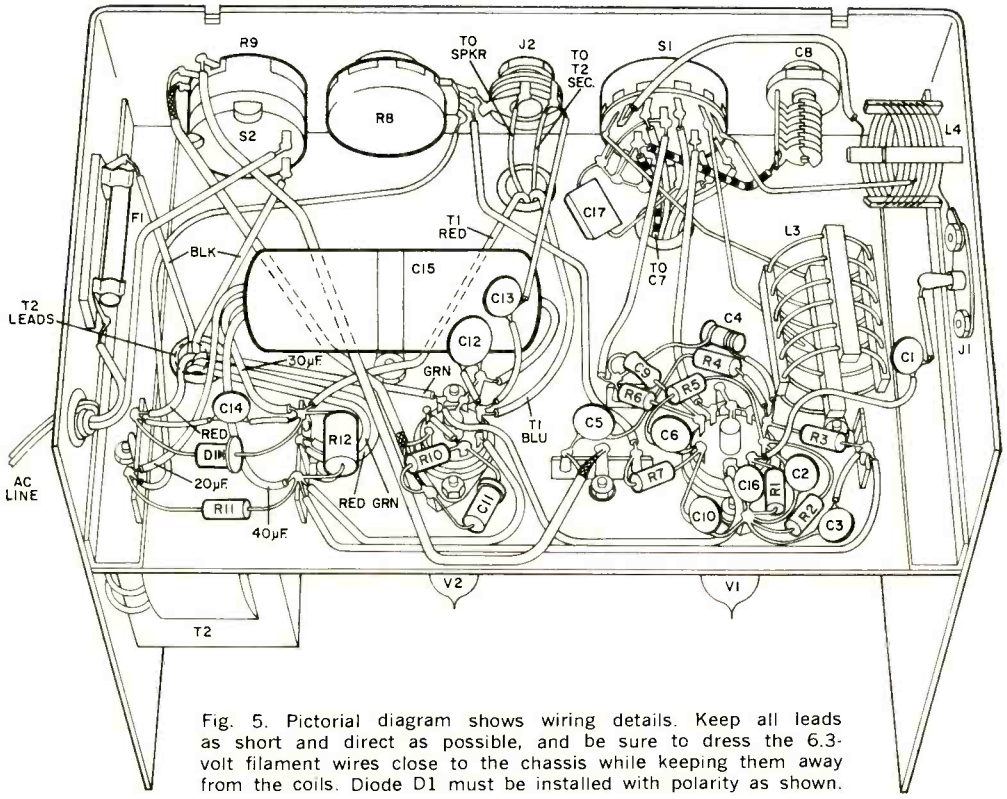


Fig. 5. Pictorial diagram shows wiring details. Keep all leads as short and direct as possible, and be sure to dress the 6.3-volt filament wires close to the chassis while keeping them away from the coils. Diode D1 must be installed with polarity as shown.

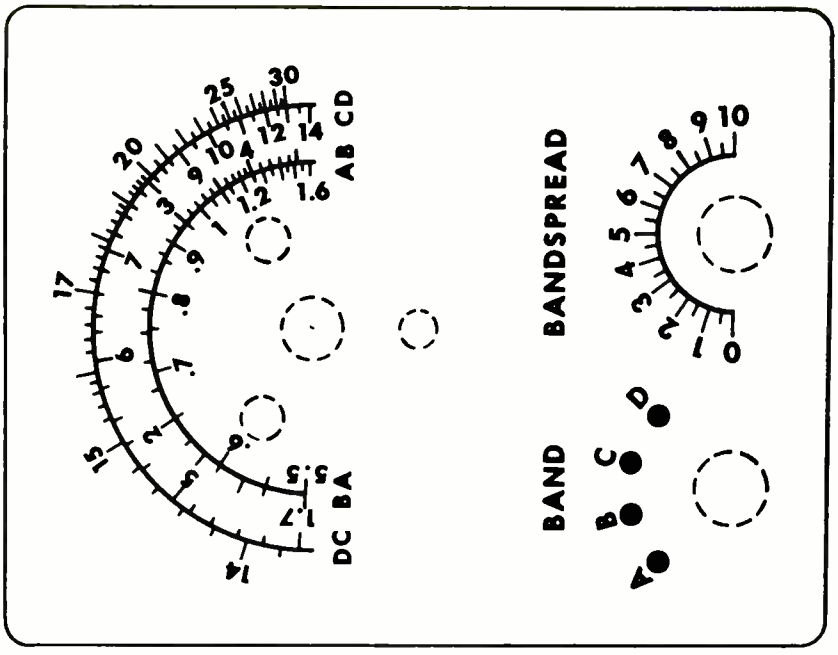


Fig. 6. This dial can be cut out, or redrawn, and pasted on receiver front panel. Actual calibration markings can be made when receiver is tuned to signals of known frequency.

Adjustments. During initial adjustment of the receiver, you may find that the frequencies of the stations tuned in do not correspond to the dial markings. This could be due to lead dress and other variables that can change the receiver tuning slightly. If this is the case, it is suggested that you either modify the template by changing the markings on it, or else make a new template which you can calibrate as necessary.

If you have a signal generator, then by all means use it to calibrate your dial settings. If you happen to live in the vicinity of a broadcasting station and find that your receiver is swamped by strong signals, you can easily clear up this condition with a series wave trap connected between the antenna jack and chassis.

Use a J. W. Miller 71-OSC coil with a 365-pF trimmer capacitor connected between pins 1 and 2 (the grid winding) of the coil to form the trap. Then simply adjust the trimmer until all interference is reduced to a minimum. This adjustment should not affect reception of other stations.

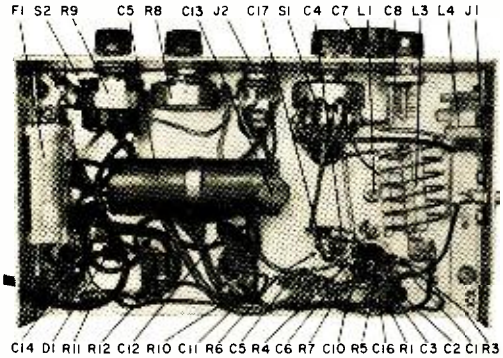


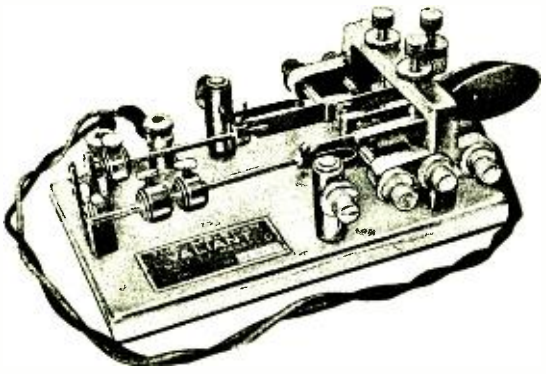
Fig. 7. Layout is simple and uncramped. Plastic fuse cover prevents accidental contact with a.c. line if you're working on the receiver with power on.

Operation. Plug in the receiver to a convenience outlet and turn the *GAIN* control all the way up. Hook up a good antenna to *J1*, and advance the *REGEN* control until you hear a loud noise or a whistle. Then back off on the *REGEN* control until the noise or whistle just disappears, and your station should come in loud and clear.

With a little practice, you will soon become a pro at adjusting the *REGEN* to the proper level while you pull in stations from all over the band. -30-

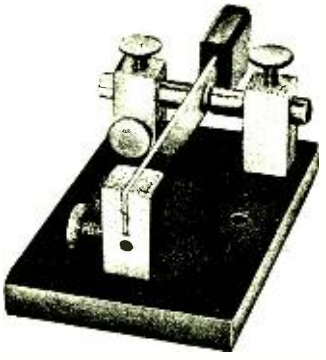
THE DIT MAKERS

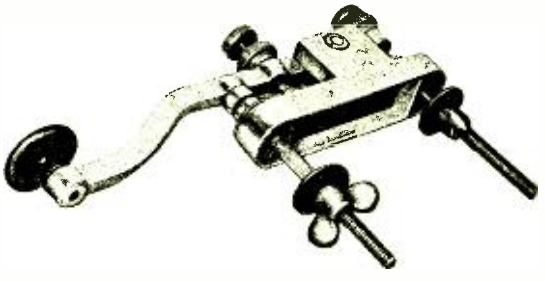
CONVERTING MUSCLE POWER TO MORSE CODE WAS THE JOB OF THESE OLD WORKHORSES



Think a "bug" is a complicated machine? How would you like to drive this impressive unit down the 80-meter ham band? You might call this a "double bug," although its proper title is "double lever automatic keyer." It formed dit's and dah's automatically, like a "modern" electronic keyer, but the operation was entirely mechanical. There were 17 adjustments to make to tune it up for use —you had to be a good man to get 'em all done before the sunspot cycle changed.

This is a "sideswiper." Also called a "cootie key," it was the granddaddy of the modern "bug" or semi-automatic key. The sideswiper was made with a spring lever suspended between two fixed (but usually adjustable) contacts. Both dit's and dah's had to be formed manually by the operator. The large silver contacts on this "dit maker" were said to be capable of handling 2000 watts.



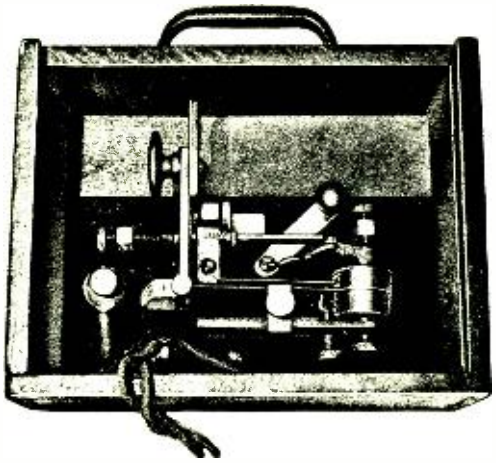


Take a look at the mounting bolts on this baby. It's just a simple straight key that was the standard type used on United Fruit Company vessels. The long bolts held the key securely bolted to the operator's worktable. The contacts aren't exactly midgets, either —those sea-going spark sets really packed a wallop.

ALTHOUGH this statement may start an argument, the heyday of the radiotelegrapher has passed. Since Marconi keyed his first transmitter, however, there have been all sorts of ingenious contraptions developed to ease the job of the radio operator. Looking back, many key designs now seem rather foolish and scarcely worth the effort involved in learning how they were to be used.

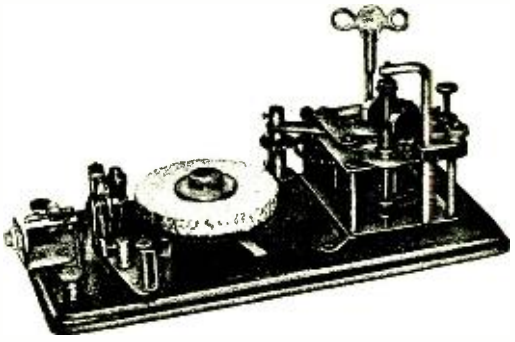
You'll find old keys, proudly polished, exhibited in the many "wireless" museums that dot the country. The keys shown here are on display in the museum maintained by the American Radio Relay League, in Newington, Conn.

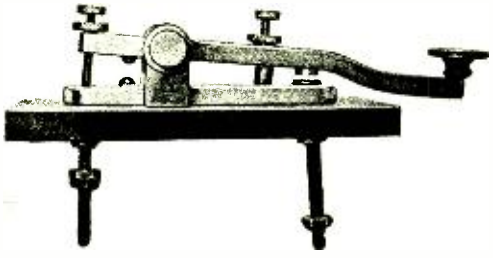
—*Marshall Lincoln*



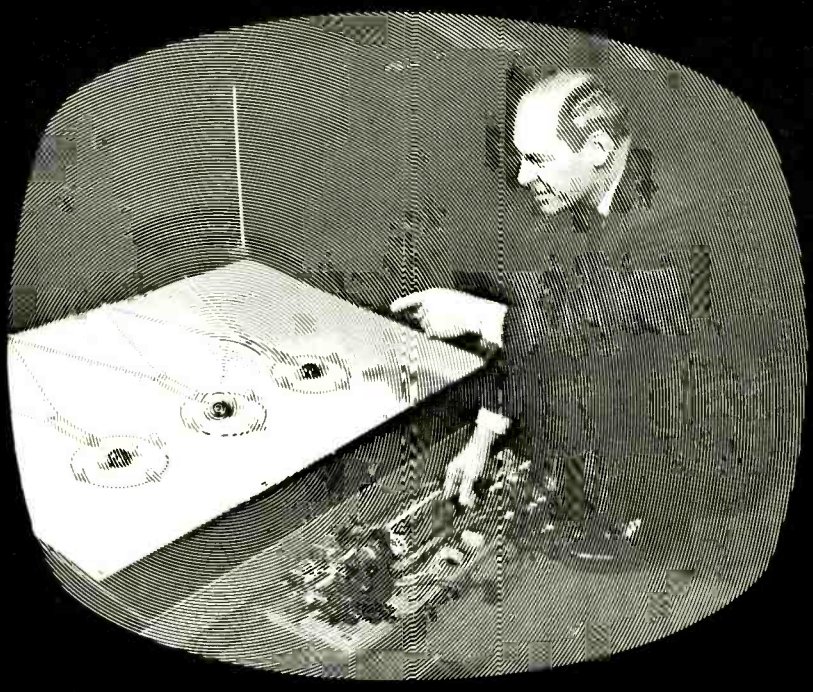
You might call this one a bug in a box. It's an early type of semi-automatic key which was called a "Mecograph," and is shown here in its carrying case. It had a paddle much like those used on bugs today, but the weight and pendulum that form the dit's are at right angles to the paddle axis.

Who says "CQ" wheels are new? This old-time "Omnigraph" was made in the early 1900's for transmitted interval signals to occupy the frequency or channel. A spring-powered clockwork at the right (notice fly-ball governor) turned the wheel in the center, which carried metal "code wheels." Raised spots on the edges of the wheels caused a spring lever to close electrical contacts, keying a transmitter. CQ, anyone?





This heavy-duty key saw some hard use. Notice the angle of the large contacts. Those big lumps of silver could handle a kilowatt with ease. They had to. The old-time transmitters were big bruisers, and the "main plumbing" was keyed directly. The old key slappers weren't called "Sparks" for nothing.



SCIENCE COMES TO TV

Broad-based programs should appeal to engineers, scientists, and laymen alike

DON HERBERT, television's "Mr. Wizard," will be on the air this fall in "Experiment," a new adult-level science series to be telecast over the National Educational Television's 104-station network. Although the series will be aimed at the general public, it should be of particular interest to scientists, engineers, and students as well.

Each program in the series will deal with the work of a single scientist. The first program, "Laser—the Light of the Future" will present the story of Dr. Arthur Schawlow of Stanford University and his contribution to the development of the laser.

Special simulators will be used to duplicate the performance of, or reaction produced by, the most sophisticated scientific projects. For example, in explaining what the LASER (*L*ight *A*mplification by *S*timulated *E*mission of *R*adiation) is, an Actan programmer made by Sealectro Corporation is used.

Consisting of a rotating drum memory switch, the programmer controls the symbolic interaction of electrons and photons by programming 324 lamps representing photons on a demonstration board designed by Don Herbert.

Other programs in the series will include the story of Mariner IV, covering its successful quest for pictures of the planet Mars; the discovery of Bernard's Star B, the invisible planet; computerized weather predictions; the attack patterns of sharks; and the social behavior of chimpanzees.

The series is to be produced by Prism Productions, Inc., and will be underwritten by grants from the National Science Foundation and the Alfred P. Sloan Foundation. Consult your newspapers in the fall for time and stations. —30—

AMATEUR EQUIPMENT JAMBOREE 1966

NEW RECEIVERS, TRANSMITTERS AND TRANSCEIVERS—KITS AND FACTORY-WIRED—FEATURE IMPROVED SELECTIVITY, SENSITIVITY, STABILITY, AND TUNING ACCURACY

By HERBERT S. BRIER, W9EGQ

IF YOU CONSIDER the wide range of frequencies encompassed by amateur radio—from 1.8 MHz up into the GHz region—and the three levels of operating privileges granted by the various amateur licenses, it is easy to see why there is a demand for so many different pieces of amateur equipment.

