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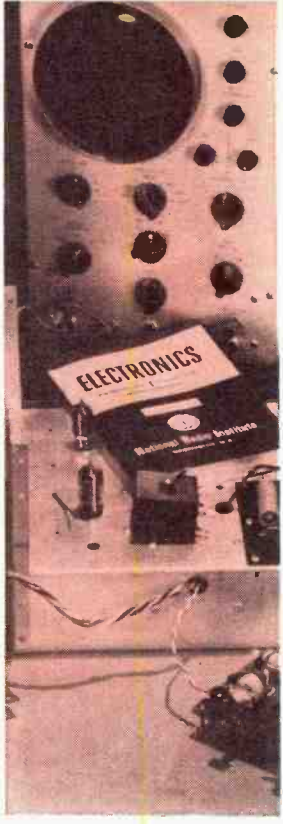

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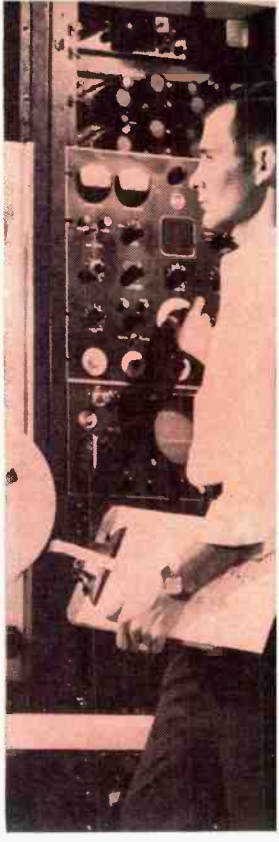

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This month's cover photo by Bruce Pendleton

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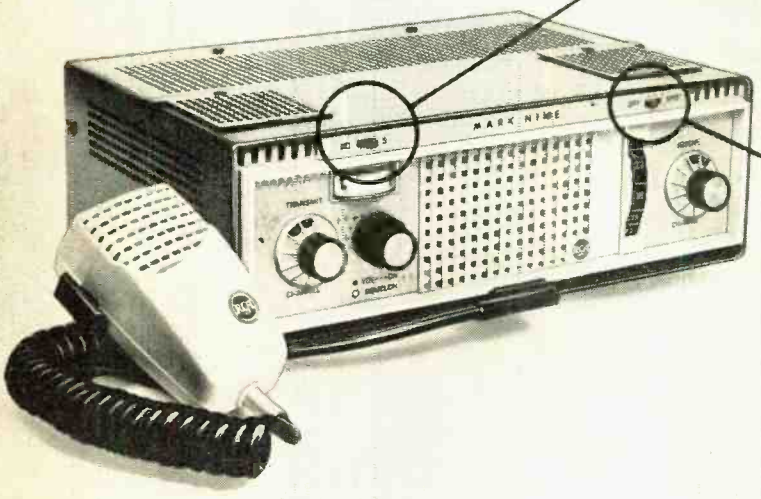

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Men 17-55

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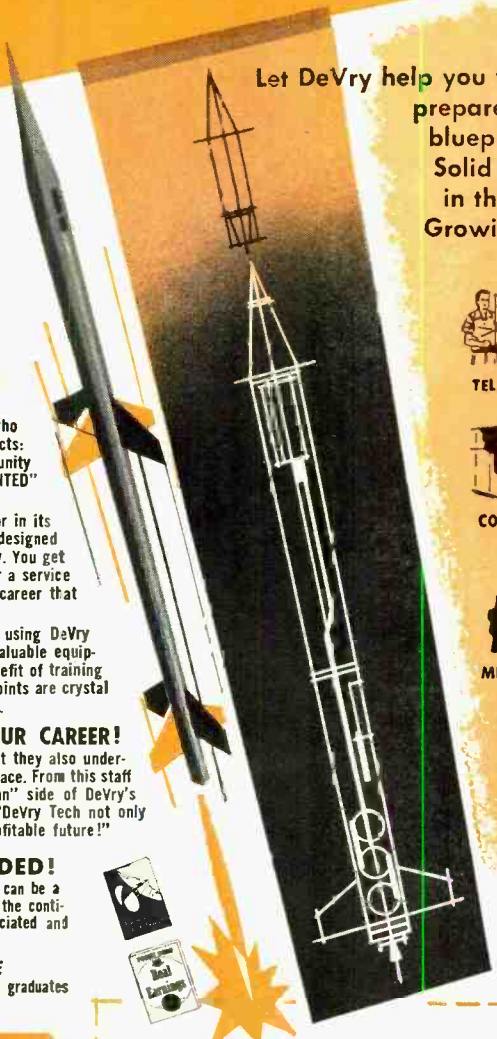

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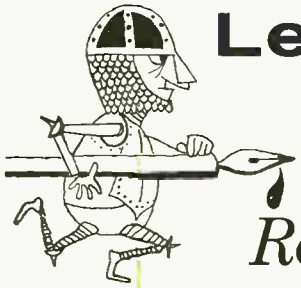

Letters *from our Readers*

Address correspondence for this department to: Letters Editor, POPULAR ELECTRONICS One Park Avenue, New York, N. Y. 10016

"Relic Radio" Draws Comments

■ Many thanks for "Restoreth Thy Relic Radio" (May, 1964). I was unable to find tubes for my old Philco Model 20 until I tried the sources mentioned in the article. The radio now works very well, has good tone quality, and plenty of volume.

ALFRED C. PETERSEN
Springfield, Mass.

■ "Restoreth Thy Relic Radio" (May, 1964) was of considerable interest to me, and a refreshing change from articles strictly on new developments. Incidentally, most of the radios of the 20's made no attempt at decoupling the B-plus lines to the various stages, relying entirely on the battery to perform the task of r.f. and a.f. bypassing and filtering. In some cases it might be advisable to add 20-μf., 250-volt electrolytic capacitors between the high-voltage taps of the power supply and ground to overcome this problem. Another tip is to reduce filament voltage by about 10 per cent from rated value; this will result in longer tube life with little loss in performance.

DONALD RATHKE
East St. Louis, Ill.

Ignitions: Kettering, De Dion, or Benz?

■ I would like to compliment you on the excellent article, "Transistor Ignition," in the June, 1964, issue. It contains the most useful information on the subject I have been able to find to date. Incidentally, though, it is erroneous to refer to the conventional ignition system as the Kettering system. De Dion of France used an identical system prior to 1900, and Karl Benz employed points, condenser, vibrating ignition coil and a spark plug on the first practical gasoline horseless vehicle in 1885. Also, the Edison Company was selling ignition coils to the trade prior to 1900.

LLOYD D. GANO
Menlo Park, Calif.

Wrong Converter, Right Directions

■ Concerning "Tuning Up on the New 460-Mc. Police Frequencies" (May, 1964), the converter shown in the photos is the Blonder-Tongue BTU-2S, while the schematic and text refer to the BTC-99. Those purchasing the converter shown will not be able to make the changes described.

EDWARD F. BIVENOUR
Philadelphia, Pa.

Right and wrong, Ed. It's true that the converter in the pictures is the BTU-2S, but it can be converted in exactly the same manner as that described for the BTC-99. The big problem is that Blonder-Tongue has

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CIRCLE NO. 28 ON READER SERVICE PAGE

Letters

(Continued from page 6)

just redesigned their line AGAIN, complete with new numbers. However, the two models mentioned above are still available from various sources.

Hi-Fi Panic Alarm

■ I was very intrigued by the "Panic Alarm" (May, 1964) and built a concealed model into my desk. A 25-watt desk lamp, used in place of a built-in lamp, plugs into a socket in the unit, and the push button

is mounted at the front of the desk. The output is fed to a stereo hi-fi system. Needless to say, the noise that results from pushing the button is enough to make the victim leave the room!

KEITH MOE, K7VRS
Phoenix, Ariz.

Remind us not to visit your office, Keith!

Shotgun Sound Snooper

■ I read with interest "Build the Shotgun Sound Snooper" (June, 1964) as it brought back memories of my trying to build one several years ago. The tubular mike was developed in 1937 at the Bell Telephone Laboratories, and originally consisted of 50 tubes ⅜" in diameter. Tube length varied from 3 to 150 cm. in equal increments of 3 cm. For those readers who would like to do more research, a paper by the inventors, W. P. Mason and R. N. Marshall, appears in the January, 1939, issue of the *Journal of the Acoustical Society of America.*

THOMAS A. BERSON, K1EQT/WA2ASJ
Boston, Mass.

■ Your article has me fairly flipping in anticipation of building my own tubular microphone, but in my neighborhood there just ain't no such "annie-mule" as ⅜"-o.d. aluminum tubing. Where can I obtain some and at what price?

GEORGE J. PAQUETTE
Bay City, Mich.

We were surprised and gratified by the interest shown by P.E. readers in the "Shotgun Sound Snooper." One source of ⅜"-o.d. aluminum tubing recommended by the author is J.R.S. Distributors, Inc., 646 W. Market St., York, Pa. Write them for prices and information. Other types of tubing, as long as they are not sound-absorbent, can also be used.

CQ Channel 1?

■ A recent letter ("Letters From Our Readers," March, 1964) reminded me of interesting times I have had on "channel 1." My Stromberg-Carlson TV set made around 1948 had continuous tuning from channel 1 through 13, rather than today's "slot" tuning. I used the set in my shack for receiving six meters

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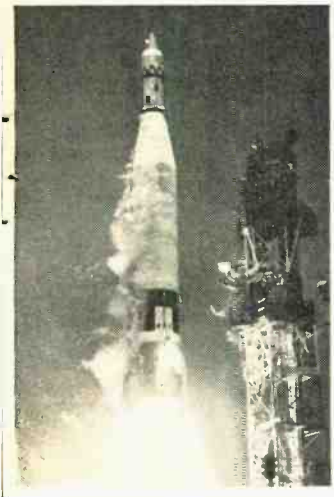

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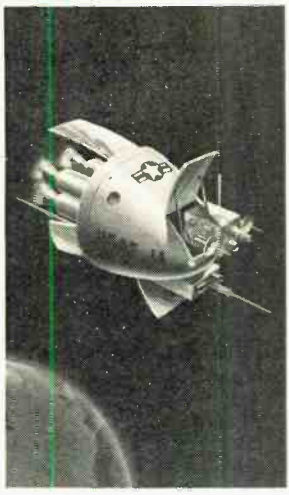

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Letters

(*Continued from page 8*)

—along with a TV antenna—and found it good for DX of about 90 miles. You should have heard some of the replies I got when I told the boys I was hearing them on my TV!

LEONARD PRESCOTT, WA9CHG
Elmhurst, Ill.

CB Compression Amp Praised

■ I found that the compression amplifier described in "Double CB Talk Power" (April, 1964) works very well indeed. You may be interested in a few changes I made to improve performance and versatility. Modulation, as viewed on a scope, was better when a 6C4 vacuum tube was substituted for the 1N34A diode; a potentiometer was installed in the filter circuit to allow control of compression voltage. Instead of connecting the amplifier in series with the mike, I placed it in series with the first audio and audio output sections to allow it to function on receive as well as transmit. The improvement in receiver sensitivity was startling.

BILL CARROLL, KEA2923
Rolling Fork, Miss.

Wanted: Cat Whiskers, Crystals

■ I would like very much to know where I can obtain old-style mounted galena crystals and cat whiskers for building crystal radios.

T. A. SADLOWSKI
Kearny, N. J.

Try Philmore Mfg. Co., Inc., 130-01 Jamaica Ave., Richmond Hill 18, N. Y. When we last checked, they had all styles of crystal detectors, crystals (Cat. No. 7004, 15 cents), and cat whiskers (Cat. No. 7006, 12 cents).

Big Transistor?

■ The third paragraph of "Build the Multi-Trol" (May, 1964) states that "the 2N1319 transistor used

had a measured d.c. current gain of 220 with a base input of *100 ma.*! Are you kidding?

C. S. ZEVAS
Bloomfield, N.J.

No, just embarrassed—somehow 100 μa. got changed to 100 ma. Twenty amps gain would take a rather large 2N1319!

Do-It-Yourself Stereophones

■ In reference to "Surplus Stereophones" (May, 1964), I put together a set of phones comparable to those costing much more by using a pair of "Cannon-

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Letters

(*Continued from page 10*)

ball Chief" earphones and a pair of 2" transistor radio replacement speakers. Other inexpensive earphones can probably be used as long as they're large enough: you simply remove the insides and substitute the speakers.

SAL GRIPPALDI
East Orange, N.J.

Interesting idea, Sal. Perhaps other readers will want to try it.

Adding "Instant-On" to Radios

■ I adapted the circuit described in "Give Your Radio Instant Sound" (January, 1963) by wiring the diode right into my five-tube radio, and omitting the neon lamp. After using the radio this way for some time, the diode has not been damaged by heat. The "instant-on" feature is most useful in cutting out commercials. Does the fact that the tubes are on all the time decrease their life? I know that the initial power surge is what wears out tubes and light bulbs.

JOHN REID
Austin, Texas

Generally speaking, John, tubes that are in use 24 hours a day will give better service than tubes that are turned on and off at regular intervals. Of course, there are other factors to consider: possible heat damage to other components, and increased power consumption. The first is no problem in reasonably well designed and ventilated equipment; the second will probably make almost no difference in your power bill due to the fact that very little power is consumed by a small radio in "stand-by" condition.

Appliances QRN Him

■ How can I get rid of my M. & S.M.I. (mixer and sewing machine interference) when the XYL tells me I'm not supposed to tear into her appliances? Is there

any way to minimize QRN at the receiver—in addition to using a noise limiter—without impairing its sensitivity?

MIKE RHODES, WPE8GAY
Celina, Ohio

Assuming that most of the noise is coming through the a.c. line, Mike, you can build yourself some small line filters (perhaps inside Miniboxes) for installation at the appliances. The simplest would be a .1-.5-μf., 600-volt capacitor connected across the a.c. line. Or, you can connect TWO capacitors in series across the a.c. line and ground the center—this type of filter will take care of many offenders. Extreme cases may require the additional filtering of two heavy-duty r.f. chokes—one in either side of the line. Your best bet at the receiver is to do your utmost to increase the signal-to-noise ratio. Use as much selectivity as possible; a Q-multiplier may help. Sometimes the additional sensitivity provided by a good preamp is also an assist. —30—

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VOID AFTER AUGUST 31, 1964 8

BREAKTHROUGHS

Brief news flashes on recent important developments in the electronics field

Yet another under-$500 home video tape recorder is now in the works (the first two were the Fairchild and Telcan machines: see P.E., Sept. 1963; Feb. and March, 1964). Developed by a new company, Par Limited, the "Par Vision" machine is unique in that it operates at the relatively slow speeds of 30 and 60 ips. Proprietors of Par Limited, Clifton, N.J., are Robert Morrow and Stewart Hegeman, both electronics engineers of long standing . . .

An improved electronic larynx that enables mute persons to speak is available from the Bell Telephone System. The device, an improvement over an earlier version, transmits sound waves through the user's throat which he can form into words with his lips and tongue. Two models are available, one high-pitched to simulate a female voice, and the other a low-pitched version for men . . .

Recently described by W. C. Brown of Raytheon Company was a workable wireless power transmission system. Operating on microwave frequencies, it has already been used to deliver several hundred watts of usable power over 25 feet, and the sending of 100,000 watts over five miles is possible. The system uses a new continuous-wave amplitron microwave tube operating with 72 per cent efficiency, new antennas that pick up half or more of the transmitted power, and a microwave receiver that converts r.f. to d.c. with high efficiency . . .

Cable or r.f. transmission of color TV signals can be improved by using digital computer techniques. RCA reports that a normal analog color TV signal can be converted into four-level binary digital signals. Transmission of digital signals insures perfect picture reproduction at the receiver, since fading and phase distortion problems that degrade analog signals are eliminated. The system is unusable for broadcasting because a bandwidth of 10 mc. is required; 16-level binary sampling may be possible, however, and would reduce the bandwidth to current broadcasting standards . . .

The first major development in weather storm-warning equipment since radar has been announced by Litton Industries—a device which measures the strength and position of electromagnetic disturbances (known as "sferics") before and during a storm. Called "SPARSA," the gadget will enable forecasters to locate and

(*Continued on page* 19)

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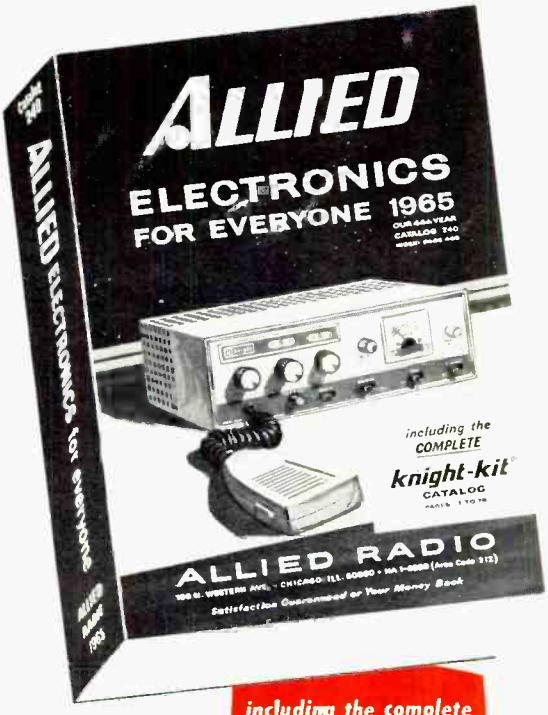

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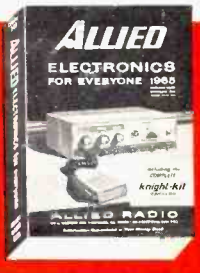

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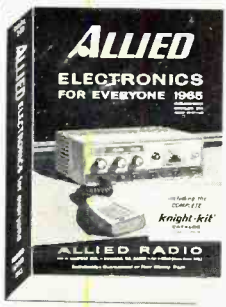

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BREAKTHROUGHS

(*Continued from page* 16)

predict turbulence and severe storms including thunderstorms, hail, high winds, and tornadoes. Numerous sferics take place during a storm; lightning, although it is the only type that can be seen, is just one kind of sferic. The first SPARSA system was built for the Air Force, and will be installed at Cape Kennedy . . .

An economical, simplified color TV system developed by Dr. Guillermo Gonzalez Camarena, chief technical advisor for Telesistema Mexicano, Mexico City, was recently demonstrated in New York for the Society of Motion Picture and Television Engineers. All that is required to receive the color signal is a standard black-and-white set modified to take a three-gun color tube. At the TV station, the only modification is to place a synchronized rotating disc holding red-orange and green-blue filters in front of the camera lens. In transmission of the color information—all colors are derived from the two filter colors—the odd-number fields correspond to red-orange and the even-number to blue-green. The system is compatible with black and white television, and receivers would cost one-half that of present color sets . . .

Dr. Fred Johnson of Electro-Optical Systems, Inc., has proposed a method of using laser technology to seek out possible signals transmitted through space by intelligent beings on other planets. A natural amplifying source for coherent laser light signals may be the gas or "nebula" surrounding an extremely hot star. Dr. Johnson proposes to telescopically scan nebulae to find modulated signals at a wavelength of 4686 angstroms in the hope that extraterrestrial beings have discovered the amplification potential in a nebula and have fed a message into it as sort of a postal drop . . .

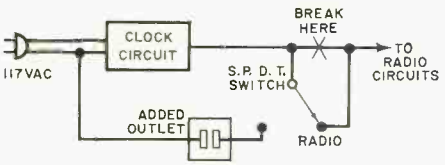
An imaginative plan for a $40 million-a-year global weather satellite system that might save the U.S. more than $6 billion annually has been proposed by a 31-man team of Stanford University engineering students. "SWAMI" (for Stanford Worldwide Acquisition of Meteorological Information) would make use of instrumented satellites orbiting about 1200 miles high; they would pick up and store weather data from several thousand airborne balloon stations and waterborne buoy stations as well as from existing land stations. On command, a satellite would "read out" stored information to a single tracking station after each two-hour orbit. The system would use three 400-pound satellites placed in circular polar orbits 120 degrees apart by Minuteman boosters . . .

—*W. Steve Bacon*

Tips and Techniques

CLOCK RADIO SERVES AS TV TIMER

A few slight modifications to your clock radio will enable it to turn your TV set on automatically at a definite time. Add an outlet to your radio and wire it according

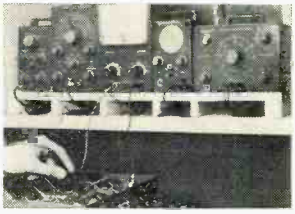


to the diagram. The s.p.d.t. switch can be mounted near the outlet. Locate the wire from the clock switch to the radio circuits and wire the added components as shown. When the TV set is plugged into the new outlet, it will be controlled by the clock mechanism if the switch is in the TV position. If the clock radio is equipped with a "sleep switch," you can use this to shut the set off automatically.

—Fred Blechman, K6UGT

NICE 'N' NEAT PROBE STORAGE

Does your test area suffer from "dangling probitis"? Make a raised instrument base for your test equipment shelf and solve the problem. Cut the base out of scrap ¾" plywood six inches wide, or as wide as necessary (measure the maximum instrument depth required), and rip a 6" length of 2 x 4 down the middle for the end pieces. Additional support / separators are formed from 6" lengths of 1 x 2; they keep adjacent probes from entangling, assuming you remember to put the probes away when you're through using the test instruments. An out-



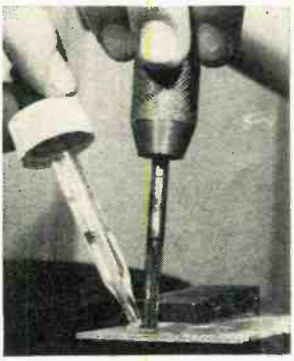
Tips

(*Continued from page 20*)

let strip behind the new base keeps line cords out of the way. —*Rus Arnold*

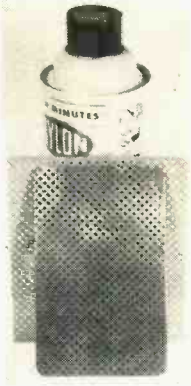
TETRACHLORIDE TAPPING TIP

If you use oil as a lubricant when tapping holes in metal, you may find that after a short time the oil gums, binds the tap, and the tap breaks off. To prevent this sort of tragedy, try using carbon tetrachloride as a tap lubricant. Because of its high rate of evaporation, neither gumming nor binding will occur, and you'll have a cleaner job. The carbon tet can be stored in an old medicine dropper bottle which will also serve as a convenient dispenser. However, make sure that the room is well-ventilated while you're using the carbon tet. —*Robert K. Dye*



NEAT LAYOUT FOR PRINTED-CIRCUIT BOARDS

You'll find it easier to keep components on a printed-circuit board aligned and neatly arranged if you try this simple tip. Instead of laying out the board with penciled guide lines (they tend to erase themselves while you work), place a piece of perforated board over the copper laminated board, and spray with acrylic paint from a height of at least two feet. This will give you a grid of small dots on the circuit board to use as component centers and guides for the copper runs. After laying out the resist tapes, quickly slosh the board with lacquer thinner to remove the paint; if you work fast, the tapes will not be affected. If you use the resistive ink method, the dots can be removed with an ordinary ink eraser. —*Donald E. Lancaster*



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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 which appears on page 15.

TRANSISTORIZED C-R BRIDGE

The Model 62 capacitance-resistance bridge is one of a group of transistorized test equipment items manufactured by Nombrex in England and sold and serviced in the United States by the *Path Products Corporation*. Power is supplied by a standard U.S.A. 9-volt transistor battery that fits inside the two-pound 6⅝" x 4⅝" x 2⅝" unit. Capacitors from 1 pf. to 100 μf. (in three ranges) can be checked for value, power factor, and leakage. The resistor bridge covers 10 ohms to 100 megohms in three ranges. Other features include: accuracy of better than 2%, a built-in indicator for bridge balance, and expanded capacitance and resistance scales. Price, $32.25, with battery and instructions.

Circle No. 75 on Reader Service Page 15

RECORDER TEST-TAPE

Tape recorder enthusiasts will be interested in the new prerecorded "Test-Tape" being marketed by *Burgess Battery Company*. It's the first step-by-step explanation, in sound, of how to be sure that your recorder checks okay for volume control, sound level, frequency response, fidelity, balance, and timing. It also tells you how to record sound on sound, splice, and edit. A 1200' tape, one side is recorded at 7½ ips, the other at 3¾ ips. Price is $1, when you buy it with one reel of unrecorded Burgess tape.

Circle No. 76 on Reader Service Page 15

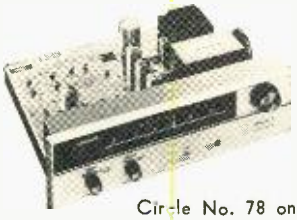
"OMNISONIC" SYSTEM

Is it a speaker, or is it a table lamp? According to *Acoustica Associates, Inc.*, it's a lamp and *two* speakers. The new "Omnisonic" system is comprised of a cylindrical wide-range electrostatic speaker in the form of a translucent lamp shade, and a base-mounted front-loaded 6" dynamic woofer. Sound output is said to be delivered in a true 360° pattern from below 40 cycles to well over 25,000 cycles. The electrostatic speaker, including the fabric shade cover, is less than ¼" thick, and consists of a diaphragm between two concentric wire mesh electrodes. The lamp-speakers come in a variety of styles and finishes. A hand-turned wooden Grecian-urn-shaped model is priced at $229.50. Another model with a leather-covered cylindrical base costs $209.50.

Circle No. 77 on Reader Service Page 15

FM STEREO TUNER

Six major engineering innovations are claimed for *H. H. Scott's* new Model 312 transistor FM stereo tuner. They include a "Comparatron" for silent automatic stereo switching, "Flat Line Limiting" circuits for noise-free FM reception, a silver-plated four-nuvistor front end, a.g.c.-controlled i.f. stages, solid-state series-gate multiplex circuitry, and a "Bi-symmetric" audio output stage. Usable sensitivity (IHF) is 2.2 μv. (minimum); signal-to-noise ratio, 65 db; distortion, under 0.8%; and drift, less than 0.02%. The frequency response (in stereo) of the Model 312 is ± 1 db, 30-15,000 cycles. Price, $259.95.



Circle No. 78 on Reader Service Page 15

INTERNATIONAL TIME INDICATOR

Amateurs and SWL's will be interested in the "I.T.I." clock announced by the *International Time Indicator Company* which eliminates the necessity of computing GMT, a.m., p.m., today or tomorrow, etc., in cities and countries around the world. The

various time zones with over 100 cities, states, and countries are shown on the front panel. The center dial revolves once every 24 hours in a clockwise direction. You set the dial to the time in your zone by means of the center knob, and the time for any other part of the world can then be read on the dial. For 117-volt, 60-cycle a.c. operation. Price, $11.95.

Circle No. 79 on Reader Service Page 15

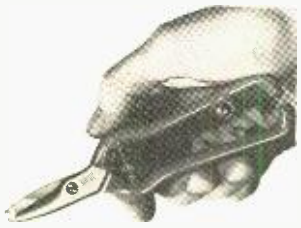
CONVENIENT OUTLET BOX

Simultaneous on-off switching of six different appliances is possible with the new power outlet box offered by *E-M Manufacturing Co., Inc.* The box incorporates its own circuit breaker, and a long-lasting neon pilot light and a toggle switch both show whether current is on or off. Three models of the outlet box are available: Model 64, for home use, accepts only ungrounded plugs ($7.95); Model 86, for garage or basement workshop, accepts both grounded and ungrounded plugs ($9.95); and Model 87, for industrial use, is a heavy-duty 20-ampere unit ($17.95).

Circle No. 80 on Reader Service Page 15

ELECTRONIC SNIPS

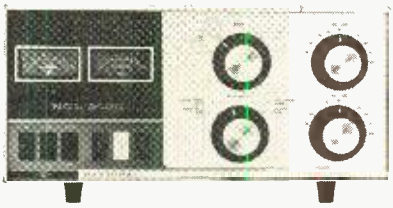
Fine wire and filament cutters for electronic assembly and service work have been added to the *Xcelite* line of professional hand tools. Made of high-carbon, hot drop-forged tool steel, the No. 86 "Electronic Snips" can also be used for removing insulation and for cutting sheet metals and other light materials up to 0.025" thick. A conveniently located, thumb-operated latch keeps the snips closed, and a coil spring returns the blades to open position for smooth, continuous cutting. Over-all length of the snips is 6½", maximum length of cut 1¼". List price, $3.90.



Circle No. 81 on Reader Service Page 15

HAM-BAND LINEAR AMPLIFIER

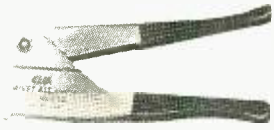
For amateur use on 80 through 10 meters, the NCL-2000 linear amplifier announced by *National Radio Company, Inc.*, is designed to provide 2000 watts SSB PEP, and 1000-watt c.w., AM, and RTTY operation. The output tubes are two RCA 8122 ceramic tetrodes intended specifically for high-power SSB service; available plate dissipation is 800 watts. A solid-state power supply is built in. The NCL-2000 utilizes a passive, untuned grid circuit so that it may be adjusted to allow excitation to full output from any transmitter or transciever providing from 20 to 200 watts of peak drive. This circuit also permits the amplifier to be used as a dummy load. Measuring only 7⅝" x 16¾" x 12¾", the NCL-2000 is priced at $585.00.



Circle No. 82 on Reader Service Page 15

HAND RIVETER

An easy-to-use hand riveter resembling a pair of pliers is now available from *Brookfield Associates*. The "Rivet-All" riveter is said to fasten virtually any two materials together. You simply insert a "Klik" rivet in a pre-drilled hole, place the riveter head over the rivet mandrel, and squeeze the handle. The rivet is clinched and the mandrel broken off, leaving a tight, vibration-proof joint. Price, $5.95 with supply of rivets; extra rivets, 98 cents.