Whether you are a Novice limited to low-power CW operation in the 80-, 40-, and 15-meter bands or phone and CW on 2 meters, or a Technician limited to the frequencies above 50 MHz, or a General with a multiband sidewinder, you'll have professional-looking and professional-operating equipment if you go in for the store-bought gear. Even the home-brew artist will recognize the excellent quality and features found in the current profusion of kits.

Receivers. Historically, the advent of SSB signals, which must be tuned to within 100 Hz (0.0025% at 4 MHz) to be intelligible, revealed how unstable pre-1955 receivers were by today's standards. It took a master's touch to tune in the signals and to keep them tuned in, as the receiver drifted with heat and line voltage changes, or "jumped" frequency if it was jarred. Today, tuning in SSB signals on a modern amateur receiver is easier than tuning in AM signals on an older receiver, especially when interference is bad.

This improvement was accomplished in steps. First, the receiver tuning range per band was reduced from many MHz to a few hundred kHz. Second, great pains were taken to design a drift-free variable high-frequency local oscillator —upon which the ultimate stability of the receiver depends.

To further improve efficiency and stability, some sets run the oscillator over only one band of frequencies (usually in the 5-MHz region), and heterodyne it against a crystal to obtain the desired i.f. frequency. Strictly amateur receivers, such as the Heathkit SB-300, contain crystals only for the amateur bands. But other receivers, such as the Drake R-4A or Collins 75S-3B, accommodate additional crystals to obtain coverage of other frequencies of interest. Of course, these improved oscillator techniques are also used in amateur transmitters and transceivers.

Another trend in modern receiver design is the swing to electromechanical and quartz-crystal lattice filters in place of conventional tuned circuits, phase-shift networks, and other complicated expedients to sharpen the response and to improve selectivity. The filters do a good job, simplify associated circuits, and don't need readjustment.

Also featured in some of the newer receivers and transceivers are i.f. noise blankers. In contrast to simple audio noise clippers, a noise blanker is effective against impulse-type noise on SSB and CW signals, as well as on AM signals. The blankers are standard equipment on the Drake R-4A receiver and the Hallicrafters SR-2000 transceiver; they are optional accessories for the Squires-Sanders SS-IR receiver and Collins KWM-2 transceiver.

Receivers intended for amateur use start at approximately $75 for the basic Heathkit HR-10 and go up to about $1000 for the super-deluxe models. Most popular price range is between $250 and $400.

This does not mean that general-coverage communications-type receivers have nothing to offer the amateur. They have been improved, too; and many amateurs prefer the wide range of frequencies covered (550 kHz to over 30 MHz). Prices for usable general-coverage receivers start at about $59.95 for a R-55A Knight-Kit and keep right on climbing to beyond $1500 for units like the National HRO-500, RACAL RA-217, and the Technical Materiel GPR-90RXD, which do everything a specialized limited range receiver will do but over a very wide range of frequencies.

Transmitters. Practically speaking, there are two types of amateur transmitters for use on the frequencies below 30 MHz—low-power CW transmitters, and medium-power CW/SSB transmitters. The former are designed for Novices and Generals who prefer CW and do not need a more elaborate transmitter.

These transmitters are all crystal-controlled and have power ratings ranging from 15 to 90 watts input; they are usually sold in kit form in the $20 to $90 price range. Wired models (when available) sell for 50% to 60% more.

The simplest of these units cover the

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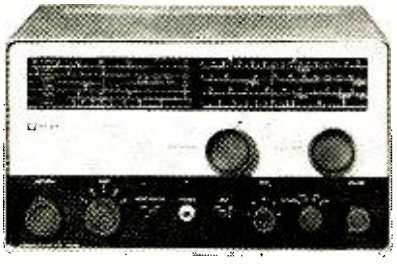
RECEIVERS



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TRANSMITTERS

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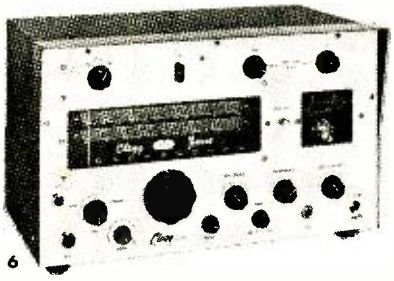

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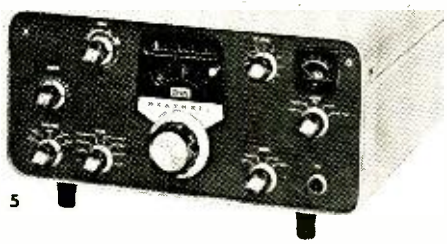

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Transmitters have been dressed up and have come down in size. Many of them match their receiver counterpart in appearance and price. Kits and wired units are plentiful, and SSB is no longer a novelty. When transmitter and receiver are properly matched, transceiver-type operation is easy to accomplish.

1 Collins 32S-3
2 Drake T-4X
3 EICO 720
4 Hallicrafters HT-46
5 Heathkit SB-400
6 Squires-Sanders "Clegg Zeus"

Rich or poor, Novice or old-timer, there's a receiver for you. Prices range from less than $75 to more than $1000. Features range from simple but substantial bandspreads to digital readout devices for "split-hairline" tuning accuracy. Filters, Q-multipliers, and other accessories are built into some receivers, and are available as add-on devices in others. Many of the receivers can be purchased ready-made or in easy-to-assemble kits.

1 Allied's Knight-Kit R-55A
2 Collins 75S-3B
3 Drake 2-C
4 Hallicrafters SX-130
5 Heathkit SB-301
6 Squires-Sanders SS-1R

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80- and 40-meter CW bands, probably the best place for the average newcomer to begin his amateur career. More elaborate units cover the 20-, 15- and 10-meter bands; some of them also cover the 6-meter band.

As a bonus feature, some transmitters (Hallicrafters HT-40, Heathkit DX-60A, Knight-Kit T-60, etc.) contain built-in screen modulators to obtain low-power AM phone facilities, at little or no additional cost. In addition, EICO's 730 plate modulator will convert almost any low-power CW transmitter into a plate-modulated AM phone transmitter. The resulting phone signal is usually about 6 dB stronger than that obtained from screen modulation of the same transmitter.

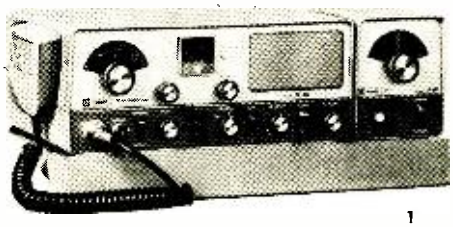
Accessory VFO's add to the versatility of these simple transmitters. Also, the transmitters may be used to drive a linear amplifier to obtain up to maximum authorized power. Watch out for the power rating of the linears; when they are used to amplify AM signals, it is usually necessary to run them at 30% to 40% of the CW/SSB ratings, because of the different efficiencies and duty cycles of the different modes of operation.

Virtually all experienced amateurs now concede that SSB phone signals are superior to AM phone signals on the amateur frequencies below 30 MHz. The signals get out better and occupy half as much channel space. In addition, at reasonable power levels, SSB transmitters are less expensive than AM transmitters. These reasons help to explain why there is not a single, high-power AM transmitter for the lower frequencies on the market today.

Transceivers. When you get above the simple low-power CW transmitter, a decision must be made as to whether to go for a transceiver or a separate receiver and transmitter.

A transceiver uses many of its components in both the receive and transmit modes. This reduces size, particularly important in mobile operation (for which the transceiver was originally designed) and decreases overall cost. Single-sideband transceivers are available from simple 1-band units up to deluxe 5-banders; power ratings range from 135 to 2000 watts PEP.

TRANSCEIVERS



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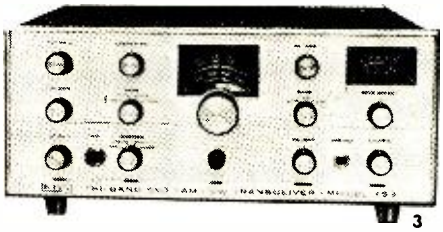

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Transceivers were originally designed for mobile operation, but the economy of having a transmitter and receiver in one package and the deluxe multiband features incorporated in many of these units make them a welcome member in any respectable shack. SSB operation is a snap with these units. Both kits and wired units are available.

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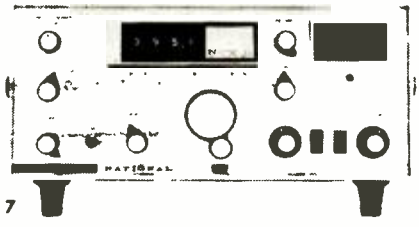

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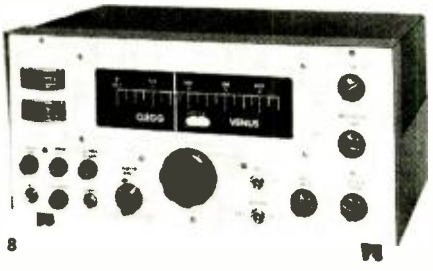

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1 Allied's Knight-Kit TR 106 and its companion VFO V-107
2 Drake TR-4
3 EICO 753
4 Hallicrafters SR-500
5 Heathkit SB-100
6 Lafayette HA-410
7 Naticnal NCX-5
8 Squires-Sanders "Clegg Venus"

A transceiver normally receives on the same frequency on which it transmits. This creates a minor problem when you're working several stations on slightly different frequencies. To combat the problem, several models, including the EICO 753, Raytheon SBE 34, and the Hallicrafters transceivers, were designed to be tuned up to 10 kHz on either side of their transmitted frequencies while receiving.

A more serious reception problem than signals a few cycles off frequency is the DX station that operates outside the U.S. phone band and listens for replies inside the band. Accessory VFO's are available for use with some transceivers to permit split-frequency operation.

Prices range from approximately $160 for a basic, single-bander with power supply in kit form up to $1500 for a deluxe, high-power 5-band job. The exact cost depends, of course, upon power and features of the individual transceiver.

Not all SSB transceivers work on CW, but those that do, perform quite well. Of special interest to Novices, some transceivers offer optional crystal control of the transmitted signal either as a built-in feature (as in the Heathkit SB-100) or as an optional accessory (Collins, Galaxy, and National units, for example). The power input of a 200-300 watt transceiver can easily be cranked down to the Novice 75-watt limit.

Advantages of Separate Units. Obviously, when a good receiver is already at hand, purchasing a separate transmitter is more economical than purchasing a multiband transceiver. Furthermore, when matching transmitters and receivers are used, the combination offers great versatility. With a snap of a switch, the combination can be operated transceiver-fashion or independently.

Compared to a transceiver, an independent receiver usually offers several degrees of selectivity vs one for the transceiver; this is particularly helpful on CW in the presence of QRM. The separate receiver may be a trifle more sensitive, but this depends upon the relative quality of the receiver and the transceiver being compared.

(*Continued on page* 99)

See Equipment Sampler on pages 72-75

RADIO AMATEUR EQUIPMENT SAMPLER

MANUFACTURER	MODEL	KIT OR WIRED	FUNCTION	TRANSMITTER CONTROL	BANDS	MODE	POWER, ETC.	PRICE
ALLIED RADIO	R 55A	Kit	Receiver		BCB/6 m.	AM/CW	6 tubes	$ 59.95
100 N. Western Ave.	R-100A	Kit	Receiver		BCB/10 m.	AM/CW/SSB	9 tubes	99.95
Chicago, Ill.	T-60	Kit	Transmitter	Xtal	80/6 m.	AM/CW	60 watts	54.95
("Knight-Kit")	TR-106	Kit	Transceiver	Xtal	6 m.	AM	12 V/117 V	139.95
	V-107	Kit	VFO for TR-106		6/2 m.			19.95
AMECO EQUIPMENT CORP.	AC-1T	Kit	Transmitter	Xtal	80/40 m.	CW	15 watts	21.95
178 Herricks Rd.	TX-62	Wired	Transmitter	Xtal	2/6 m.	AM/CW	75 watts	149.95
Mineola, L.I., N.Y.	VFO-621	Wired	VFO for TX-62		1¼/2/6 m.		117 volts	59.95
	CB/CN	Kits	Converters		1¼/2/6 m.			19.95[1] and up
	PS-1W	Kit	Power Supply for CB/CN				117 volts	12.50[1]
COLLINS RADIO CO.	KWM-2	Wired	Transceiver	VFO	80/10 m.	SSB/CW	180 watts	1150.00
Cedar Rapids, Ia.	32S-3	Wired	Transmitter	VFO	80/10 m.	SSB/CW	180 watts	750.00
	MP-1	Wired	Power Supply for KWM-2				12 V d.c.	198.00
	516F-2	Wired	Power Supply for KWM-2/32S-3				117 V a.c.	115.00
	75S-3B	Wired	Receiver		80/10 m.	SSB/CW/AM	117 volts	620.00
	62S-1	Wired	VHF Converter		2/6 m.	SSB/CW	150 watts	895.00
CONAR DIVISION OF NATIONAL RADIO INSTITUTE	400	Kit	Transmitter	Xtal	80/40/15 m.	CW	25 watts	32.50[1]
3939 Wisconsin Ave.	500	Kit	Receiver		80/40/15 m.	AM/CW/SSB	a.c.	37.50[1]
Washington, D.C.								
DAVCO ELECTRONICS INC.	DR-30	Wired	Receiver		80/10 m. + part of 6 m.	AM/CW/SSB	Solid-State	389.50
P.O. Box 2677								
2034 S. Monroe St.								
Tallahassee, Fla.								
DELTA ELECTRONICS LTD.	KW-2000A	Wired	Transceiver	VFO	160/10 m.	SSB/CW	180 watts	595.00
70 Ronson Dr.		Wired	Power Supply				117 volts	99.50
Rexdale, Ont., Canada		Wired	Power Supply				12 volts	120.00
R. L. DRAKE CO.	2-C	Wired	Receiver		80/10 m.	AM/CW/SSB	Solid-State	229.00
540 Richard St.	R-4A	Wired	Receiver		160/10 m.	AM/CW/SSB	117 volts	399.95
Miamisburg, Ohio	2-NT	Wired	Transmitter	Xtal	80/10 m.	CW	100 watts	129.00
	TR-4	Wired	Transceiver	VFO	80/10 m.	AM/CW/SSB	300 W PEP	599.95
	T-4X	Wired	Transmitter	VFO	80/10 m.	AM/CW/SSB	200 W PEP	399.95
	AC-4	Wired	Power Supply for TR-4/T-4X				117 volts	99.95
	DC-3	Wired	Power Supply for TR-4				12 volts	149.95