Circle No. 83 on Reader Service Page 15

DRY BATTERY REPLACEMENT

The "Lectrocell" will permanently replace the dry battery used in any vacuum-tube voltmeter to enable it to measure resistance. Manufactured by *Lectrotech, Inc.*, it is a miniaturized power supply of exactly the same size and shape as the battery it replaces. It can be installed in a few minutes and, once in place, furnishes the 1½ volts

Circle No. 84 on Reader Service Page 15

New Products

(*Continued from page 25*)

of d.c. formerly supplied by the dry battery. Price, $3.95.

FM STEREO TUNER-AMPLIFIER

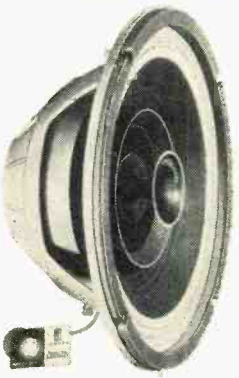
Featured in the new 80-watt FM stereo tuner-amplifier introduced by *Sherwood Electronic Laboratories, Inc.*, is a powered center channel for direct connection of

Circle No. 85 on Reader Service Page 15

middle channel or extension mono speakers. The S-8000IV also has a front panel stereo headphone jack and a separate speaker disabling switch. Sensitivity is 1.8 μv. (IHF), FM distortion ⅓% at 100% modulation. A 2.4-db capture effect eliminates stereo broadcast background noise, and special FM interchannel hush circuits suppress between-station noise. Accurate tuning is insured by a D'Arsonval zero-meter. Price, $329.50; optional leatherette case, $9.50; walnut cabinet, $29.50.

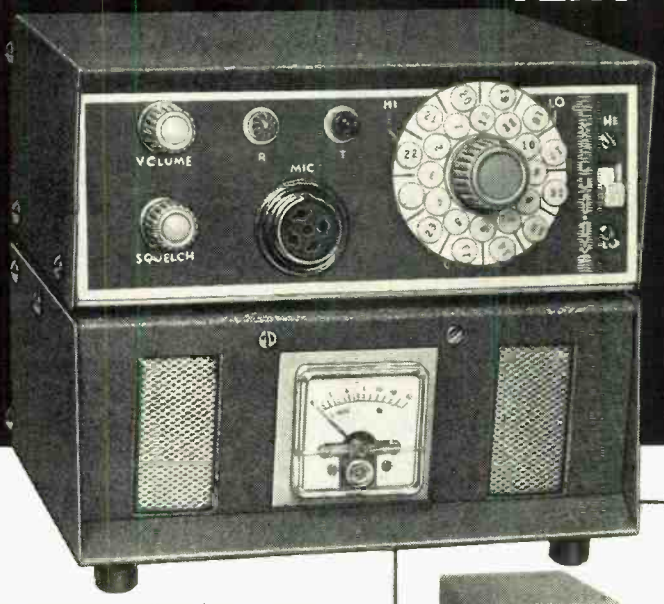
HI-FI SPEAKER LINE

Jensen Manufacturing Company has announced a new line of hi-fi speakers, the DELTA series, which consists of three models. The DL-220 (shown in the photo) is a 3-element, 12" coaxial unit which provides 25-cycle resonance, has a frequency range of 25 to 16,000 cycles, and is priced at $34.75. The DL-120 is a dual-cone 12" speaker with a frequency range of 40 to 15,000 cycles, priced at $21.50. A dual-cone 8" speaker, the DL-80 has a 50 to 15,000 cycle range and costs $15.25. Power capacity of all three units is 20 watts. —30—



Circle No. 86 on Reader Service Page 15

INTERNATIONAL'S NEW EXECUTIVE 750-H CITIZENS BAND TRANSCEIVER . . . FOR PEOPLE WHO EXPECT THE VERY BEST*



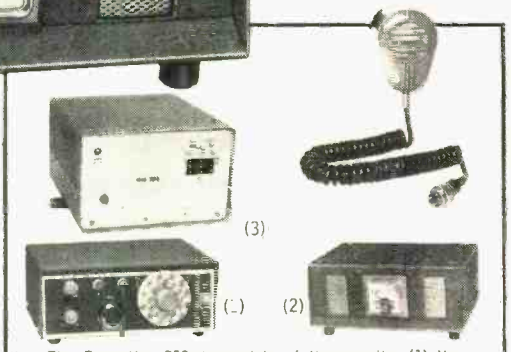
The International **Executive 750-H** introduces a transceiver that is quickly adaptable to all types of mobile or base installations.

The remote console, which is normally installed under the auto dash, has a new companion speaker console. It may be combined with the remote unit or mounted separately. The speaker makes a perfect base when the remote console is used on a desk. Provision has also been made for adding an S/meter.**

What's more, the Executive 750-H is loaded with extra performance features; such as, 23-crystal controlled channels, illuminated channel selector dial, a new speech clipper, increased selectivity, new connections for easy cabling.

The Executive 750-H is complete with crystals, mounting rack for the remote console, trunk mounting rack for the set, push-to-talk microphone, power cable kit, plus all necessary connecting cables. Operates on 6 vdc, 12 vdc, or 115 vac.

Your International dealer has a liberal trade-in plan. **Step up to an Executive 750-H today!**



The Executive 750-H consists of three units: (1) the remote console, which turns the set (in the trunk) on or off, adjusts speaker volume and squelch; (2) the speaker console; (3) the main set which houses all other transmitting and receiving components.

*Performance—Construction—Design—Components
**S/meter available as an accessory item.

WRITE TODAY FOR OUR 1964 CATALOG.

INTERNATIONAL
CRYSTAL MANUFACTURING CO., INC.

18 NORTH LEE • OKLAHOMA CITY, OKLA.

CIRCLE NO. 15 ON READER SERVICE PAGE

ODDS 'N' ENDS

Old-timers in the ham ranks who fondly recall the "8JK" beam antenna will welcome news that the inventor, Dr. John D. Kraus, W8JK, is still using his antenna experience to good advantage. For the past decade, Johnny Kraus has supervised the radiotelescope research program at Ohio State University. According to a recent announcement, W8JK has found evidence that the galaxy of which our sun and solar system are small members may have a halo of radio energy. By the way, the antenna at the 8JK project is a movable reflector 260 feet long and 100 feet high!

This year is the 50th anniversary of the National Radio Institute, Washington, D. C. In 1909, James E. Smith, a young high school teacher, saw the vast possibilities in "wireless" and some five years later had developed a radio correspondence course. This marked the beginning of the National Radio School (later the word "School" was dropped and "Institute" substituted). Continuously in business throughout these 50 years, NRI has taught radio or electronics to over 750,000 students. Congratulations!

The new Boy Scout Electronics Merit Badge was recently awarded to the first 32 scouts to qualify in the New York—New Jersey area, with Robert W. Sarnoff, chairman of the board of NBC, taking part in the ceremonies. To earn the badge, a scout must know how to read and draw schematics, labeling components and explaining their purposes. He must also wire a circuit, and complete a special project in electronics.

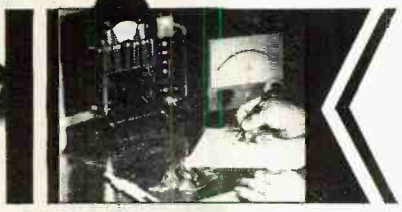
One thin dime sent to Supreme Publications, 1760 Balsam Rd., Highland Park, Ill., will buy you the new "1964 Master Index to Supreme Publications." The Index lists every radio and TV set included in the various volumes of Supreme's "Most-Often-Needed Servicing" manuals. It normally goes for two bits, but if you say you saw it in P.E., you get the special price.

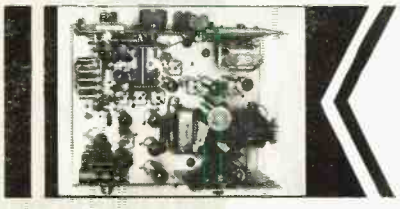
MORE AND MORE CB'ERS ARE MOVING UP TO...

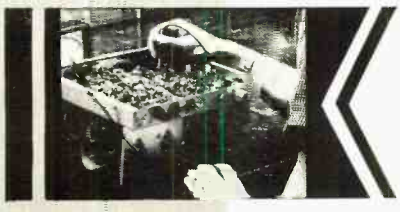
TRAM

TR-70C MOBILE

Now available with PS-101 A.C. Power Supply







PERFORMANCE ENGINEERED

Designed from the start with one important thing in mind – *top performance*. The receiver sensitivity is .1 uv. for 300 milliwatts of audio. Adjacent channels are 60 db. down. A minimum of 3.5 watts of output and keyed compression mean you will get out like you never have before.

BUILT-IN QUALITY

Every set is carefully assembled, using the finest materials available, and is carefully inspected at each step along the way. Tram Electronics, Inc. believes you buy a CB Transceiver to use, not repair.

GUARANTEED RELIABILITY

The Tram Electronics people make every effort to make each set perfect . . . for continued top performance in hard use. If your new Tram does not perform to your expectations – use your unconditional 10 day return privilege for an exchange or full refund.

TRAM **ELECTRONICS INCORPORATED**

P.O. BOX 187, DEPT. P8 WINNISQUAM, N.H., 03289

Please send by return mail at no obligation, detailed information and specifications on TRAM Citizens Band equipment and my FREE TRAM ANTENNA BANNER.

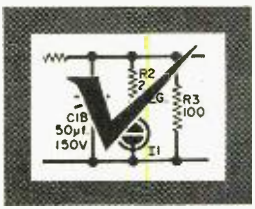
Name _____

Street _____

City _____ State _____

CIRCLE NO. 32 ON READER SERVICE PAGE

Operation Assist



THROUGH THIS COLUMN we try to make it possible for readers needing information on out-dated, obscure, and unusual radio-electronics gear to get help from *other* readers. Here's how it works: Check over 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 post card direct to OPERATION ASSIST, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016. Give the maker's name, the model number, year of manufacture, bands covered, tubes used, etc. Be sure to print or type everything legibly, including your name and address, and be sure to state specifically what you want, i.e., schematic, source for parts, etc. Remember, *use a post card;* we can handle them much faster than letters. Don't send a return envelope; your response will come from fellow readers. Because we get so many inquiries, none can be acknowledged, and POPULAR ELECTRONICS reserves the right to publish only those requests that normal sources of technical information have failed to satisfy.

Schematic Diagrams

Stromberg-Carlson radio/phono combination, ser. 414237, circa 1940, FM, AM, s.w. Push-button tuning, 14 tubes. (Chris Nystrom, 1615 W. Oakton St., Arlington Heights, Ill. 60004)

Radiotone transcription center, Model HR-8, about 1946, made by Radiotone Corp, N. Hollywood, Calif. (R. A. Kerr, Jr., 1714 Heritage Ave., Placentia, Calif.)

RCA Victor 12" TV receiver, Model 8TS-30. Covers channels 1-13. (R. M. Gabrielson, 728 Eagle Rock Ave., West Orange, N.J. 07052)

Lectra Laboratories Model LV-2 wave generator used in therapy work, about 1941. (J. E. Willson, 19 Ivy Lane, Glen Burnie, Md. 21061)

Truetone Model D692, 3-band, 10-tube receiver, about 1950. Made by D.R.C. Factory, Detroit. (Keith Toliver, 632 West Southern, Springfield, Ohio)

Crosley Model 9-408 TV set, ser. 3311, 28 tubes. (Sam George, 2237 Brown Rd., Lakewood 7, Ohio)

Sentinel Model 242, 3-way portable, about 1940-41. (Russel E. Thorpe, 15552 Stone Ave., N. Seattle, Wash. 98133)

RCA Model AVR-20-A aircraft receiver. Covers 2.3-6.5 mc. (Rowie Precoco, 3944 Dearborn Ave., Sarasota, Fla.)

Brunswick Model 5 KRO receiver, ser. 156966, vintage 1928. Tunes 550 kc.-1400 kc. (Robert H. Wilson, 8 Del Ray Ct., Vallejo, Calif. 94590)

Aeronautic 6-tube BC-s.w. phono console. (John Taylor, 22036 Hart St., Canoga Park, Calif. 91304)

Coronado BRC Model 6D115-6 a.c.-d.c. receiver, chassis 856199, 1947. (D. G. Soderling, 6507 Grand Ave. S., Richfield 23, Minn.)

Zenith Model 5-R-312 AM radio, circa 1930-40(?). (Harry Walters, 1513 Brinton Rd., Pittsburgh 21, Pa.)

SCR-284/T4 radio transmitter-receiver, ser. 14, made by Philco. (D. Mirto, 409 Church St., Ambler, Pa.)

(*Continued on page* 32)

Operation Assist

(*Continued from page* 30)

RME Model 70 communications receiver, ser. W94. (Tom Carter, Blue Mountain Ranger Station, Prairie City, Oregon 97869)

Monarch Mfg. Co. Model 12N signal generator, 100 kc.-28 mc. (Frank W. White, 4762 Wheeler Ave., Jacksonville 10, Fla.)

Wilcox Electric Model S-101 receiver, 1941. Tunes 195-425 kc. (Bradley J. Thompson, 347 Davis St., Greenfield, Mass.)

Precision Apparatus Corp. Model 860 multi-range VOM. (T. T. Balan, 5577 Waterbury Ave., Maple Heights, Ohio 44137)

Freshman Masterpiece receiver, ser. E29063, about 1925. (J. W. Perkins, 76 Florence St., Green Ridge, Pa. 19014)

Zenith Model 5907 receiver, 8 tubes plus magic eye, about 1939; **Zenith** Model 6S15 6-tuber, about 1937. (Peter Bartlett, 1866 Main St., Marshfield Hills, Mass.)

Mains Model 48A a.c./d.c. table radio, 4 tubes. (Steve Konon, 416 Maple Ave., Uniondale, L.I., N.Y. 11553)

Delco Model R1118 BC-s.w. receiver, made by United Motor Service Inc. (Harlan H. Schomburg, Route 3, Madison, Wis. 53713)

Zenith Model 6-S-229 6-tube receiver. Covers .55-18 mc. (Danny Wilson, R.R. 2, Manchester, Okla. 73758)

BC-197 receiver, ser. 124, 1934. Tunes 100-1000 kc. Made by Hygrade-Sylvania Corp. for Signal Corps. (Fred Marx, 251 W. 74 St., New York 23, N.Y.)

Schuttig & Co. Model RCP s.w. receiver ser. 310, made for CAA. Tunes 0.2-30.0 mc. (D. F. Clark, 85 Fifth St., Gilroy, Calif.)

IP-94/APA-17 radar indicator. (Terry L. Prajsner, 9217 Schrier Rd., Rossford, Ohio 43460)

Eagle neutrodyne receiver, about 1923. Has five 201-A tubes. (Merideth Funk, 1619 Howe Ave., Apt. C, Sacramento, Calif.)

Arborphone Model 27 TRF receiver, circa 1926. (Michael K. Dunn, Route 1, Box 398, Chippewa Falls, Wis.)

Crosley Model 51 two-tube receiver, about 1925, ser. 37201E. (G. Barber, 18 Landis Dr., Las Vegas, Nev. 89110)

RCA Radiola Model AR920 receiver. Has 8 tubes, is battery-operated. (Howard C. Fisher, R.D. #6, Washington, Pa.)

United American Bosch Model 470 Vibro-power receiver. Has 7 tubes, 4 bands. (Willie Stockton, Jr., Box 11, Elgin, Texas 78621)

Special Data or Parts

Radio City Products Model 322 tube tester. Tube chart and manual needed. (E. W. Usakowski, 9820 Flatlands Ave., Brooklyn 36, N.Y.)

Supreme Model 599A tube tester. Tube settings wanted and info for making adapters 3742-9545X, 9544. (Leo G. Smith, R.D. #1, Box 375B, Sandy, Utah 84070)

Philco 10C853 record player, about 1941, and HR-1 home recording kit (39-7081). Schematic and operating info needed. (Fred Brakeall, 101 Tulip Lane, Dayton, Ohio 45432)

Magnovox Model D TRF receiver, No. 6064, circa 1925. Schematic, battery connections and voltages, and other info needed. (Bill Verduin, 84 Ridgewood Rd., Chagrin Falls, Ohio)

Philco Model 91 BC receiver, circa 1934. Manual, schematic, and sources for replacement parts wanted. (Keith Thompson, Route 5, State Park Rd., Greenville, S.C. 79609)

Emerson 2-band BC and s.w. 5-tube radio, about 1948. Data and schematic needed. (Frank A. Shevock, Jr., 268 Miller St., Luzerne, Pa. 18709)

BC-654A surplus communications receiver made by Crosley. Tech manual, schematic and equivalents for tubes needed. (John Weaver, 1929 Arnold, Topeka, Kan. 66604)

BC-221-AN frequency meter, ser. 4, made by Allen D. Cardwell Corp. Manual TM 11-300-AN needed. (I. Simmons, Bloom, Kan. 67833)

(*Continued on page* 34)

NOW IT'S A BREEZE

to paint everything you see here — including the room — with the

WORLD'S FIRST ROTARY ACTION PAINT GUN!

All yours with practically NO MISTING — NO OVERSPRAY — CAN'T EVER CLOG IN OPERATION!

ONLY THE SLOAN-ASHLAND ROTARY ACTION PAINT GUN ...

let's you paint a line so fine you can write your name ...

cover a full foot-and-a-half swath with one pass ...

paint within inches ...

Delivers as much paint per minute as a $200 industrial compressor model. HANDLES WATER SOLUBLE, RUBBER BASE, OIL BASE, FLAT, SEMI-GLOSS AND ENAMEL PAINTS. LIGHT OILS ... INSECTICIDES ... FLOOR WAXES, POLISHES AND OTHER LIQUIDS.

- No costly compressors
- No nozzles, needles, strainers to clog
- No air hoses to drag
- No flimsy vibrators
- 2-SPEED OPERATION for perfect control of light and heavy liquids.
- FINGER-TIP CONTROL OF PAINT FLOW—trigger lets you start and stop spraying instantly
- ADJUSTABLE GATE FOR EXACT WIDTH OF SPRAY YOU WANT—from ¼" to 18"—can't ever clog in operation.

- CLAMP-ON CAN holds full quart
- PAINT VOLUME CONTROL lets you deliver just the amount of paint-desired to the working surface
- For 115V AC operation
- Fully guaranteed
- ALUMINUM DIE CAST HOUSING for light weight and rugged durability
- CAN'T EVER CLOG IN OPERATION
  Powerful GE motor and rotary action spin the paint at a steady 17,000 RPM ... actually makes the Sloan-Ashland Paint Gun impossible to clog in operation!
- Reduces misting and overspray to a minimum. Eliminates 90% of usual masking! No more need to cover everything in sight.

Powered by GENERAL ELECTRIC

AMAZINGLY EASY TO CLEAN OR CHANGE COLORS ...
Fill container with water or proper solvent, run gun for a minute or two. That's all there is to it! No mess, no bother!

FREE TWO QUARTS OF SPRED-SATIN PAINT

$59.95

Covers 300% more width in each stroke than a 6" brush or roller ...

Now you can do 100 Sq. ft. of surface in minutes—because you cover three times as much area on each stroke, with the Sloan-Ashland Rotary Paint Gun. You cover a full foot-and-a-half swath with perfect control. Big job or small ... inside or outside ... whether you're spraying paint or other fluids—nothing does the work as quickly, as easily as this amazing paint gun!

Typical Oval Pattern of Ordinary Spray Gun.

Oval spray and wide feathering around edges make precise work difficult, requires extensive masking.

"Straight Line" Pattern of Sloan-Ashland Paint Gun.

Straight line spray and minimum of feathering gives you perfect control for the most precise painting.

American Products Division, 589 Broadway, New York 12, N.Y.
Send me your new Sloan-Ashland Rotary Paint Gun. I may use it for seven days free, and return it at your expense if I am not fully satisfied.

Also—send me two free quarts of Spred Satin Paint (worth $4.30) which I may keep and use whether or not I agree to buy the Sloan-Ashland Rotary Paint Gun.

If I do agree to keep it, I will pay only $8.50 a month until I've paid the low price of just $59.95 (plus shipping and handling).

Name_____
(Please print)

Street_____

City_____ Zone____ State_____

Where employed_____

Home phone number_____

PE8

Operation Assist

(*Continued from page 32*)

Heathkit Model V1 VTVM. Meter replacement needed. (L. J. Leigh, 409 McDonald St., Oconto, Wis.)

GE Model A-82 8-tube, 4-band superhet, table model. Alignment data and schematic needed. (O. Laney, 9008 Eton Rd., Silver Spring, Md. 20901)

Philco Model 90 9-tube superhet, about 1937. Parts source and schematic wanted. (John Liqua, 224-30 Horace Harding Blvd., Bayside 64, N.Y.)

Oregon Electronics Model A2 variable regulated power supply. Parts list and schematic needed. (Kenneth Ogston, Box 441, Boise City, Okla.)

National HRO 9-tube communications receiver, about 1938. Plug-in coils needed for long-, medium-, and short-wave bands. (Donald Marcinuk, 524 N. Main St., Southampton, N. Y. 11968)

Magnascriber Model 160 deluxe wire recorder, made by Standard Business Machines Co. Schematic, adjustment data, and manual needed. (Dallas H. Waltman, 17 E. Mason Ave., Alexandria, Va. 22301)

Geloso G 307/108 AM-FM receiver made in Milan, Italy. Tube replacement numbers wanted. (Robert E. Henning, 110 N. Front St., Darby, Pa.)

Douglas electronic organ. Source of supplies needed. (B. R. Hartz, 45 Vermilion Way, Levittown, Pa. 19054)

RCA Radiola III, Type R1, Model 405965, circa 1924; tunes 220-550 meters. Manual, schematic, battery info and source for WD-11 tubes needed. (Carl Underwood, Mellwood Dr., New Lexington, Ohio)

Col-R-Tel color converter, using color wheel and 7-tube circuit, about 1954. Schematic and installation instructions wanted. (Ken Templin, 738 S. Church, Jacksonville, Ill. 62650)

Atwater Kent TRF receiver, chassis type L, ser. 623147. Tech data, schematic, and PM replacement for original Type N speaker needed. (R. A. Guilfoil, 2353 Larkin St., San Francisco, Calif. 94109)

Westinghouse one-tube (WD-11) receiver, circa 1914. Any data or info will be appreciated. (Ernest Herzog, 1239 Otis Pl., Bethlehem, Pa.)

Heddon Models DC7 and DC8 12-kc. metal detectors, about 1950. Schematic and technical data wanted. (Frank J. Falkner, 9507 N. 12 St., Phoenix, Ariz. 85020)

Graybar 700 broadcast receiver, 9 tubes, circa 1930-35(?). Schematic and alignment data needed. (Alan E. Frisbie, 161 N. Thompson St., Hemet, Calif. 92343)

Fada Neutro Jr., Model 195-A, about 1923. Battery and hookup info needed. (John P. Brand, Chisago City, Minn.)

RCA "Rider Chanalyst," Models 162 and 162A. Manual, schematic, other technical data needed. (David Earman, 327 Pullega Cir., Staunton, Va. 24401)

Sonar Model D-120 depth indicator, about 1955. Operating manual and schematic needed. (Charles W. Burnham, 789 Jim Isle Dr., Charleston, S.C. 29407)

Hallicrafters S-20R receiver. Service manual needed. (Ing. Roberto Pflucker C., Apartado N. 3126, Lima, Peru)

Meissner Signal Shifter (Model EX), circa 1940. Schematic and modification suggestions wanted. (Dave Martin, K7VOC, 3802 West State Ave., Phoenix, Ariz. 85021)

DuMont Labs Type 274A oscilloscope. Manual needed. (Leonard Rogoza, 1926 W. Cornelia Ave., Chicago, Ill. 60657)

Westinghouse Model TBW-3 transmitter. Manual needed or info on how to operate. (B. R. Adams, West Yadkin School Electronics Club, Hamptonville, N. C. 27020)

Olympie-Opta Type 5146 T/W console with Phillips phono built in, chassis 5700-2987, made in West Germany. Schematic and technical data needed. (R. H. Patrick, 2237 Mason Dr., Savannah, Ga.)

Atwater Kent Models 20 and 49. **Freshman Masterpiece.** Info on battery voltages and schematics wanted. (Rod R. Hogg, 715 N. Sheridan, Minneapolis, Kan. 67467)

Harvey-Wells XN-25 transceiver, about 1943. Service manual and schematic wanted plus alignment procedure data. (James Sims, Box 68, Hingham, Mass. 02043)

-30-

You get two very important benefits from this great new CB transceiver:

1. *Hallicrafters performance standards.*
2. *Change from a $100 bill.*

NEW CB-7

six channel citizens band
TRANSCEIVER

$99.95 complete

You also get a flock of other, very useful benefits that help to make the CB-7 the greatest transceiver value in citizens band history.

- New design concepts give you great economy with no sacrifice in performance.
- Six channel, crystal-controlled convenience.
- New **all-electronic** push-to-talk circuitry.
- Highly compact new size (only 12" x 5" x 7") . . . same great "drop-down" chassis feature as CB-3 series.
- Nothing else to buy! Ready to operate either base AC or mobile DC, including all necessary power cords and mounting bracket.
- Standardized channel crystals — interchangeable in all Hallicrafters transceivers.
- Accommodates all CB-3 Series accessories: HA-9 S-Meter; HA-11 Noise Eliminator; HA-12 Encoder/Decoder; HA-13 VFO.
- Full 100% modulation capability; sensitivity 1 μv for 10 db. S + N/N ratio; power input 5 watts, receive output 2 watts.

The new ideas in communications are born at . . . **hallicrafters**

5th & Kostner Aves., Chicago, Illinois 60624

Export: Hallicrafters International Div.; **Canada:** Gould Sales Co., Montreal, P.Q.

CIRCLE NO. 12 ON READER SERVICE PAGE

POP'tronics Bookshelf

BEGINNER'S GUIDE TO ELECTRONICS

by Terence L. Squires

Although this book may be somewhat difficult to obtain in North America, we suggest that those of our readers who are just starting out in electronics ask for it at their local bookstores. Mr. Squires has covered almost the entire field of electronics with his direct, easily read, non-mathematical text. Scores of line drawings further provide a "short-cut" study (the author's own words) of the field. Recommended.

Published by George Newnes Ltd., Tower House, Southampton St., London W.C.2, England. Hard cover. 196 pages. Price, 15 shillings.

RADIO REGISTRY—INDUSTRIAL RADIO SYSTEMS

Getting fatter year by year is this callbook of VHF and UHF stations licensed by the Federal Communications Commission in the Industrial Service. In this category are stations in the power utility, petroleum and gas, forestry, press, motion picture and VHF maritime fields. Details on frequencies, power, number of mobiles, etc., are included.

Published by Radio Magazines, Inc., Box 629, Mineola, N.Y. 322 pages. Soft cover. $8.00.

AUDIO AND ACOUSTICS

by G. A. Briggs

Great Britain's man-of-audio, the irrepressible G.A. Briggs, has favored Americans with another set of his "personalized" facts and opinions on hi-fi. If you are technically oriented and a stereo enthusiast, then Briggs' books are your meat. His style of writing (this is a gratuitous term—the Briggs.

A professional quality mike... for CB

THE TURNER MODEL 333

latest addition to a long line of winners

A professional communications mobile microphone that's now available for CB use! It's all new . . . all quality . . . and it goes right at the top of Turner's already fine line of CB microphones.

Be the first in your area to upgrade your present CB equipment, install the new Turner 333. This carefully crafted instrument includes the noise cancelling feature. It's equipped with a shielded Koiled Kord that is so long-lasting that it's used professionally on police cars, taxicabs, etc. The 333 features a rugged, modern design in a high impact cycolac case. Tailored voice response.

THE TURNER MODEL 333 ... BEST WAY YET TO LEND PROFESSIONAL QUALITY TO YOUR CB RIG.

For Quality, Dependability, Ruggedness... the complete TURNER CB Line

Send today for TURNER'S Full Line Catalog

THE TURNER MICROPHONE COMPANY
946 17th Street N.E.
Cedar Rapids, Iowa

In Canada: Tri-Tel Associates, Ltd., 81 Sheppard Ave. West, Willowdale, Ontario
Export: Ad Auriema, Inc., 85 Broad Street, New York 4, N.Y.

CIRCLE NO. 33 ON READER SERVICE PAGE

Bookshelf

(*Continued from page* 36)

books read like a day-to-day diary) is fascinating and lively, full of personal observations and commentary on the hi-fi scene. This book started out to be an updated version of the 1949 *Sound Reproduction*, but to keep it in a semi-popular vein and available at a modest price, facts and opinions, observations and test results are fired at the reader in broadsides. One can't help admiring this stripped-down text. Particularly recommended.

Distributed in U.S.A. by Herman Publishing Service Inc., Stamford House, Stamford, Conn. 168 pages. Soft cover. $2.95.

THE STORY OF THE LASER

by John M. Carroll

This is one of the first cracks at what will probably become a popular book topic in the next few years. The laser and its predecessor, the maser, are described in this book in terms that can be understood and appreciated by a non-technical reader. The historical development of both devices is carefully traced, and appropriate credits are given to the inventors and laboratories that have accomplished so much in so few years. Future uses of the laser are also examined in detail. There are no construction details—in case you should want to build your own—but the book does contain a reasonably good bibliography with which more information can be sought.