EICO ELECTRONIC INSTRUMENT CO., INC.	720	Kit	Transmitter	Xtal	80/10 m.	CW	90 watts	89.95[1]
131-01 39th Ave.	723	Kit	Transmitter	Xtal	80/10 m.	CW	50 watts	59.95[1]
Flushing, N.Y.	753	Kit	Transceiver	VFO	80/40/20 m.	AM/CW/SSB	200 watts	189.95[1]
	751	Kit	Power Supply for 753				117 volts	79.95[1]
	752	Kit	Power Supply for 753				12 volts	79.95[1]
	722	Kit	VFO for 720 and 723		80/10 m.		117 volts	44.95[1]
	730	Kit	Modulator for 720 and 723				50 watts	59.95[1]
GALAXY ELECTRONICS	"V"	Wired	Transceiver	VFO	80/10 m.	AM/CW/SSB	300 watts	399.95
10 S. 34th St.	AC-35	Wired	Power Supply for "V"				117 volts	79.95
Council Bluffs, Ia.	G-35DC	Wired	Power Supply for "V"				12 volts	89.95
	RX-1	Wired	Remote VFO for "V"					69.95
	NOX-1	Wired	Novice Crystal Adapter					24.95
GONSET, INC. **Altec Lansing Corp.** **1515 S. Manchester Ave.** **Anaheim, Calif.**	G-50	Wired	Transceiver	Xtal/VFO	6 m.	AM	48 watts	367.30
HALLICRAFTERS	HT-40	Wired	Transmitter	Xtal	80/10 m.	AM/CW	75 watts	129.95[2]
5th & Kostner	HT-46	Wired	Transmitter	VFO	80/10 m.	SSB/CW	180 W PEP	349.95
Chicago, Ill.	HA-5	Wired	VFO		80/2 m.			79.95
	SR-42A	Wired	Transceiver	Xtal	2 m.	AM	12 watts	199.95
	SR-46A	Wired	Transceiver	Xtal	6 m.	AM	12 watts	199.95
	HA-26	Wired	VFO for SR-42A/SR-46A					49.95
	SR-540	Wired	Transceiver	VFO	80/10 m.	SSB/CW	400 W PEP	[3]
	SR-500	Wired	Transceiver	VFO	80/40/20 m.	SSB/CW	500 W PEP	395.00
	P-500-AC	Wired	Power Supply for SR-540/500				117 volts	119.95
	SR-2000	Wired	Transceiver	VFO	80/10 m.	SSB/CW	2000 W PEP	995.00
	P-2000-AC	Wired	Power Supply					395.00
	SX-146	Wired	Receiver		80/10 m.	AM/CW/SSB		269.95
	SX-122	Wired	Receiver		BCB/10 m.	AM/CW/SSB		289.95
	SX-130	Wired	Receiver		BCB/10 m.	AM/CW/SSB		169.95
HAMMARLUND MFG. CO. **73-88 Hammarlund Dr.** **Mars Hill, N. C.**	HQ-170A-VHF	Wired	Receiver		160/2 m.	AM/CW/SSB	Built-in 6/2 m. converters	429.00
HEATH COMPANY	HW-12/HW-22/ HW-32	Kits	1-band Transceivers	VFO	80/40 or 20 m.	SSB	200 W PEP	119.95 each
Benton Harbor, Mich.	HW-29A/HW-30	Kits	1-band Transceivers	Xtal	6 or 2 m.	AM	5 watts	44.95
	SB-100	Kit	Transceiver	VFO/Xtal	80/10 m.	CW/SSB	180 W PEP	360.00
	SB-110	Kit	Transceiver	VFO/Xtal	6 m.	CW/SSB	180 W PEP	320.00
	HP-13	Kit	Power Supply for HW-12/SB-100/SB-110				12 volts	59.95
	HR-10	Kit	Receiver		80/10 m.	AM/CW/SSB		75.00
	SB-301	Kit	Receiver		80/10 m.	AM/CW/SSB	10 tubes	250.00
	SB-400	Kit	Transmitter	VFO	80/10 m.	CW/SSB	180 W PEP	325.00
	DX-60A	Kit	Transmitter	Xtal	80/10 m.	CW/AM	90 watts	79.95

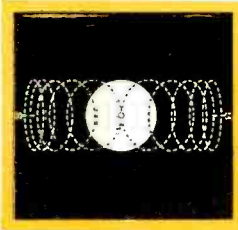
(Continued on next page)

RADIO AMATEUR EQUIPMENT SAMPLER

MANUFACTURER	MODEL	KIT OR WIRED	FUNCTION	TRANSMITTER CONTROL	BANDS	MODE	POWER, ETC.	PRICE
INDUSTRON INC. Whippany Labs. Inc. 77 Jefferson Ave. Westwood, N.J.	Li'l Lulu	Wired	Transmitter	VFO	6 m.	AM/CW	12 V d.c./ 117 V a.c.	$ 225.00
	Li'l Lulu	Wired	Receiver		6 m.	AM/CW/SSB		250.00
INTERNATIONAL CRYSTAL MFG. CO., INC. 18 N. Lee St. Oklahoma City, Okla.	AOD-57	Wired	Transmitter	Xtal	6 m.	CW	5 watts	69.50
E. F. JOHNSON COMPANY Waseca, Minn.	Viking "6N2"	Wired	Transmitter	Xtal	6/2 m.	AM/CW	150 CW 100 AM	194.50
		Wired	VFO for 6N2		6/2 m.			54.95[2]
		Wired	Receiver Converter for 6N2		6/2 m.	AM/CW		89.95[2]
JUSTIN, INC. Box 135 San Gabriel, Calif.	Mobiltrans 40	Wired	Transceiver w/car radio	Xtal	160/80 or 40 m.	AM	40 watts Hybrid	99.50
LAFAYETTE RADIO ELECTRONICS 111 Jericho Turnpike Syosset, L.I., N.Y.	HA-225	Wired	Receiver		150 kHz/54 MHz	AM/SSB/CW	14 tubes	119.95
	HA-230	Wired	Receiver		BCB/10 m.	AM/SSB/CW	9 tubes	69.95[2]
	HA-350	Wired	Receiver		80/40/20/15/10 m.	AM/SSB/CW	10 tubes	139.95
	HA-500	Wired	Receiver		80/40/20/15/10 m.			149.95 approx.
	HA-410/HA-460	Wired	Transceivers	Xtal/VFO	10 or 6 m.	AM	20 W 12/117 V	149.95 each
	HA-650	Wired	Transceiver	Xtal	6 m.	AM	2.5 W, Solid-State	119.95
NATIONAL RADIO CO. 37 Washington St. Melrose, Mass.	NCX-5 Mark II	Wired	Transceiver	VFO	80/10 m.	AM/SSB/CW	200 watts	685.00
	NCX-A	Wired	Power Supply for NCX-5				117 volts	110.00
	VX-501	Wired	VFO for NCX-5					249.95
	NC-77X	Wired	Receiver		BCB/10 m.	AM/CW	117 volts	69.95
	HRO-500	Wired	Receiver		5 kHz/30 MHz	AM/CW/SSB/MCW/FSK	Solid-State	1560.00
PARKS ELECTRONICS LAB. 419 S.W. First Ave. Beaverton, Ore.	50-1	Wired	Converter		6 m.		Nuvistor, 117 V	38.00
	144-1	Wired	Converter		2 m.		Nuvistor, 117 V	54.95
	220-1	Wired	Converter		1¼ m.		Nuvistor, 117 V	65.00
	432-3	Wired	Converter		¾ m.		Solid-State	49.95
	144-1P	Wired	Preamp		2 m.		Nuvistor, 117 V	25.00
POLYTRONICS LABS, INC. 900 Burlington Ave. Silver Spring, Md.	PC-6/PC-6CD	Wired	Transceiver	VFO/Xtal	6 m.	AM	18 W 12/117 V	199.95

RACAL COMMUNICATIONS 8440 2nd Ave. Silver Spring, Md.	RA-217	Wired	Receiver		980 kHz/30 MHz	AM/CW/SSB/ FM/MCW	Solid-State	2500.00
RAYTHEON CO. 213 E. Grand Ave. So. San Francisco, Calif.	SB-34	Wired	Transceiver	VFO	80/15 m.	SSB	Hybrid, 12/117 V	395.00
SOMMERKAMP IMPORTED Barry Electronics Corp. 512 Broadway New York, N.Y.	FR-100B FL-200B	Wired Wired	Receiver Transmitter		80/10 m. 80/10 m.	AM/CW/SSB AM/CW/SSB	12 tubes 130 watts	250.00 350.00
SQUIRES-SANDERS INC. Martinsville Rd. & Liberty Corners Millington, N.J. (Clegg Labs.)	SS-1R Interceptor B Venus 416 22'er Zeus	Wired Wired Wired Wired Wired Wired	Receiver Receiver Transceiver Power Supply for Venus Transceiver Transmitter	 VFO Xtal Xtal & VFO	80/10 m. 6/2 m. 6 m. 2 m. 6/2 m.	AM/CW/SSB AM/CW/SSB AM/CW/SSB AM AM/CW	 117 volts 85 watts 117 volts 20 watts 185 watts	995.00 495.00 495.00 110.00 249.95 745.00
SWAN ELECTRONICS CORP. 417 Via Del Monte Oceanside, Calif.	350 400 250 410 117-XC 14-117	Wired Wired Wired Wired Wired Wired	Transceiver Transceiver Transceiver VFO for 350/400 Power Supply for 350/400/250 Power Supply for 350/400/250	VFO VFO	80/10 m. 80/10 m. 6 m. 80/10 m.	CW/SSB CW/SSB CW/SSB	400 W PEP 400 W PEP 240 W SSB PEP Solid-State 117 volts 12 volts	420.00 420.00 325.00 95.00 95.00 130.00
TECHNICAL MATERIEL CORP. 700 Fenimore Rd. Mamaroneck, N.Y.	GPR-90RXD	Wired	Receiver		BCB/10 m.	AM/CW/SSB/ ISB/FAX/FSK	117/230 V	1552.00
TRANSCOM ELECTRONICS, INC. 375 Hale Ave. Escondido, Calif.	SBT-3 SBA-3 SBD-3A	Wired Wired Wired	Transceiver Power Supply for SBT-3 Power Supply for SBT-3	VFO	80/40/20 m.	SSB	165 W Hybrid 120 volts 12 volts	299.50 99.50 99.50
UTICA COMMUNICATIONS CORP. 2917 W. Irving Park Rd. Chicago, Ill.	650A 92-05	Wired Wired	Transceiver Receiver	VFO/Xtal	6 m. BCB/30 MHz	AM AM/CW	12/117 V 117 V	199.95 64.95
VANGUARD ELECTRONICS LABS. 190-48 99th Ave. Hollis, N.Y.	301 Series 	Wired Wired	Converters Power Supply for 301		40/20/6/2 m. & other 	 	Solid-State 117 V in, 9 V out	16.95 2.95
WORLD RADIO LABS., INC. 3415 W. Broadway Council Bluffs, Iowa	84 AC-384 AC-48 DC-384 TC-6A TCA	Wired Wired Wired Wired Kit Kit	Transceiver Power Supply for 84 Power Supply for 84 Power Supply for 84 Transceiver Power Supply for TC-6A	VFO Xtal 	80/40 m. 6 m. 	SSB AM 	300 W PEP 300 W, 117 V 250 W, 117 V 300 W, 12 V 5 watts 115 volts	159.95 79.95 49.95 89.95 39.95 15.95

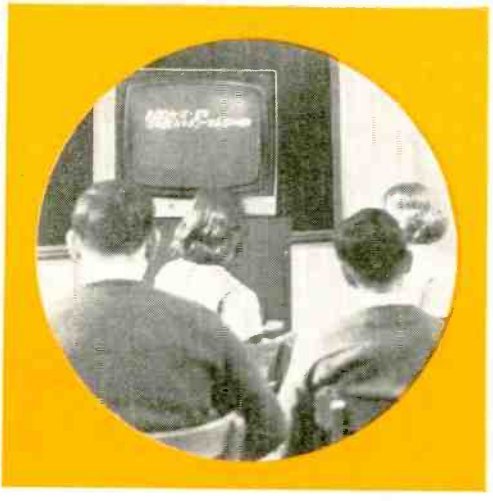
1. Also available in wired form *2. Also available in kit form* *3. Information not available at press time*

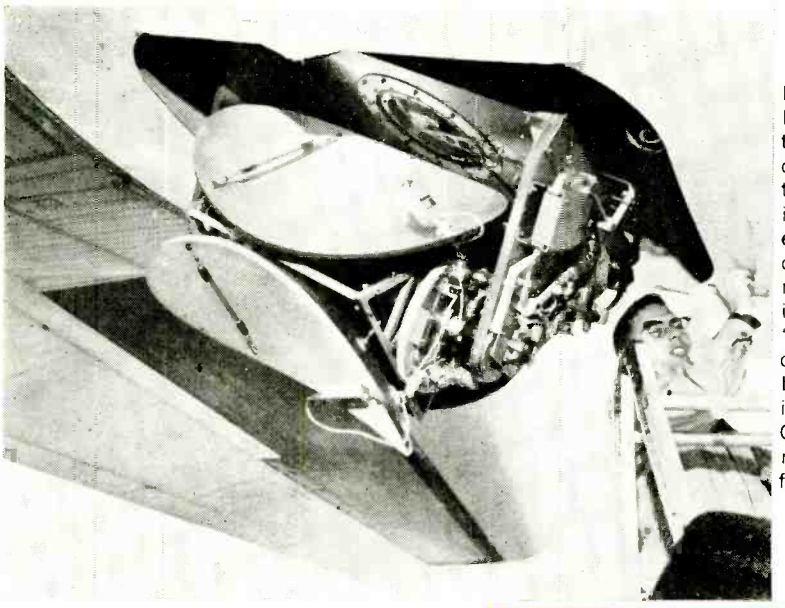


ZERO-BEATING THE NEWS

SETTING THE STAGE—Television monitors—part of an electronic stage control system designed by Cutler-Hammer, Inc.—will be used by stagehands in the new Metropolitan Opera House in New York City to tell how far curtains are open on a dark stage. Photo below shows plant engineer testing prototype with an oscilloscope.

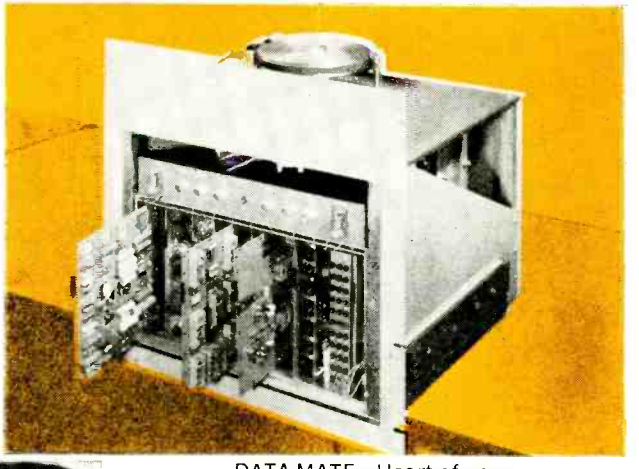
BLACKBOARD BY WIRE—An electronic teaching system by Sylvania Electric Products transmits voice and handwriting over telephone lines for long-distance illustrated lectures. Students (below, right) watch TV monitor and hear voice of instructor (below) on speaker.



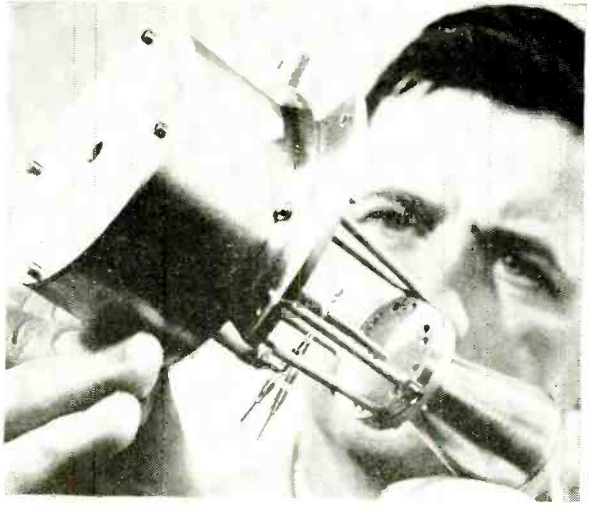


ICEBERG DETECTION—Revolving dish detectors, jutting from beneath the tail of a U.S. Coast Guard aircraft, track down icebergs even in dense fog. Radiometric equipment scans the sea, taking continuous readings of the microwave thermal energy. An iceberg has a distinct "signature" which the operator can identify. Developed by Sperry Rand, the equipment is installed in two Coast Guard planes flying the international ice patrol from Argentia, Newfoundland.

ATTACHE-CASE TELEPHONE—Calls can be made in complete privacy from any telephone with "Tel-Lips" (telephone version of Litton Industries Privacy System) which is self-contained in an attache case (left). User places telephone handset in special cradle in case and takes out privacy handset. By flipping a switch, he automatically scrambles his voice; it is unscrambled by a decoding device at the other end. An alpha-numeric enciphering feature is incorporated in some sets—important words or critical figures can be sent by depressing the proper buttons.



DATA MATE—Heart of new automatic alternate voice-data system is the compact magnetic drum storage unit above which automatically detects silent gaps in telephone conversations and fills them with data for transmission over a single international voice circuit. System was developed by ITT World Communications, Inc., for use by Pan American World Airways.



SATELLITE CONTROL—An electric space rocket with only 1/100,000-pound push has been developed by Electro-Optical Systems, Inc., for the U.S. Air Force. Fueled by 1/10-pound of liquid cesium, the 3" × 8" 2-pound ion engine will provide the minute thrust which is needed to control a satellite's deviations from orbit.

WARM UP THOSE EARPHONES

HERE COMES THE DRAKE SW-4

Hybrid tube/transistor SWL receiver is the hottest thing on the market

IF A MAGAZINE could fall in love with a short-wave listening receiver, it would fall for the Drake SW-4. A renowned manufacturer of quality ham radio gear, the R. L. Drake Co. (540 Richard St., Miamisburg, Ohio 45342) is making its first venture into the SWL market. Using requirements specified by *Radio New York Worldwide*, Drake has produced the Model SW-4.

POPULAR ELECTRONICS tested out one of the first SW-4 receivers and, in a nutshell, can report after two months of intensive use that the SW-4 is everything claimed for it. Intended for tuning the principal international short-wave broadcasting bands, it uses a system of crystal-controlled high-frequency oscillators, so that each complete rotation of the tuning scale is exactly equal to 500 kHz. The main dial window is calibrated from 0 to 0.500 MHz and 0.500 to 1.000 MHz. The skirted vernier dial is calibrated from 0 to 25 kHz in 1.0-kHz divisions. Thus, the SWL can not only read frequency directly from the dial, but can also tune to a specified frequency! This is the closest thing we've seen to automated SWL'ing.

The idea of direct frequency dialing in radio receivers is not new, but heretofore the SWL has been left out in the cold. The SWL either had to buy a ham radio receiver with lots of extras he didn't need, or reach way down in his pocket for an all-band receiver selling at $600-700. The Drake SW-4 represents

Operation of the Drake SW-4 is simplified through the use of color-coding. In the photograph above, the SW-4 receiver is set for the 9.5-MHz "Band" in the 6-10 "Range MC." The "Range Peak" control is really an r.f. preselector and the color dash on the panel matches the dots of the other two controls.

To show the versatility of the SW-4, the station being heard at this dial setting is VLW/X9, Perth, Australia, operating 5 kHz lower than the assigned normal frequency. Match this dial setting to the other photo (9.5 MHz) so that the dial reads 9.5 MHz plus 0.100 MHz, plus 5 kHz, or 9.605 MHz.

SHORT SPECS

- Designed for listening in on the international broadcasting bands, the SW-4 tunes in seven bands: 6.0-6.5 MHz, 9.5-10.0 MHz, 11.5-12.0 MHz, 15.0-15.5 MHz, 17.5-18.0 MHz, 21.5-22.0 MHz, and 25.5-26.0 MHz, plus three "accessory" 0.5-MHz segments between 1.5 and 30.0 MHz.
- Sensitivity is better than 2.0 μV for 10 dB AM signal to noise. Selectivity is 16 kHz wide at 60 dB down, for optimum broadcast reception.
- Dial calibration when set with WWV is better than plus or minus 2.0 kHz (in test model).
- Stability from cold start is under 0.1 kHz.
- The SW-4 has 10 tubes, 3 transistors, plus diodes in special hybrid circuitry.
- Unit draws 45 watts from 117-volt a.c. line, and measures 5½" high, 10¾" wide, and 11⅝" deep. Speaker is in identically sized cabinet.
- Price: $289. Speaker, $19.95 extra.

the first breakthrough in this respect, and serves as recognition of the fact that SWL's are looking for a receiver of its capabilities.

We used two different antennas with the SW-4, and we certainly recommend that the SWL really searching for DX make provisions for antenna changeover —it's definitely worthwhile. One antenna was the Mosley SWL-7, the other a long wire (100') strung about 35' in the air. After calibrating the dial with WWV on 10.0 MHz and 15.0 MHz, we never found it necessary to change the hairline settings. Unknown stations down in the mud could be tentatively identified from the 1966 WRH station listing. Programs that we especially wanted to hear were simply dialed and "there they were" nine times out of ten —that's pretty good dialing. -30-

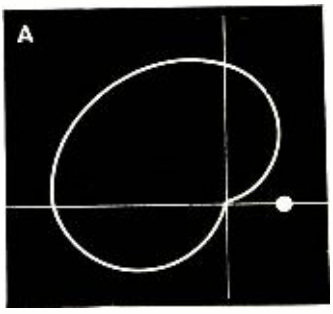
DIAGRAM QUIZ

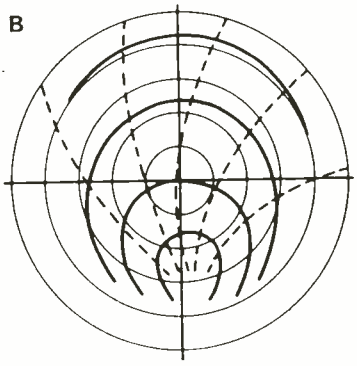
By ROBERT P. BALIN

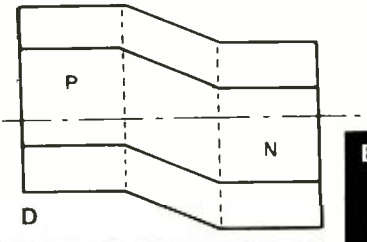
Most electronic technicians work with schematic diagrams, wiring diagrams, and block diagrams on a routine basis, and are familiar with all symbologies used. But how many have heard of a Nyquist or a Venn diagram? See if you can correctly identify the diagrams shown here by matching their names (1-10) with the actual drawings (A-J). Consider yourself fairly knowledgeable if you can identify six or more. But you could still be a crackerjack technician if you match no more than four.

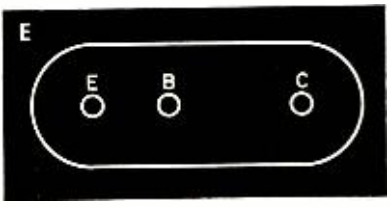
1 Basing ___ 6 Logic flow ___
2 Chromaticity ___ 7 Nyquist ___
3 Circle ___ 8 Rieke ___
4 Directivity ___ 9 Venn ___
5 Energy level ___ 10 Winding ___

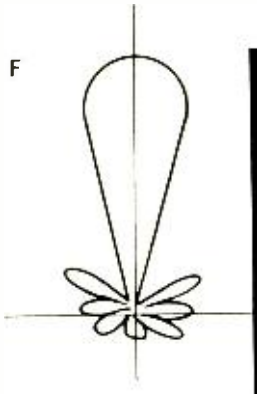
(*Answers appear on page* 104)

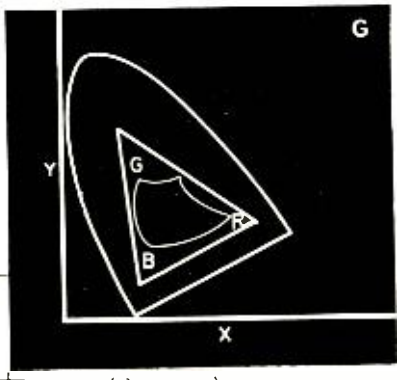


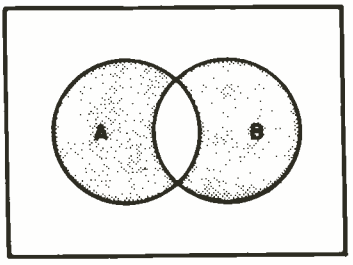


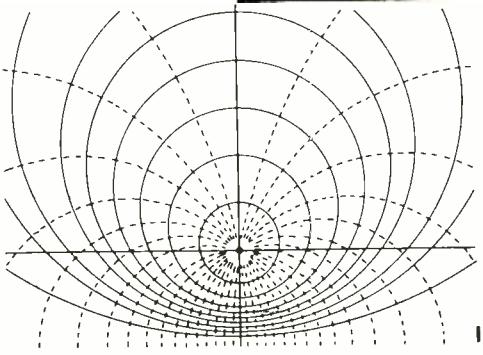


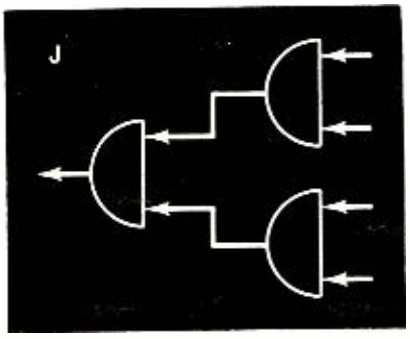






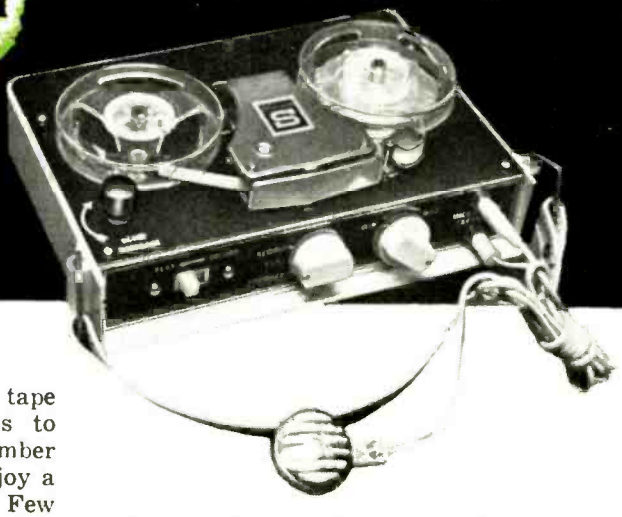






BUILD A TAPE RECORDER ECHO CHAMBER FOR UNDER $10

...and enjoy a new dimension in sound



By **STEPHEN E. AUYER**

DO YOU HAVE an inexpensive tape recorder and about ten bucks to spare? Why not build an echo chamber for the tape recorder and really enjoy a new dimension in sound effects? Few devices can add as much pleasure and enjoyment to tape recording as an echo chamber. And as a family fun-maker and entertainer, it has no peer.

Actually, an echo chamber is a very simple device. It takes a recorded sound, delays it, and then sends it on to follow the original sound. The delayed sound is heard as an echo, and produces a very pleasant effect.

How It Works. An additional pickup head is installed on the tape recorder about two inches away—in the direction of tape travel—from the recording head (for tape speeds of 3¾ ips). A signal is recorded on the magnetic tape as it passes the original head. As the tape moves on, the same signal is picked up by the new head (Fig. 1), amplified by *Q1*, and re-recorded as an echo a short time later. The setting of *R5* determines how much of the signal is fed back and re-recorded to produce a strong or weak echo as desired; distance between heads determines echo separation.

The echo chamber preamplifier circuit is shown in Fig. 2. Transistor *Q1* in a common emitter configuration provides sufficient gain to the delayed signal. Base bias is achieved by the voltage divider action of *R6*, *R1*, and *R2*. The collector voltage is developed across *R4* and *R6*.

Capacitor *C2* bypasses emitter resistor *R3* to eliminate degeneration, while *C3* serves to block d.c. from across *R5*. Capacitor *C5* couples the audio to the recorder amplifier.

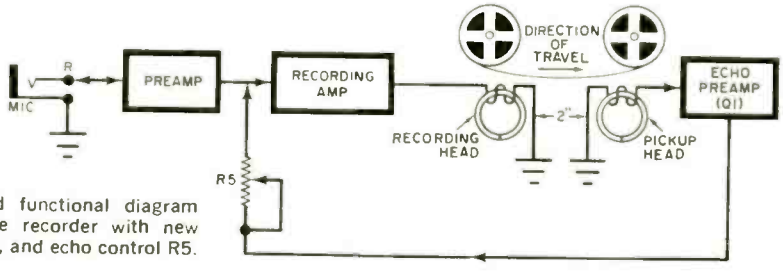


Fig. 1. This simplified functional diagram shows a modified tape recorder with new head, echo preamplifier, and echo control R5.

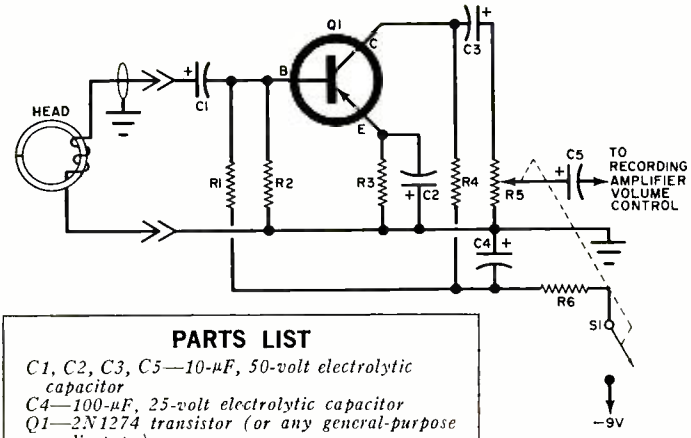


Fig. 2. The echo preamplifier employs a single common emitter stage to provide the necessary gain for the echo effects. Shielded cable connects new pickup head to preamplifier.

PARTS LIST

C1, C2, C3, C5—10-μF, 50-volt electrolytic capacitor
C4—100-μF, 25-volt electrolytic capacitor
Q1—2N1274 transistor (or any general-purpose audio type)
R1—47,000-ohm, ½-watt resistor
R2—10,000-ohm, ½-watt resistor
R3, R6—1000-ohm, ½-watt resistor
R4—4700-ohm, ½-watt resistor
R5—5000-ohm potentiometer (with switch S1)
S1—S.p.s.t. switch (mounted on R5)
1—Tape head (Midland 25-735 or Lafayette 99 R 6194)
Misc.—Small piece of perforated phenolic board, knob, mounting hardware

Construction. The preamplifier can be assembled on a 2″ x 3″ piece of perforated phenolic board, using push-in Vector terminals for the connections. If there is a space problem, you can use a smaller board and simply utilize both sides of the board. Mount the assembled board in any convenient spot in the recorder using stand-off spacers or two right-angle brackets which you can make from a thin piece of aluminum cut to the proper size.

Install the echo control (*R5*) at any convenient spot on the tape recorder deck. Then connect the + (plus) side of *C3* to the echo control (see Fig. 2). Now wire the plus side of *C5* to the center lug of *R5*, and the other side of the capacitor to the output terminal of the tape recorder volume control. And be sure to establish a good common ground between preamplifier and recorder.

Mount the second tape head approximately two inches away from the first head, in the direction of tape travel. A word of caution: in many of the lower priced units, all parts of the tape do not make uniform contact with the head as the tape passes over it. For best results, you must therefore make certain that the second head covers the same part of the tape as the original head.

During operation, the echo control (1) is turned up just enough to produce the desired echo level. If greater echo separation is desired, move new head (2) further away from the main recording head.

It may be necessary to install additional tape guides to keep the tape properly aligned. These can be made from a ½″-long, ⅛″-o.d. brass spacer, and can be secured to the deck with ¾″-long #4 hardware. Use shielded cable when connecting the new head to its preamplifier.

Operation. Set up your recorder for normal recording. While monitoring the signal being recorded, increase the setting of the echo control (*R5*) until the desired amount of echo is produced. If the echo control is advanced too far, you will get an annoying feedback.

If your recorded sound comes out too "brassy," chances are the recording heads are not properly aligned. To correct this condition, loosen the screws that mount the second head, and rock the head slightly from side to side until the best response is obtained.

You can get an interesting effect by connecting the tape recorder monitor output to your hi-fi system, while the recorder is set to the *record* position. Then, as you talk into the microphone, your voice—plus its echo—will be heard.

For an extra-special sound effect, try connecting the output of an audio oscillator to the echo chamber. Then vary the frequency of the oscillator while recording. -30-

SHORT-WAVE LISTENING

By HANK BENNETT, W2PNA/WPE2FT
Short-Wave Editor

A NEW COUNCIL FOR DX'ERS

SOME YEARS AGO the numerous radio clubs in Sweden decided to form an organization to represent all of them. This organization became known as "DX-Alliansen." Each participating club appoints one of its members to attend the annual meeting of the organization, at which time matters of common interest are discussed.

More recently, an organization was formed in North America, following the general pattern of the Swedish group, to promote closer cooperation among the many clubs in the U. S. and Canada, and also in the Caribbean area. Headed most ably by Don Jensen, of Milwaukee, Wis., the "Association of North American Radio Clubs" (ANARC) has made considerable headway on a wide variety of subjects.

Now comes word of still another group which is in the formative stage. The Norwegian DX-Listeners Club has proposed that clubs in Belgium, Denmark, Finland, France, Germany, Great Britain, Holland, Italy, Norway, Sweden and Switzerland band together and form a "European DX Council." It is proposed that each country have one representative, an active DX'er who would be backed by not less than 50 registered DX'ers in his country. Like the two previously mentioned organizations, the new group would handle such problems as verification policies and the maintenance of good relations among the various clubs as well as between the stations and the DX'ers. It would also act as a "Decisive Assembly" in the event of any conflict, should the affected parties so request.