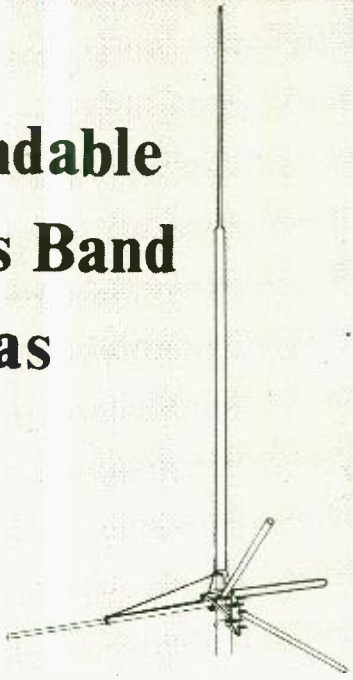
Published by E. P. Dutton & Co., Inc., 201 Park Ave. South, New York 3, N. Y. Hard cover. 182 pages. $3.95. —30—

ODDS 'N' ENDS

The second convention of the International Amateur Radio Club, to be held in Geneva Sept. 5-6, will have as its theme "The Future of Amateur Radio." Reservations to attend and requests for a copy of the IARC magazine, "4U1ITU CALLING," should be sent to the Secretary, International Amateur Radio Club, Geneva, Switzerland. Magazine requests should be accompanied by four International Reply Coupons. Established in 1962 at the headquarters of the UN's International Telecommunications Union, the IARC has as its purpose the world-wide encouragement of amateur radio.

MOSLEY'S Communication Antennas....

...Dependable Citizens Band Antennas



MODEL UL-27

An Omni-Directional Vertical Ground Plane Antenna which overshadows all other antennas of similar type available today. This antenna has an extreme low angle radiation and a complete revolutionary matching system. These superior features combined with the world famous Mosley construction assures the CB'er of an out standing antenna for dependable communications.

MODEL SWL-7

for 11, 13, 16, 19, 25, 31, and 49 meters.

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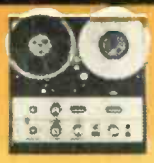

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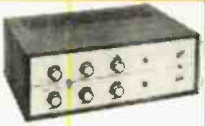

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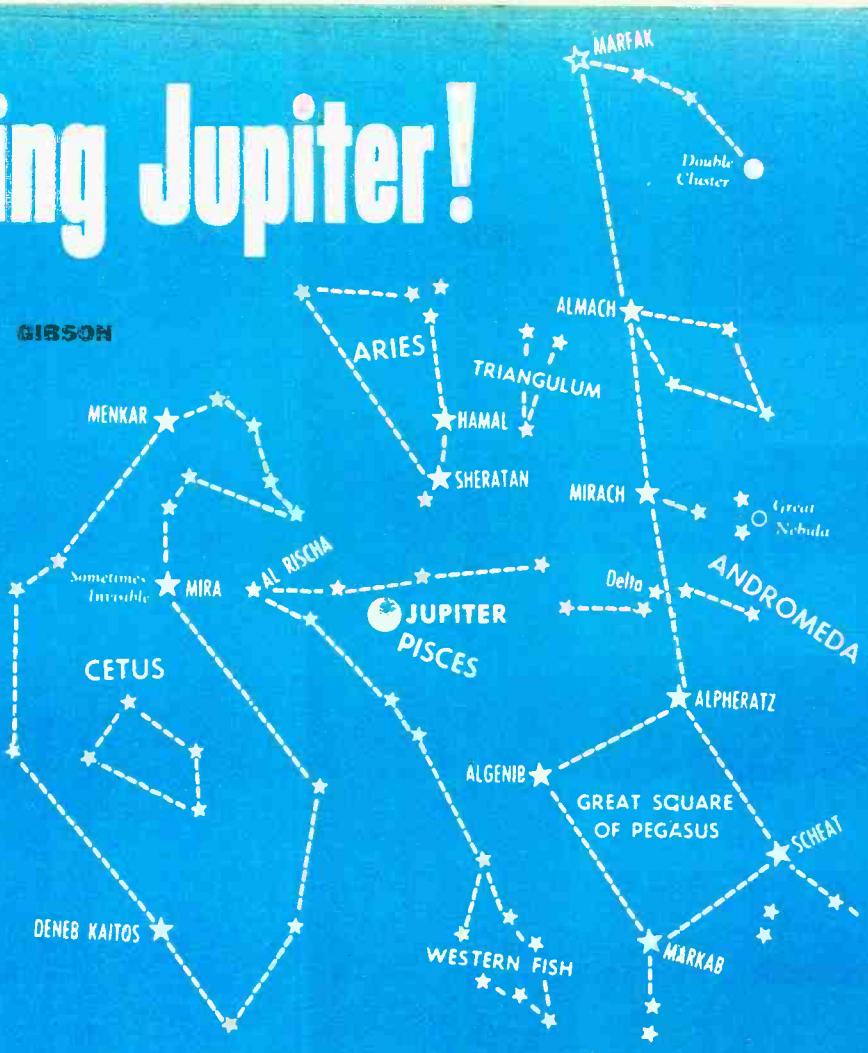
DX'ing Jupiter!

By SCOTT GIBSON



Signals from outer space? It wasn't known until recently, but the Giant Planet broadcasts signals any ham or SWL can monitor

ONE EVENING last summer, radio astronomer Dr. Alexander G. Smith of the University of Florida tuned his Japanese pocket BC/SW receiver to 18 megacycles and heard radio signals from the planet Jupiter. He was not surprised; Jupiter's characteristic wide-band, surf-breaking-on-the-beach sound is easy to distinguish from the narrow-band, fading-in sound of a distant phone station or the staccato crash of earth-made static.

Dr. Smith has been studying Jupiter's radiations for nine years. He generally uses Collins receivers and directional beam antennas, but on that particular night an unusually severe noise storm in the atmosphere of the giant planet produced signals strong enough to be readily detected even by a pocket radio with a short whip antenna.

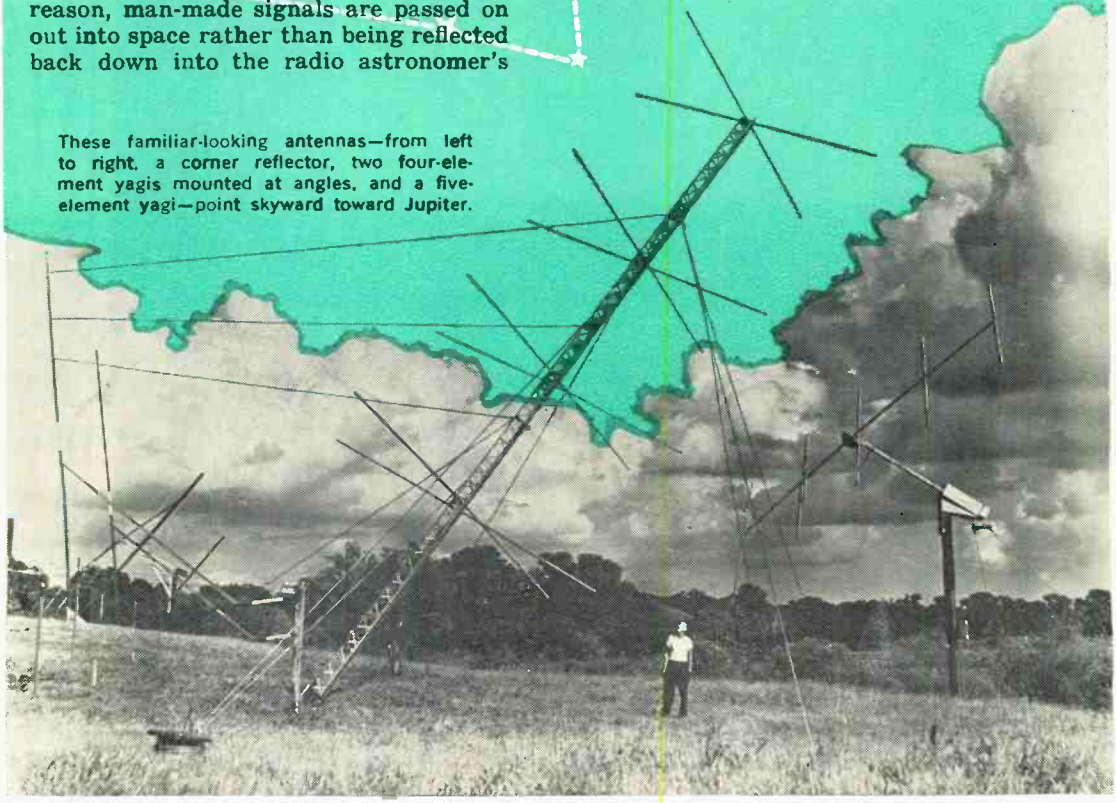
YOU can hear radio signals from Jupiter, too—with nothing more than an ordinary amateur or SWL receiver and a good antenna!

It wasn't known until 1955 that Jupiter radiates low-frequency radio signals of considerable intensity. Most radio astronomers search the microwaves with intricate low-noise receivers and elaborate antenna arrays, but Dr. Smith's 23-man research group is able to use conventional communications receivers and familiar-looking beam antennas thanks to the excellent signal strengths and low frequencies involved—5 megacycles and up. In fact, Jupiter's signal strength increases the lower you go in frequency; above 15 mc. the energy falls off as the fifth power of the frequency!

Although Jupiter's signals are heard in the very heart of the short-wave broadcasting bands—Dr. Smith's group is currently observing 5, 10, 15, 16, 18, 20, 22, 27, and 53 mc.—interference from earthside stations is not as serious as you might expect. From 15 mc. up, observations are made at selected hours of the night, usually between midnight and dawn, when the sun-made ionosphere has thinned and no longer deflects Jupiter's incoming signals. For the same reason, man-made signals are passed on out into space rather than being reflected back down into the radio astronomer's antennas. On the lower frequencies, however, the ionosphere never gets sufficiently thin to pass out man-made signals, so the radio astronomers listen in the 10 kc.-wide guard bands on each side of WWV's carriers. By international agreement these guard bands carry no radio traffic—most of the time, anyway.

Even though QRM can be evaded on the lower frequencies, ionospheric deflection of the incoming signals from Jupiter sets a limit on the lowest frequencies that can be observed; below a critical frequency, the planet's signals are reflected back into space. This critical frequency depends on both the density of the ionosphere and the angle between horizon, receiver, and Jupiter. If Jupiter is close to the horizon, even 18-mc. signals may not get through; but if the planet is straight overhead, much lower frequency signals are passed down to the receiving site.

Sunspots introduce another variable. The sunspots come and go in 11-year cycles. During the sunspot maximum the



These familiar-looking antennas—from left to right, a corner reflector, two four-element yagis mounted at angles, and a five-element yagi—point skyward toward Jupiter.

ionosphere is much denser and the lower frequencies are blocked much more than they are at sunspot minimum. Since the next sunspot minimum will occur in late 1964 or early 1965, conditions are now good—and getting better every day—for studying the lower frequency radiation from Jupiter.

Receiving the Giant Planet. The radio astronomers use ordinary Collins 75S receivers with the a.v.c. cut off. For scientific reasons, three receiving sites are in action at the same time. The main site is on the University of Florida campus and works directly with a second site 35 miles away. In effect, these two antenna sites contribute to a common received signal. Actually, the signals are photographed with high-speed cameras simultaneously at both sites, and later the two images are combined from the negatives.

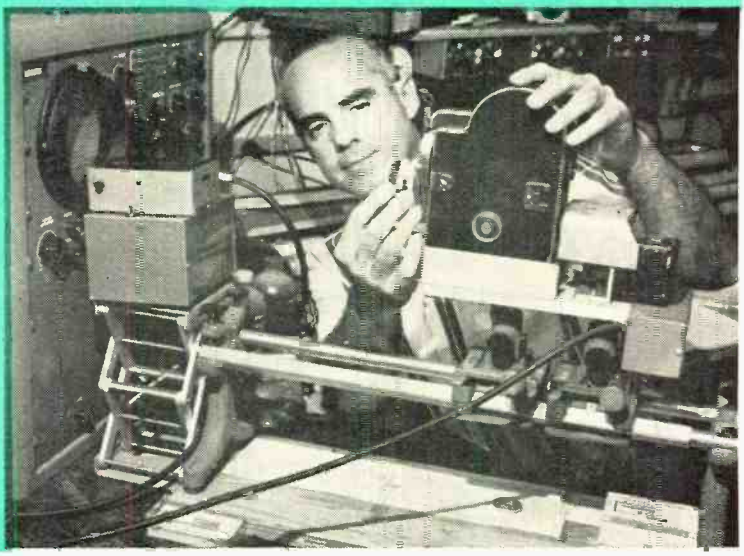
The two sets of antennas behave like segments of a radio telescope 35 miles in diameter. In terms of resolving power, the results are as good as if you had a complete radio telescope of this diameter, although the amount of energy received is much less. The loss of signal is no problem, however, because the signals are very strong—stronger than any other extraterrestrial signals.

As both optical and radio telescopes are increased in diameter, it becomes possible to get finer resolution of details, and Dr. Smith and one of his colleagues, Dr. T. D. Carr, hope to be able to distinguish Jupiter's four separate radio sources which have been predicted by statistical data.

The third station in the chain is located in Chile. In 1959, with the aid of a grant from the National Science Foundation, a field station was built in Santiago at the University of Chile to permit simultaneous observation of Jupiter from both hemispheres. Because interference is not likely to occur in both hemispheres at the same time, wasted observation time is minimized as much as possible,

(*Continued on page* 94)

Collins and Hammarlund gear above—enough to delight any DX'er—is connected to antennas at left for monitoring Jupiter's emissions from 5 to 30 mc.; Hallicrafters unit monitors WWV. Other equipment shown: three paper recorders and a tape machine, all used to record Jupiter's signals for study.



Right: Dr. Alexander G. Smith of the University of Florida's Radio Astronomy Department adjusts 16-mm. movie camera used to film Jupiter signals displayed on scope screen of a panoramic receiver.

"BATTLE OF THE

THE CLOSER we bring our technology to the ultimate, the more vigorous are demands of various countries to have one of their citizens credited with inventions or early developments that first contributed to the state of the art.

A story is whispered behind the Iron Curtain that a Russian peasant was working in a forest and found a wire strung between two trees. On the strength of this discovery, Russia claimed credit for the invention of the telegraph. At about the same time, a peasant in Red China was plowing a rice paddie and did not find any wires, so the Red Chinese government claimed the invention of the wireless!

Everybody knows that Thomas Alva Edison invented the electric light bulb in 1879. Everybody? Not in the town of Springe, Germany! The citizens of Springe are convinced that the light bulb was invented by Heinrich Goebel, born there in 1818. So convinced are the townspeople of Springe that they have erected a memorial to Goebel in the shape of a huge incandescent lamp. On the base of the memorial, a commemorative tablet reads as follows (translated into English):

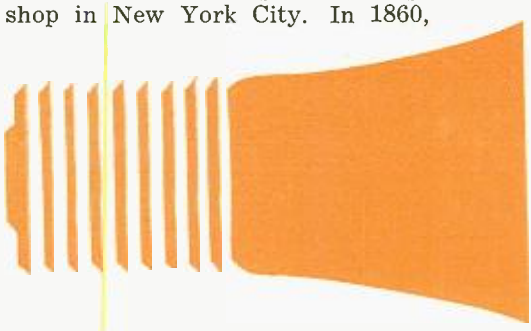
To the honor of the
inventor of the incandescent lamp

HEINRICH GOEBEL

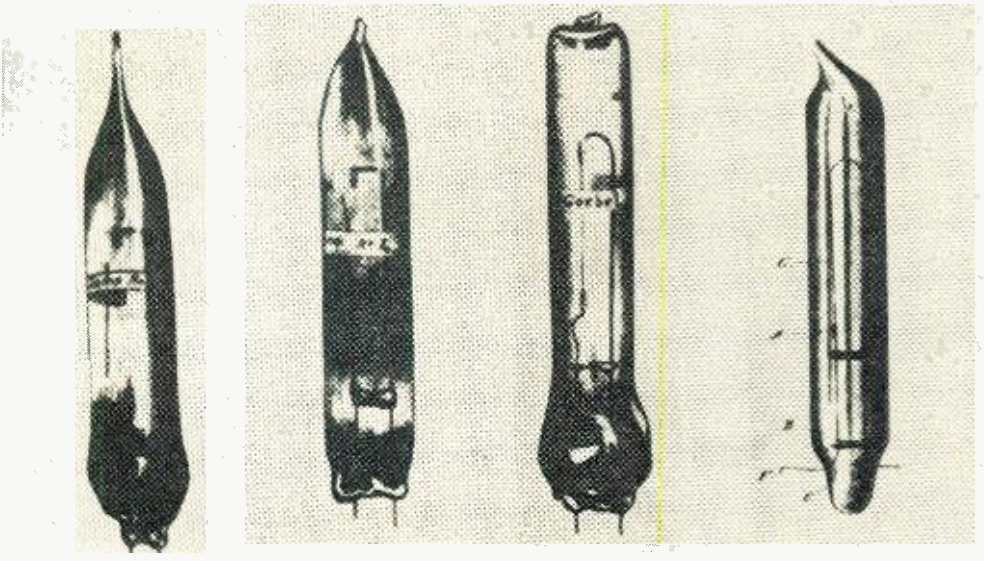
Born April 20, 1818, in Springe
Died December 16, 1893, in New York

Erected June 26, 1954, by the Town of Springe on the occasion of the centennial celebration of the invention

Who Invented What? Henry Goebel (he Americanized his name) operated an optics shop in New York City. In 1860,



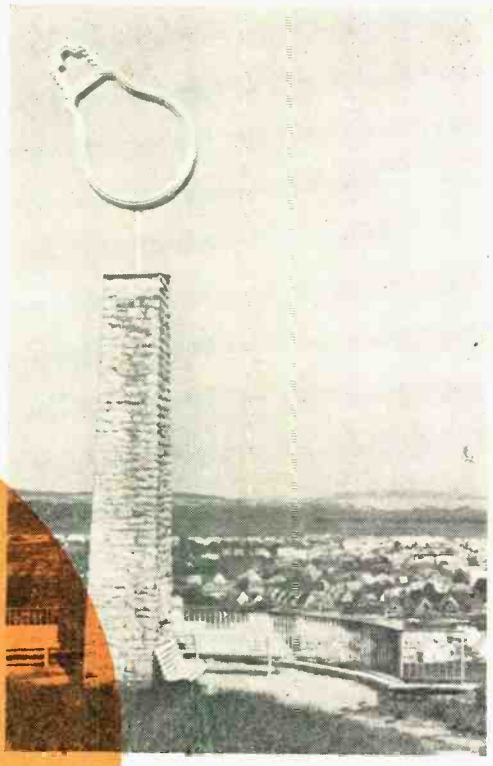
Here are the first four "electric" lamps made by Goebel 25 years before Edison invented his lamp.



BULBS"

Necessity may be the "mother" of invention but, with many brainchildren, there's a fight about who the "father" is!

By HANS F. KUTSCHBACH



A memorial to Goebel was built at Springe, Germany, in 1954. The illuminated lamp that tops the stone pillar is used as an airplane beacon at night.

Heinrich Goebel died in 1893 at the age of 75—the same year that an American court acknowledged the priority of his lamp.

according to reliable witnesses, he used an electric lamp which he had made himself to illuminate the store and to attract customers. A cylindrical glass tube closed at the top, it contained a "high vacuum." The light-giving part was of a hairlike thinness and consisted of a carbonized grain.

Goebel wasn't the only one to work on the incandescent lamp. In 1845, two inventors named Starr (an American) and King (an Englishman) experimented with lamps in which thin bars of coal were brought to a glow in a vacuum. In 1878, in Berlin, Alexander Siemens experimented with an electric lamp, and in the same year, J. W. Swan, in Newcastle, England, developed a carbon filament lamp whose filament had a 1-mm. diameter.

How Goebel Made His Lamp. Goebel stripped a piece of bamboo cane between the knots, taking a piece one-inch long. This was ground with planishing rollers to hairlike thinness. After carbonizing the bamboo, the center was moistened, and the filament was bent to a hairpin shape over a hot iron. The piece was held until it cooled, and retained this

(*Continued on page* 100)

MICROPHONES

A MICROPHONE is a transducer—that is, it takes one form of energy (sound energy) and converts it to another form of energy (electrical energy). With this simple statement of fact we define a vast complex of equipment, some of which is so different from other units that not even a vague family resemblance remains.

Microphones have become highly specialized instruments, each category designed for special characteristics, and in truth, every unit within a given group has its own peculiar personality. Entertainers become familiar with microphones to the point where many singers carry their own mikes as a part of the equipment they lug from stage to stage.

You are undoubtedly familiar with the microphones used in the entertainment medium, for you often see them on television, and when an actor who is seated gets quickly to his feet, you see the boom mike. Sometimes, if the actor *doesn't* see it, he gets a crack on the noggin' and sits down again—fast!

People react differently to microphones, and when an individual is brought face to face with these little plastic or metal boxes, he may do some strange things. The most common reaction is to get a stranglehold with one fist on the mike stand. Others start by stretching the stand or lowering it. Perhaps the most common reaction is to blow into the mike. Blowers never blow just once—they blow twice, in rapid succession, sounding somewhat like a locomotive about to work up a full head of steam. Realizing immediately how foolish this must sound, they follow with a question: "Can you hear me?" or a statement such as "One-two-three-four-five." Then, for some reason, the mike gets tapped with the fingers, again, twice.

Crystal and Ceramic Mikes. Perhaps the most common way to convert sound to electricity is to use a crystal mike or its younger offspring, a ceramic mike. Crystal and ceramic mikes depend on flexing a material (crystal or ceramic) to produce, through the piezoelectric effect, an electrical output. By far the most versatile of microphones, crystal and ceramic types are found in the possession of hams, CB'ers, tape recordists, p.a. system operators, and hi-fi fans across the country.

The main reasons for the popularity of crystal and ceramic mikes are: (1) the high output (most are rated between −44 and −55 db by manufacturers); (2) the high impedance which eliminates the need for matching transformers; and (3) the relatively low cost of these mikes. Although they are rarely used where frequency response is critical—in broadcasting, for example—they are capable of good response, and can be tailored for uses where a limited response is desirable, as in mobile communications.

Of the two types, the ceramic mike is better in some respects because it can withstand more heat and humidity and general abuse (albeit with slightly lower output in some cases) than the crystal mike.

Carbon Mikes. The old standby, especially in communications

work, is the carbon mike. Consisting of carbon granules packed between two electrodes, it is a variable resistor, changing the small d.c. current flowing through it into audio as sound waves strike its movable front electrode. The movement of the electrode causes the packing of the granules to alternately increase and decrease, reducing and increasing the resistance of the mike.

Although the carbon mike has a much higher output than any other type, it has a limited frequency response, and must be used with a battery and matching transformer, or in the cathode of a vacuum-tube amplifier. It will work only with circuits specifically designed to accommodate it.

The Dynamic Microphone. The *sine qua non* of the serious audiophile, especially those with tape recorders, is the dynamic microphone. Capable of superb frequency response and almost immune to heat, humidity, and damage from falling off the table, the dynamic mike is analogous to a loudspeaker in reverse; that is, it consists of a coil attached to a diaphragm which moves through a magnet assembly to produce an electrical output. Unfortunately for some applications, it is like a loudspeaker in another way: it is a low-impedance device.

Although adding somewhat to the cost of the microphone, the low-impedance output of a dynamic mike can be easily converted to high impedance with a small built-in transformer. Many dynamics have this feature along with a switch which cuts out the transformer when the mike is connected to an amplifier with a low-impedance input. The output of most dynamics is somewhat lower than that of high output ceramic and crystal types, usually falling in the —50 to —60 db range. Dynamic mikes, in addition to the applications mentioned above, are used a great deal for broadcasting and p.a. purposes.

Specialized Microphones. Much used in broadcasting is the ribbon or velocity mike. The condenser mike is an exotic type; very expensive to produce, it finds application in recording studios where the ultimate in frequency response is desired. In communications work, two types of mikes that never quite made it—at least not generally—are the throat mike and the lip mike. The first used an elastic band to press two large microphone buttons to your throat thuggee-style, and the latter hung, like a small moustache, under your nose!

Specialization in terms of the job a microphone must perform brings in a number of considerations. If you are trying to record a group sitting in a circle, a non-directional (or omnidirectional) microphone would be used. A single speaker at a podium will want his voice picked up and background noise eliminated, so he will select a mike with a cardioid, or heart-shaped, pattern of pickup. If you have a situation where an audience is to participate, you can prevent having to run to each questioner with a mike by using a highly directional "cannon" mike (see top left and top center color pictures above). Simply aim it at the speaker, and you'll pick up his voice.

Whether you are a salesman on the road, a driver reporting to the home office, or an airport announcer or a radio dispatcher, there's a microphone available to suit your own special requirements.

In automobiles, where you may have a high ambient noise level, a noise-cancelling microphone is used. This has acoustic ports placed in such a way that noise coming from any direction other than from directly in front cancels itself out. Only the speaker's voice gets through to the microphone's diaphragm.

The area of pickup that a microphone has determines its practical application to a large extent. A mike with a large frontal lobe (directional) can also serve as an omnidirectional mike if it is pointed straight upward, and mounted low in relation to a group of speakers or singers. Other microphones may use more than one element to achieve a full omnidirectional pattern.

With stereophonic tape recording in the home coming into its own, cardioid pattern mikes are being sold in pairs, and are then set up for stereo recording, depending on directionality to cut down

(*Continued on page* 101)

THE MICROPHONES

Front cover (left to right): Telex Magna-Twin Mark III dynamic, $29.10, for language labs, communications; Electro-Voice Model 664 dynamic, $49.98, for communications, p.a. systems; Shure Model 578 Omnidyne dynamic, $49.50, for general hi-fi applications.

Pages 46 and 47. Top row (left to right): Electro-Voice Model 643 Cardiline dynamic, $936.00, for long-range pickup; Electro-Voice Model 644 dynamic, $66.00, medium-long ranges, boom mounting; Lafayette PA-104 dynamic, $9.75, communications, p.a. systems. Middle row (left to right): Shure Bros. Model 201 ceramic, $10.80, for communications (mobile); LTV University Model 71 dynamic, $34.25, schools, p.a., home recording; Electro-Voice Model 729SR ceramic, $15.58, communications use; Turner Model 454, crystal or ceramic, $12.50, mobile communications. Bottom row (left to right): Sonotone Model CM-17B ceramic, $14.41, for home recording; Knight KN-4510 ceramic, $9.50, p.a., recording, paging; Shure Bros. Model 51 Sonodyne, dynamic, $29.11, general-purpose mike; Electro-Voice Model 647A dynamic, $48.51, stage, broadcasting; Shure Bros. Unidyne II, Model 55S, dynamic, $49.80, stage, recording, fixed station communications.

For less than $15 you can build real convenience into your hi-fi stereo system

Build Hi-Fi INTERLOCK

By CHARLES J. ULRICK

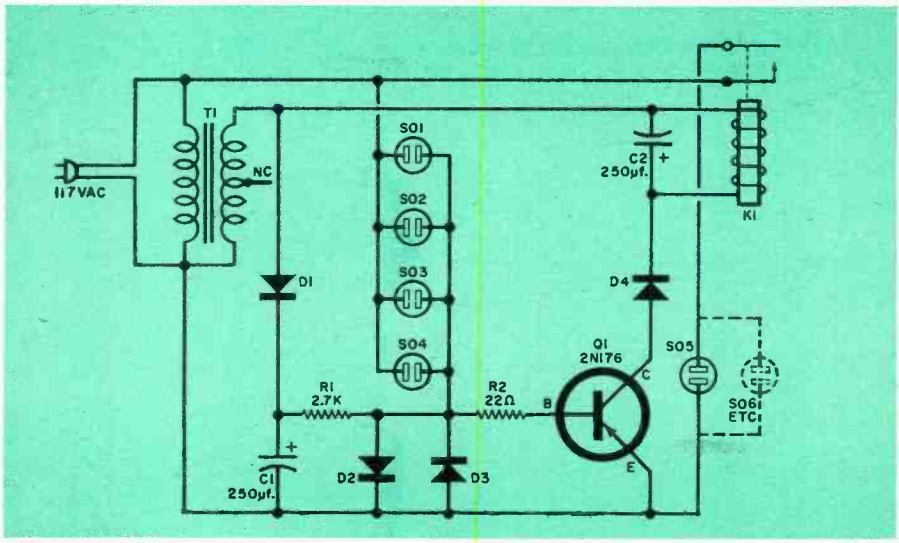
IN THIS AGE of automation, it's ridiculous to have to throw more than one switch to accomplish one ultimate function. If, for example, you want to listen to a record, why should you first have to turn on the phonograph, then the amplifier? With the "Hi-Fi Interlock," turning on the phonograph (or the FM tuner or the tape recorder) also turns on the amplifier. An auxiliary benefit accrues in that turning *off* the primary device also turns off the secondary, or controlled device, preventing the possibility of leaving the amplifier on all night to cook up lots and lots of heat.

How It Works. Diodes *D2* and *D3* are connected back-to-back in series with sockets *SO1* through *SO4*, and then across the a.c. line. A load applied to these sockets will cause a voltage drop in the diodes, activating the relay-controlling circuit at *Q1*, and causing relay *K1* to pull in and apply full 117-volt a.c. to socket *SO5* where the controlled devices are connected.

When a load is applied at sockets *SO1* through *SO4*, diode *D2* or *D3* will conduct (one or the other, depending on the a.c. polarity at the time), providing a negative base voltage for transistor *Q1*. This base is normally held positive by the bias supply formed by diode *D1*, capacitor *C1* and resistor *R1*. Diode *D2* limits the voltage to 0.75 volt. Resistor *R2* is used to limit base current, and capacitor *C2* is used as a filter for the half-wave d.c. that is applied to relay *K1* by transistor *Q1*.

Mounting the Components. All of the components are mounted in a small, open-end chassis. While parts placement is not critical, you can obtain a general idea of the arrangement the author used by examining the pictorial diagram on page 51.

Mount the larger components first—the transformer, relay, and transistor. Next mount diodes *D2* and *D3*, then the



Devices plugged into sockets SO1 through SO4 will control voltage at socket SO5.

PARTS LIST

C1, C2—250-μf., 12-volt electrolytic capacitor
D1, D4—400-PIV, 750-ma. silicon rectifier
D2, D3—200-PIV, 12-amp. silicon rectifier (Allied Radio Stock No. 39 A 926-D or equivalent)
K1—S.p.s.t. relay, 6 volts d.c., 10-amp. contacts (Guardian 1R-505-A6 or equivalent)
Q1—2N176 transistor
R1—2700-ohm, 2-watt resistor
R2—22-ohm, 2-watt resistor
SO1-SO5—Chassis-mounting a.c. receptacle
T1—Filament transformer: primary, 117 volts a.c.; secondary, 6.3 volts a.c. @ .6 amp
1—2" x 5" x 7" aluminum chassis
1—1¾" x 3¼" x 5" aluminum open-end chassis
14—½" standoff insulators
Misc.—A.c. line cord and plug, rubber grommet, assorted wire, hardware, solder, etc.

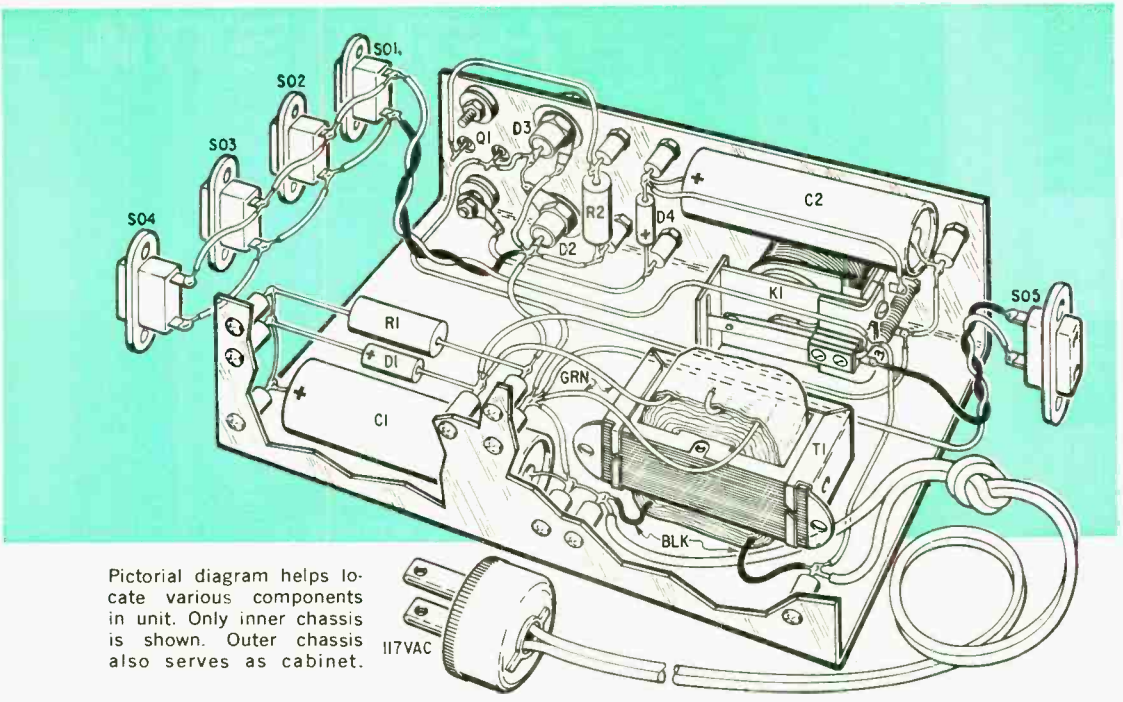
standoff terminals. Transistor *Q1* and diodes *D2* and *D3* should be mounted on the mica forms supplied as mounting kits for these components.

Drill two holes in the base of the open-end chassis in order to mount it on the larger chassis. Use the small chassis as a template to locate the mounting holes in the larger chassis before proceeding with the wiring.

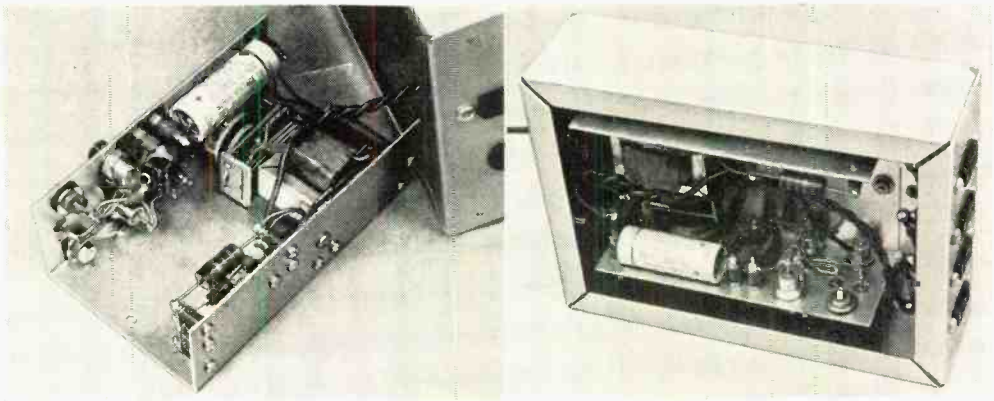
Because transistor *Q1* must go on during the negative half-cycles of the a.c. line, the transformer voltage must also be negative at that time to turn it on. To phase the transformer, connect a secondary lead to a primary lead and apply 117 volts a.c. across the primary. Measure the voltage at the open secondary and primary, and if it is higher than the 117 volts, untwist the two transformer leads you connected together, and substitute the other secondary lead. Be sure to remove the primary voltage while making these tests. When the transformer is properly phased—resulting in a voltage *lower* than the line voltage—solder the leads.

To insulate diodes *D2* and *D3*, drill larger holes than are required for the mounting studs. A pair of mica washers above and below the hole will keep the diodes from touching the chassis. Transistor *Q1* must also be insulated from the chassis, and in addition to using oversize holes for the two terminals, it will be necessary to insulate the transistor case as well. Toward this end, a mica sheet is placed under the transistor, and fiber shoulder washers are used for the mounting screws. After *D2*, *D3* and *Q1* have been mounted, an ohmmeter should be used to check for continuity to the chassis. If such continuity is present, additional adjustments in positioning are indicated.

Drilling and Wiring. The larger chassis also serves as a cabinet for the unit. The two mounting holes that were marked are first drilled, and then additional holes for the line cord and a.c. sockets are marked off. A hand nibbler is a great help in cutting the square-cornered holes for the sockets. Do not mount the sockets or the small chassis until after



Pictorial diagram helps locate various components in unit. Only inner chassis is shown. Outer chassis also serves as cabinet.



After wiring, subchassis (above, left) is installed in larger chassis and fastened in place.

the unit has been tested and is working properly.

Following the schematic diagram, carefully wire the small subchassis, twisting the wires to the sockets before soldering them into place. Before wiring the line cord into place, knot it so it will act as a strain relief.

Be sure to deburr all mounting holes to guarantee proper fit. This can best be accomplished by the judicious use of a ½" or ¾" twist drill, gently rotated by hand.

Using the Interlock. To install the interlock in a high-fidelity stereo system, plug the various controlling units into sockets *SO1* through *SO4*. The interlock is then plugged into a wall outlet and the unit to be controlled is connected at *SO5*. If it is necessary to control more than one unit, a cube-tap can be connected to *SO5*, or more sockets can be added. Other applications for the interlock will be found in the ham or CB shack, or wherever remote or automatic power switching is needed. —30—

Electronics Primer

By DAVID W. MOORE

(With a•pol'o•gies to McGuffey's Read'er)

Oh see the POPULAR ELECTRONICS read'er. What is the reader do'ing? He is playing with min'i•a•tur•i•za'tion. He is wearing a jew'el•er's loupe. See his fun'ny eyes? See the one-inch square cab'i•net? It is a ra'di•o trans•mit'ter. It is called a "teent'•sy•weent'sy" radio transmitter. That is its tech'ni•cal name. People who work with miniaturization also have a technical name. We can'not print that here.

Would you like to help the read'er with his work? Let us all clap hands and help the reader. You may throw away that ti'ny lit'tle scrap of num'ber for'ty wire. Oh no, no, no! You threw away the am'pli•fi•er. See the reader cry. Cry, reader, cry.

Oh see Dick. See Dick talk. Talk, Dick, talk. Talk, talk, talk. Funny, fun'ny Dick. Dick is a CB'er, nat'u•ral•ly. Look at Dick's wall. See the pret'ty cards. They say 2W1111, 2W2222, 2W3333, VE1XX—oops! Shame on Dick! Naugh'ty, naughty Dick.

See Dick's sta'tion. See, see, see. It is a nice station. See the re•ceiv'er. See the transmitter. See the lin'e•ar am'pli•fi•er. See the 813's . . . hmmm.

Lis'ten to the knock'ing on Dick's door. Knock, knock, knock. Guess who's there? Knock, knock, knock. Dick o'pens the door. It is the FCC. They want to see Dick's li'cense. What license?

See the hi-fi buff. See the ex•pen'sive turn'ta•ble. See the pow'•er•ful am'pli•fi•er. See the beau'ti•ful pre'amp. See the huge speak'ers. See the piles of rec'ords. See the yards of tape. See the pret'ty L-pad. When the hi-fi buff is in his pad, all L breaks loose.

The hi-fi buff plays his mu'sic loud. He makes the plas'ter in the wall crack. He broke the win'dows long a•go'. Oh see the set'tings on his vol'ume con•trol'. They say Loud, Ver'y Loud, and Thresh'•old of Pain. Hear the sound of the jet. Hear the train. Hear the an'gry people moving to'ward the door. Gee, that sounds real!

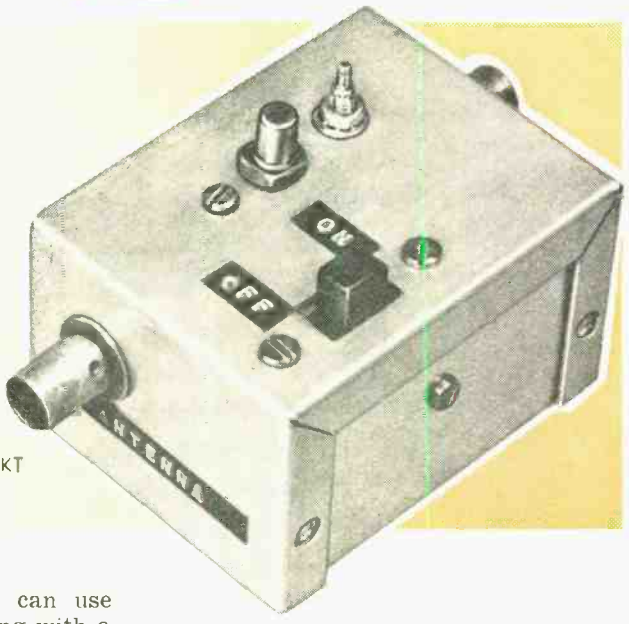
See the rich ex•per'i•ment•er. He has a big spread down south. He calls it U'ru•guay. See him fool with proj'ects to keep himself busy. See him tink'er with moon'bounce (yawn). Watch him dab'ble with ra'dar (ho-hum). See him toy with col'or TV (stretch). The rich ex•per'i•ment•er is bored. He is search'ing for some'thing new. See him try to buy one of the Sand'wich Is'lands. Poor experimenter. Eng'land does not want to break up the set.

See the experimenter's junk box. Back! Back, I say! See the par'a•bol'ic re•flec'tor. See the hun'dred-foot tow'er. See the dis•card'ed TV cam'er•as.

Why does the luck'y experimenter look so sad? He has ev'er•y•thing in the world. Bet you would like to trade places with him, wouldn't you? Bet he would like to trade with you! —30—

THE 6 METER 7 AND 2 PREAMP

A high-gain, low-noise transistor preamp for 6— for just $7 and 2 hours of labor



By **JOSEPH TARTAS,** W2YKT

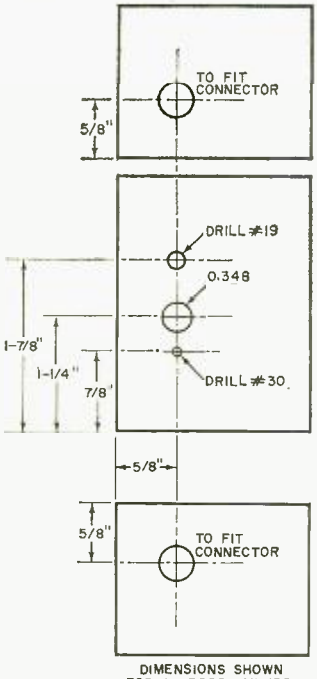
IF YOU work 6 meters and can use more r.f. gain on receive along with a reduction in signal-to-noise ratio (and who can't?), the "6 Meter 7 and 2 Preamp" is for you. Heart of this little one-evening project is a new low-noise germanium transistor, the 2N2188, made by Texas Instruments. At 50 mc., the preamp has a measured 6 db noise figure, which represents a maximum sensitivity (the smallest signal it can receive) of about 1.5 μv. Inserted between the antenna and receiver input, it can boost signal level by at least 12 to 15 db.

Other advantages of the preamp are that it is compact and self-powered—at a battery drain of 4 ma., the battery should last for nearly its shelf life. Although the unit was designed for 50-ohm input and output, it will work well at impedances up to 300 ohms without much deterioration in performance. Lastly, the total cost is only about $7.00.

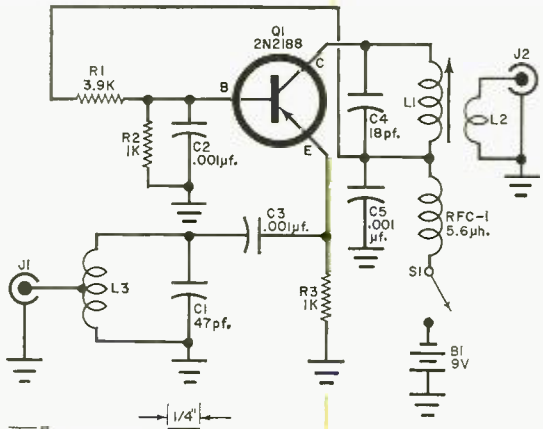
The 6-meter preamp is housed in a small 1⅝" x 2⅛" x 2¾" Minibox, and straight-line, minimum length leads are employed. Carefully follow the layout as shown in the photos. Drill holes in the box for mounting r.f. connectors *J1* and *J2* (use the type you presently employ for convenience), the on-off switch *S1*, the transistor socket, and the output coil form (*L1* and *L2*).

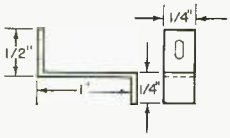
The Coils. Wind input coil *L3* with #14 wire; consisting of five turns with an i.d. of ⅜", it should have an approximate length of ½". Support it by soldering the center turn directly to the center conductor of the input r.f. connector. The grounded end is connected to a lug held to the chassis with a screw and bolt. The same lug also serves as a ground for the 47-pf. capacitor (*C1*) and resistors *R2* and *R3*.

The output coil is wound with the three-turn secondary (*L2*) at the cold



DIMENSIONS SHOWN FOR CU-3000A MINIBOX



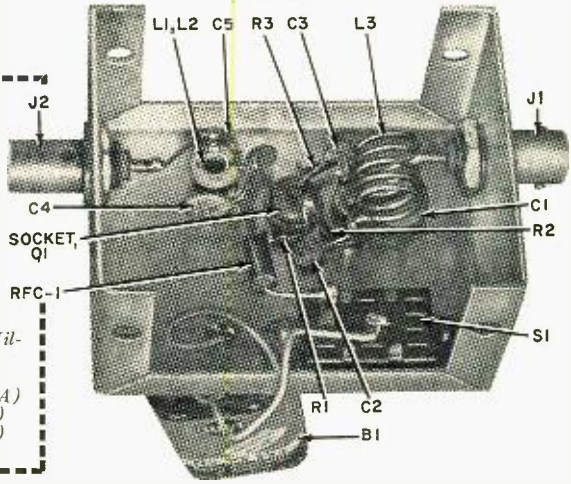


BATTERY RETAINER

Follow "straight-line" layout shown here. Leads must be kept short for good results. The positive battery terminal is grounded.

PARTS LIST

B1—9-volt transistor battery
C1—47-pf. ceramic disc capacitor
C2, C3, C5—0.001-μf. ceramic disc capacitor
C4—18-pf. ceramic disc capacitor
J1, J2—R.f. connector
L1, L2—8 turns and 3 turns, respectively, of #24 wire wound on Cambridge Thermionic slug-tuned coil form PLST/2C4L/P
L3—5 turns of #14 wire, i.d. ⅜", length ½"
Q1—2N2188 transistor (Texas Instruments)
R1—3900-ohm, ½-watt resistor
R2, R3—1000-ohm, ½-watt resistor
RFC-1—5.6-μh. miniature r.f. choke (J. W. Miller 9330-18 or similar)
S1—S.p.s.t. slide switch
1—1⅝" x 2⅛" x 2¾" Minibox (Bud CU-3000A)
1—Transistor socket (Elco 3304 or equivalent)
1—Battery clip (Cinch-Jones 5D or equivalent)



end of the primary (the end of the coil form closest to the box top). The primary (*L1*) has eight turns. Wind the coils in the same direction, connecting the top leads to *Q1*'s collector and to *J2*, respectively. Both are wound on the slug-tuned, .2"-o.d. (coil winding area) coil form given in the Parts List. As specified, this form comes with terminals and slug designed for VHF applications. It is available from suppliers in large cities, or from most parts suppliers on special order. Another source is Newark Electronics Corp., 223 West Madison St., Chicago 6, Ill.

Tuning the Preamp. To peak the preamp, simply insert the transistor in the socket—after checking first to make sure battery polarity is correct—and tune the output coil for maximum noise or signal level in the middle of the band. If necessary, the input coil can also be peaked by squeezing the turns together or gently pulling them apart. Since the bandwidth of the preamp is about 2.5 mc., adjustment is not critical. For best results, you may want to peak the unit in the middle of the portion of the 6-meter amateur band most used in your own area. -30-

This one-evening project lights up, sounds off, and is really de-LIGHT-ful

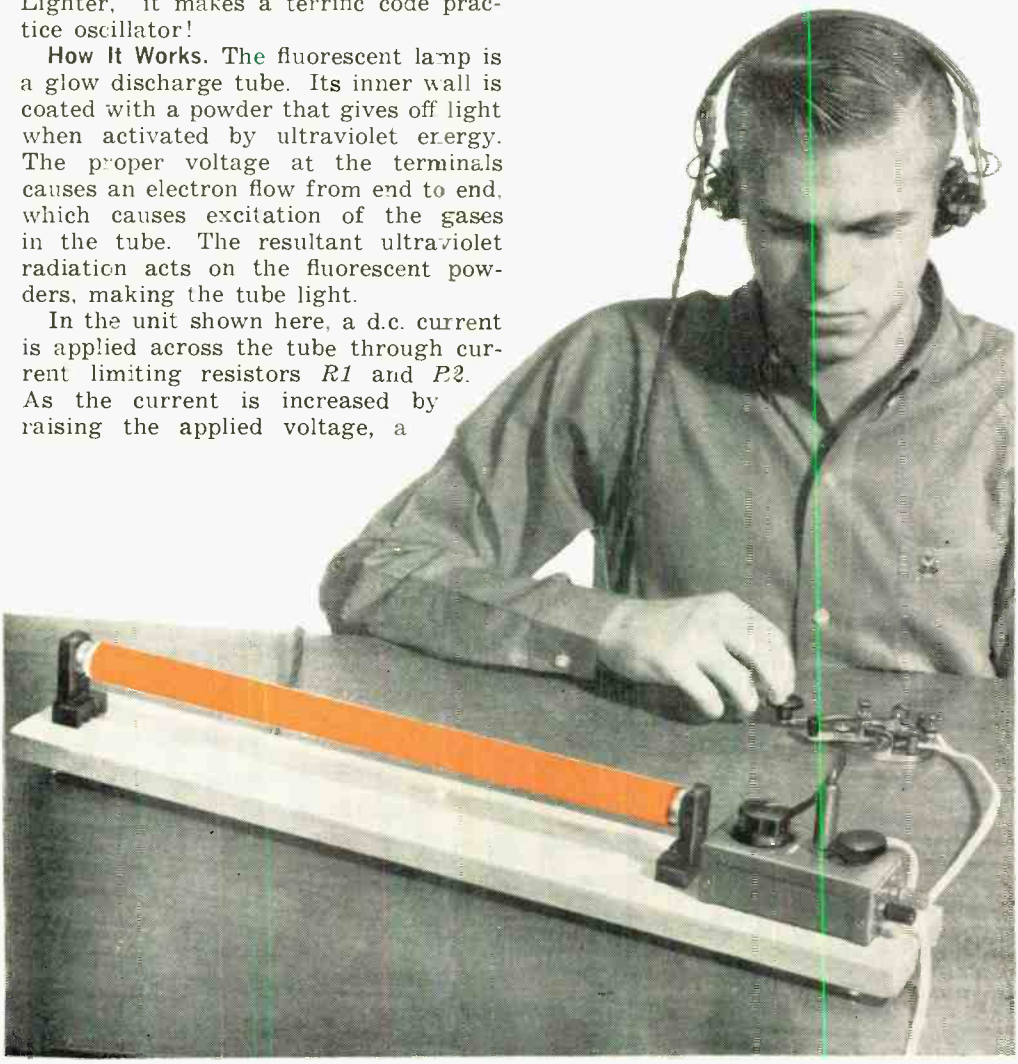
Build the LAMP LIGHTER CPO

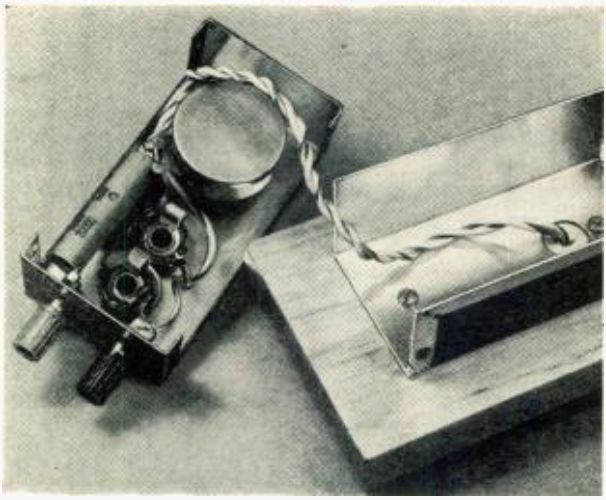
By **ROY E. PAFENBERG,** W4WKM

THE neon lamp relaxation oscillator was a pip of a project for many experimenters, and this big-brother version is even better. It lights up, makes noise, uses inexpensive materials that are easily obtainable, and the simple circuit can be wired in one evening. If you *must* have a practical reason to build the "Lamp Lighter," it makes a terrific code practice oscillator!

How It Works. The fluorescent lamp is a glow discharge tube. Its inner wall is coated with a powder that gives off light when activated by ultraviolet energy. The proper voltage at the terminals causes an electron flow from end to end, which causes excitation of the gases in the tube. The resultant ultraviolet radiation acts on the fluorescent powders, making the tube light.

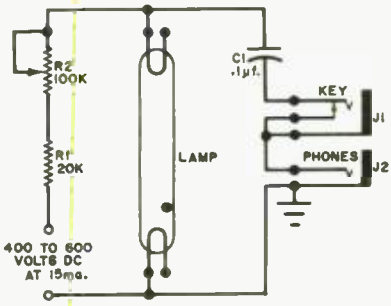
In the unit shown here, a d.c. current is applied across the tube through current limiting resistors *R1* and *P2*. As the current is increased by raising the applied voltage, a





Keep all wiring as short and direct as possible, with all connections well insulated from the metal chassis and from each other. Wires to lamp sockets go under board.

Only one terminal at each end of fluorescent lamp is used, as lamp's heaters are not employed in this unit.



PARTS LIST

C1—0.1-μf., 600-volt paper capacitor
J1—Closed-circuit phone jack (key)
J2—Open-circuit phone jack (phones)
R1—20,000-ohm, 5-watt wire-wound resistor
R2—100,000-ohm, 5-watt wire-wound potentiometer (Centralab WW-104 or equivalent)
1—Fluorescent lamp (GE T-8 recommended)
2—Fluorescent lamp "tombstone" connectors
1—1½" x 2¼" x 4¼" aluminum Minibox
2—Insulated binding posts
1—1" x 4" x 24" white pine wood base
Misc.—Hardware, staples, insulators, wire, solder, knob, etc.

self-maintaining glow discharge occurs. As the voltage is increased further, a point is reached where the current decreases, and beyond this point, the conduction again alters, and increased voltage produces increased current. It is in the negative resistance region—the point where an *increase* in voltage produces a *decrease* in current—that oscillation takes place. This region is broad, and oscillation can be heard over the entire range of *R2*. The output is connected through headphones and a key with d.c. blocking capacitor *C1*.

The "Lamp Lighter" can be powered by any supply furnishing 400-600 volts d.c. at between 10 and 15 ma.—any bench or junk TV supply will do. Keep in mind that many lower-voltage supplies will deliver in excess of 400 volts at this low current.

Building the Lamp Lighter. The over-all size of the unit is determined by the lamp selected. Various brands of lamps ranging from 8 to 40 watts, in lengths of from 12" to 48", were tested. While every lamp oscillated, the GE 15-watt T-8, which is one-inch in diameter and 18" long, was found to be the most practical.

The base is made of 24 inches of 1" x 4" white pine. The "tombstone" sockets for the lamp are mounted so that the lamp will be close to one end of the board. Clearance holes are drilled under the sockets to pass the wires beneath the board, and furniture glides keep the board and wires away from the surface on which the unit is used. The underside of the Minibox is mounted to the board with wood screws, and a clearance hole is drilled through the wood base and aluminum cover for the lamp wires.

Binding posts are used to connect the CPO to the power supply, and are mounted with insulating washers to prevent shorting to the metal case. Note also that the key jack is mounted on insulated shoulder washers. As the lamp heaters are not used, connection to only one terminal need be made at each socket. The wires beneath the board can be secured with insulated staples.

Be careful in handling the unit, for high voltages are present. It was designed as a demonstration of the unusual characteristics of glow discharge tubes, rather than strictly as a code practice oscillator, but it will perform this function and also serve as a wonderful conversation piece. -30-

X-LINE NITE LIGHT

Prepackaged components are easily assembled into an automatic low-wattage night lighter for your home

By L. F. HUDSON

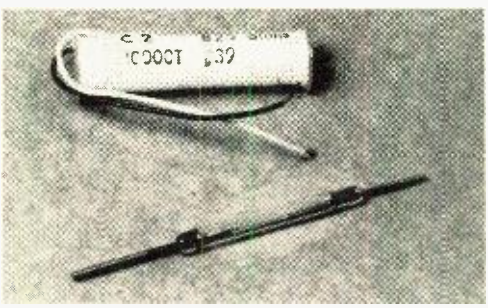
WHILE you're away on vacation, the "X-Line Nite Light" will automatically turn a lamp on when night falls, and turn it off again at dawn. Or if you just like to see a light burning in the window when you return home after dark, the Nite Light will take care of it for you. Built around the GE "Experimenter Line" X-7 magnetic reed switch and X-6 photoconductive cell, it's both compact and inexpensive.

How It Works. Resistor *R3* and coil *L1* are wired in series, and are in parallel with photocell *PC1*. As night falls, the light striking the sensitive surface of *PC1* decreases, increasing the resistance of the cell and thereby reducing its shunting effect on *L1*, causing more current to flow through it. When the light level is sufficiently low, the field generated by *L1* becomes strong enough to cause switch *S1* to close as the magnetic switch is mounted in the coil. When the switch operates, it closes the 117-volt circuit to the socket, turning on a small lamp that's plugged in.*

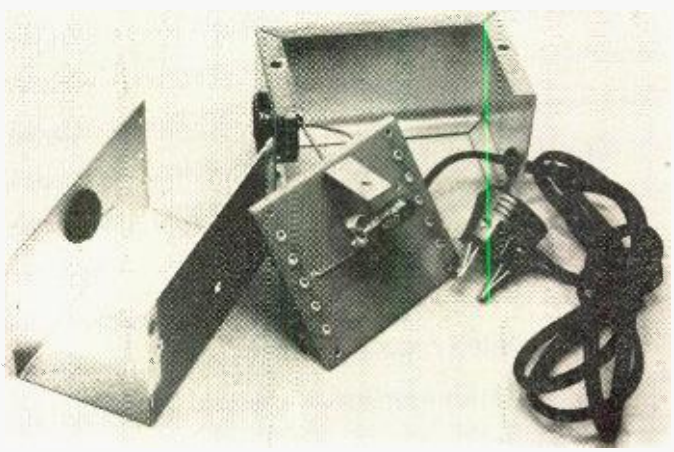
Conversely, an increase in ambient light will decrease the current drawn through coil *L1*, deactivate the switch, and cause the circuit to open.

The power circuit is a simple half-wave rectifier that provides d.c. voltage to the electromagnetic coil. The nominal value of capacitor *C1* is 4 μf., although a greater value can be used if convenient. Less capacity might cause chattering of the switch.