While representing DX'ers in a relatively small portion of the world, such a council could be a vital instrument in improving the already high standards of our hobby. We here in New York would like to see similar organizations formed in other parts of the world. For example, there is room for such a council in Africa, South America, the Balkan countries, and South and Southeast Asia.

In time it is conceivable that all areas of the world might be represented in an annual or biennial general parliamentary meeting.

About WPE Identifications. Two slightly disgruntled readers of this column have

(*Continued on page* 108)

Stephen Bruns, of Wellesley, Mass. (above), is otherwise known as WPE1GNO. Steve's receiver is a Knight-Kit "Star Roamer" which "roams" from 2000 to 30,000 kHz. His antenna is 150' long.

A Canadian teacher interested in the educational aspects of SWL'ing, Don Allen, VE2PE1JM, does his own DX'ing in Arvida, Quebec. Don's Trio 9R-59 and Toho 1008 receivers have "logged" 7 provinces, 27 states, 25 countries, and 6 continents.

ENGLISH-LANGUAGE BROADCASTS TO NORTH AMERICA

FOR THE MONTH OF AUGUST

Prepared by ROBERT LEGGE

TO EASTERN AND CENTRAL NORTH AMERICA

COUNTRY	CITY	TIME-EST	TIME-GMT	FREQUENCIES (MHz)
		MORNING BROADCASTS		
AUSTRALIA	Melbourne	7:15-8:15 a.m.	1215-1315	9.58
CANADA	Montreal	7:15-8:15 a.m.	1215-1315	5.97, 15.32
DENMARK	Copenhagen	7:30-8 a.m.	1230-1300	15.165
FINLAND	Helsinki	7:15-7:45 a.m.	1215-1245	15.185 (Tues., Sat.)
GREAT BRITAIN	London	9:30-11:30 a.m.	1430-1630	15.35, 17.81
SWEDEN	Stockholm	9-9:30 a.m.	1400-1430	15.42
		EVENING BROADCASTS		
ALBANIA	Tirana	7-7:30 p.m.	0000-0030	7.265
AUSTRALIA	Melbourne	8-10 p.m.	0100-0300	15.22, 17.84
BULGARIA	Sofia	7-8 p.m.	0000-0100	9.70
CHINA	Peking	8-10 p.m.	0100-0300	11.945, 15.06, 17.68
CUBA	Havana	8-11 p.m.	0100-0400	9.525
CZECHOSLOVAKIA	Prague	8-9 p.m.	0100-0200	7.345, 9.505, 11.99
DENMARK	Copenhagen	9-9:30 p.m.	0200-0230	9.52
ECUADOR	Quito (HCJB)	9-11:30 p.m.	0200-0430	9.745, 11.915, 15.115
EGYPT	Cairo	8:30-10 p.m.	0130-0300	9.595
GERMANY	Berlin	8-9 p.m.	0100-0200	9.73, 11.875
	Cologne	8:30-9:50 p.m.	0130-0250	9.64, 11.945
GREAT BRITAIN	London	4:15-10:30 p.m.	2115-0330	7.13, 9.51, 11.78
HUNGARY	Budapest	8:30-9:30 p.m.	0130-0230	9.833, 11.91
ITALY	Rome	8-8:20 p.m.	0100-0120	11.81, 15.385
JAPAN	Tokyo	6:45-7:45 p.m.	2345-0045	15.135, 17.825
LEBANON	Beirut	9:30-10 p.m.	0230-0300	11.76
NETHERLANDS	Hilversum	8:30-9:30 p.m.	0130-0230	9.59 (via Bonaire Relay)
PORTUGAL	Lisbon	9-9:45 p.m.	0200-0245	6.025, 6.185, 9.74
ROMANIA	Bucharest	8:30-9:30 p.m.	0130-0230	6.15, 11.935
SPAIN	Madrid	8-9:30 p.m.	0100-0230	6.13, 9.76
SWEDEN	Stockholm	8:15-9:45 p.m.	0115-0245	11.885
SWITZERLAND	Berne	8:15-9:15 p.m.	0115-0215	6.12, 9.535, 11.715
U.S.S.R.	Kiev	7:30-8 p.m. (Mon., Thurs., Fri.)	0030-0100 (Tues., Fri., Sat.)	9.66, 9.685
	Moscow	5-5:30 p.m. and hourly to 12-1 a.m.	2200-2230 and hourly to 0500-0600	7.15, 9.665, 9.685
VATICAN	Vatican	7:50-8:10 p.m.	0050-0110	5.985, 7.25, 9.645

TO WESTERN NORTH AMERICA

COUNTRY	CITY	TIME-PST	TIME-GMT	FREQUENCIES (MHz)
ARGENTINA	Buenos Aires	10-11 p.m. (Mon.-Fri.)	0600-0700 (Tues.-Sat.)	9.69
AUSTRALIA	Melbourne	5-7 p.m.	0100-0300	15.22, 17.84
BULGARIA	Sofia	8-8:30 p.m.	0400-0430	9.70
CHINA	Peking	7-9 p.m.	0300-0500	9.457, 11.82, 15.095
	Taipei	6:50-7:50 p.m.	0250-0350	11.86, 15.345
CUBA	Havana	9-10 p.m.	0500-0600	6.135
CZECHOSLOVAKIA	Prague	7:30-8:30 p.m.	0330-0430	7.345, 9.505, 11.99
GERMANY	Berlin	7:45-8:15 p.m.	0345-0415	9.73, 11.92
	Cologne	9-9:40 p.m.	0500-0540	9.735, 11.89
HUNGARY	Budapest	7-8 p.m.	0300-0400	9.833, 11.91
JAPAN	Tokyo	6-7 p.m.	0200-0300	15.135, 17.825
KOREA	Seoul	7-7:30 p.m.	0300-0330	15.125
PORTUGAL	Lisbon	8-8:45 p.m.	0400-0445	6.025, 6.185, 9.74
SWEDEN	Stockholm	7:15-7:45 p.m.	0315-0345	11.885
SWITZERLAND	Berne	8:15-9:15 p.m.	0415-0515	9.535, 11.715
U.S.S.R.	Moscow	7-10:30 p.m.	0300-0730	9.735, 11.755, 11.85

SOLID STATE

By LOU GARNER, Semiconductor Editor

CHANCES are you've read about miniature integrated circuits not only in this column but in more general publications and newspapers as well. You may also have heard about these new units on special radio and TV programs. If you're a student, your science or physics teacher may have discussed them with you in class. If you're a typical hobbyist, it's a good bet that your curiosity has been thoroughly aroused and that you're "itching" to work with these devices.

The integrated circuits offered through distributors have been—in the past—too expensive, or they have been special-purpose units designed for computer and digital logic applications. Although there are many inexpensive logic circuits on the market, comparatively few hobbyists find use for NOR and NAND gates, flip-flops, shift registers, core drivers and similar circuits. Integrated linear amplifiers, on the other hand, can be used in a variety of projects, but the prices of these units—$75.00 and up—put them out of reach of the average experimenter.

But now comes good news from the West Coast. International Rectifier Corp. (233 Kansas St., El Segundo, Calif. 90245), recognizing the interest of many hobbyists and experimenters in integrated circuits, has broken the price barrier by introducing a complete three-transistor audio amplifier for under $20.00. A new addition to the IRC line of experimenter/hobbyist components, the integrated circuit audio amplifier can be used in a number of practical applications, either as a self-contained unit or as part of a more elaborate system.

The complete microminiature amplifier, shown in Fig. 1, is housed in a standard five-lead TO-5 transistor case. All components within the dotted line are formed on a monolithic silicon chip. The user merely adds an external bias resistor (*Rb*), an input capacitor (*Cin*), a d.c. power source, and an output load such as a resistor, earphone, inductance coil, or transformer. All transistors are *npn* types.

Transistors *Q1* and *Q2* form a Darlington stage which is direct-coupled to common-emitter output amplifier *Q3*. Resistor *R1* serves as a common collector load for *Q1* and *Q2*, and as *Q3*'s base bias resistor. The operation of *Q3* is stabilized by unbypassed emitter resistor *R2*. Supply voltage of from 6 to 12 volts can be used.

According to the specifications released by International Rectifier, the unit is capable of a current gain ranging up to 6000, depending on bias and supply voltage. It has a minimum bandwidth of 1 MHz. Requiring less than 100 mA for operation, a typical unit has an input impedance com-

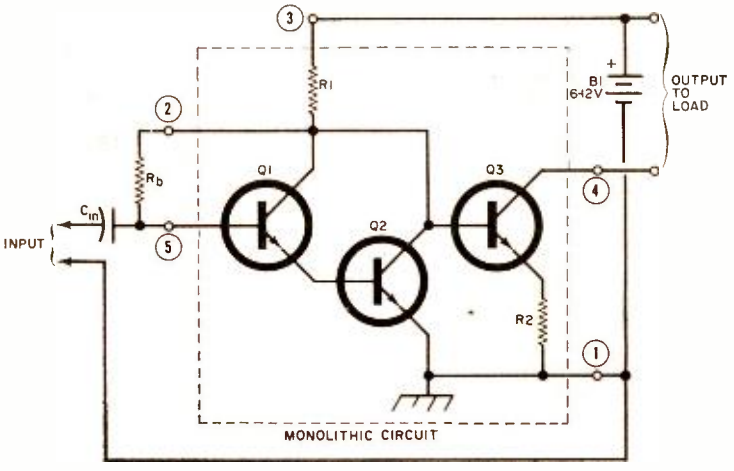


Fig. 1. Boasting a current gain of up to 6000, this microminiature integrated circuit linear amplifier from International Rectifier Corp. can deliver 45 milliwatts to a transformer load.

parable to that of standard small-signal transistors and an output impedance of approximately 20,000 ohms; and, with a 6-volt power source, it can deliver 45 milliwatts to a transformer load.

Now that the ice is broken, more low-cost integrated circuits for the hobbyist will probably be introduced. And you can look for further reductions in price.*

There's also good news from other manufacturers. Both Motorola Semiconductor Products (5005 E. McDowell Rd., Phoenix, Ariz. 85008) and Siliconix, Inc. (1140 W. Evelyn Ave., Sunnyvale, Calif. 94086) are now producing moderately priced field-effect transistors (FET's) for hobbyist and experimenter applications. And Radio Corporation of America, a pioneer in the manufacture of high-frequency overlay transistors, is now offering commercial units capable of handling up to 40 watts at 400 MHz. Also available from RCA are some low-priced units capable of delivering 1 watt at 600 MHz.

Biasing the Transistor. If we are to develop a systematic approach to the technique of analyzing and servicing transistor circuits, it is essential to have a good working knowledge of transistor biasing in practical circuits. For only then can we determine the conditions under which the transistors in a given circuit configuration will conduct or fail to conduct.

Transistors are biased both in the forward and in the reverse direction. For example, a forward bias is put across the emitter/base junction while a reverse bias is across the collector/base junction.

Four basic rules govern the biasing of transistors:

(1) Battery polarity must correspond to the emitter material. In other words, the positive side of the battery goes to the emitter in *pnp* units, while the negative side goes to the emitter in *npn*'s.

(2) Forward bias is established by applying a small potential of the proper polarity between the emitter and base. In practice, this potential can vary from about 0.05 volt to 0.5 volt.

(3) Transistors conduct in the direction of current saturation as the potential on the base increases in the direction of the collector voltage.

(4) Conversely, transistor current decreases as the base potential changes in the direction of the emitter potential. When there's no difference of potential between base and emitter, the transistor cuts off.

**As we go to press, word has been received that low-power integrated circuit linear amplifiers in the $2 to $3 price range are being marketed by Radio Corporation of America and General Electric Company.*

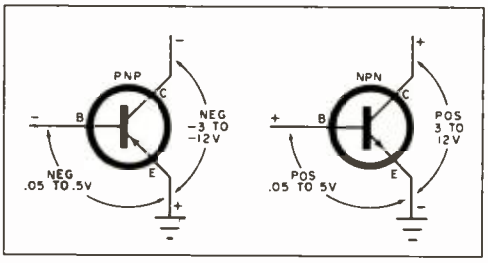


Fig. 2. Electron flow is from emitter to collector in npn types and from collector to emitter in pnp's.

Most transistors of the variety used in radio and audio frequency work operate with emitter-to-collector voltages in the range of from 3 to 12 volts, or more. When measured from the emitter, these voltages will be positive for the *npn* types, and negative for the *pnp* types. (See Fig 2.)

Once you know how a transistor functions under varying bias conditions, you should have no trouble whatsoever in developing an effective approach to building and servicing transistor circuits.

From Overseas. A British firm, Pulrose Co., Ltd. (6 Great John St., Manchester 3, England), is now marketing a transistorized photoelectric control system which responds *only* to the light from its own source, thus eliminating false alarms as well as the need for cowls, hoods, and similar shade covers. Highly sensitive, it can detect the presence of a sheet of clear glass, even in daylight. The design is based on an opto-electronic feedback loop formed by the light beam from a neon bulb striking a photocell.

Also from England comes news that solid-state devices are being used as automatic defrosters for power lines to prevent excessive accumulations of ice, packed snow, and frost which can cause breaks in long lines. Special insulated sleeves of a nickel, chromium, and iron alloy are employed at properly spaced intervals along the transmission lines. When the temperature falls below 15°C, the alloy becomes magnetic, developing eddy currents which generate heat in the cable to raise the temperature to above 15°C.

From Japan we hear that both the Teisco Corp. and Ace Electronics Co., Ltd. are producing transistorized portable electronic organs. Much more compact and lighter than familiar console types, these organs are suitable for jazz bands, rock 'n' roll combos, and similar itinerant musical groups. In fact, the production of all-electronic musical instruments is growing by leaps and bounds on the island, with major efforts concentrated on the manufacture of

(*Continued on page* 105)

TECHNICIAN BAND ANTENNA COUPLER

Secure optimum coax line match on either 6 or 2 meters

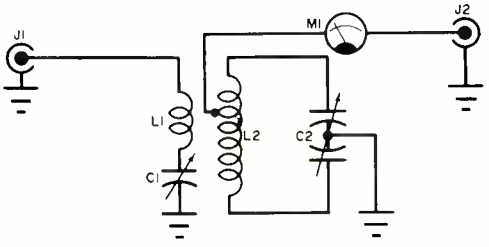
By **E. H. LEFTWICH,** WA6GQZ

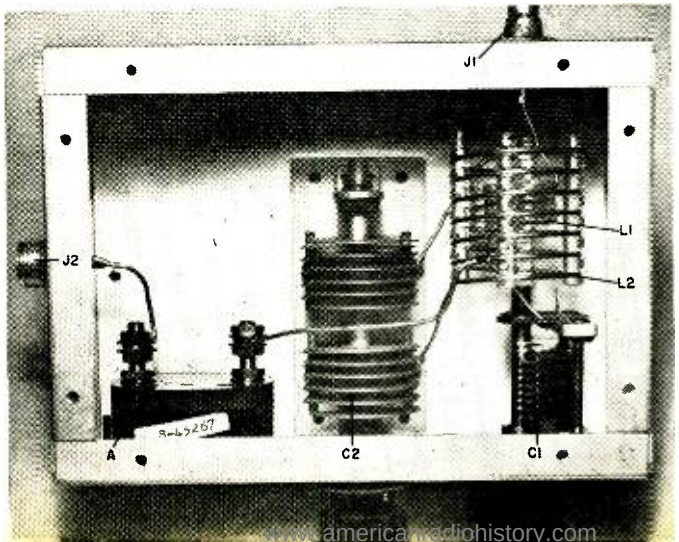
THE PRACTICE OF running a 52-ohm coax line right into a 50- or 144-MHz rig without a matching network has been accepted by most hams by default, since there just isn't enough information available on building 52-ohm coax fed antenna tuners and couplers. But maybe a few details on the tuner/coupler at the WA6GQZ shack will help those hams, Techs or Novices, who feel that they are not getting the best possible results from their antennas.

Construction of this tuner/coupler is straightforward and there should be no difficulty in duplicating—more or less—the general plan in the photographs. In the 50-MHz version of the unit, the coils are cut from standard B&W 3015 and 3021 stock. The smaller diameter coil, *L1*, is mounted inside coil *L2*, and the plastic supports and turn-spacers provide sufficient insulation for power outputs up to 50 watts. In the 144-MHz unit, the coils are both hand-wound and self-supporting, but *L1* is mounted outside of *L2*.

The r.f. ammeter is not necessary, but it's a handy indicator of antenna performance. Look around the surplus electronics stores for bargains in meters. A good r.f. ammeter can be purchased for four or five dollars.

The initial setting up of the tuner/coupler necessitates the use of a good





In the 50-MHz version, L2 is tapped two turns from either end; ir 144-MHz unit, it is tapped one turn from either end. Position of tap in each case may be varied slightly if necessary to obtain the lowest SWR.

Bottom view of 50-MHz version shows general parts placement; mounting is not critical. But note that L1 is inside of L2.

PARTS LIST

J1, J2—Phono jack (Amphenol SO-239 or BNC UG-209A/U)

M1—2" r.f. ammeter, 0-2 expanded scale (Weston 507 or equivalent)

50-MHz Version

C1—140-pF capacitor (Hammarlund MC-140-S or equivalent)
C2—35-pF capacitor, 2 sections, double-spaced (Hammarlund MC-35-SX or equivalent)
L1—3 turns of #16 wire, 1" diameter, 16 TPI (B&W 3015 or equivalent)
L2—7 turns of #14 wire, 1¾" diameter, 4 TPI, tapped 2 turns from either end (B&W 3021 or equivalent)

144-MHz Version

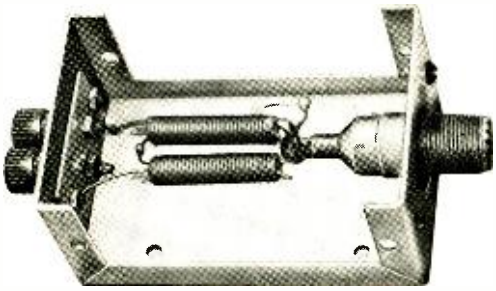
C1—100-pF capacitor (Hammarlund MC-100-S or equivalent)
C2—20-pF capacitor, 2 sections, double-spaced (Hammarlund MC-20-SX or equivalent)
L1—2 turns of #14 enamel-covered wire, 1" diameter, spaced ¼" (hand-wound)
L2—5 turns of #10 bare wire, ½" diameter, spaced 1", tapped 1 turn from either end hand-wound)

VSWR bridge. Set the bridge to *FORWARD* and adjust the transmitter final and tuner/coupler for a maximum reading. Then switch the bridge over to *REFLECTED* and adjust *C1* and *C2* in tuner/coupler for minimum reading.

Repeat this procedure once or twice, and your SWR—with a decently resonant antenna—should drop down to 1.3:1 or better. If your antenna is slightly off-resonance, it may be necessary to shift the position of the tap on *L2*. -30-

TV BALUN USEFUL ON 6 AND 2

THE NEXT TIME you cannibalize a defunct television receiver, set aside the pair of antenna input balun coils. These coils will be useful if you ever want to get a low-power 6- or 2-meter ham transceiver on the air using only an outdoor TV antenna.

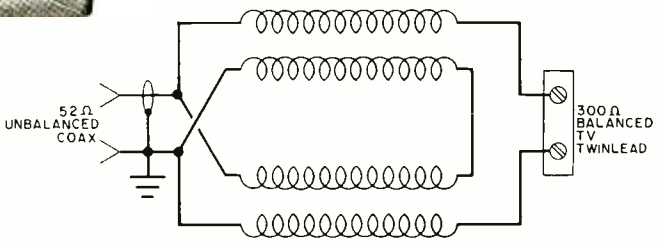


Balun coils connected back to back make it possible to use 300-ohm TV twin lead as a low-loss feedline.

The writer took a pair of balun coils and permanently mounted them in a small aluminum metal box as shown. At one end of the box are terminals for feeding a 300-ohm twin lead and at the other end a coax connector. When emergency portable operation is called for, the encased balun is put into the line and the 52-ohm output of the transceiver is matched to a 300-ohm fed TV antenna.

In case you don't want to wait around for balun coils, you can buy a pair dirt cheap from practically any electronics supply house or mail order dealer.

—James Youngberg, K1NKR



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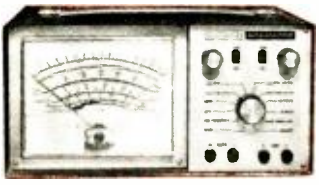

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- Detects condition of point surfaces
- Checks ignition coil and distributor
- Finds poor or open ground connections
- Checks alternator diodes
- Checks headlights, pilot lamps, horns, starter relays, fuses, accessories
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- Determines battery charge/discharge rate
- Measures spark output & leakage
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CB'ERS ARE WONDERING

(*Continued from page* 50)

the habitual violators can expect a rough time during the coming months.

What about the "10 Code" which has become so popular? Many operators have received rule violation notices for coming on the air and uttering "10-8" (standing by). Turns out that it isn't *what* you say, it's what you *mean* by it. For instance, in most cases the FCC considers "10-8" as little more than a thinly disguised "CQ" call. Those who use it properly—and use several other "problem" 10 code messages properly—are left alone by the FCC.

New Mailing Address? Something that has been on the minds of CB'ers for several years has recently been settled. This was the problem of notifying the FCC when you changed your mailing address. Under previous rules, when you moved you were required to go through the whole licensing rigamarole, right down to the FCC Form 505 application and the $8 license fee. This meant that you not only spent $8, but you also lost your old call-sign. As a result, most CB'ers never bothered to tell the FCC when they moved.

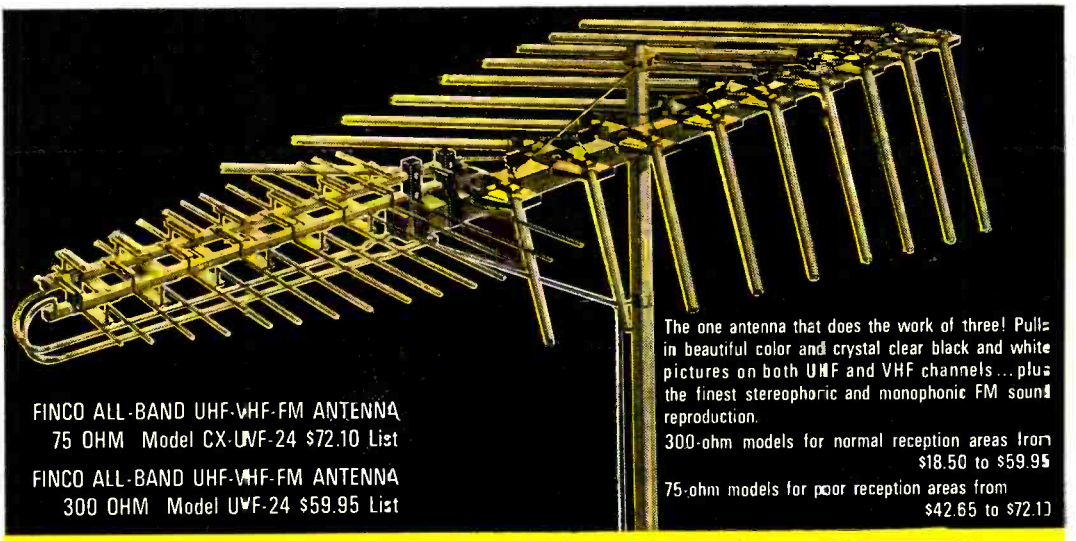
So there was the poor old FCC, sitting with several million dollars' worth of computerized record-keeping equipment loaded with wrong addresses. Well, the FCC finally threw in the towel. New rules say that when a CB'er moves he can drop the FCC a postcard giving his call-sign, his name (as it appears on the CB license), and the old and new addresses (including the zip code of the new address). That's all; no money changes hands, and you can keep your call-sign.

The FCC hopes that all CB'ers who have moved since the issuance of their present license will send this information, even if the move took place three or four years back. There are no penalties for late reporting since the FCC doesn't ask *when* you moved.

You've moved? Okay, send the necessary information to the computer in order to square yourself. Send it to: Federal Communications Commission, 334 York St., Gettysburg, Pa. 17325.

FCC Does Its Own Wondering. Many people at the FCC are beginning to wonder about the repairs being made on CB rigs by local CB shops. The rules are quite specific in that *only* the holder of a First or Second Class Radiotelephone or Radiotelegraph license may tinker with the innards of the transmitter portion of a transceiver.

Three ways to up modulation. If that old CB rig is missing modulation punch, you can use one of the compressor/clippers at left to set things straight. On the stand is the Turner "+2" microphone with a preamp built into the base; the volume control is at the rear. In the background is the Knight-Kit C-577 compressor and speech amplifier; it is attached between your existing mike and base station rig. The output is metered for control of modulation percentage. If you have a mobile station that needs pepping up, try the E-V/American D-501K microphone with miniaturized preamp/clipper built in. Photo above shows the mercury battery of the D-501K. All three of these compressors are battery-operated.



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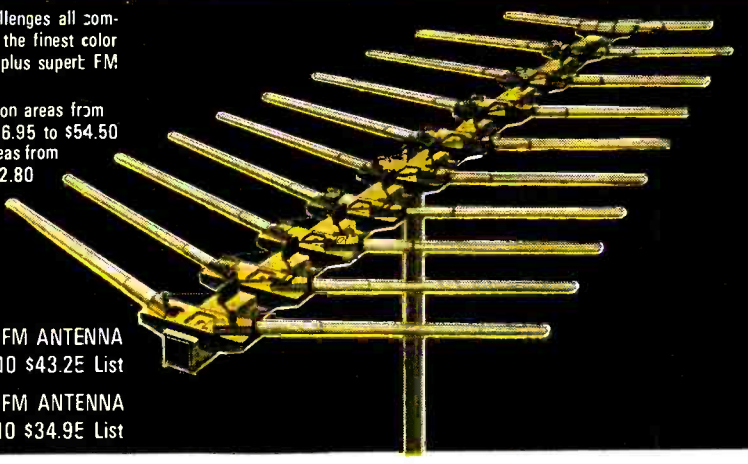

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300 OHM Model VL-10 $34.95 List

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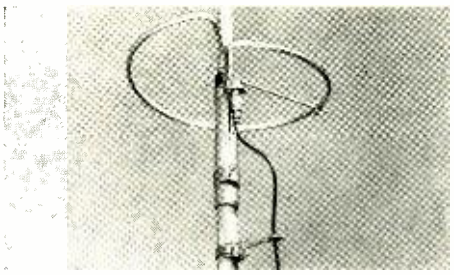

Something new in matching. Does the CushCraft "Ringo" antenna presage the demise of ground plane radials? Developed by Lester Cushman for the CB market, the "Ringo" has a matching system that is simply a 14"-diameter aluminum ring. A feed line tap point on the ring was adjusted to put the SWR down to under 1.3:1 in the test version erected by POPULAR ELECTRONICS. The radiator is 17' 10" long and has a claimed gain of about 3 db over a ground plane with quarter-wave radials. The "Ringo" sells for $16.95 and can be put up in an hour.

It seems that many CB shops *claim* to have a properly licensed technician at the workbench, when, in fact, the repairman has little more than a license to drive a motor scooter. Result: the rigs don't operate properly, the CB'er gets hung for being off frequency (or overmodulating, or running over power, or whatever), and he squawks loud and long to the FCC that the set was worked on by someone licensed by the FCC to do that type of work.

This neat little racket may blow sky high in the near future, and shady CB repair shops will be put back in the bicycle renting business.

Canadian CB'ers Wonder, Too. Many CB'ers have been quick to accept the kindness of our Canadian neighbors by obtaining free licenses in the "Tourist Radio Service." This is a service established by the Canadians to permit American CB'ers to use their gear while north of the border. Canadian CB'ers have been sort of anxious to obtain the same operating privileges while on vacation in the States. *They* are wondering when this will happen. Unfortunately, it's safe to predict that it will probably *never* happen or, if it does, it will be a long way off. It seems to be a matter of *very* complicated Washington-type legal goings-on, and it's going to take Congressional action.

As CB'ers continue to worry and won-

der, there are other things they think about as well—like making major decisions on which of the new rigs will eventually grace the top of the operating table or which new antenna will protrude from rooftop or fender.

While you, as a CB'er, worry and wonder, there's no reason why you can't or shouldn't enjoy the benefits of this great communications medium and take advantage of a national resource. There's enough equipment around to satisfy your needs, and chances are that no one will bother you— not even the FCC— if you use a little common sense and observe the rules. -30-

REPORT ON CB EQUIPMENT

(*Continued from page* 58)

from last year. The "Sentry" ($99.90) is a hybrid transceiver combining tubes and transistors. It has 6 crystal-controlled channels. Last in the Pearce-Simpson lineup is the "Sea-B-Mate" ($189.90), a CB module that plugs into the manufacturer's Catalina 75-watt marine radio rig.

POLYTRONICS LABORATORIES, INC. (900 Burlington Ave., Silver Spring, Md. 20910): This company is now a subsidiary of Vitro Corp. and has moved from New Jersey to Maryland. First of its new products to hit the market is the "Poly Pup" ($149.50). This new unit retains the same ultra-small dimensions of the "Poly Compact" ($199.95), but has 7 crystal-controlled channels as compared to the 11-channel performance of the "Poly Compact." The "Compact" uses a Collins mechanical filter which is an optional extra in the "Pup." Both of these units are obviously for mobile use, although a 117-volt a.c. power supply is being made available. Continued in the Polytronics line is the "Duo Com 120" ($129.50). This 1.2-watt-output walkie-talkie is now available in an explosion/hazardproof model for $139.50. The "Poly Comm 23" ($299.50) and "Poly Comm 23 Senior" ($349.50) are being continued. Both are 23-channel units, with the "Senior" containing built-in selective calling. The "Poly Comm 30" ($329.95) is retained in the line. This transceiver has provisions

for switching between 5 watts and 100 milliwatts input.

RADIO CORPORATION OF AMERICA (Harrison, N.J. 07029): The continued popularity of the three RCA CB transceivers will be sufficient to keep all of them on the market in 1966-67. The prices of "Mark VIII" ($99.95) and "Mark Nine" ($114.50) have been reduced. These two units are similar, although the "Mark Nine" has a tunable receiver and S-meter. Both have provisions for 9 transmit channels. Top of the RCA lineup is the "Mark 10" ($189.95). This transceiver has provisions for 12 transmit/receive crystal-controlled channels. The "Mark 10" is designed for mobile operation, but a power supply pedestal for base station use is available for $40.65. The "Mark VIII" and "Mark Nine" are for base station use and a 12-volt d.c. supply for either unit is $19.95. A special accessory ($27.30) is now available for the "Mark 10" which permits tuning of all 23 channels.

RADIO SHACK CORP. (730 Commonwealth Ave., Boston, Mass. 02215): Although your Editors did not receive detailed information by press time, statements were made by company personnel which indicate that a whole new line of equipment will be available in the late fall. In the meantime, the Model TRC-X23 ($169.95) is being continued.

RAYTHEON COMPANY (213 East Grand Ave., South San Francisco, Calif.): Some very unusual transceiver designs have been announced by Raytheon, aimed, we are inclined to believe, at the housewife CB'er. For base station use, Raytheon has a new TWR-9 ($99.95) with 6 crystal-controlled channels. Channel selection is made via tape recorder style push-tabs. There is no separate mike since the "acoustic lens" in the speaker grille focuses the sound so the speaker can double as a mike. And, the TWR-9 has a push-tab for a 1-station intercom, plus another push-tab to activate a remote speaker. For mobile operation, Raytheon offers the TWR-11 ($159.95). This unit also has push-button channel selection (11 channels), and in the TWR-11T model ($169.95) there is a tunable receiver section. A new selective-calling accessory is offered at $29.95. The TWR-11 is solid state and is available with 117-volt a.c. and 24/32-volt d.c. power supplies.

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CIRCLE NO. 42 ON READER SERVICE PAGE

- A new walkie-talkie from Raytheon is the TWR-8 ($119.95). This unit is set for 2 channels and comes complete with 2 different antennas—one for indoor use that is 9½" long and an outdoor antenna that is 51" long. Power input of the TWR-8 is 2 watts. Continued in the Ray-Tel line is the TWR-7 ($129.95).