Assembling the Nite Light. Wiring is not at all critical, and the author assembled all components on a terminal board, except for *PC1*. The photocell is mounted



Magnetic reed switch (above) slips into center of the coil which applies electromagnetic force to operate the switch.



Unit is shown open at right, with back of terminal board. Angle bracket supports board, resistor R2 mounts on reverse.

**The GE X-7 reed switch is a 15-watt unit. A 50-watter is being added to the line, and may be available when you read this article.*

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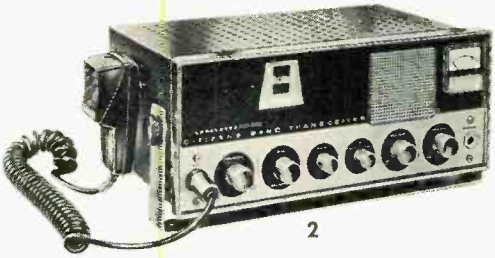

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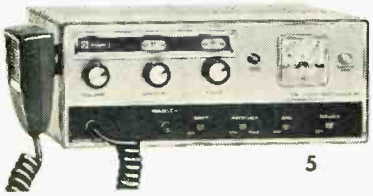

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1 Regency's "Range Gain" is one of the two CB transceivers with DSB. **2** A sure winner for Lafayette is the new "HB-222." **3** Just announced by Mark Products is a 23-channel AM transceiver called the "Cobra." **4** In the medium price range is the new Hallicrafters "CB-9." **5** The new Knight-Kit "C-560" (Allied) will feature a preassembled front end. **6** New from Regency is a straight AM transceiver called the "Romper." **7** Top item in the new Allied Radio line is the "KN-2565." **8** Selling under $100 is the 6-channel Hallicrafters "CB-7." **9** Johnson's "Messenger III" can be purchased as a complete portable field pack; included are accessory cables for 12-volt car operation, 4-foot antenna, battery metering, and rechargeable nickel-cadmium batteries. **10** Looking roughly the same as last year's model, but very definitely updated, is the new "Mark Nine" from RCA.

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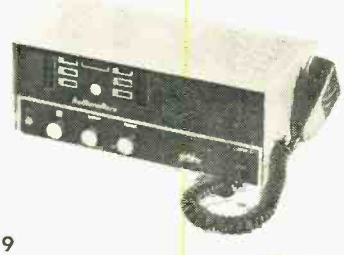

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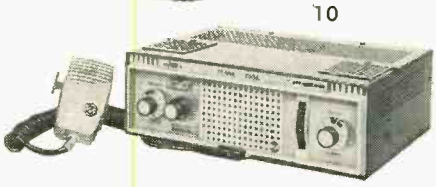

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their interests by writing directly to the manufacturers. Addresses and a breakdown of products being manufactured appear at intervals throughout the text.

1963-64: What Happened? In preparing the 1963 Buyer's Guide, we broke our necks to announce the new *B&K/Mark* "Sidewinder" transceiver—the first CB unit featuring single-sideband reception and transmission. While the more technically minded CB'er does not argue about the merits of SSB (it would increase range and effectively double the number of useful channels if everyone used it), there is no denying the fact that numerous technical problems have not been unraveled as quickly as had been anticipated. *B&K/Mark* has taken a giant step in getting this first SSB transceiver on the market—although this company is apparently alone in its strong belief in the future of SSB.

Of course, the other manufacturers are not turning their backs on SSB—in fact, *Utica* has put SSB receiving facilities in its "Town & Country III"—but are watching it closely, waiting to see if it will catch the public's fancy.

Enhanced speech power through reducing the CB carrier strength (total r.f. power input is always limited to 5 watts) and packing more punch into the all-important intelligence-carrying sidebands has faired better than SSB. This form of modulation enhancement goes under a variety of nicknames and titles, but technically—for purposes of consistency—we refer to it as "double sideband with reduced carrier" (DSB) in our transceiver table.

The first manufacturer *(Regency)* to introduce this form of modulation is selling every transceiver that can be produced. This company is also "branding" similar transceivers with more or less the same features as its own "Range Gain" through *Olson Electronics, Inc.* Oddly enough, DSB seems to be used only in transceivers featuring 23-channel operation, thus leaving open the question of whether the buyer wants DSB first and 23-channel operation second, or vice versa. Possibly in 1964-65 we will see a limited number of crystal-controlled channels (say 6 or 8) in a transceiver employing DSB modulation.

Transistors have been slowly gaining a foothold in the bigger (5-watt input) transceivers. POPULAR ELECTRONICS thinks that the principal inroads are made through mothers and housewives who like the smaller size of the completely transistorized CB units. The average transistorized transceiver measures only 2" x 6" x 8", and fits comfortably in any size automobile. Most transistorized equipment is designed for operation directly from the 12-volt car battery; 117-volt a.c. power supplies are generally optional extras.

During the past year *Osborne* (a pioneer in transistorized equipment) was bought by *Polytronics*, and a whole new line is now being produced. The *E.F. Johnson* "Messenger III" received an enthusiastic welcome and has been selling like hot cakes. Another pioneer, *Hallicrafters*, is miniaturizing a new model (tentatively called the "CB-11" and not shown in our transceiver table) which will be just barely smaller than the "Messenger III" and "Osborne 320." A newcomer in this miniaturized field is *Pace*, with its new Model "5000."

The Selectivity Situation. How to improve selectivity and reject adjacent channel interference are problems now uppermost in the minds of metropolitan CB'ers. Channel density (the number of stations per channel per square mile) is increasing and the chance of another CB'er moving into your city block is getting that much greater. Even if the "new" CB'er operates on a channel 60 or 80 kc. away, you are likely to find his signal breaking through your squelch unless your transceiver has the best possible selectivity characteristics.

The need for better selectivity brought on the demise of the superregenerative CB receiver with its inherently broadband characteristics.* In its place, superheterodyne receivers reign supreme.

Insofar as selectivity is concerned, there are a few basic "truths" about superhets that the CB'er should consider:

(1) When properly designed, two stages of intermediate frequency (i.f.) amplification are much better than one, and three stages are slightly better than two.

(2) The lower the intermediate frequency (i.f.), the greater the selectivity. If the number of i.f. stages are equal, two stages with an i.f. at 455 kc. should give more adjacent channel selectivity than two stages at 1650 kc.

(3) An r.f. stage (signal amplification before first detection) does not necessarily improve selectivity, but does help discriminate against interference from other services which operate outside of the Citizens Band.

As the need for more and more selectivity became obvious to CB equipment manufacturers, many companies began offering transceivers of the "dual" or "double" conversion superhet variety. This type of unit requires additional circuitry, and as a general rule you will find double-conversion

**As this Buyer's Guide was being prepared, we could find no transceivers with superregenerative receivers, although two such units were still being sold only two years ago.*

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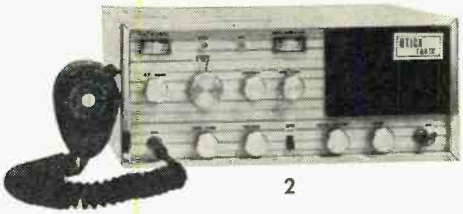

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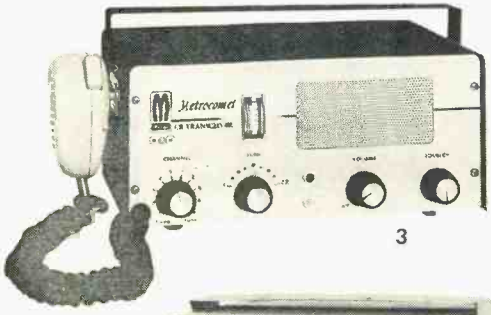

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1 Newcomer to the CB field is Midland's Model "13-160" selling at $109.95. **2** Brand-new from Utica is the "T&C III" featuring SSB reception as well as regular AM. **3** A "Metro-Comet" from Metrotek is favored by many CB'ers. **4** The Tram "TR-70C" features 23-channel operation and a tunable receiver. **5** Many CB'ers ask if the Mark Products single-sideband transceiver, the "Sidewinder," is a vision of the future; if everyone went to SSB, the number of channels would go from 23 to 46 overnight. **6** Selectivity in this Heath "MW-33" is the product of a special crystal filter—one of the very few used in CB equipment. **7** Another attack on the problem of selectivity is offered in the Polytronics "Pro"—easily the most selective unit on the market. **8** The Pearce-Simpson "Escort" (corrosion-proof) is a great performer in humid or salt-spray climates. **9** Top member of the Sonar line is the new "FS-23" featuring an outboard VOX control system as an optional extra.

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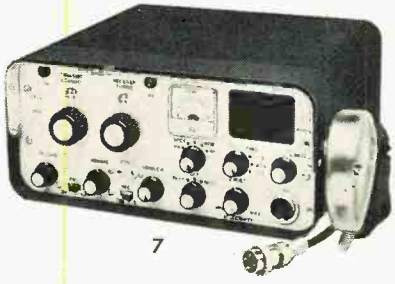

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superhets $25 to $50 more expensive than a comparable transceiver with a single-conversion receiver.

The double-conversion superhet changes the incoming signal first to one intermediate frequency, than to a second, lower one. In so doing, it is able to very effectively discriminate against adjacent channel and other types of interference. It is not uncommon to find the second i.f. amplifying the signal at about 260 kc. See point (2) on page 61.

There are several tricks possible in the design of simple superhets to vastly improve selectivity. One transceiver (the *Heathkit* "MW-33") uses a crystal lattice filtering network and achieves a remarkable degree of adjacent channel rejection. The Q-multiplier is another circuit which improves selectivity, but is used only in the *Hammarlund* "HQ-105 TRS" and the *Polytronics* "Pro"—which is really gilding the lily since the "Pro" is a double-conversion superhet to begin with!

Microphones & Speech Accessories

PRACTICALLY every 5-watt input CB transceiver is sold with a microphone. To some extent this is as it should be because a few transceivers can only be operated with specific types of microphones (*Raytheon, Webster,* etc., transceivers can only be used with carbon mikes, for example). Other manufacturers eliminate a microphone socket and connector (*Allied Radio* "C-22," *E. F. Johnson* "Messenger III," *Pearce-Simpson* "Companion," etc.) to keep costs down and to insure that an improper microphone is not accidentally connected to the transceiver. Of course, in the latter case, a mike can be changed by altering the internal wiring, but this is not recommended practice.

The large majority of CB transceiver manufacturers, however, do use a microphone socket and connector, permitting microphone substitutions. Such substitutions should be made with care—replace a ceramic cartridge mike with another ceramic, not with a dynamic or carbon type—and for valid reasons. For example, in mobile use you may find the push-to-talk lever on one manufacturer's mike easier to handle than on another manufacturer's mike. If the ceramic elements and output ratings (expressed in db) are reasonably similar, there is no reason why a substitution should not be attempted. Mobile microphones are also subject to hard use, and when your base station reports a deterioration in speech quality and modulation level, the mike should be one of the first things to inspect for possible damage.

The frequency response of microphones for mobile use should be limited to the speech frequencies—200 to 4000 cycles. Full range response is unnecessary and if the audio frequency response is too great, your voice may be blotted out by extraneous road and mobile noises. Several manufacturers (particularly *Electro-Voice* and *Shure*) offer mobile mikes with built-in noise-cancellation, meaning that noise which approaches the mike from the back or sides is greatly reduced or cancelled out.

Microphones are generally not sold with a connector—remember this when buying a replacement. Some minor soldering is called for, but all manufacturers of mikes will include a wiring diagram to enable the user to distinguish the color-coded wires.

Lastly, if your wife has a color preference, investigate the blues, greys, beiges, and black plastic housings of the various mobile mikes. Or, a very popular feature is the magnetic catch introduced in the *Sonotone* line which enables the mike to hang almost anywhere on the metallic dash panel of your auto.

MOBILE MICROPHONE MANUFACTURERS

American Microphone Co., Buchanan, Mich.
Electro Voice, Buchanan, Mich.
Euphonics Acoustics, Inc., Guaynabo, Puerto Rico
LTV University, Oklahoma City, Okla.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Sonotone Corp., Elmsford, N. Y.
Turner Microphone Co., 909 17th St., N.E., Cedar Rapids, Iowa

Base station microphones can, of course, be the same style and type as mobile mikes, but many CB'ers prefer something better. Because of the lower household noise level, the frequency response can be considerably greater without signal deterioration. Also, the sensitivity may be greater since the user doesn't need to clasp the mike close to his lips to put out an intelligible signal—he can be more relaxed and speak at the mike from 8" to 12" away.

A current fancy in base station mikes is to have one on a stand with the push-to-talk switch built into the upright portion of the stand (*Electro-Voice* and *Shure*) or as part of the mike base plate (*Turner*).

Base station microphones should have a mechanism to tie down the push-to-talk switch in order to leave the carrier on the

(*Continued on page 72*)

Specifications: 1964-65 CB Transceivers

Manufacturer	Model	Type of Signal	Final Input (watts)	No. of Transmit Channels	No. of Xtal Receive Channels	Tunable Receiver	Power Supply (volts)	Receiver Circuit	Meters	Accessory Notes	Price
General Radiotelephone Co. 3501 W. Burbank Blvd., Burbank, Calif.	MC-6	AM	5	7+	4	yes	117 and 12 and 6	superhet	S and output	1,2,8,15, 20	$199.95
	VS-4	AM	5	5	5	no	117 and 12 or 117 and 6	superhet	—	1,2,15,20	$149.95
Hallicrafters 5th and Kostner, Chicago 24, Ill.	CB-3A	AM	5	8	8	no	117 and 12 or 117 and 6	double superhet	—	1,2,10,23	$159.95
	CB-5 Mark II	AM	5	6	6	no	12	double superhet	—	1,2,3,10,24	$179.95
	CB-7	AM	5	6	6	no	117 and 12	superhet	—	1,2,10,23	$ 99.95
	CB-8	AM	1	2	2	no	batteries self-contained	double superhet	—	1,2,3,6	$ 99.50
	CB-9	AM	5	6	6	yes	117 and 12	superhet	S	1,2,7,10	$129.95
Hallmark Instruments 2620 Freewood Dallas, Texas 75220	512	AM	5	12	12	no	117 and 12	superhet	S	1,2	$149.50
	1250	AM	5	12	12	no	117 and 12	superhet	S	1,2	$169.50
Hammarlund Mfg. Co. 53 West 23rd St. New York 10, N.Y.	CB-Six	AM	5	6	6	no	117 and 12	double superhet	—	1,2,10,12	$179.50
	HQ-105 TRS	AM	5	1+	—	yes	117	superhet	S	1,2,8,12, 21,30,31	$224.50
Heath Company Benton Harbor, Mich.	GW-11	AM	5	3	1	yes	117 or 12 or 6	superhet	S	1,2	$ 69.95 (kit)
	GW-12	AM	5	1	1	no	117 or 12 or 6	superhet	—	1,2,22	$ 39.95 (a.c. kit) $ 44.95 (d.c. kit)
	GW-22	AM	5	5	5	no	117 or 12 or 6	superhet	—	1,2,22	$ 59.95 (a.c. kit) $ 64.95 (d.c. kit)
	GW-32	AM	5	5	5	no	117 or 12 or 6	superhet	—	1,2,22	$ 84.95 (a.c. kit) $ 89.95 (d.c. kit)
	GW-42	AM	5	5	5	yes	117 and 12 and 6	superhet	S and output	1,2,5	$119.95 (kit)
	GW-52	AM	1	1	1	no	battery self-contained	superhet	battery	1,2,3,6	$ 74.95 (kit)

	MW-33	AM	5	5	5	yes	117and 12and6	superhet	S and output	1,2,4	$ 89.95 (kit)
Inter-Mark Corp. 29 West 36th St. New York 18, N.Y.	Cipher 1000	AM	1	2	2	no	battery self-contained	superhet	—	1,2,3,6	$109.95
International Crystal Mfg. Co., Inc. 18 North Lee, Oklahoma City, Okla.	Executive 750-H	AM	5	23	23	yes	117 and 12 and 6	double superhet	S	1,2,11,13, 23	$299.50
E. F. Johnson Co. Waseca, Minn.	Mess-enger	AM	5	5	5	no	117 and 12 or 117 and 6	superhet	—	1,2,10,13	$114.95
	Mess-enger Two	AM	5	10	10	yes	117 and 12 or 117 and 6	superhet	—	1,2,10,13	$169.95
	Mess-enger III	AM	5	11	11	no	12	double superhet	—	1,2,3,10, 13,24	$189.95
	Personal Mess-enger	AM	1.5	1	1	no	batteries self-contained	superhet	—	1,2,3,6	$129.50
Kaar Engineering Corp. 2989 Middlefield Road Palo Alto, Calif.	D333	AM	5	8	8	no	117 and 12 or 117 and 6	superhet	S	1,2,7,10	$194.50
	D333B	AM	5	8+	8	yes	117 and 12 or 117 and 6	superhet	S	1,2,7,8,10	$229.50
	TR327A	AM	5	4	4	no	117 or 12 or 6	superhet	S	1,2,9	$199.00
Lafayette Radio 111 Jericho Turnpike Syosset, L.I., N.Y.	HA-150	AM	1	2	2	no	battery self-contained	superhet	modulation and battery	1,2,3,6	$ 79.95
	HB-111	AM	5	8	8	yes	117 and 12	double superhet	S and output	1,2,7,10,19	$129.50
	HB-115A	AM	5	8	—	yes	117 or 12 or 6	superhet	—	1,2,22	$ 64.50 (a.c. only)
	HB-222	AM	5	23	23	yes	117 and 12	double superhet	S and output	1,2,10,11, 12	$169.50
	HB-333	AM	5	23	23	yes	117 and 12	double superhet	S and output	1,2,10,11, 12,13	$209.50

Specifications: 1964-65 CB Transceivers

Manufacturer	Model	Type of Signal	Final Input (watts)	No. of Transmit Channels	No. of Xtal Receive Channels	Tunable Receiver	Power Supply (volts)	Receiver Circuit	Meters	Accessory Notes	Price
Lafayette Radio 111 Jericho Turnpike Syosset, L.I., N.Y.	HE-20C	AM	5	8	8	yes	117 and 12 or 117 and 6	superhet	S and output	1,2,10	$109.50
	HE-75	AM	1	1	1	no	battery self-contained	superhet	—	1,2,3,17	$ 66.50
Mark Products 1801 W. Belle Plaine Ave. Chicago 13, Ill.	Cobra	AM	5	23	23	yes	117 and 12	superhet	S and output	1,2,11,12, 15,19	$214.95
	Side-winder SSB-27	SSB	10 PEP	5	5	no	12	SSB with product detector	—	4,12,17,21, 24,25	$299.50
Maxwell Electronics Corp. 229 Garvon St. Garland, Texas	Radio-Com	AM	5	3	3	no	117 or 12 or 6	superhet	—	1,2,22	$159.50
Metrotek Electronics Inc. 205 W. Cabarrus St. Raleigh, N.C.	Metro-Comet	AM	5	5	5	yes	117 and 12	superhet	S	1,2	$129.95
	Metro-Star	AM	5	8	8	yes	117 and 12	double superhet	S and output	1,2,10,15	$169.95
	Space Station	AM	5	5	5	yes	117	superhet	S	1,2,10,13	$199.95
Midland International Corp. 1519 Atlantic St. N. Kansas City, Mo. 64116	13-133	AM	1	2	2	no	batteries self-contained	superhet	—	1,2,3,6	$ 99.95
	13-160	AM	5	8	8	yes	117 and 12	superhet	S and output	1,2,7,10	$109.95
Multi-Elmac Co. 21470 Coolidge, Oak Park, Mich. 48237	Citi-Fone SS	AM	5	23	23	yes	117 and 12	superhet	S and output	1,2,10,11, 12	$169.50
	CD-5A	AM	5	5	5	no	117 and 12 or 117 and 6	superhet	—	1,2,10	$139.50
	CD-7	AM	5	5+	5	yes	117 and 12 or 117 and 6	superhet	S and output	1,2,7,8	$189.50

Olson Electronics, Inc. **260 S. Forge St.** **Akron 8, Ohio**	Side-Bander	DSB	5	23	23	yes	117 and 12	double superhet	S and output (2)	1,2,11,12	$214.95
	Spotter 2	AM	5	12+	—	yes	117 and 12 and 6	double superhet	S and output	1,2,7,8,29	$119.95
	23	AM	5	23	8	yes	117 and 12	superhet	S and output	1,2,7,13,15	$139.95
Pace Communications Corp. **520 West 182nd St.** **Gardena, Calif.**	5000	AM	5	6	6	no	117 or 12 or 6	double superhet	—	1,2,3,14,17	$221.00
Pearce-Simpson, Inc. **2295 N.W. 14th St.** **Miami 35, Fla.**	Compan-ion	AM	5	5+	5	yes	117 and 12	superhet	—	1,2,8,17, 23	$189.50
	Escort	AM	5	8+	8	yes	117 and 12	superhet	S and output	1,2,7,8	$229.50
Polytronics Labs, Inc. **88 Clinton Road** **West Caldwell, N.J.**	Osborne 320	AM	5	4	4	no	117	double superhet	—	1,2,3,15,22	$249.50
	Poly-Comm 23	AM	5	23	23	yes	117 and 12	double superhet	S and output	1,2,4,5,11, 12,15	$379.95 (senior) $349.50 (senior less note 4) $329.45 (less note 5) $299.50 (less notes 4 and 5)
	Poly-Comm N	AM	5	8	8	no	117 and 12 or 117 and 6	double superhet	—	1,2,4,10,17	$229.45 (117 and 12 volts with note 4) $199.50 (without note 4)
	Poly-Comm N-4	AM	5	4	4	no	117 and 12 or 117 and 6	double superhet	—	1,2,4,10,17	$219.45 (with note 4) $189.50 (without note 4)
	Poly-Comm "Pro"	AM	5	23+	23	yes	117 and 12	double superhet	S and output	1,2,7,8, 10,11,12, 15,17,28, 30	$269.50
Radio Corporation of America **Harrison, N.J. 07029**	Mark Nine	AM	5	9	9	yes	117	superhet	S and output	1,2,7,22	$134.75

Specifications: 1964-65 CB Transceivers

Manufacturer	Model	Type of Signal	Final Input (watts)	No. of Transmit Channels	No. of Xtal Receive Channels	Tunable Receiver	Power Supply (volts)	Receiver Circuit	Meters	Accessory Notes	Price
Radio Shack Corp. 730 Commonwealth Ave. Boston 17, Mass.	TRC-X23	AM	5	23	23	yes	117 and 12	double superhet	S and output	1,2,11,12, 15,19	$169.95
	TRC-5	AM	5	5	1	yes	117	superhet	—	1,2,22,	$ 49.90
	TRC-27A	AM	5	3	3	no	117 and 12	superhet	—	1,2	$ 89.95
Regency Electronics Inc. 7900 Pendleton Pike Indianapolis, Ind. 46226	Range Gain	DSB	5	23	23	yes	117 and 12	double superhet	S and output	1,2,11,12	$269.95
	Romper	AM	5	8	8	yes	117 and 12	superhet	S and output	1,2,7,8,10	$179.95
Sonar Radio Corp. 73 Wortman Ave. Brooklyn 7, N.Y.	E	AM	5	8	8	yes	117 and 12 or 117 and 6	superhet	—	1,2,23	$179.50
	FS-23	AM	5	23	23	yes	117 and 12	double superhet	S and output	1,2,10,11, 12,27	$299.95
	G	AM	5	8	8	yes	117 and 12	double superhet	S and output	1,2,7	$229.50
Tecraft Sales Corp. P.O. Box 84 South Hackensack, N.J.	Mark V	AM	5	5	1	yes	117and12 and 6	double superhet	S and output	1,2,16	$189.95
Tram Electronics Inc. Box 187 Winnisquam, N. H.	TR-27E	AM	5	23	1	yes	117	double superhet	S and output	1,2,7,13	$328.00 (8-channel model available for $273.00)
	TR-70C	AM	5	23	1	yes	12 and 6	double superhet	S and output	1,2,7,13, 24,29	$288.00 (8-channel model available for $246.50)
Utica Communications Corp., 2917 W. Irving Park Rd. Chicago, Ill. 60618	MC-27	AM	5	6	6	no	117 and 12	double superhet	—	1,2,10	$142.50
	T&C II	AM	5	6+	6	yes	117 and 12	double superhet	S and output	1,2,8,10	$162.50
	T&C III	AM	5	23	23	yes	117 and 12	double superhet	S and output (2)	1,2,10,11, 12,15,18, 21	$259.95

Vocaline Company of America Old Saybrook, Conn.	ED-276 Commaire	AM	5	5+	5	yes	117 and 12	double superhet	S and output	1,2,3,8,12-14	$199.50
	ED-278 Commaire	AM	5	8	8	no	117 and 12	double superhet	—	1,2,12,19	$189.50
	PT-27	AM	1	4	4	yes	battery self-contained	double superhet	output	1,2,3,6,9,12	$199.50
Webster Mfg. 317 Roebling Rd., South San Francisco, Calif.	412	AM	5	5+	5+	no	117 and 12	double superhet	S and output	1,2,8,10,17	$174.50
	440	AM	5	10	10	yes	117 and 12	double superhet	S and output	1,2,28	$219.50
	WT-2	AM	2	2	2	no	batteries self-contained	superhet	battery voltage	1,2,3,6,13	$119.50
World Radio Laboratories 3415 W. Broadway Council Bluffs, Iowa 51504	DX'er	AM	5	12+	—	yes	117 and 12 and 6	double superhet	S and output	1,2,7,29	$119.95

Accessory Notes

1—Receiver has adjustable squelch circuitry with panel control
2—Receiver has noise limiting circuitry
3—Transceiver circuitry is completely transistorized
4—Receiver has crystal filter circuitry to provide improved selectivity and rejection of adjacent channel interference
5—Transceiver is sold with a built-in selective calling system
6—Transceiver has input jack or socket for use with external power supply
7—Receiver circuitry includes "spotting" switch to cue receiver to transmit crystal-controlled channel
8—Transmitter has crystal socket on panel to permit optional channel exclusive of internal crystal switching
9—Receiver includes bandswitch to permit reception of AM standard broadcast-band signals
10—Transceiver has rear skirt socket provision to connect a selective calling system without additional wiring changes
11—Transceiver uses special frequency synthesis to receive and transmit on all 23 channels
12—Receiver has vernier tuning (generally about plus or minus 3 kc.) in addition to frequency-synthesis circuitry
13—Transmitter modulator includes speech compression or special filtering for enhanced "talk power"
14—Transceiver is constructed in modules for easy servicing
15—Transmitter modulator has switching provisions to enable it to be used as a public address system
16—Receiver includes special noise eliminating circuitry referred to as "TNS"
17—Transmitter has metering jacks to permit tuning the transmitter final amplifier
18—Transceiver has master switch with key lock to prohibit illegal use of equipment
19—Transceiver is sold with a special noise-cancelling microphone
20—Receiver includes "local-distant" switching circuitry for better automatic volume control (a.v.c.) action
21—Receiver has beat frequency oscillator for carrier insertion to receive SSB signals
22—A.c. model supplied, but d.c. voltages from car batteries may be used with this transceiver via special cords or cables, and/or external power supply
23—S-meter is available from manufacturer as optional extra, requires no internal wiring for connection
24—D.c. model supplied, but a.c. power supply available as optional extra
25—Receiver has adjustable selectivity controlled from front panel
26—Transmitter metering also reads standing wave ratio
27—Transmitter has provisions for VOX (voice-operated transmissions), eliminating the necessity for on-off switching
28—Special frequency-synthesis circuit uses one crystal per channel for receiving and transmitting
29—Receiver circuit includes audio tone for "spotting" transmitter crystal frequencies
30—Additional i.f. selectivity through the use of a Q-multiplier circuit
31—Transceiver is built into short-wave communications receiver

1

2

3

4

1 A very popular kit offering quality performance in a small package is the EICO Model "777"; wired versions of this unit are also available. **2** Top of the Polytronics line is the "Poly-Comm 23"; shown in this photo is the model which is sold without the selective calling, listening and ringing features. **3** New from GC Electronics is the "President" with 8-plus transmitting channels and tri-purpose power supply arrangement. **4** Top of the line from Lafayette is the "HB-333," a straight AM transceiver, although special circuitry is used to add speech compression to the modulator.

Microphones and Speech Accessories

(*continued from page* 63)

air when you take your hands off the mike. This particular gadget is not as important for mobile use (it may even be a deficit) as it is around the base station.

BASE STATION MICROPHONE MANUFACTURERS

American Microphone Co., Buchanan, Mich.
Electro-Voice, Buchanan, Mich.
LTV University, Oklahoma City, Okla.
Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.
Sonotone Corp., Elmsford, N. Y.
Turner Microphone Co., 909 17th St., Cedar Rapids, Iowa

There are numerous arguments pro and con regarding the use of "outboard" speech compressors or limiters. The philosophy behind the design of such devices is to pack more speech power into the 3 watts output of the typical CB transceiver. It is a known electronic fact that the human voice can be compressed (even though some distortion is thereby introduced) and the average modulation level of the transceiver increased from 50% to 75-80%. At a distant point (15-25 miles), this can make a weak signal somewhat more readable, and to nearby stations a signal may actually sound "louder" than it really is.

Use of a speech compressor or limiter is not all gravy—for every advantage, there appears to be a compensating disadvantage. For one thing, there is an unfortunate tendency among CB'ers to put too much modulation on the carrier; this results in splattering and interference to stations operating on adjacent channels. Distortion is another problem, and the use of a compressor must be a compromise between the highest modulation level possible (100%) and keeping the signal intelligible.