REGENCY ELECTRONICS, INC. (7900 Pendleton Pike, Indianapolis, Ind. 46226):

- Brand-new from this manufacturer is the "Ranger" ($169.95), a solid-state unit with provisions for 11 crystal-controlled transmit/receive channels. Small and compact, the "Ranger" includes a Collins mechanical filter for optimum selectivity. For base station use, a separate 117-volt a.c. power supply is being made available. Regency's double-sideband-with-reduced-carrier transceiver, "Range
- Gain II" ($219.95), has been re-styled. This 23-channel unit continues to attract considerable interest and has proven its worth in QRM problem areas.

ROBYN COMPANY (Rockford, Mich.):

- The price of the "Ranger 1000" ($109) has been adjusted. This bargain base station unit features a dual-conversion receiver (it tunes all 23 channels), plus 8 crystal-controlled channels. Selection of channel is by push button. When the "Ranger 1000" is sold with crystals for all 8 channels, the price is $124.95. Robyn is continuing the 1-watt walkie-talkie "650" ($69.95). This unit has 2 channels.

SONAR RADIO CORPORATION (73 Wortman Ave., Brooklyn, N.Y. 11207):

- A new item from this company is the 2-watt-input walkie-talkie "Model T-2" ($139.95). This 2-lb. dual-channel unit has squelch, power source and output metering, and noise limiting. Continued in the Sonar line are the "Model E" ($179.50), "Model FS-23" ($299.95), "Model G" ($229.50), and "Model H" ($159.95). The "Model E" and "Model G" are somewhat similar in physical appearance although the "Model G" has an S-meter and dual-conversion receiver. Both units have 8 transmit channels and a tunable receiver. The "FS-23" is set up for all 23 channels, plus VOX and selective calling. Low-cost "Model H" introduced last fall has 7 crystal-controlled transmit channels, plus extra panel-mounted crystal sockets. AT PRESS TIME:
- A new solid-state transceiver, Model J-23 (about $229), will be introduced.

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SQUIRES-SANDERS, INC. (Martinsville Rd., Millington, N.J. 07946): A 5-channel transceiver from this manufacturer
● (new since our last Report) is the "S5S" ($185). This solid-state unit is very similar circuit-wise to the "23'er" ($235) which is being continued in the lineup. Both units have a special i.f. gated noise silencer (pat. pending) and are ideally designed for mobile operation. The "23'er" is crystal-controlled on all 23 channels (all crystals furnished) and is available with a p.a. adapter ($12.95) as an optional extra. Both the "S5S" and "23'er" can be used as base stations in conjunction with a 117-volt a.c. power supply pedestal and S-meter ($39.50).

TRAM ELECTRONICS, INC. (Lower Bay Rd., P.O. Box 187, Winnisquam, N.H. 03289): What is probably the base station transceiver to end all base station transceivers has just been announced. It
● is the "Titan" 23-channel unit ($434), and features all the accessories the CB'er would want built into one cabinet. The metering details signal strength, power output, and VSWR. Selectivity is optimized through the use of a Collins mechanical filter. Sensitivity is almost unbelievable at 0.1 microvolt. Tram is continuing the "XL-100" ($318) for mobile operation—although an a.c. power supply is now available. This is another high-selectivity transceiver which incorporates a crystal lattice rather than a mechanical filter. The TR-27E has been phased out of production.

UTICA COMMUNICATIONS CORP. (2917 W. Irving Park Rd., Chicago, Ill. 60618): All three Utica transceivers are being continued, including the MC-27 ($142.50), "Town & Country II" ($162.50), and "T&C III" ($259.95). A new low-cost unit may be released this month.

WORLD RADIO LABORATORIES (3415 West Broadway, Council Bluffs, Iowa
● 51504): New from WRL is the "Rustler" ($79.95) featuring 8 crystal-controlled transmit/receive channels plus a transmit crystal panel socket—and a tunable receiver. The "Rustler" is universally powered and has built-in speech clipping. WRL is continuing a hand-held 1-watt walkie-talkie called the "Spacemaster" ($59.95). CB'ers can find some useful accessories in the latest WRL catalog, including a receiver preamp ($11.95) and a speech compressor ($14.95). -30-

AMATEUR EQUIPMENT JAMBOREE

(*Continued from page* 71)

Compared to the transceiver, the independent transmitter may have greater carrier and sideband suppression on SSB, and it may key a trifle better on CW. Here, too, it depends upon the relative quality of particular pieces of equipment.

UHF/VHF Amateur Equipment. Traditionally, much UHF/VHF amateur operation has been on low-power AM phone. Today, SSB is beginning to gain some acceptance on 50 MHz, at least partially because of the availability of excellent 6-meter SSB equipment such as the Clegg "Venus" SSB transmitter and the Heathkit SB-110 transceiver.

Nevertheless, the low-power AM transceiver is still king of the VHF hill, as evidenced by the just-announced Knight-Kit TR-106 15-watt, 6-meter transceiver, and Lafayette's brand-new HA-460 20-watt, 6-meter transceiver with a built-in VFO; plus the other 6- and 2-meter AM transceivers already on the market.

Separate transmitters are less plentiful—there are only two: the "Lil Lulu" 12-watt VFO-controlled, 6-meter AM/CW transmitter; and the AMECO TX-62 75-watter for 6- and 2-meter AM and CW.

Some of the less-expensive VHF transceivers work relatively better as transmitters than they do as receivers when connected to a high-gain beam antenna. If a good low-frequency amateur receiver is available, a crystal-controlled VHF converter will convert the receiver at a very reasonable cost, and do a good job.

Kits. Virtually every type of amateur equipment available in ready-to-operate form is available in kit form. There's an interesting thing about kits: as they become more sophisticated, they seem to become easier to assemble. The use of husky, well-designed printed circuit boards, pre-cut wiring harnesses, easy-to-follow instruction books, and pre-assembled critical, hard-to-adjust circuits all combine to make the kits easy to assemble. When properly put together, kit equipment performs as well as factory-assembled equipment, looks just as good, and costs from 30% to 60% less. —30—

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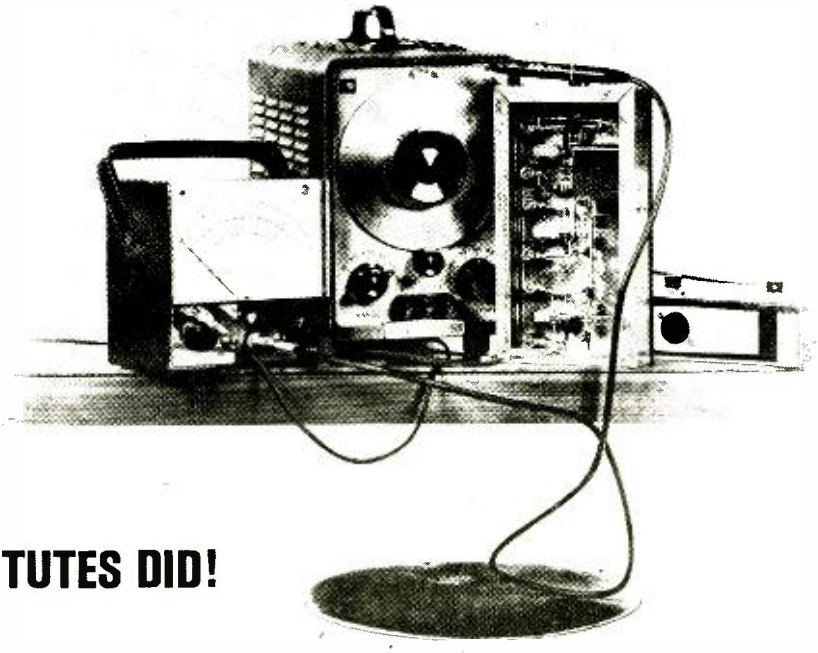

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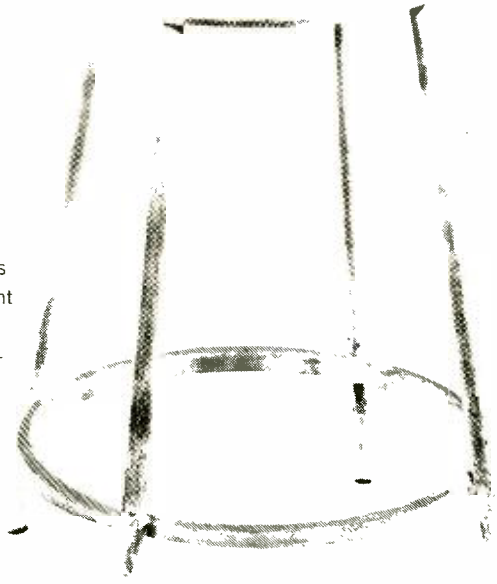

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Automation Electronics. Gets you ready to be an Automation Electronics Technician; Manufacturer's Representative; Industrial Electronics Technician.

Automatic Controls. Prepares you to be an Automatic Controls Electronics Technician; Industrial Laboratory Technician; Maintenance Technician; Field Engineer.

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DIAGRAM QUIZ ANSWERS

(*Quiz appears on page 80*)

1 — E A BASING diagram (also called outline drawing) shows the location of, and identifies the pins of, a vacuum tube or solid-state device.

2 — G A CHROMATICITY diagram displays the various spectral colors that can be reproduced in our color TV system by using the standard wavelengths of red, green, and blue primaries. From it we can see the range of hues and saturation of the colors with respect to white.

3 — I A CIRCLE diagram is used to determine the input impedance of a transmission line, in terms of its electrical length and load impedance. The solution is displayed graphically.

4 — F A DIRECTIVITY diagram (also called polar diagram) is a plot of the directional characteristics which enable an antenna to radiate or receive more energy in some directions than in others.

5 — D An ENERGY LEVEL diagram shows the increases and decreases of electric power as current intensities rise and fall along a channel of signal communications.

6 — J A LOGIC FLOW diagram provides a graphical representation of a computer program or routine at various stages during an operation.

7 — A A NYQUIST diagram is used to evaluate the stability of feedback systems over a wide range of operating frequencies.

8 — B A RIEKE diagram is used to evaluate the performance of microwave oscillators such as klystrons and magnetrons. Contours of constant power output and frequency are plotted on a diagram in which the circles represent the SWR, and the axial lines the phase angle of the load.

9 — H A VENN diagram shows the relationship between two independent variables, A and B. The diagram is of assistance in visualizing logic operations.

10 — C A WINDING diagram for an alternating current machine shows the phase and polar relationships of the windings of a multiphase generator, and provides a means of connecting several groups together to obtain a desired output.

SOLID STATE

(*Continued from page 86*)

transistorized electronic guitars and instrument amplifiers.

A number of Japanese firms are devoting considerable time and money to the increased production of integrated circuits in a determined effort to overcome the long lead which the United States enjoys in this field.

Transitips. According to experts in the field, conventional mechanical or electromechanical switches are being steadily replaced by the ever-increasing number of solid-state switching devices. According to some predictions, from 60% to 75% of new home appliances within the next few years will utilize one or more semiconductor switching or control elements. Today, even the familiar SCR is being used more and more in light dimmers, power tool controls, kitchen mixers, and related appliances. But, in addition to the SCR, a whole new family of semiconductor switching and control devices has been developed, most of which are identified by new—and, perhaps, unfamiliar—schematic symbols.

According to a well-known expression, "You can't tell the players without a program." The same can be said about new devices: you can't tell one from the other without learning their symbols. Some of the more important symbols used for switching and control devices are given in Fig. 3. Think you can memorize them?

From left to right is a unijunction transistor (UJT), a silicon unidirectional switch (SUS), silicon bilaterial switch (SBS), DIAC trigger diode, and a TRIAC bidirectional control.

Keep cool, or cool it . . . as the case may be. Until next month . . . —*Lou*

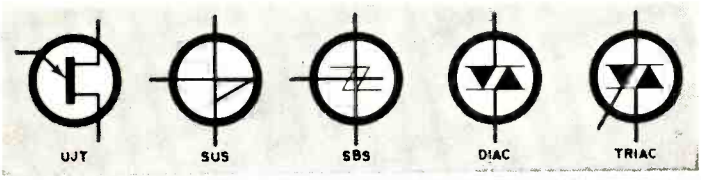


Fig. 3. These are some of the important symbols used for switching and control devices.

MODBOX

(*Continued from page* 45)

ulation control up to a point where the meter reads 0.7 mA (100% modulation).

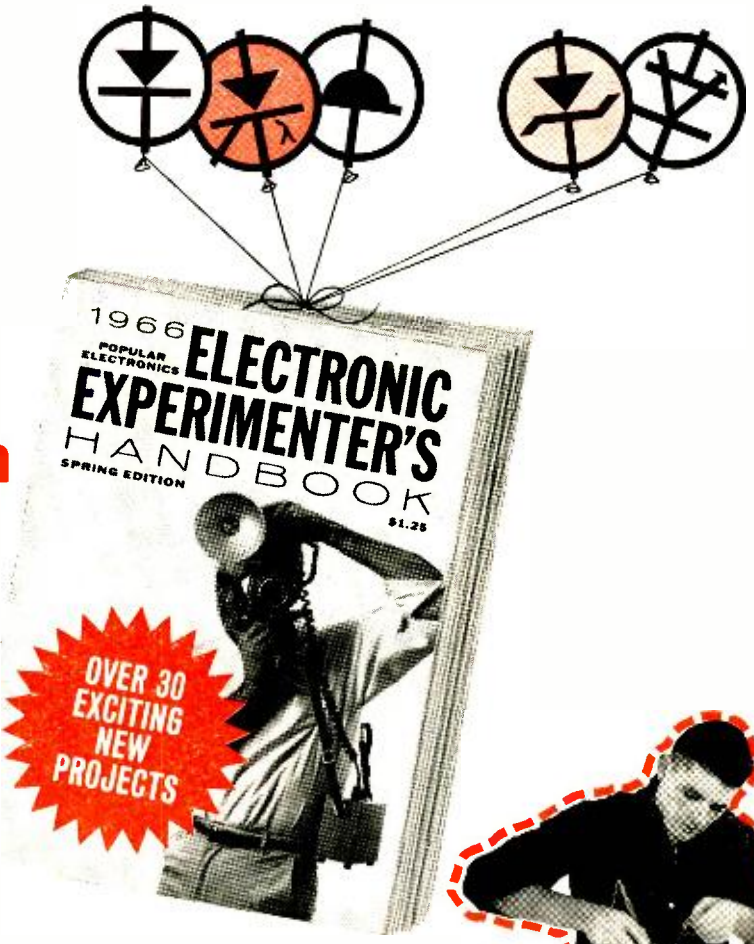
To check the *DISTORTION* indicator, whistle or shout into the microphone to intentionally overmodulate the carrier. The indicator should flicker; if it doesn't, and the meter shows more than 100% modulation, your rig's modulator may be splatter-suppressed, or have a very "bassy" response. To compensate for this condition, increase the value of *R4* in the distortion-indicating circuit until *I1* just flickers when the transmitter is intentionally overmodulated. Then plug a pair of 2000-ohm headphones into the *MONITOR* jack and listen to your audio as you speak into the transmitter's microphone. This is a good check because it tells you how you actually sound on the air.

Operating Hints. Once you've familiarized yourself with the Modbox's monitoring provisions, use them constantly on the air. Each time you work another station, keep an eye on the modulation meter and distortion indicator, doing your best to hold the modulation level as high as possible without overmodulating. Your logbook and compliments from other operators will let you know what the Modbox is doing for you.

One final word: if the Modbox says you don't have 100% modulation, believe it. Check your rig carefully before you suspect the monitoring circuit. Tubes become weak and parts do change value with age. Also, some rigs are definitely lacking in talk-power due to design skimping. The specs may say "fully-modulated," but they may be talking about a big, full 75-percent modulation capability. If your rig can't make it to the 100% mark, at least you can hold the level as high as possible by watching the meter and "riding the gain."

After you've used the Modbox for a while, listen around the band to all those other station operators who have no idea what their audio is like, and you'll agree that there's nothing like knowing for sure—with the Modbox. —30—

spring edition



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SHORT-WAVE LISTENING

(*Continued from page 83*)

asked questions that may be of interest to many: "Is it because I am not a WPE-registered monitor that you won't print my report?" and "How come Citizens Band operators are getting WPE identifications? They aren't DX'ers."

We suggest that the first gentleman check back through any issue of this column—in each one he will find the names of reporters who are not registered WPE monitors. We have never placed any restriction of any kind on who may or may not submit reports for publication. The items chosen are based on their newsworthiness alone.