No discussion of this topic would be complete without recognizing that most CB equipment manufacturers initially build into their equipment the capability of 100 per cent modulation. Adding compressed audio from an outboard source for greater intelligibility defeats the manufacturer's design—unless it is done wisely and with caution.

SPEECH COMPRESSOR MANUFACTURERS

Demco Electronics Co., Bristol, Ind.
Holstrom Associates, P. O. Box 8640, Sacramento, Calif. 95822
Instruments and Communications, Inc., 33 Danbury Rd., Wilton, Conn.
Smea Engineering, 123 East Washington, Tipton, Ind.
Stoner Electronics, Box 7388, Alta Loma, Calif.

Selective Calling Systems

ASK any CB'er what he feels is the principal disadvantage of Citizens Band operation and he'll probably tell you that it's "listening to the useless chatter on my channel." If his mobile is in operation away from the base station, he thinks he has to leave the volume control and squelch set so that every station on the channel can be heard. But is this really necessary? Not if he installs some form of a selective calling system.

Selective calling, or tone signaling, has been used by the commercial business radio services for some 25 years. Here's how it works. The transmitting station operator (either mobile or base) flicks a switch or lever to broadcast one, two, or three audio tone signals for 8-10 seconds. If the base or mobile station of the licensee is on the air, these tone signals activate relays and turn on the speaker—which has hitherto been silent, although the receiver has been in operation. In other words, business on the channel goes on as usual, but the receiver speaker remains off until triggered by the appropriate tone signal combination.

Even though it's remarkably simple, selective calling has not been fully exploited by CB'ers. Initially—even two or three years ago—calling system equipment was expensive and had to be wired into transceivers by a technician. Now, in 1964, a large number of manufacturers offer selective calling systems as optional extras with either mobile or base station transceivers. Most of these same manufacturers have provided outlets on the rear skirt of their transceivers to permit such a system to be plugged in without tearing apart the innards of the transceiver. In the table on pages 64-71 note particularly those units which have a "10" in the "Accessory Notes" column.

Don't forget, in looking for a selective calling system, that you need both the "encoder" (to transmit the tones) and the "decoder" (to receive the tones). Many manufacturers offer both items in the same package so that they may be used interchangeably, while other companies sell encoders and decoders separately.

Just in case you're wondering, most selective calling systems have a provision for altering the tone signals so that several different stations can use the same channel with the same manufacturer's system without interference or false "openings."

A few manufacturers are adding a new feature to selective calling—a system of "latching" or turning on a signal light indicating that the transceiver has been *called* during the operator's absence. Such systems have an obvious value and are available from *E. F. Johnson* ("Tone Alert"), *Polytronics* ("Poly-Call"), *Reach* ("Page Alarm"), and *Raytheon/Webster* ("Trans Pager"), etc.

SELECTIVE CALLING SYSTEM MANUFACTURERS

Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.
Cadre Industries Corp., 20 Valley St., Endicott, N. Y.
Hallicrafters Co., 5th & Kostner, Chicago 24, Ill.
Heath Company, Benton Harbor, Mich.
International Crystal Mfg. Co., Inc., 18 N. Lee, Oklahoma City, Okla.
E. F. Johnson Co., Waseca, Minn.
Lafayette Radio Electronics, 111 Jericho Turnpike, Syosset, L.I., N. Y.
Metrotek Electronics, Inc., 205 W. Cabarrus St., Raleigh, N. C.
Multi-Elmac Co., 21470 Coolidge, Oak Park, Mich. 48237
Polytronics, 80 Clinton Rd., West Caldwell, N. J.
Reach Electronics, Inc., Airport Park, P. O. Box 308, Lexington, Nebr.
Webster Manufacturing, 317 Roebling Rd., South San Francisco, Calif.

Test Equipment

SERVICING CB transceivers could have become a complex problem were it not for the ingenuity of several manufacturers. The FCC Rules governing CB'ers explicitly prohibit work on the transmitter—predicated on the possibility that operation off-frequency, over-modulation, or operation with excess power input may result. Since many CB'ers are not technically proficient, this is a valid assumption—whether most CB'ers like it or not.

To circumvent this problem, a new breed of test instruments has been developed. Generally speaking, a number of test functions have been wrapped up in one small package. Power output in actual watts can be checked; the activity of a suspected weak crystal can be checked; the VSWR of the transmission line to the antenna can be measured for possible defects, etc. Up to ten different functions can be tested on some of these units, which are available at surprisingly attractive prices.

TEST EQUIPMENT MANUFACTURERS

Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.
GC Electronics, Rockford, Ill.
Hallmark Instruments, 2620 Freewood Drive, Dallas, Texas 75220
Seco Electronics, Inc., 1201 S. Clover Drive, Minneapolis, Minn.

Antennas—Base and Mobile

THERE IS little doubt that we are seeing the gradual demise of the "ground-plane" antenna with its quarter-wave radiator and three or four quarter-wave radials. The anxiety of every CB'er to put as much signal on the air as possible has brought forth a variety of non-directional, vertically polarized antennas that have some signal gain above that of the older ground-plane. This gain may not be much, but at least it's something for nothing—and after all, just how far can 5 watts input expect to go?

Within the past year practically every antenna manufacturer concentrated on improving base station antennas. An 0.68-wavelength (19′ 8″ high) base station antenna called the "Pro-27" was brought out by *New-Tronics*; a "Uni-Linear" was announced by *Mosley*; the collinear gain antenna "Mark V" was improved by *B&K/Mark*; and *Hy-Gain* added new refinements to the popular "CLR-2." Still leading the parade of the most base station antennas up in the air was the *Antenna Specialist Co.* and its "Magnum 27." Any one of these antennas can add more punch to your CB signal, and if you want maximum range within the limits established by Part 95 of the FCC Rules, your best bet is a collinear.

Beam antennas consisting of a radiator and one or more directors, plus a reflector, are still offered by several manufacturers. Unfortunately, the combination of size and the necessity for vertical polarization has not made them very popular. Nevertheless, if you have the room and need the extra signal out beyond a nominal 20-mile range, a beam antenna is always worth serious investigation.

Probably the most novel approach to hit the base station antenna market in the past year was that incorporated in the *Hy-Gain* "Co-Phaser." Consisting of two independently mounted "CLR-2" antennas, the array's feedlines are connected to a phasing network that shifts the radiation pattern around to provide either cardioid or figure-8 coverage.

BASE STATION ANTENNA MANUFACTURERS

Antenna Specialist Co., 12435 Euclid Ave., Cleveland 6, Ohio
B&K/Mark, 1801 W. Belle Plaine Ave., Chicago 13, Ill.
Columbia Products Co., RFD 3, Columbia, S.C.
Cubex Company, 373 Parkman St., Altadena, Calif.
GC Electronics Co., 400 S. Wyman St., Rockford, Ill.
Francis Industries, Pataskala, Ohio
Hy-Gain Antenna Products, N.E. Highway 6 at Stevens Creek, Lincoln, Nebr. 68501
Mosley Electronics, Inc., 4610 N. Lindbergh Blvd., Bridgeton, Mo. 63044
New-Tronics Corp., 3455 Vega Ave., Cleveland, Ohio 44113
Telrex Laboratories, Asbury Park 80, N. J.
Utica Communications Corp., 2917 W. Irving Park Rd., Chicago 18, Ill.

Not only is the ground-plane antenna gradually disappearing from base stations, but more and more mobile CB'ers are discarding the quarter-wave whip. Shortened antennas serving a dual purpose for CB and AM broadcast reception are being cowl-mounted. These shortened antennas are

reasonably effective within 5-10 miles of a base station, and to perform efficiently they need only a signal splicer, such as the *B&K/Mark* "CBC-1," *GC Electronics*' "29-824," *Hy-Gain*'s "Duo-Topper," or the *Ozco* "1-10'er." A base-loaded, center-loaded, or even a top-loaded whip of from 35″ to 50″ in height can be cowl-mounted. Also gaining some acceptance are shortened antennas (less than 3′ high) mounted in the center of a sedan or station wagon metal roof.

The steel and fiberglass quarter-wave whip is still a good antenna for cars which have a very large steel body, but compact cars require an antenna that is more independent of the sheet metal ground-plane effects. Gaining increasing acceptance for mobile use are the "Heliwhip" (*B&K/Mark*); "The Criterion" (*Columbia*); "Buster" (*Master Mobile*); "Hustler" (*New-Tronics*); "Topper (*Hy-Gain*); and the "Q-top" (*Webster*).

MOBILE ANTENNA MANUFACTURERS

Antenna Specialist Co., 12435 Euclid Ave., Cleveland 6, Ohio
B&K/Mark, 1801 W. Belle Plaine Ave., Chicago 13, Ill.
Columbia Products Co., RFD #3, Columbia, S.C.
GC Electronics Co., 400 S. Wyman St., Rockford, Ill.
Hy-Gain Antenna Products, N.E. Highway 6 at Stevens Creek, Lincoln, Nebr. 68501
Master Mobile Mounts, 4125 W. Jefferson Blvd., Los Angeles, Calif. 90016
Mosley Electronics, Inc., 4610 N. Lindberg Blvd., Bridgeton, Mo. 63044
New-Tronics Corp., 3455 Vega Ave., Cleveland, Ohio 44113
Ozco Sales, Granite Ave. Extension, Canaan, Conn.
Utica Communications Corp., 2917 W. Irving Park Rd., Chicago 18, Ill.
Webster Mfg., 317 Roebling Rd., South San Francisco, Calif.

Ignition Noise Elimination

ALTHOUGH the average mobile CB transceiver is equipped with a good noise limiter, you can get ahead of the game by suppressing the ignition, regulator, or alternator interference in your vehicle. Several kits are now being sold that provide all of the components to shield, bypass, or otherwise eliminate or suppress such interference. Each kit has its own particular set of advantages and some are designed for use with specific cars or even medium-size power boats. Investigate them all by obtaining more information from a local dealer, or by writing directly to the manufacturer.

NOISE SUPPRESSION KIT MANUFACTURERS

E. F. Johnson Co., Waseca, Minn.
Sprague Products Co., North Adams, Mass.
Webster Mfg., 317 Roebling Rd., South San Francisco, Calif.

Unique Accessories

IN PREPARING this *CB Buyer's Guide,* the Editors encountered numerous gadgets and accessories that did not fit in any one of the classifications already covered. Some of these accessories are particularly novel and deserve editorial mention.

We were impressed by the "Quietron" (*RaeCo,* 1351 Deloss. Indianapolis, Ind.) which is a take-off on POPULAR ELECTRONICS' feature construction article on eliminating vibrator hash through the use of transistors (December, 1963, page 41). This eliminator works like a charm and generally puts 20-30 volts more into the transmitter than reed-type vibrators.

A tunable outboard filter to curb channel 2 TV interference is sold by *Gavin,* Depot Square and Division St., Somerville, N. J., and is an extraordinarily worthwhile investment—even though many transceiver manufacturers claim to have eliminated TVI. It is called the "CB-T" and is available at scores of radio parts stores.

Several interesting CB accessories are offered by *Business Radio, Inc.,* Box 368, Osseo, Minn., including the "S-Master" which is an outboard calibrated S-meter that is connected to the transceiver with only two wires, and the "Noistop"—a two-tube combination squelch and ignition noise eliminator. The "Noistop" is similar in circuitry to the famous "TNS" noise eliminator used by radio hams throughout the world.

If you think your receiver is lacking in sensitivity, you can easily try hopping it up with a nuvistor r.f. preamp sold by *World Radio Labs,* 3415 W. Broadway, Council Bluffs, Iowa 51504. Or, if you would like to try listening to CB on your car radio without worrying about transmitting facilities, try a Model 65C "Crowne Converter" (*Aquaspace Development, Inc.,* Box 586, Canoga Park, Calif.). The preamp is sold for $11.95 and the converter for $19.95—both via mail order only. -30-

Transistor Topics

By **LOU GARNER,** Semiconductor Editor

SEMICONDUCTOR devices have been employed in the photographic field for many years. First used in exposure (or light) meters, this is perhaps their best known application. Essentially a very simple instrument, the basic light meter consists of a photovoltaic (self-generating) cell connected directly to a suitably calibrated microammeter.

The next major step forward came with the invention of the transistor. Inserted between the photocell and the meter, transistor amplifiers not only increased over-all sensitivity but also permitted use of less costly and more rugged meter movements.

Later, modern semiconductor components and refined circuit design techniques led to the development of fully automatic cameras—units which combine the functions of a light meter and camera in a single instrument. In these cameras, the shutter speed and/or iris opening is set automatically by the lighting of the scene to be photographed.

Semiconductors have also been used in photographic lighting control, with photocells, light-activated switches, and transistors employed in a variety of remote "slave" flash units. These "slaves" serve to provide back, side, or supplemental lighting by firing a flash bulb or strobe when triggered by light from the main flash.

Until recently, semiconductor applications in photography were confined principally to light measurement and control. Within the past year, however, at least one firm has introduced an electronic *focusing meter.* Dubbed a "Focatron" by its manufacturer, LogEtronics, Inc. (500 East Monroe Ave., Alexandria, Va.), the new instrument permits, for the first time, a direct measurement of image sharpness. Previously, proper focusing was achieved primarily by visual observation. In contrast, using the Focatron is analogous to using a thermometer to measure, say, bath temperature as compared to dipping a finger or hand in the water and guessing at the degree of warmth.

The instrument's basic design is illustrated in Fig. 1. In its simplest form, the Focatron employs two photoconductive cells, *PC1* and *PC2*, two batteries, *B1* and *B2*, and a microammeter (*M1*) arranged in a modified bridge circuit. The photocells, usually cadmium sulphide types, are aligned in the image plane of the optical system.

In operation, the light reaching *PC1* first passes through a diffusion plate so that only a defocused image appears on its surface. The light path in front of *PC2*, on the other hand, is clear, permitting either

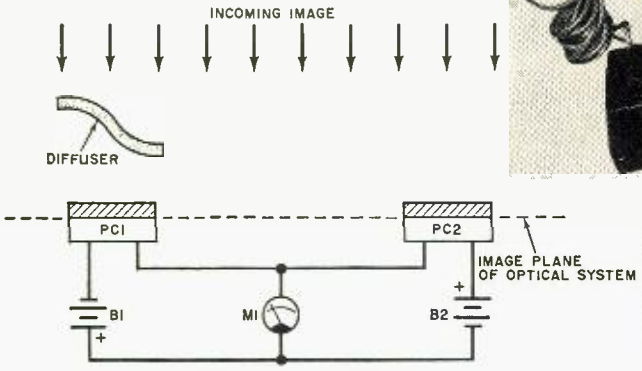


Fig. 1. The diagram shows the basic design of LogEtronics' "Focatron" electronic focusing meter for photographic use. Two models are available: a professional/industrial unit (at left, above), and a moderately priced semi-pro/advanced amateur unit (right).

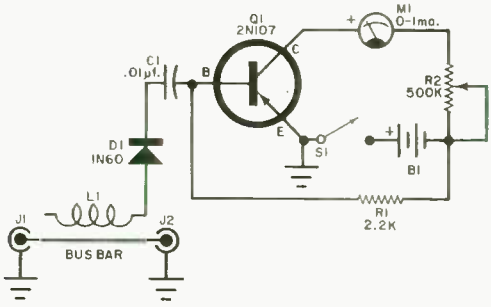


Fig. 2. The transmitter tune-up meter circuit submitted by reader William Halleron can be connected "in-line" between any low- or medium-power transmitter and antenna.

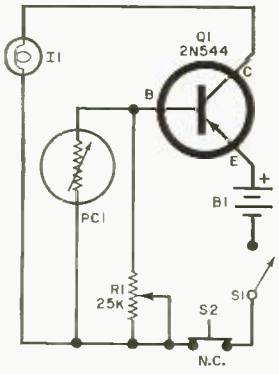


Fig. 3. Reader Bob Kuhnemund's magic "electronic" candle goes on only when "lit" with a match.

a defocused or sharp image to be received, depending on the adjustment of the optical system. At best focus, the brightness difference between light and dark areas will reach a maximum. Since the photocells have a nonlinear response characteristic, *PC2*'s resistance will be different from that of *PC1* as focus sharpens, causing an unbalance in the bridge and a resulting up-scale meter reading. The bridge unbalance—and hence the meter reading—reaches a maximum at sharpest focus.

Currently, the Focatron is available in two models—a moderately priced unit designed for amateur and semiprofessional use with enlargers, and a more expensive commercial/industrial model suitable for use with view, copy, process or microfilm cameras as well as enlargers (see photo). The latter version employs a separate (accessory) light probe, with the type determined by the intended application.

Readers' Circuits. Suitable for use by both hams and CB'ers, the *transmitter tune-up meter* shown schematically in Fig. 2 was submitted by William C. Halleron (2707 Cleveland Blvd., Louisville, Ky.). Reader Halleron is, in one sense, an "old hand," for this is his third contribution to "Transistor Topics." His previous most recent contribution, a general-purpose CPO, appeared in the January, 1964, column.

Referring to Fig. 2, a "sample" of the r.f. energy furnished to the transmitting antenna is picked up by coil *L1* and coupled through diode detector *D1* and isolating capacitor *C1* to a single-stage common-emitter amplifier, *Q1*. The transistor, in turn, drives the milliammeter (*M1*) which serves as its collector load. Transistor *Q1*'s base bias is supplied through resistor *R1*, while potentiometer *R2*, in series with *M1*, is used as a calibration control. Operating power is furnished by *B1*, controlled by s.p.s.t. switch *S1*.

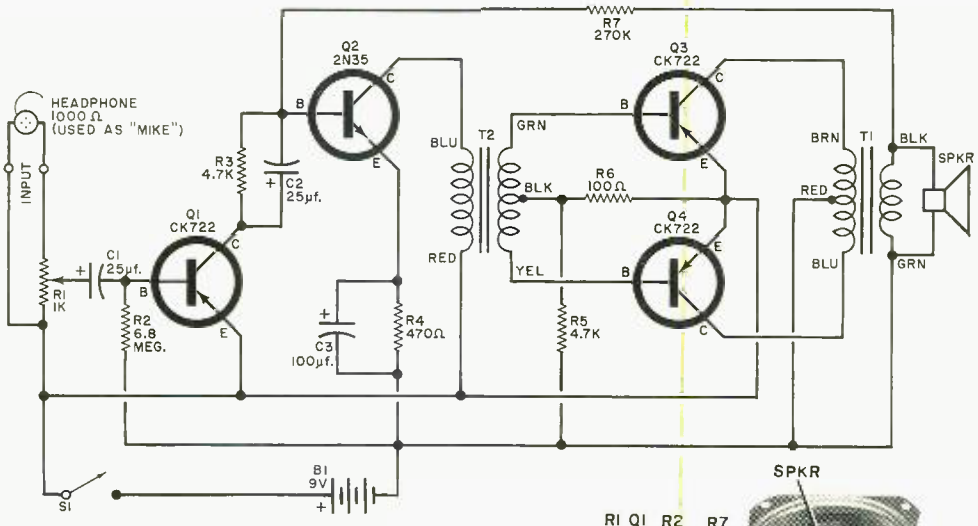
The components are all readily available. Diode *D1* is a 1N60, while *Q1* is a general-purpose *pnp* transistor—such as a 2N107. Resistor *R1* is a ½-watt unit and *R2* is a small 500,000-ohm potentiometer. Capacitor *C1* can be a ceramic or mica capacitor—its voltage rating is not critical. An 0-1 milliammeter (*M1*) is used as *Q1*'s load. Jacks *J1* and *J2* are r.f. coaxials chosen to match the transmitter's output connectors. The power switch, *S1*, can be a toggle, slide, or rotary type, as preferred, while the power supply, *B1*, is made up of two penlight cells connected in series to supply three volts.

Although layout is not overly critical, good wiring practice should be observed. William suggests that the circuit be assembled in a shielded case, such as a small Minibox. Jacks *J1* and *J2* should be mounted as close together as is practicable, with their "hot" center terminals connected by a short length of moderately heavy bus bar (such as #12 tinned wire). The pickup "coil," *L1*, consists of 10 turns of insulated hookup wire.

Intended for use with low- to medium-power transmitters, the tune-up meter is connected "in-line" between the transmitter and its antenna. Jack *J1* is connected to the transmitter's output jack with a short length of coaxial cable, while *J2* is connected to the antenna or dummy load—again, through a suitable cable. In practice, as few turns as necessary for a good tuning indication should be used for pickup coil *L1*.

Whether or not amateur magic is one of your hobbies, you should be interested in the circuit given in Fig. 3 if you enjoy fooling your friends. Robert Kuhnemund (Yarmouth Rd., White Plains, N. Y.), who submitted the circuit, has dubbed his design an "*electronic*" *candle*, for it is an electric lamp which (apparently) can be turned *on* only when "lit" with a match.

The circuit's basic operation is relatively simple. Transistor *Q1* is used as a direct-coupled amplifier to furnish power to a small lamp bulb, *I1*. The collector current



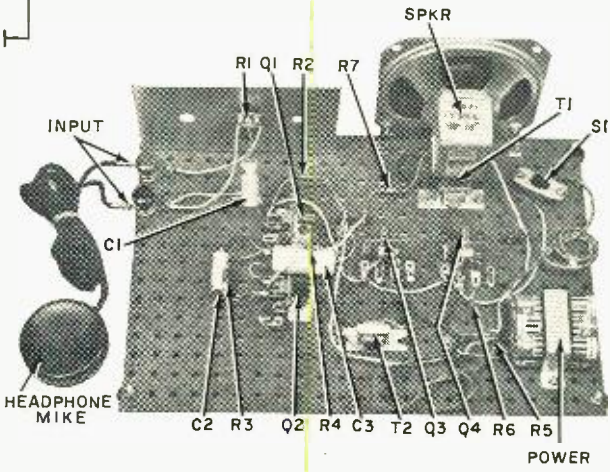


Fig. 4. A typical audio amplifier circuit for demonstration purposes. Breadboarded version appears at the right. See Transitips for details.

of *Q1* is determined by its base bias, furnished partially through sensitivity control *R1* and partially through a photoconductive cell, *PC1*. The photocell, in turn, is mounted in such a way that it is illuminated by light from the lamp bulb. Circuit power is supplied by *B1*, controlled by a pair of series-connected s.p.s.t. switches, *S1* and *S2*.

In operation, *Q1*'s steady collector current, established by *R1*'s setting, is not sufficient to light *I1*. When a lighted match (or other source of light) is brought near *PC1*, the cell's resistance decreases, increasing *Q1*'s base bias and causing a corresponding increase in collector current. Lamp *I1* lights and, afterwards, serves as a source of light for *PC1*. The lamp then stays "on" until circuit power is interrupted by opening one of the power switches.

Standard parts are used in the circuit. Transistor *Q1* is a 2N544 power unit, *PC1* an RCA 7163, and *I1* a GE 123 lamp bulb. The sensitivity control, *R1*, is a small 25,000-ohm potentiometer. Switch *S1* is an s.p.s.t. toggle, slide or rotary switch, while *S2* is a normally-closed, momentary-contact push-button switch. Power supply *B1* consists of two size "D" flashlight cells connected in series.

Since neither layout nor lead dress is critical, the "electronic" candle can be assembled in almost any type of case. For best "magical" effect, however, the photocell should be shielded from overhead light and, preferably, mounted right against one side of the lamp bulb. In addition, the push-button power switch (*S2*) should be concealed in some fashion, permitting the operator to "light" the lamp with a match and "blow" it out (secretly depressing *S2* at the same time).

Transitips. Many readers seem to be interested in circuits intended either for bench study or for group demonstrations—as in a science fair project. Although, theoretically, almost any standard circuit can be used for such applications, there are basic rules which should be followed in order to obtain best results.

First, the circuit chosen should be suitable for open breadboard assembly. Circuits requiring extensive shielding, special layouts or lead dress should be avoided.

Second, the circuit should be a typical rather than an "off-beat" design, especially when used for educational purposes. Steer

(*Continued on page* 92)

FAMILY MESSAGE CENTER

No more need for chalk boards or note pads when you've got this efficient little secretary working at home

By HOMER L. DAVIDSON

THERE'S NO LONGER ANY NEED to hastily scrawl a note on a scrap of paper and hope that the member of the family to whom it is addressed will see it! With this device, you actually "talk" the note into a repeating tape recorder, and switch a small light on to tell the others in the household that the note is waiting to be "read."

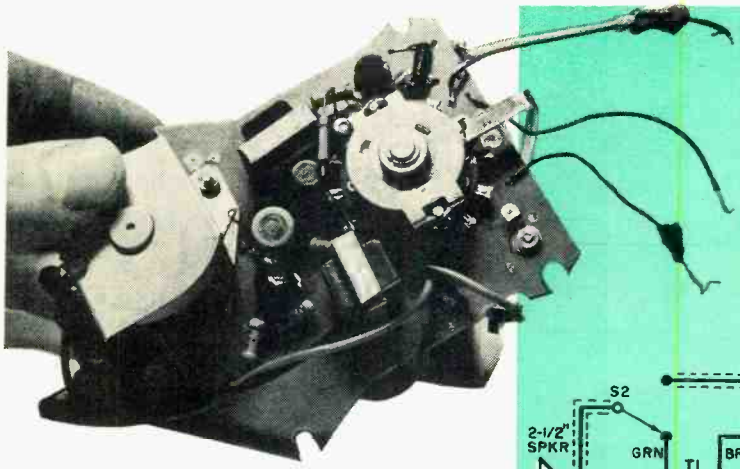
Design Notes. The unit is built around the "Min-Corder," an inexpensive ($8.99) little tape repeater available from Mission Liquidators, 735 Celis St., San Fernando, Calif. It uses an endless Mobius tape loop, coated with oxide on both sides, and the cartridge remains permanently in place. Adding additional tape would be a mistake as this would overload the motor. There is no rewind position on the machine, but as the total tape time is on the order of 20 seconds, this is not required.

A nine-volt battery operates the built-in transistor amplifier, and a 1½-volt flashlight battery powers the motor.

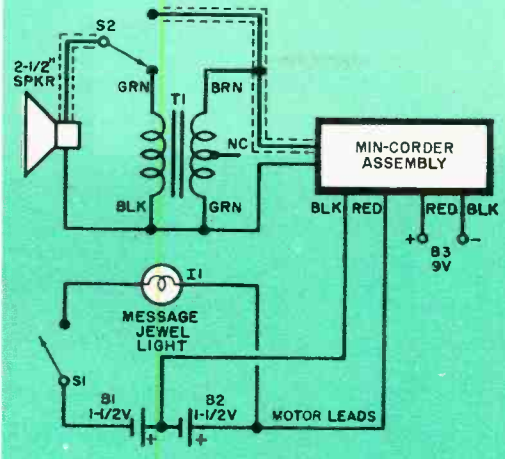
Erasure of the tape is accomplished by a small magnet that moves into the erase position whenever the lever is moved to record. Full erasure of the tape can be done in 20 seconds by holding the lever in the record position. If you are able to locate the tape splice, this will serve as an excellent reference point for start and finish.

Building The Unit. Construction is mostly a matter of installing the components in a usable metal container and effecting some small improvements.

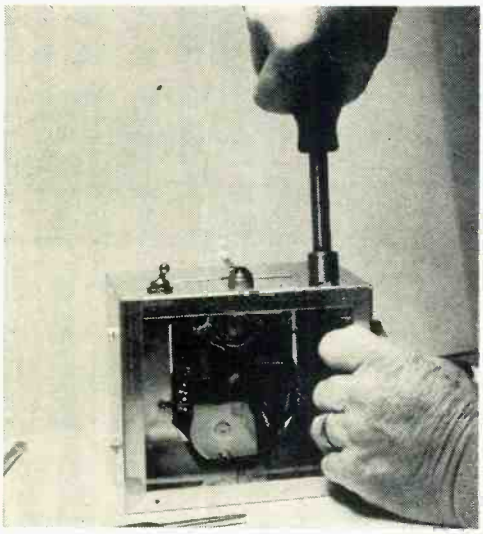
The Min-Corder is mounted in a 4″ x 5″ x 6″ aluminum utility box. The bottom of the box is removed, and ¼″ is cut from the 5″ dimension so it will fit inside the box. Cut the two tape recorder mounting brackets from the cover as shown in the drawing, laying out ½″ lips to be bent up for flanges.



The Min-Corder comes assembled and ready to put into the cabinet. It uses a continuous loop of tape with oxide on both sides.

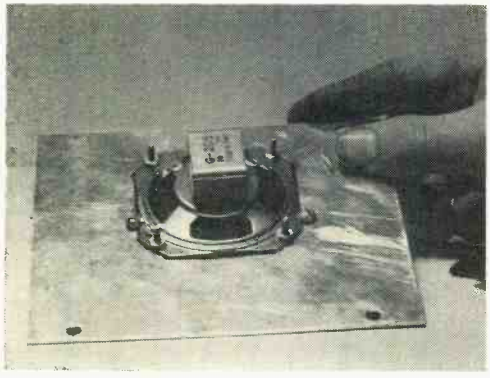


Loudspeaker also serves as a microphone. Diagram shows few parts needed.



After wiring, fasten all components in place.

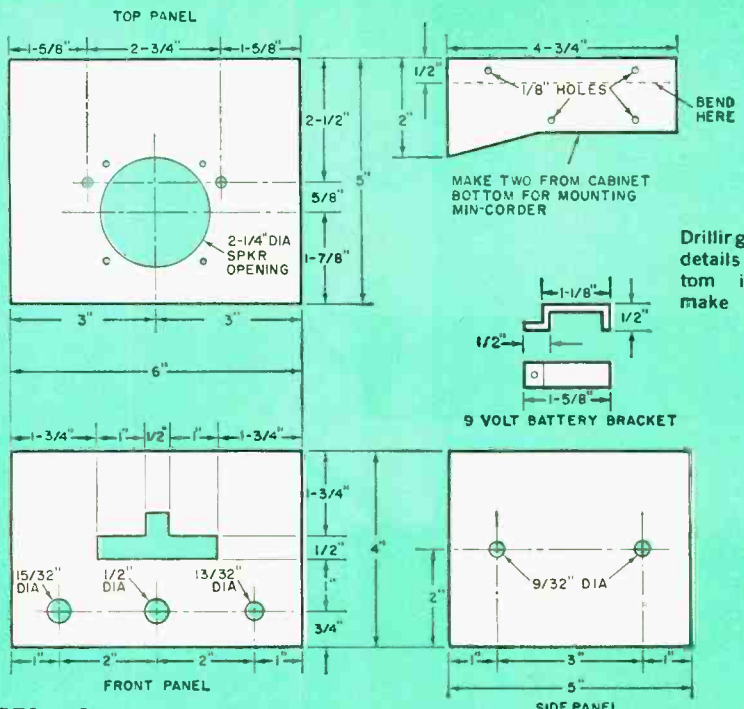
Large screws underneath top plate hold handle.



Drill the required mounting holes as shown. Bend the flanges and try the Min-Corder on the mounts for size. Drill the remaining cabinet holes according to the layout, and then cut the front control slot with a hand nibbler. This tool can be used to cut the hole for the speaker on the top plate if a circle cutter isn't available.

Mount all the components in place, and the unit is ready to wire.

Wiring The Device. The black wire from the Min-Corder motor goes to the negative side of *B2* and also to the positive terminal of *B1*. The positive side of *B2* goes to the red motor lead and to one side of the message light, *I1*. Battery *B1*'s negative terminal goes to toggle switch *S1*, which goes to the other terminal of *I1*. This effectively provides 1½ volts for the Min-Corder motor, and 3



Drilling and punching details for cabinet. Bottom is sacrificed to make chassis support.

PARTS LIST

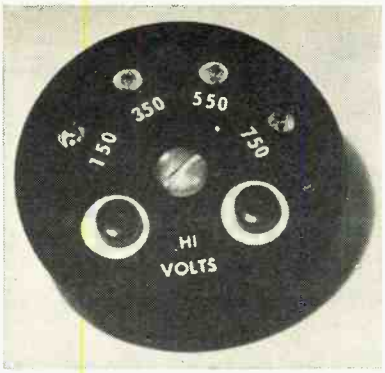
B1, B2—1½-volt battery (Eveready 950 or equivalent)
B3—9-volt battery (Eveready 216 or equivalent)
I1—#49 miniature bayonet lamp
S1—S.p.s.t. toggle switch
S2—S.p.s.t. rotary switch
T1—Output transformer; primary, 500 ohms, CT; secondary, 8 ohms (Lafayette TR-116 or equivalent)
1—Jewel pilot light assembly (Dialco 111 or equivalent)
1—Min-Corder (available from Mission Liquidators, 35 Celis St., San Fernando 8, Calif., for $8.99 postpaid)
2—Battery holders (Lafayette MS-175 or equivalent)
1—4" x 5" x 6" aluminum cabinet
Misc.—Handle, wire, hardware, solder, etc.

volts for the light. Connect the black primary lead and green secondary lead of *T1* together and to ground. Connect the hot speaker terminal to switch *S2*'s wiper with shielded wire, and the Min-Corder signal lead to one switch terminal along with the brown secondary lead from *T1*. The primary green lead from *T1* goes to the other position of *S2*.

Testing. Insert the batteries in the battery holder, and place the 9-volt battery in its clip. With switch *S2* (the right-hand switch in the photo) in the *Talk* position, slide the control to *Talk* and hold it while you speak into the loudspeaker. Place *S2* in *Listen* and you will hear the message repeated in the speaker. This control lever—part of the Min-Corder—moves the erase magnet closer to or further from the tape, and also controls the motor operation. The recorder will repeat at 20 second intervals until you erase by switching to record. At the same time, you can try the message light by throwing toggle switch *S1* to the message position.

If everything performs satisfactorily, button 'er up. Explain the operation of the unit to the various members of the family, and leave the device where all can get at it. Nobody will be able to resist using the system, and everyone will be far less apt to forget to leave a spoken note than the more tedious written kind. The unit will also find application wherever repeated spoken messages are used. Storekeepers can use it to announce sales, and the 20-second interval is just right to catch the attention of a shopper. The recorded material can be changed as often as you like by erasing and re-recording. —30—

HI! VOLTS, THAT IS

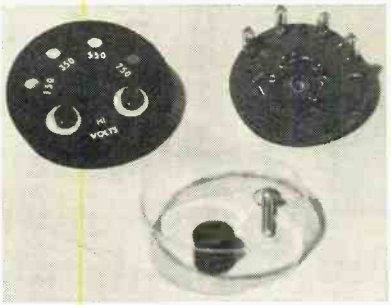


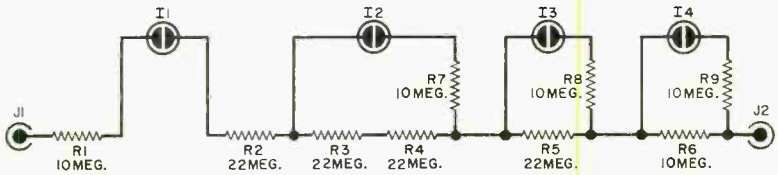
IF YOU EVER need a quick means of testing unknown high voltages, such as those that appear at the secondaries of unmarked transformers, this gadget will give you a pretty good indication. It is also useful for constant monitoring of high peak voltages such as appear in photographers' strobes or in Geiger counters.

There are no scales to read or needles to follow. You simply count the number of neon lamps that are lit. One neon glows at 150 volts, two at 350, three at 550, and if all four light, the voltage is 750 or more. Mount the resistors and neon lamps on a Micarta disc, cut to fit a plastic box such as a typewriter ribbon comes in. The components can be soldered to eyelets attached to this disc. Another disc serves as a panel, and is appropriately marked. A nut, bolt and spacer hold the assembly together.

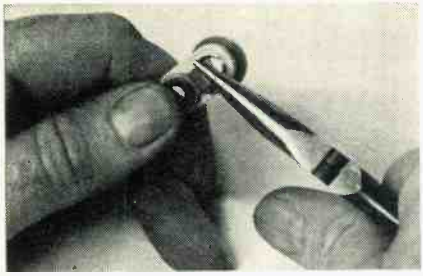
The resistance values indicated below are for d.c. or peak a.c. You can tell which type of current is being applied to *J1* and *J2*, for on d.c. only one element in the NE-2P (high intensity neon) lamps will glow. After wiring the base board, clean it with carbon tet or trichlorethylene to remove excess flux or grease which may cause leakage paths.

—I. C. Chapel





I1, I2, I3, I4—NE2P NEON LAMPS
ALL RESISTORS 1/2 WATT



CARTRIDGE DIODE MOUNT

THE 1N21, 1N23, 1N34, and other "ceramic cartridge" diodes are readily and inexpensively available on the surplus market. While they would serve well as detectors in crystal radios and undoubtedly have numerous other applications, they are unwieldy to work with. These diodes are extremely sensitive to heat, and soldering directly to them is completely out of the question. But the cartridge diodes fit nicely into standard phone jacks. A simple adjustment of the tip contact of a jack can be made with long-nose pliers to bring it into contact with the diode. After installing the cartridge diode in a modified phone jack, it can be held in place with a dynamotor brush cap. The jack can be insulated from the mounting panel if desired.

—Walt Boyd, K6DZY

Monthly Short-Wave Report

By **HANK BENNETT,** W2PNA/WPE2FT
Short-Wave Editor

BLACKBALLING IRON CURTAIN COUNTRIES—RIGHT OR WRONG?

FOR the past several years one of the well-known European short-wave clubs has been advocating the blackballing of those countries that resort to the operation of jamming transmitters. The blackballing was to take the form of withholding reception reports from all of the stations in the "offending" countries. For the most part, these countries are behind the Iron Curtain.

As a companion measure to the ban on reports, the foreign club has also attempted to persuade radio clubs and organizations the world over to join them in refusing to publish any information whatever pertaining to reception of the stations in question —including miscellaneous reception items as well as full operating schedules. This campaign has not been heartily endorsed by many organizations so far as we can tell.

Your Short-Wave Editor has tried to analyze this situation carefully for many months in an effort to come to a personal conclusion as to whether these two forms of blackballing have anything to recommend them, and to find out whether the stations in the countries concerned have suffered to any extent from a loss of reception reports. As might be expected, we were unable to gain any useful information from the stations involved—if there has been a decline in the number of reports they are receiving, they aren't admitting it.

We are definitely in agreement with the motives behind the plan advocated by the European club but we do not entirely agree with the plan itself. Your Short-Wave Editor does not believe that individual reports (or the lack of them) are of great concern to the stations in these "jamming" countries. It is fairly obvious that many of the foreign governments have their own paid monitors in our country who regularly report to them on reception conditions.

As a Short-Wave Editor, I have always taken the stand that my chief duty is to publish news about stations regardless of the propaganda policies of the governments of the countries in which they are located. Every reporter has a right to be heard and to have his report published whether his report covers stations in Africa, America, Asia, or any other country or territory. We try to maintain that policy within the space allotted for this column.

We personally feel that it is in order for an SWL to report to *any* station that he may hear if he wishes to do so. It would be another matter if we all *believed* what

Old-timer Frederic Waite (above), of Rowley, Mass., has 60 countries verified—his best verie is from 6KW in Tuinucu, Cuba. Fred, WPE1AFP, has been DX'ing for 28 years. His receivers are a National NC-190 and a NC-57B plus a Hallicrafters S-22R.

The shack of Robert Mladenka, otherwise known as WPE5DIW, is located in Flatonia, Texas. Bob DX'es with a Hallicrafters S-38 receiver backed up by a Lafayette "Explor-Air." He also owns a surplus BC-455 Command unit which covers 6000 to 9100 kc.

John Ophaug (WPEØDSR) and friend hail from Wayzata, Minn. To date John has 53 countries heard with 23 verifications. His receiver is a Hallicrafters SX-99, his antenna a 40-foot vertical; he also uses a Continental tape recorder. From all appearances, shooting would seem to be another of John's hobbies.

we hear at times, but from the purely technical standpoint of listening and reporting in an effort to add a verification to the collection, we do not think that anyone should feel it imprudent to ask for a QSL.

Incidentally, one of the aftereffects of reporting to Iron Curtain countries is that you may receive literature from them periodically. This is part of their well-known propaganda campaign. Once you are on their mailing list, it is next to impossible to have your name removed. However, this material can always be thrown out or refused. Of course, if you happen to be a stamp collector as well as an SWL, you'll have a new source of choice items.

(*Continued on page* 102)

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

All of the stations below specifically beam English-language newscasts to the U.S.A. The times may vary a few minutes from day to day.

COUNTRY	STATION	FREQUENCY *(kc.)*	TIMES *(EST)*
Argentina	Buenos Aires	11,780, 9690, 6090	2200, 0100 (Mon.-Fri.)
Australia	Melbourne	17,840, 15,220	2030, 2130, 2230
		9580	0745
Bulgaria	Sofia	6070 (and/or 9700)	1900, 2000, 2300
		7290	1630
Canada	Montreal	15,190, 11,760, 9585	1800 (Caribbean)
		9625, 5970	0215, 0300 (W. Coast)
East Congo	Leopoldville	11,755	1630, 2100, 2230
Czechoslovakia	Prague	11,990, 9795, 9550, 7345 (also 15,285 at 2030; 11,990 at 2230)	2030, 2230
Denmark	Copenhagen	15,165	0700
		9520	2100
Finland	Helsinki	15,185	1530 (Mon.-Fri.)
West Germany	Cologne	11,945, 11,795, 9735	1010
		9545, 6075	2035
		9735, 9575, 6145, 6075	0000
Hungary	Budapest	9833, 7215, 6234	1930, 2030, 2200, 2330
Italy	Rome	9575, 5960	1930, 2205
Japan	Tokyo	15,285, 15,135, 11,780	1900
Lebanon	Beirut	11,890	1630
Netherlands	Hilversum	17,810, 15,445	1030 (Tues., Fri.)
		11,950, 9590	1415 (Tues., Fri.)
		7125, 6085	1630 (exc. Sun.)
		6035, 5985	2030 (exc. Sun.)
Portugal	Lisbon	6185, 6025	2105, 2245
Rumania	Bucharest	11,810, 9510, 7225, 7195, 6190, 5990	1730
Spain	Madrid	9360, 6130	2215, 2315, 0015
Sweden	Stockholm	15,240	0900
		9660	2215
		5990	2045
Switzerland	Berne	11,865, 9655, 9535	2015, 2315
		15,315	0950
U.S.S.R.	Moscow	9740, 9730, 9700, 9680, 9660, 9650, 9620, 9610, 9570, 7320, 7310, 7240, 7200, 7150 (may not all be in use at any one time)	1730, 1900, 2000, 2100, 2300, 0040
Vatican City	Vatican City	9645, 7250, 6145	1950

Across the Ham Bands

By **HERB S. BRIER,** W9EGQ
Amateur Radio Editor

A QUICK LOOK AT THE HEATHKIT SB-300 RECEIVER

THE NEW SB-300 eleven-tube communications receiver for the amateur bands between 3.5 and 30 mc., manufactured by the Heath Company, Benton Harbor, Mich., incorporates several interesting design features: a crystal-controlled front end and BFO for maximum frequency stability; separate i.f. crystal filters with selectivity characteristics specifically tailored for AM, c.w., and SSB reception; highly accurate dial calibration; and ease of tuning in all modes.

Assembly. Many hams shy away from communications receiver kits because they are supposed to be so complicated. But anyone who is adept with a small soldering iron or soldering gun and with simple tools like a screwdriver and a pair of pliers should have no trouble assembling the SB-300—if he has the patience and willingness to follow the precise, step-by-step instructions.

It took your Amateur Radio Editor approximately 60 hours (spread over a two-week period) to assemble the kit. Step for step, the task was no more difficult than the assembly of a number of Novice transmitter kits now on the market. The reason the job took so much time is that there are quite a few more steps to complete than one finds in the average kit.

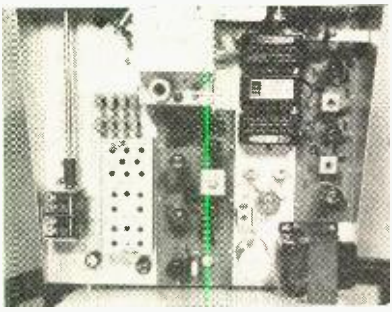
Contributing to the relative ease of construction are the high-quality printed-circuit boards used in the critical r.f. and i.f. sections of the receiver. We completed them both during the course of a single evening.

The average ham should be able to align the SB-300 in less than two hours, using either the built-in 100-kc. crystal calibrator or a standard signal generator as the signal source. Also required is a vacuum-tube voltmeter to measure the crystal-oscillator d.c. grid voltage (at a test point) in the preliminary oscillator adjustment.

Evaluation. The measured selectivity of the SB-300 was 2.1 kc. with the SSB filter furnished, 400 cycles with the optional c.w. filter, and 3.75 kc. with the optional AM filter—just as the instruction manual stated. It also met its sensitivity specs handily. And in side-by-side comparisons with other communications receivers, the SB-300 held its own.

On the minus side, the SB-300 does not contain a noise limiter. This is no disadvantage on SSB or c.w., where the normal noise limiter doesn't work anyway, but it could be a minor disadvantage in AM phone operation in a noisy location.

At approximately $265 in kit form (less the optional c.w. and AM filters, both of which carry a $19.95 price tag), the Heath-



Inside and outside views of the Heathkit SB-300 receiver. Although there are more steps to complete than with the average kit-type unit, the SB-300 is not difficult to assemble. Printed-circuit boards are used in the critical r.f. and i.f. sections.

Novice Station of the Month

With a Johnson "Ranger" transmitter and a Hallicrafters SX-117 receiver, Mike Stenstrom, WN4OIX, Hendersonville. N.C.. has worked 40 states and eight countries. His antennas are a multiband "trap" dipole and a rotary 15-meter dipole. Mike will receive a free one-year subscription for submitting the winning photo in our Novice Station of the Month contest for August. To enter the contest, send in a picture of yourself at the controls of your station, along with some information about your equipment and operating achievements. Entries go to Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, Box 678, Gary, Indiana.

kit SB-300 compares very favorably with preassembled, ham-band-only receivers in the $500-plus class.

CLASSIC HAM CIRCUITS

Way back in 1921, E. H. Armstrong first described the superheterodyne receiver in the "Proceedings of the I.R.E." And by the mid 1930's, the superheterodyne had become the accepted receiver in progressive ham shacks.

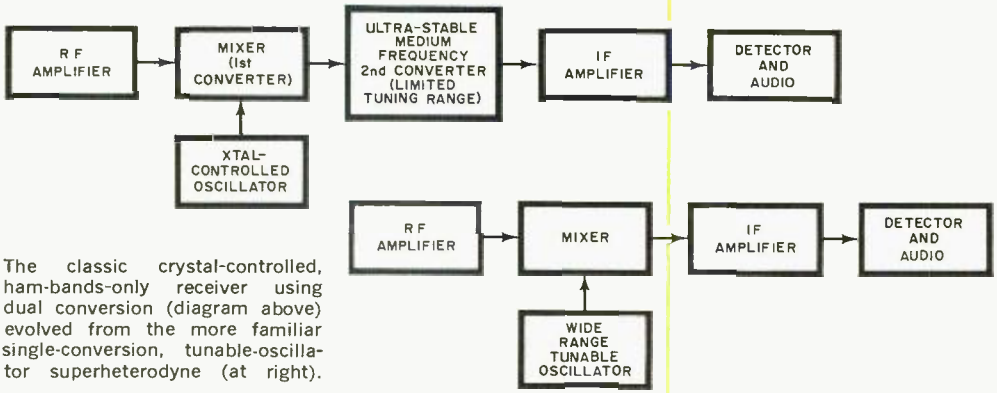
Superhet Operation. Reviewing briefly the theory of superheterodyne operation, when two r.f. signals are fed simultaneously into a mixer or converter circuit, a multitude of signals are produced at the mixer output terminals. In receiver applications, the most important of these output signals has a frequency equal to the *difference* in frequency of the two input signals.

In a superhet receiver, one of the input signals is normally a radio signal picked up by the receiving antenna, and the other signal is generated by a local heterodyne oscillator in the receiver. In a conventional superheterodyne receiver, the oscillator is always tuned the same number of kilocycles —say 465 kc.— away from the desired broadcast signal. As a result, the mixer output frequency is always the same: 465 kc. in our example. Thus, it is possible to design an efficient, *intermediate-frequency* (i.f.) amplifier to select and amplify the desired incoming signals before delivering them eventually to the loudspeaker.

High-Frequency Oscillator. Obviously, the over-all performance of a superheterodyne receiver depends largely on the stability of its high-frequency oscillator. If its frequency drifts or varies, the signal fed to the i.f. amplifier varies exactly the same amount. Unfortunately, the higher the frequency of operation, the more difficult it becomes to build a really stable, tunable oscillator.

In fact, serious VHF/UHF workers long ago discovered that it was virtually impossible to build a tunable oscillator which was stable enough to use as the heterodyne oscillator in a selective superheterodyne receiver for frequencies above 50 mc. Obviously, this imposed quite a problem, as a really selective receiver is required to take

(*Continued on page 97*)

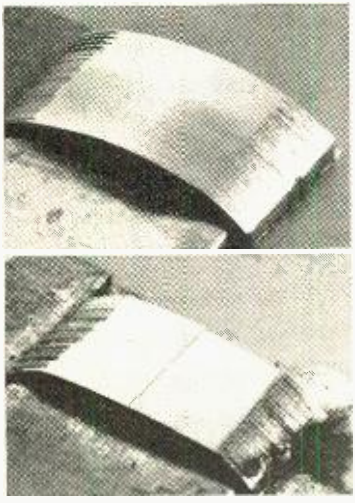


The classic crystal-controlled, ham-bands-only receiver using dual conversion (diagram above) evolved from the more familiar single-conversion, tunable-oscillator superheterodyne (at right).

Some plain talk from Eastman Kodak about tape:

surface smoothness and sound brilliance

Visualize a roll of sandpaper ¼-inch wide. Now thread it into your tape recorder and run it awhile. Devastating thought? Sure is. Some poorly made tapes are just about like that. Here's the story: Iron oxide is actually harder than many types of sand. And each particle of this destructively hard material can exert thousands of pounds of pressure, cutting a recorder head brutally. Luckily, that sort of thing can't happen here.



The entire story becomes dramatically clear when we compare heavily worn head (lower) with new one. Note how abrasive tapes have worn down the head, widened recording gap. Uneven wear characteristics are caused by improperly slit tape. Note, too, the accumulation of oxide in the gap and around the head. This head is useless!

And for two good reasons. The first is our "R-type" binder. This resinous material has a number of unique advantages. For example, it covers each particle of iron oxide thoroughly, and because the binder can be critically controlled, the iron oxide can be coated to a glass-like smoothness. No other binder, in fact, can be handled like our "R-type" binder. This means that Eastman tape gives you a smoother, more friction-free surface to begin with.

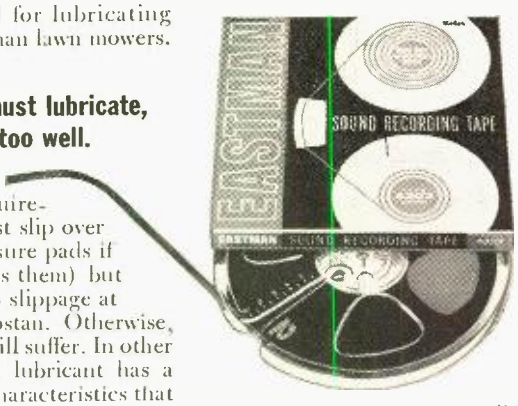
But because we are the pesky, finicky bunch that we are, we go even further. To make certain that your recorder heads will get tender, kindly treatment, we have taken the extra precaution of lubricating the entire thickness of the binder. Not just any lubricant, but a very special one. One that is exclusively ours. Why a special one? Well, here's the story. Out of the thousands of materials available as lubricants, only a few are suitable for use with tape surfaces. The rest aren't good for lubricating anything other than lawn mowers.

A lubricant must lubricate, but not too well.

Here are the requirements. Tape must slip over heads (and pressure pads if your recorder has them) but there must be no slippage at all over the capstan. Otherwise, constant speed will suffer. In other words, the ideal lubricant has a combination of characteristics that allows it to glide friction-free (relatively, of course) in certain places and hold fast in others. Designing lubricants that give this sort of performance is something akin to trying to bake a cake that tastes like steak. Pretty tough to hit on the first try. After a few thousand tries, however, we did hit it, and got some pretty big rewards in terms of performance.

We never take chances with lubrication.

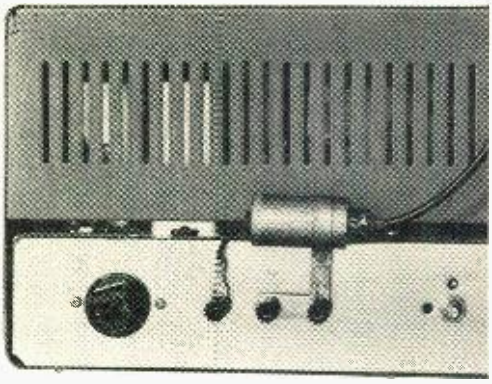
Just to make certain that everything that can be going for us is . . . we make use of our lubricants in every way possible so that we never miss a bet in terms of quality and/or performance. For example: we incorporate our lubricants into the magnetic coating. And we lubricate the base as well. In that way, all bets are covered. You might have noticed from time to time how some tapes smear their lubricants all over your equipment. You'll never get that sort of "gunking" from an Eastman tape because our lubricants are stable.



Choose EASTMAN Sound Recording Tape, Type A303, for all general-purpose applications. Choose Type A304 wherever high output characteristics are called for. For long-play applications choose Type P105—so thin you get 3600 feet on a 7-inch reel! EASTMAN Sound Recording Tapes are available at your local electronic dealer's and other tape outlets.

EASTMAN KODAK COMPANY, Rochester, N.Y.

CIRCLE NO. 9 ON READER SERVICE PAGE



ZENER RECEIVER MUTER

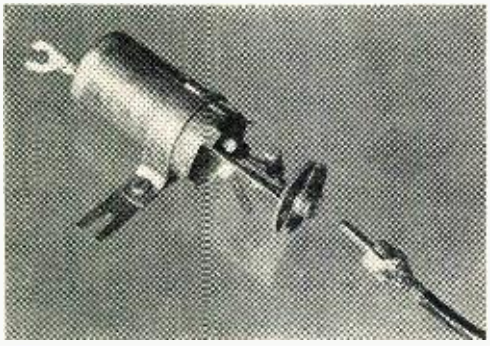
Two inexpensive diodes and a capacitor add up to a highly effective, useful device

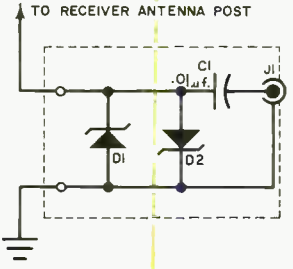
ZENER DIODES, by virtue of their unique ability to short-circuit high voltages while presenting a high resistance to low voltages, can easily be used to mute an amateur receiver while transmitting or to ground out high level atmospherics without affecting normal reception. All this can be done with no modifications to the receiver and with a few inexpensive components—thanks to the increasing availability of low-priced zeners.

As shown in the schematic diagram, diodes *D1* and *D2* (International Rectifier Z-1100's, Hoffman HB1's, or equivalents) are connected in opposite directions between the receiver antenna post and ground in a shielded enclosure which is simply the can from an old fluorescent lamp starter. A phono pin jack (*J1*) fits neatly in the end of this can; it is connected to a .01-μf., 200-volt miniature Mylar capacitor (*C1*). Mount the diodes on a piece of Formica or similar insulating material, and connect all grounds to the starter can. Add a ground strap around the can and a lead with a lug on it to connect to the receiver antenna terminal, and you have a zener muter.

To test the gadget, simply tune your VFO to the receiver frequency. Key the transmitter while using a dummy load—you'll note that the signal silences the receiver, leaving only a slight power hum. If you use a separate receiving antenna, leave it connected while transmitting. The microsecond recovery time of the muter will give you break-in operation.

—I. C. Chapel

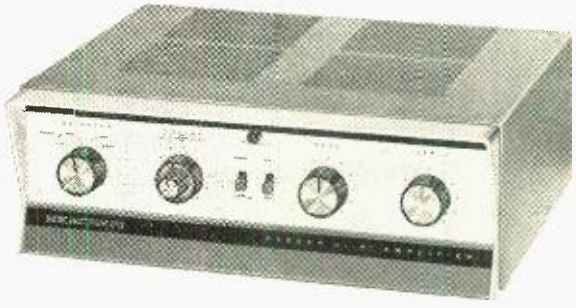




Muter mounts neatly to receiver terminals as shown in top photo. Author attached a piece of insulating material to J1 (photo at left) and used it to hold C1, D1, and D2. Connection to receiver antenna is brought out through grommet in top of can.

This New Heathkit® FM Stereo Tuner At $49.95...

Plus ... This Heathkit® 16-Watt Stereo Amp At $39.95...



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And yet, you enjoy a host of maximum performance features like the built-in stereo converter ... automatic frequency control that locks-in all stations for quiet, drift-free reception ... a stereo indicator light that silently signals when stereo is being broadcast ... large edge-lighted slide-rule dial for easy station reading ... easy flywheel tuning ... external antenna terminals ... plus point-to-point wiring and a pre-assembled, prealigned "front-end" for fast, simple assembly! Goes together in a couple of evenings! **You'll Like The Modern Color Styling, Too! ...** mocha brown & beige steel cabinet with midnight black trim accents.

Now Add The Heathkit AA-32 16-Watt Stereo Amplifier with its 4 stereo inputs ... mag. phono, ceramic phono, tuner & auxiliary. Its clean, pure power response of ± 1 db from 30 to 30,000 cps at 8 watts per channel! Its full complement of controls ... mono stereo switch; a dual-concentric volume control for adjusting both channels simultaneously or individually; full-range tandem-type tone controls for simultaneous adjustment of bass or treble. Its 7-tube amplifying circuit with 2 fourstage preamps, and 2 push-pull power output stages. Its complete transformer operated full-wave silicon-diode circuit. Its simple fast point-to-point wiring ... beginners finish in just a few hours! Its attractive styling ... matches the AJ-13 Tuner. Its low, low price ... $39.95!

Now Settle Back & Listen! The sound's superb ... the operation simple ... the styling handsome ... the savings big! Discover why more people rely on Heath to take the high cost out of quality. Use the handy coupon & choose both units now!

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Kit AA-32, 16-Watt Stereo Amp, 15 lbs. $39.95

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1964 OTCB JAMBOREE CALENDAR

Planning a jamboree, get-together, banquet or picnic? Send the details to: 1964 OTCB Jamboree Calendar, POPULAR ELECTRONICS, One Park Avenue, New York, N. Y. 10016. For more information on the jamborees below, contact the clubs or club representatives listed.

Decatur, Ga. — **August 1-2**
Event: Georgia CB Radio Council Jamboree. Location: Atop Stone Mountain. Contact: Dixie Communications Club, Box 136, Decatur.

Marshalltown, Iowa — **August 8-9**
Location: Izaak Walton League, 1½ miles from Highway 30 on South 12th. Sponsor: Corn Belt CB Radio Club of Marshalltown. Contact: Al Polley, 1608 E. Nevada St., Marshalltown.