In answer to the second query, we would like to point out that many CB operators are also excellent DX'ers. True, we will not issue a Monitor Certificate to a CB operator (or to anyone, for that matter) who is unable to supply satisfactory proof that he has the required number of bona fide QSL's in his possession. But so far as CB'ers with WPE identifications are concerned, you can rest assured that they have all submitted proof of their abilities as DX'ers.

CURRENT STATION REPORTS

The following is a resume of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Greenwich Mean Time (GMT) and the 24-hour system is used. Reports should be sent to SHORT-WAVE LISTENING, P.O. Box 333, Cherry Hill, N.J., 08034, in time to reach your Short-Wave Editor by the fifth of each month; be sure to include your WPE Monitor Registration and the make and model number of your receiver. We regret that we are unable to use all of the reports received each month, due to space limitations, but we are grateful to all contributors.

Brazil—*R. Mundial,* Rio de Janeiro, was heard with Latin American music, and *R. Imperial,* Petropolis, with a talk, both on 5045 kHz; a clear ID was given for each at 0000. *Voz Amazonia,* Manaus, 5025 kHz, was logged at 0000 with pop music and anmts in Portuguese. Some reports indicate that a station with an ID of *Guanabara* has also been noted on 5025 kHz; this could be the "inactive" PRC8, Rio de Janeiro, listed for 5015 kHz. Station ZYR206, *R. Clube de Ribeirao Preto,* 15,415 kHz, was heard from 0000 with the usual Brazilian music and commercials. Reactivated is ZYN30, *R. Cultura da Bahia,* Salvador, 15,225 kHz, heard from 0250 with pop music. Also among the numerous recently reactivated stations are: *R. Tupi,* 11,765 kHz, and *R. Bandeirantes,* 11,923 kHz, both in Sao Paulo.

Canada—Station CFVP, *Voice of the Prairies* Calgary, Alberta, is back on the air on 6030 kHz relaying CFCN, 1060 kHz. This low-powered unit has been heard from Washington, D. C., to the West Coast at 0410-1315 with old-time Gene Autry records, pop records, and news. Unless a new xmtr is being used, the power is 100 watts.

Canary Islands—*Radio Nacional Espana, Centro Emisor del Atlantico,* Santa Cruz de Tenerife 11,800 kHz, was very strong when logged at 2045.

2215 with Spanish pop music and language and frequent ID's, and from 0120 with "Radiorama" in which the *VOA* has a 10-minute program complete with IS.

Ceylon—Colombo is occasionally audible on 15.-332.5 kHz around 0100-0115, although there is no such xmsn listed.

Dominican Republic—*R. San Pedro*, San Pedro de Macoris, is heard on 3200 kHz to 0400 s/off. *R. Television Dominicana*, Santo Domingo, is back on the air and was heard from 9490 to 9502 kHz.

Ecuador—The current Eng. schedule from HCJB, *Voice of the Andes*, Quito, reads: to the Americas at 1400-1500 from Tuesday to Friday (to 1600 on Sundays and Mondays and to 1630 on Saturdays) and to the Americas, Caribbean areas, and Europe at 2330 on 15.115 and 17.890 kHz; to Great Britain at 1845 and 2100 on 15,115 kHz (or 15,405 kHz) and 17.890 kHz; to the South Pacific at 0700-1000 on 6050, 9745 and 11,915 kHz; to the Americas at 0200-0430 on 9745, 11,915, and 15,115 kHz. Station HCCD1, *Luz de America*, Quito, is being detected at times beneath PRC5, Brazil, at 0000-0300 on 4865 kHz. Station HCVC3, *R. La Centinela del Sur*, Apartado 196, Loja, has been noted again on 5053 kHz with QRM from the Venezuelan on 5055 kHz; it features Ecuadorian music, closes at 0400.

El Salvador—*R. Nacional*, YSS, San Salvador, has Eng. on 9555 kHz at 0440-0515 with Spanish and Eng. pop records. There is another Eng. period on Tuesdays, Thursdays and Saturdays at 0115-0130 on 9555 and 6010 kHz, during which Eng. lessons are given.

Ethiopia—ETLF, *Radio Voice of the Gospel*, Box 654, Addis Ababa, has Eng. on the following schedule until September 3: Transmitter I at 1345-1400 to India on 15,315 kHz, at 1545-1600 to Ethiopia on 6140 kHz and at 1900-1945 to W. Africa on 15,295 kHz; Transmitter II at 1330-1400 to India on 15,410 kHz, at 1630-1645 to Malawi and at 1745-1810 to E. Africa on 11,925 kHz, and at 1900-1915 to S. Africa on 9705 kHz. The morning test broadcast schedule is as follows (figures in parentheses are alternate channels): 0330-0400 to E. Africa and 0400-0430 to S. Africa on 9540 (9660) kHz; 0430-0500 to Western Arabian areas on 11,890 (11,850) kHz; 0500-0530 to the Congo on 11,850 (11,785) kHz; 0330-0400 to Madagascar and 0430-0500 to Malawi on 11,710 (11,810) kHz; 0400-0430 to Eastern Arabian areas on 15,370 (15,400) kHz; and 0500-0600 to W. Africa on 15,400 (15,230) kHz.

Ghana—Two newly monitored frequencies for Accra are: 3350 kHz, dual to 3366 kHz, at 0600 with Eng. news; and 6130 kHz at 0340 beamed to India and Pakistan in English. A new schedule lists Eng. to N. A. and Caribbean areas at 0330-0430 on 6110 kHz, and at 2000-2100 on 9760 and 11,800 kHz.

Haiti—Station 4VB, *La Voix de la Revolution Duvalieriste*, Port-au-Prince, is now heard on 9480 kHz, strong around 0360; it is also noted on 6000 kHz at 2100-2145 with commercials in French and uninterrupted orchestral music. Station 4GS, *R. Independence*, Gonaives, was heard under heavy QRM from Manizales, Col., both on 5020 kHz; best listening time for 4GS is from 0200 to 0300/close, and all programming is in French.

Honduras—Station HROE, *R. La Voz de la Frontera*, Ocotepeque, has been heard after 0100 with Latin American music and frequent ID's on 5035 kHz. Listen carefully for the sound of a cuckoo clock before the time signal.

India—In accordance with a new schedule, *All India Radio* has introduced an extensive General Overseas Service in English. The schedule lists times and meter bands only, with no specific wavelengths: 2245-0115 in the 25-, 31-, 41-, 49-, and 75-meter bands; 1000-1100 in the 16-, 19-, and 25-meter bands; 1330-1500 in the 19- and 25-meter bands; and 1745-2230 in the 25-, 31-, and 41-meter bands. Actual monitoring has located 9915 kHz in use at 1950 with Indian music, at 2000-2010 with Eng. news, at 0045 with "Radio Newsreel," at 0055 with Indian music, and at 0100 with Eng. news.

International Waters—According to *Radio New York Worldwide*, a pirate radio ship is being outfitted in Miami in great secrecy for the purpose of invading United Kingdom home waters. An item in a Swedish publication states that a joint British-American station will operate from the "Olga Patricia" with two programs: pop music, and light music. There is also a report of a plan to operate a pirate station off the U. S. East Coast.

The BBC is scheduled to operate to Rhodesia from a ship to be stationed off the Mozambique coast, replacing the present station at Francistown, Bechuanaland, which has not had the desired effect because of jamming by Rhodesia.

Liberia—Station ELWA, Monrovia, was found at 0630 with religious bulletins in Eng. on 11.950 kHz.

Mauritius—Forest Side has been heard on 4850 kHz from 1040 to past 1115 with selections of Indian music, some commercials, and a male announcer using an Indian vernacular. Another station noted on 9710 kHz with Indian music around 1200 but with no commercials may be the 31-meter outlet.

SHORT-WAVE ABBREVIATIONS

anmt—Announcement	QRM—Station interference
BBC—British Broadcasting Corporation	R.—Radio
Eng.—English	s/off—Sign-off
ID—Identification	s/on—Sign-on
IS—Interval signal	VOA—Voice of America
kHz—Kilohertz	xmsn—Transmission
N.A.—North America	xmtr—Transmitter

SHORT-WAVE CONTRIBUTORS

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International Short Wave League, Derby, England
Radio ETLF, Addis Ababa, Ethiopia
Radio HCJB, Quito, Ecuador
Radio Nederland, Hilversum, Netherlands
Radio New York Worldwide, New York, N. Y.
Sweden Calling DX'ers Bulletin, Stockholm, Sweden

Mexico—The correct call for the Mexican on 2390 kHz is XEJN-OC, according to a letter from F. Xavier Mesa, Recor, Universidad Iberoamericana, Av. Cerro de las Torres 395, Mexico 21, D. F. Educational programs are transmitted daily at 0000-0200.

Mongolia—Your Short-Wave Editor's conversion of *R. Ulan Bator's* schedule, as given last month, was in error. It should have read: 1420-1520 (not 0220-0320) and 2130-2230 on Mondays, Tuesdays, Thursdays and Fridays on 11.850 and 9540 kHz. The exact address is listed as: CPO Post Box 365, Peace Street, Ulan-Bator.

Netherlands—The "Happy Station Program," aired by *R. Nederland* on Sundays only, is scheduled until early September at 0600-0720 to New Zealand on 11.730 and 9715 kHz; at 0730-0850 to Australia on 11.730 and 9525 kHz; at 1030-1150 to Europe on 9715, 5980, and 6020 kHz; at 1430-1550 to S. Asia on 17.810 and 15.425 kHz and to Europe on 6020 kHz; at 1600-1720 to Africa on 15.160 and 11.730 kHz; at 1900-2020 to N.A. on 11,730 and 9590 kHz; at 2030-2150 to Spain, N. Africa, and S. America on 17,810 and 11.950 kHz and to Europe

on 6020 kHz; at 2200-2320 to South and Central America on 15,320 and 9590 kHz and to Europe on 6020 kHz; and at 2330-0110 to North, South, and Central America from Bonaire, 800 kHz.

Pakistan—Recent loggings include: 15.325 kHz with Eng. news to S. E. Asia from 0045 to 0115 s/off; 15,100 kHz with Eng. dictation news from 1335 to 1350 s/off; 15,095 kHz with Eng. news at 1500-1515; 9695 kHz with Eng. news to the United Kingdom to 2005, a native-language talk to 2010, then more Eng.; and 7096 kHz, to Europe, at 1945-2030 with severe QRM at times.

Peru—*R. Continental*, Arequipa, 5934 kHz, broadcasts the "Hour of Decision" in Eng. on Sundays at 0030-0100.

Portugal—*Emissora Nacional* has two new outlets in the 19-meter band, 15,047 and 15.203 kHz, heard in dual to 15,125 kHz around 1600.

Reunion—For those who have the patience, St. Denis is coming through at times on 4820 kHz. East Coast'ers should tune at 0500-0630; West Coast DX'ers may be able to hear it after the HRVC (Honduras) s/off at 0330 and before the Mogadan (U.S.S.R.) s/on at 0620.

Rwanda—A new frequency for the *Deutsche Welle* relay station in Kigali is 9565 kHz; a broadcast in Eng. was heard at 0430.

Somali—*R. Mogadiscio* seems to have dropped both 7120 and 7160 kHz in favor of 6095 kHz, where it opens at 0300 with Somali music and talks; Eng. news is given at 0320.

South Africa—According to a current schedule, opening is at 0356 on 6150 and 7270 kHz, with news in Eng. at 0400; 4895 kHz is added at 0430 and news in Eng. and music are presented at 0445. At 0515 the frequencies in use are 4895, 9525, and 11,900 kHz, with Eng. news from 0545 to 0558/close. At 1000, the frequencies are 15,220 and 17,805 kHz, and 4895 kHz is added at 1558. Frequencies used at 1800 are 4895, 9525, and 11,900 kHz; at 1900 they are 4895, 7270 and 9525 kHz; and at 2045 they are 9525 and 11,900 kHz.

Togo—*Radiodiffusion du Togo*, Lome, 5047 kHz, is one of the easiest African stations to log. The Eng. at 2100-2115 is generally not too good but the signal improves considerably before 2300 s/off.

U.S.S.R.—*R. Vilnius*, Lithuanian SSR, 11,715 kHz, has been noted in Eng. from 2240 with programs about Russia, Irkutsk, Asiatic SSR, 11,845 kHz, was heard at 1300 with Moscow IS and then native language; there was QRM from VOA-Honolulu.

Venezuela—Station YVLG, *R. Giradot*, Maracay, 2440 kHz, is good at times for a 120-meter station. Try for it around 0100 with Spanish talks and music.

Vietnam (South)—Saigon is heard on 9623 and 4877 kHz (or simultaneously on 4875 and 4877 kHz) in Vietnamese until 1630, and on 9755 kHz from 1600, all in parallel with 6160 kHz.

Zambia *R. Zambia* has apparently dropped 4911 kHz in favor of 4965 kHz, possibly just for test purposes since the broadcasts are not being noted regularly. Most xmsns are heard at 0345-0545 and 1500-2100; some days they may run through from 0600 to 1500.

—30—

ATTENTION: HAMS AND CB'ERS

Due to the large amount of space taken up by the special reports on up-to-date happenings in the CB field (starting on page 47) and the radio amateur field (starting on page 67), it was necessary to omit the regular columns written by Herb Brier ("Across the Ham Bands") and Matt Spinello ("On the Citizens Band") this month. You'll find these two columns back in the book as usual next month.

ELECTRONICS MARKET PLACE

COMMERCIAL RATE: For firms or individuals offering commercial products or services. 90¢ per word (including name and address). Minimum order $9.00. Payment must accompany copy except when ads are placed by accredited advertising agencies. Frequency discount: 5% for 6 months; 10% for 12 months paid in advance.
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GENERAL INFORMATION: First word in all ads set in bold caps at no extra charge. Additional words may be set in bold caps at 10¢ extra per word. All copy subject to publisher's approval. Closing Date: 1st of the 2nd preceding month (for example, March issue closes January 1st). Send order and remittance to: Hal Cymes, POPULAR ELECTRONICS, One Park Avenue, New York, New York 10016.

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CANADIANS—GIANT Surplus Bargain Packed Catalogs. **Electronics, Hi-Fi, Shortwave, Amateur, Citizens** Radio. Rush $1.00 (Refunded). ETCO, Dept. Z., Box 741, Montreal, **CANADA.**

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JAPAN & Hong Kong Electronics Directory. Products, components, supplies. 50 firms—just $1.00. Ippano Kaisha Ltd., Box 6266, Spokane, Washington 99207.

CANADIANS, TRANSISTORS AND PARTS. Free catalogue contains reference data on 300 transistors. J. & J. Electronics, Dept. PE, Box 1437, Winnipeg, Manitoba.

TRANSISTORS—Miniature Electronic Parts. Send for free Catalog. Electronic Control Design Company, P. O. Box 1432K, Plainfield, N.J.

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TRANSISTORIZED Products Importers catalog. $1.00. Intercontinental, CPO 1717, Tokyo, Japan.

RADIO – T.V. Tubes—33¢ each. Send for free catalog. Cornell, 4213 University, San Diego, Calif. 92105.

ELECTRONIC Ignition Kits, Components, Free Diagrams. Anderson Engineering, Epsom, New Hampshire 03239.

"GREAT BUYS" Catalog 10¢ Multimeter 20,000 Ω/v $9.95. 1001 Bargains. Fertik's, 5249 "D" St., Phila., Pa. 19120.

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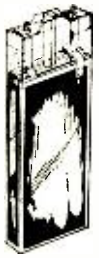

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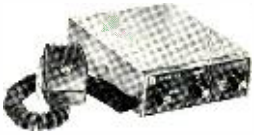

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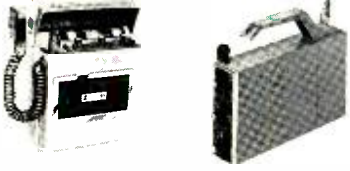

Take your transistorized Messenger 100, III, 300 or 350 into the field with the Power Pack or Portable Field Pack. Units operate at full power. Rechargeable nickel-cadmium batteries.

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Write today for complete specifications, or visit your E-V sound specialist's to see this remarkable new microphone. And when difficult sound problems must be faced squarely, stand up and fight back with the microphone with a backbone (and CV-D)—the new Electro-Voice 676 dynamic cardioid!

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