Reno, Nevada — **August 8-9**
Sponsor: Silver State CB Association (Reno-Sparks), 1549 Prospect Ave., Sparks, Nevada.

Plaistow, N. H. — **August 8-9**
Event: Interstate (Mass. & N. H.) Jamboree. Location: American Legion Farm, Haverhill, Mass. Sponsor: CB Socialities, Box 336, Plaistow.

New Waterford, Ohio — **August 9**
Event: Picnic. Location: New Waterford Fish & Game Park. Sponsor: Penova CB Club. Contact: Virginia Craig, Box 606, East Liverpool, Ohio.

Washington, Mich. — **August 15-16**
Location: Green Acres Recreation Area. Sponsor: Oakland Social CB's. Contact: CB Jamboree Information, 2280 Maple Crest, Pontiac, Mich.

Lebanon, Ohio — **August 16**
Event: Second Annual SWOCBA Nationwide Jamboree. Location: Warren County Fairgrounds. Sponsor: Southwestern Ohio Citizens Band Assn., Box 231, Mason, Ohio.

Chattanooga, Tenn. — **August 22**
Event: Annual Barbecue. Location: Hamilton County Park. Sponsor: Volunteer State CB Radio Club, Inc. Contact: Garland Freeman, 546 Alexander Drive, Chattanooga.

Norwalk, Ohio — **August 22-23**
Event: Second Annual Week End for CB'ers. Location: Huron County Fairgrounds. Sponsor: Sheriff's Huron County Emergency Net, Box 201, Norwalk.

Norfolk, Va. — **August 22-23**
Event: Convention and Trade Show. Location: Monticello Hotel. Sponsor: Virginia State Citizens Band Radio Assn., Inc., Ruckersville, Va.

Enon Valley, Pa. — **August 30**
Event: Picnic. Location: Brady's Run Park. Sponsor: Sociable 5 Watts CB Club. Contact: Roy Shetler, Enon Valley.

Dalton, Ga. — **September 4-7**
Location: Abertson Midget Lakes. Sponsor: North Georgia CB Radio Club, Inc.

Crisfield, Md. — **September 5-6**
Event: Labor Day Week End Jamboree. Location: Crisfield Derby Grounds. Sponsor: Chesapeake CB'ers. Contact: Ruth Brown, Manokin, Md.

Lynwood, Calif. — **September 11-13**
Event: Second Annual Home Show & Radio Communications Jamboree. Location: Bateman Hall, Lynwood Community Center. Sponsor: Southern California Radio Assistance Unit. Contact: Jim Servi, Box 127, La Mirada, Calif.

Pittsburgh, Pa. — **September 13**
Event: Picnic. Location: White Swan Park. Sponsor: Five-Eleven CB Radio Club, 868 Glass Run Rd.

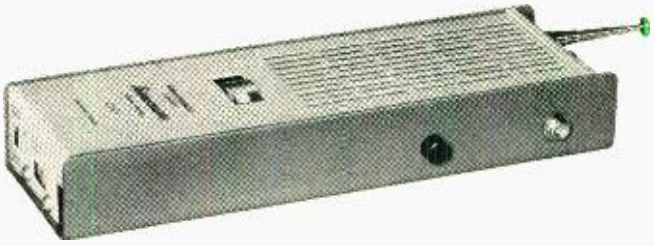
Fort Wayne, Ind. — **September 20**
Event: Fall Roundup. Location: Memorial Coliseum. Sponsor: Maumee Valley CB Radio Club. Contact: Mort Knott, Box 1031, Fort Wayne.

Albany, N. Y. — **September 27**
Event: Tri-Club Chicken Barbecue Jamboree. Location: Halfmoon Beach, Crescent, N. Y. Sponsors: Troy Area CB Club, Schenectady Electric City CB'ers, Saratoga Spa Ten-Fourers. Contact: Stephen Stracher, Box 299, Lans. Station, Troy.

Bristol, Conn. — **October 11**
Location: Lake Compounce. Sponsor: Bell City Citizens Band Radio Club. Contact: John P. Dempsey, 163 High St., Bristol.

Heathkit's great base station deserves

an equally fine working partner!



In a two-way radio communications system, overall performance is only as good as it's weakest link. The deluxe Heathkit GW-42 "Master Station" CB Transceiver teamed up with the powerful GW-52 1-watt "Walkie-Talkie" brings you Citizen's Band radio facilities of outstanding capability with complete freedom and mobility of operations. Check and compare the many features offered in Heathkit equipment with any other...see why Heathkit is your best buy in CB!

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Kit GW-42....23 lbs.....$119.95
Assembled GWW-42....22 lbs.....$189.95

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• Rugged 10-transistor, 2-diode circuit • Long-range transmitter—1-watt input • Sensitive superheterodyne receiver with RF stage • Adjustable squelch control • Automatic noise limiter • Crystal-controlled transmit & receive channels • $20 rechargeable battery included • Built-in 117 v. AC battery charger • Built-in battery condition meter • Easy circuit board assembly.

Kit GW-52....4 lbs.....$ 74.95
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GX-124R

CIRCLE NO. 14 ON READER SERVICE PAGE

Transistor Topics

(*Continued from page 78*)

clear of "gimmick" circuits or those requiring unusual or special components.

Third, the circuit should not use dangerously high voltages and, preferably, should be battery-powered rather than line-powered to minimize the dangers of accidental shock or blown line fuses.

Fourth, power levels should be kept to a minimum, both to conserve battery life and to prevent interference with the work of other experimenters. If ten lab groups, for example, should all attempt to test, say, 20-watt amplifiers at the same time, the result could be deafening. Similarly, a student might have trouble aligning a small receiver if another worker on the opposite side of the bench tried to tune a 100-watt transmitter at the same time.

A typical demonstration audio amplifier circuit is shown in Fig. 4. This design incorporates all the basic features of amplifiers used in phonographs, intercoms, hi-fi installations and p.a. systems, yet can be breadboarded quite easily, uses standard, low-cost parts, and has a power output in the milliwatt range. A wired version of the circuit is shown in the photo.

Referring to Fig. 4, the amplifier uses common-emitter stages throughout. A preamp (*Q1*) is complementary-coupled to a driver stage (*Q2*) which, in turn, is transformer-coupled to a Class AB push-pull output amplifier (*Q3-Q4*). Operating power is furnished by a 9-volt battery made up of six penlight cells connected in series.

In operation, an audio signal obtained from a standard 1000-ohm headphone (used as a microphone) is applied across gain control *R1*. A portion of this signal, depending on *R1*'s adjustment, is applied through d.c. blocking capacitor *C1* to *Q1*'s base-emitter circuit. Transistor *Q1*'s base bias is furnished through *R2*. The amplified signal is applied to the driver stage, *Q2*, through coupling capacitor *C2*. Transistor *Q1*'s collector load includes *R3*, *R7* and *Q2*'s base-emitter circuit.

The driver stage (*Q2*) obtains its base bias through a voltage divider which includes *R3*, *R7* and *Q1*'s emitter-collector circuit. Emitter resistor *R4*, bypassed by *C3*, provides bias stabilization. Resistor *R7*, part of *Q1*'s load and *Q2*'s bias network, also provides a small amount of negative feedback across the driver and output stages.

Interstage impedance-matching transformer *T2* couples *Q2*'s output signal to the push-pull power amplifier, *Q3-Q4*. Another step-down transformer, *T1*, couples the power amplifier, in turn, to the loudspeaker's voice coil. The base bias for *Q3-Q4* is supplied through voltage divider *R5-R6*.

Parts needed for the assembly of this circuit are readily available. Transistors *Q1*, *Q3* and *Q4* are CK722's or similar general-purpose *pnp* units and *Q2* is a 2N35. Capacitors *C1*, *C2* and *C3* are 12-volt electrolytics. Potentiometer *R1* is a 1000-ohm unit, while *R2*, *R3*, *R4*, *R5*, *R6* and *R7* are all half-watt resistors. Transformer *T1* should have a 500-ohm, CT, primary, and a 3.2-ohm secondary (Argonne AR-119 or equivalent), while *T2* has a 10,000-ohm primary and a 2000-ohm, CT, secondary (Argonne AR-109 or equivalent). The speaker can be any standard 4″ to 8″ type with a 3- to 4-ohm voice coil. Finally, *S1* is an s.p.s.t. toggle or slide switch.

With neither layout nor lead dress critical, the individual builder can follow his own preferences on these points, taking care simply to provide adequate separation between the input and output circuits to prevent feedback. All d.c. polarities and transformer color codes should be observed, of course. The model shown in the photo was assembled on a piece of pegboard.

Component News. Nine high-power, encapsulated "sticks" capable of handling peak reverse voltages from 2 kv. to 75 kv. and output currents from 0.2 to 3 amperes have been introduced by the International Rectifier Corporation (233 Kansas St., El Segundo, Calif.). They can be used in a variety of applications requiring high d.c. voltages at moderate currents.

The Tung-Sol Electric Co., Inc. recently introduced three circuit components called "Barretters" which provide protection for power transistors against damaging current surges or overloads. Made with tungsten filaments chosen for a positive temperature coefficient of resistivity, these new units are designed to be used in series with a transistor emitter. Acting like a variable resistor. they offset any increase in transistor collector current by a corresponding increase in their resistance.

Two silicon transistors have been introduced by RCA (Harrison, N. J.). The 2N3229 is a *pnp* planar type designed for r.f. power applications; with a 17.5-watt dissipation rating, it can deliver as much as 15 watts at 50 mc. or 5 watts at 150 mc. The 2N3262 is a high-voltage, high-frequency, triple-diffused *npn* type; although designed primarily for military and industrial use, it could be of value to hams planning high-quality medium-power transmitters.

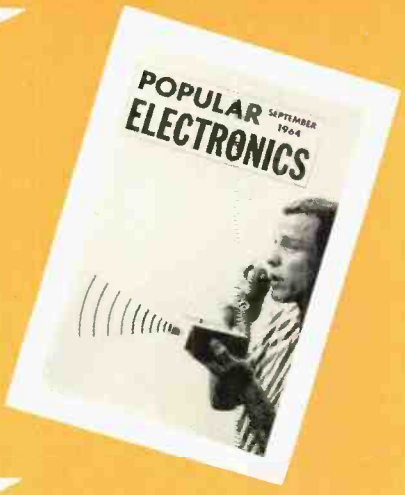
It's closing time once again, fellows. Keep cool!

—Lou

Coming up in September

Transmitting on "Ultrasonics"

Would you be interested in a secret form of voice communications that no one can intercept—unless they have a special receiver? It requires no license, does not use radio waves, and the transmitter is smaller than any 100-milliwatt CB transceiver. What is it? An Ultrasonic Transmitter that broadcasts either voice or tone modulated signals within line of sight. Detailed construction plans (using a printed-circuit board and five moderately priced transistors) appear in our September issue.



The Fabulous Fuel Cell

You already know about the "Biocell" (February 1964 issue), but have you heard that scientists are now working on electric cars powered by Fuel Cells? The possibility is not as remote as you might think. Read how this amazing device, the most efficient generator of electricity known, will be used to power manned flights to the moon, to provide silent, readily available sources of power on the battlefield, and, ultimately, to furnish power for conventional uses.

The 6-Meter Companion Transmitter

Whether or not you built the "Simple Superhet for 6" (April, 1963), you'll want to try your hand at this ingenious little transmitter. Both inexpensive and easy to build, the "Companion Transmitter" gives you a quality 6-watt-input phone signal on 6 meters—all with two tubes exclusive of rectifier.

"Spooking Light"

Get a head start on Halloween with this solid-state oscillator that makes a 60-watt electric bulb act like a candle flame. Just the gadget for developing eerie lighting effects for your kids.

DX'ing Jupiter!

(*Continued from page* 43)

and if there is a question as to whether a given signal is from Jupiter or just similar sounding interference, the answer can usually be found by comparing records.

It is also possible that there are certain modifications in Jupiter's radiations which might be caused by the earth's ionosphere and magnetic field; since the earth's magnetic field is opposite in the two hemispheres, these effects can be sorted out and it becomes possible to tell which are due to the radiation of the planet and which are due to the earth's ionosphere and magnetic field. Because of more favorable atmospheric conditions and less man-made interference, signals as low as 5 mc. can be observed in Chile.

What Causes Radiation? Since the earth's ionosphere is so reluctant to admit incoming low-frequency signals, Dr. Smith has asked NASA to orbit a low-frequency receiver. This receiver, circling high above the ionosphere, could record Jupiter signals that never reach the earth's surface. An orbiting receiver might also tell us if radio-frequency radiations are generated in the earth's own Van Allen radiation belts. Because the earth's magnetic field is relatively weak, it is believed that any such radiations would again be of too low a frequency to be passed through the ionosphere.

The stronger the magnetic field around a planet, the higher the frequency of planetary radiations. On this basis, Jupiter's magnetic field is calculated to be ten times as strong as the earth's. Study of the polarization of the received signals tends to confirm this deduction.

Jupiter's radiations are far stronger than those of any other source except occasional outbursts from the sun. Although Saturn is roughly the same size as Jupiter, it is not yet certain that Saturn radiates at all in the short-wave bands; in any event, the signals must be far weaker and less frequent. This lack of signals is possibly due to Saturn's famous rings. They lie in the central plane of the probable magnetic field and would tend to prevent the pole-to-pole circulation of particles, as must occur in a radiation belt.

What causes this radio radiation and what significance does it have for us? Although the exact cause is unknown, it is believed that the radio signals are the result of "cyclotron radiation" emitted by solar particles trapped in Jupiter's powerful magnetic field and spiraling back and forth just like the particles in the Van Allen radiation belts around earth. These particles are spit out by the sun, part of the outward flowing solar plasma. If this is true, then there must be powerful and dangerous radiation belts around Jupiter just as there are around the earth, and space explorers will have to be wary when in the vicinity of the planet.

The Jupiter signals may serve as guidance beacons some day. So far it has been difficult to hit even the moon with a ballistic missile, demonstrating a great need for guidance. Interplanetary explorers could use Jupiter's radio signals as a huge radio beacon. Although the planet is not always "on the air," the transmissions are frequent enough to be very useful as a means of correcting course during a long flight.

Solar flares are one of the gravest dangers to space travelers. These are great outbursts of radiation from the sun—unpredictable and extremely dangerous. If some way could be found to predict the occurrence of these deadly radiation storms, space travel would be much safer, just as ocean travel is much safer now that meteorologists are able to predict the birth and movement of storms. There is evidence of a correlation between solar flares and radio noise from Jupiter, and there is also a correlation between the number of sunspots and radiation from Jupiter. Thus, there seems to be some connection between solar phenomena and Jupiter's radio signals, so perhaps the latter may be used as a means of predicting solar flares, just as approaching terrestrial storms may be heralded by changes in atmospheric pressure.

Future research will include a study of the polarization of the Jupiter signals which should give more information on the planet's magnetic field and the particles it contains, plus an investigation of

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CIRCLE NO. 18 ON READER SERVICE PAGE

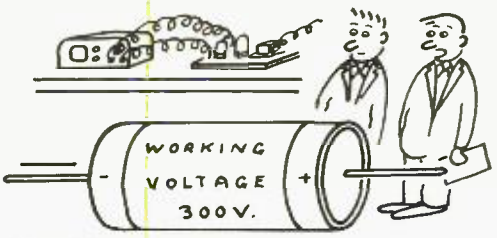
the curious spitting and popping signals occasionally heard. These signals sound like the loud popping you hear when someone dials a telephone in the next room and you have your receiver r.f. gain turned up high, and may be due to the effect of our own ionosphere. A space satellite to be launched in the near future will carry a transmitter radiating a 20-mc. c.w. signal. This known steady signal will be compared with the Jupiter signal to see if the satellite signal is broken up in the same way as the planet's signals occasionally are, thus giving a clue to the effect of our own ionosphere on Jupiter's signal.

Interplanetary SWL'ing. If *you* would like to do a little interplanetary DX'ing, all you need is a reasonably good communications receiver and a good antenna. An existing 14- or 21-mc. beam would be ideal, although a dipole will do, and even a long-wire will bring in this DX when the signals are strong. You can readily identify the Jupiter signals as described at the beginning of this article, and if you happen to have a panoramic adapter, their 2- to 3-mc. wide envelope is easily distinguished from the "spikes" of earthly radio signals.

Remember to consult your newspaper or almanac to learn approximately where in the sky Jupiter is at the time. The higher overhead it is, the lower will be the frequency of the signals coming through. The planet does not radiate continuously, but only when one of its several noise sources is turned toward the earth, so a little patience may be required.

The lower the frequency monitored, the more likely you are to hear Jupiter, for both signal strength and rate of occurrence of outbursts are greater on the lower frequencies.

Good DX! —30—



"It's a one-farad capacitor!"

Across the Ham Bands

(*Continued from page 86*)

full advantage of the DX capabilities of the VHF/UHF bands. Good communications receivers for the lower frequency amateur bands already had the desired selectivity and stability built into them. If there were only some way that they could be made to tune VHF/UHF without losing their stability, the problem would be solved.

The solution was to connect a VHF/UHF converter, employing a crystal-controlled oscillator, ahead of the receiver. For example, if you had a converter for the 50-mc. amateur band with a 43-mc. crystal-controlled oscillator, a 50-mc. input signal would produce a 7-mc. output signal, a 50.1-mc. signal would produce a 7.1-mc. output signal, a 50.2-mc. signal would produce a 7.2-mc. output signal, and so forth. Thus, such a crystal-controlled converter would make a good 7-mc. communications receiver into an equally good 50-mc. receiver.

From these beginnings, receiver design engineers began asking themselves why they couldn't design ultra-stable receivers for the low-frequency amateur bands by utilizing crystal-controlled converters in them.

Multiband Crystal Control. The first step was to build a de luxe superheterodyne receiver with optimum selectivity, stability, and other desirable characteristics for only a single, limited frequency range—say 2500 to 3000 kc. The next step was to build a crystal-controlled converter in front of this optimized receiver; and, by switching in separate crystals and tuned circuits for each amateur band (or other frequency segment), a multiband, tunable, crystal-controlled receiver was born.

The first commercial version of the receiver was the Collins 75A-1 introduced shortly after World War II. For about ten years, the Collins 75A series of amateur receivers were in a class by themselves. Today, however, the requirements of high stability and ease of tuning imposed on ham receivers by SSB, etc., has resulted in a number of other manufacturers announcing amateur receivers and transceivers (and even transmitters) which use a single, limited-range, tunable oscillator in conjunction with crystal-controlled converters to determine their operating frequencies. Unfortunately, equipment of this type is not cheap; but, on a cost-vs.-performance basis, it is not over-priced.

News and Views

Frank C. Meduna, WAØAHX, 2607 White Bear Ave., St. Paul, Minn., is one of those Novices who continue to prove that it's possible to run up a good contact total with modest equipment. His crystal-controlled EICO 723 transmitter, Hallicrafters S-38A receiver, and 40-meter inverted-V antenna have put 45 states, four Canadian provinces, and Venezuela in his worked list. He also has 300 U.S. counties. In the works is a cathode modulator to put the 723 on 15-meter phone . . . **Rob Wolos, WB2HYO,** 70 Ave. "F," Lodi, N.J., parlayed his P.E. SWL registration (WPE2IKX) into a General Class ticket in two years. His Knight-Kit T-60 transmitter and Drake 2-B receiver combined with a Mosley TA-33 beam to put 30 states and nine countries in his logbook on 15-meter phone. Unfortunately, the beam played "Gone With the Wind" and went during an Easter storm. Rob and WB2KKS would like to start a local radio club; suggestions and members are both welcome . . . **Mike Ford, WN9KFQ,** 3502 Oliver St., Fort Wayne, Ind., is looking for Alaska and Hawaii—what Novice isn't? Mike sticks to 40 meters, where his Knight-Kit T-60 transmitter pushes educated electrons into a dipole antenna 30′ high. A Gonset GR-91 is the receiver. The score is 34 states, Canada, Guantanamo Bay, Panama Canal Zone, and Mexico.

Chuck Stigberg, WN4QIT, 142 Findley Square, Hampton, Va., didn't mention his

receiver, but he transmits on a Heathkit DX-60 via a 40-meter vertical or 120' inverted-V antenna. On the 80-, 40-, and 15-meter Novice bands, Chuck has worked 45 states and 13 different countries while making 500 contacts . . . **Steven Roberts, WN4QXH,** 807 13th Ave., Decatur, Ala., can work 80, 40, and 15 meters. His favorite, however, is 40. An EICO 720 transmitter and a new Hammarlund HQ-170 receiver do the inside job, and a 40-meter dipole or a Gotham V-80 antenna do the outside job; 23 states worked are the result . . . **Joseph Berry, WN6HKK,** 1349 N. Gardner, Los Angeles, Calif., and his brother Bill, WN6HKJ, share a Knight-Kit T-60 transmitter and a "vintage" Hallicrafters SX-25 receiver. They have worked 16 states and three countries with the help of a 40-meter dipole.

Joseph A. Jones, WN8KNF, 3557 Panama Dr., Westerville, Ohio, has exchanged reports with 42 states, including Hawaii, Canada, and Venezuela. A Globe Chief 90A, exciting a 40-meter dipole and a home-built 15-meter beam, and a Hammarlund HQ-129A receiver are Joe's tools of achievement. A Heathkit "Two-er" keeps him in touch with the local 2-meter gang . . . **VE7AAG** is the call of the Victoria High School Amateur Radio Club, Victoria, B.C., Canada. Founded in 1956, this club is the oldest of its kind in Canada; it has 20 members, seven of them licensed and the rest studying for their licenses. Among the club's activities is handling most of the radio communications for the annual yacht race in the Victoria harbor. Our thanks to Jim Taylor, VE7BML, president, for the above data . . . If you haven't already worked the New York World's Fair, keep your ear open for **K2US** operating from the Coca Cola Pavilion. This station is active on all the popular ham bands. And if you visit the fair, you can have the thrill of operating K2US yourself—if you have your ham ticket with you.

Need Nevada? **Ron Pollock, KN7ZBW,** 929 Mezpah, Las Vegas (who may be a K7 by the time you read this), will sked anyone needing a Nevada contact and a QSL card. Ron uses a Heathkit DX-60 transmitter to feed either an 80-meter inverted-V antenna or a Mosley vertical; a Hallicrafters SX-111 does the receiving. KN7ZBW has worked 27 states, Canada, and Puerto Rico—so he should be able to work you . . . If you need Delaware, **John Low, K3YHR,** 6 Westmont Ave., Wilmington, Del., is your man. He operates on all ham bands from 80 through 2 meters and has worked 45 states and eight different countries. John's "equipment catalog" lists a "High-Performance Transmitter" (P.E., January, 1962, p. 76); a Knight T-50; a homebrew 6-meter transmitter; a Heathkit "Two-er"; a Heathkit "Mohawk" receiver; a homebrew, 6-meter receiver (P.E., April, 1963, p. 58); and an AMECO converter. His antennas range from a 40-meter dipole to a 7-element, 2-meter beam.

Will we see your "News and Views" or picture in these pages next month? The first step is mailing them to: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Ind. 46401. 73,

Herb, W9EGQ

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Battle of the Bulbs

(*Continued from page 45*)

shape. Many of these filaments were packed into a gas-coal mold, forming a packing of bituminous coal. Wires were fastened to the lower ends of the bamboo fibers, and these were packed with wood shavings. The whole was then packed with more powdered gas-coal and the airtight assembly was heated for an entire night. The next morning it was allowed to cool, it was opened, and the filament was ready for use.

Edison vs. Goebel. The Goebel lamp operated from batteries and had a limited life because of the current drain required from the batteries. The Edison lamp used dynamo power and wasn't affected by current drain.

The Edison Company brought suit against the firms making Goebel lamps in 1893. Goebel introduced proof that his invention was prior to Edison's, and among others, a professor of physics and chemistry and the president of the Electric Company of New York testified that he had indeed seen the Goebel lamp in 1860, and the court did indeed acknowledge the priority of Goebel's invention.

In the same year, at the age of 75, Goebel passed away. His heirs let the matter drop, and this decided the case. If they had continued the fight in court to its end, there's no telling how it would have been resolved. —30—

ODDS 'N' ENDS

Re "Not Cricket, Caroline!" (July, 1964), correspondent Max Pooley reports that another pirate radio ship has taken to the seas off Great Britain and is airing commercially sponsored programs in defiance of Britain's BBC government broadcasting monopoly. *Radio Atlanta,* which has been using 1495 kc. and 1516 kc., and *Radio Caroline,* 1508 kc., are stirring up a storm in the press, with some people suggesting that land-based commercial radio might be a good thing as an alternative to the pirates. Since the British government's re-

cent decision not to take direct action against the pirates, some 100 commercial radio companies are preparing to ring Her Majesty's coasts with "pop" (for popular music) vessels. Our correspondent speculates about the mysterious departure of several announcers from the BBC. If the pirates continue, the missing announcers may be found shortly—aboard ship.

Also on the pirate scene, the R.E.M. Company of Holland is planning to broadcast commercial TV programs from an artificial island to be anchored in the North Sea eight miles off the Dutch coast. The "island" has just been completed by an Irish shipyard, and will include transmitting and power equipment, living quarters for a staff of twelve, and a 260-foot transmitting tower.

Another handy SWL, CB, and ham operating aid has just been released by Electro-Voice. Patterned after E-V's popular "Second OP," this new aid—called the "Q-Dial"—was developed by ARRL Sweepstakes winner W9IOP. The "Q-Dial" is a circular slide rule with information on Q signals, 10-code signals, call letters by districts (ham), CB call areas, time conversions, state capitols, common abbreviations, WWV schedules, modes of transmission, international Morse code, and much more. The "Q-Dial" is sold for $1 at most parts distributors, or it may be ordered directly from Electro-Voice, Buchanan, Mich.

Microphones

(*Continued from page 48*)

on crosstalk. Other microphones, designed especially for stereo, consist of two opposed elements, insulated with acoustic material from each other, mounted in one housing. The home stereo recordist will also find an accessory stand being sold which consists of a single stand with two microphone mounts, separated by an acoustic wall.

Using A Mike. It's simple—just talk. Oh, yeah? There's much more to it than that, as any professional announcer can tell you. Certain critical factors can only be determined by test. For example, labial sounds—those noises which are not normally a part of speech but which occur when the speech organs are used—are annoying if picked up. They come through as sputters, clicks and pops. To eliminate most of them, you just move further away from the mike. With some mikes, especially mobile types, you must speak *across* the mike rather than *into* it. If you need to be close to the mike for the type of pickup you desire but haven't the time or inclination to worry about the minor points, you can fit a wind screen over the mike.

Microphones are sensitive, for the most part, to changes in level. To secure the best results, you should speak in an even voice, using tonal inflections for emphasis rather than level changes. This takes a bit of practice, but is well worth the effort. -30-

Short-Wave Report

(*Continued from page 84*)

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 Eastern Standard and the 24-hour system is used. Reports should be sent to P.O. Box 254, Haddonfield, N.J., 08033, in time to reach your Short-Wave Editor by the eighth 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 everyone who contributes to this column.

Aden—The S. Arabian B/C Service, Aden, has been noted on 5060 kc. from 2237 to 2300 with Arabic music and language. This station is very close in frequency to that of a New York City telephone station.

Angola—*R. Clube da Huila,* CR6RH, Sa da Bandeira, 5024 kc., has non-stop Portuguese music from 1645 to as late as 1800.

Antigua—The Antigua and Barbuda B/C Service is heard only on 644 kc. Try for it around 1900 when it carries the London-relayed "Caribbean Magazine."

Australia—Melbourne's complete Eng. schedule reads as follows: to N.A. at 0715-0815 on 9580 kc. and at 2000-2300 on 15,220 and 17,840 kc.; to Africa at 2329-0045 on 15,220 and 17,820 kc.; to the British Isles and Europe at 0130-0230 on 9570 and 11,710 kc.; to the Mid-Pacific Islands at 2129-0145 on 15,240 kc., at 0159-0712 on 7190 kc., and at 1500-1700 on 15,315 kc.; to the South Pacific Islands at 0100-0415 on 9570 and 11,710 kc. and at 1500-1700 on 11.840 kc.; to Indonesia, Malaysia, S., S. E., & S. W. Asia at 1714-1815 on 15,330 kc., at 1714-2000 on 15,220 kc., at 1845-0430 on 17,870 kc., at 2000-0300 on 21,540 kc., at 0330-0430 on 15,220 kc., at 0330-0945 on 11,880 kc., at 0429-1230 on 9570 kc., and at 0930-1230 on 7220 kc.; to East Asia & N. W. Pacific Islands at 0359-0500 and 0600-0712 on 11,810 kc., at 0600-0712 on 9580 kc., and at 1559-1745 and 1845-1915 on 15,240 kc.

A letter from Perth reveals that VLX has increased power to 50 kw. This station provides service for "out back listeners" in the far north and northeastern areas of Western Australia. The programs, basically intended for country listeners, originate in the Perth studios of VLX and VLW and are sent out on two s.w. channels and seven medium-wave outlets, designated as "The Third Network." Station officials claim that a single station ID is rarely given. The xmtr is at Wanneroo.

Bechuanaland—An overseas source lists ZND, Lobatsi, as having returned to the air on 3356 kc. where it is scheduled from Monday to Friday from 1030 to 1130 s/off.

Bolivia—Station CP70, *R. Grigota,* Santa

Latest DX Country Awards Presented!

To be eligible for one of the DX Country Awards designed for WPE Monitor Certificate holders, you must have verified stations in 25, 50, 75, 100, or 150 different countries. The following DX'ers recently received their awards.

One Hundred Countries Verified

Harold E. Schrock (WPE9AKF), Paxton, Ill.
Bo Yeargan (WPE4DVU), Rome, Ga.

Seventy-Five Countries Verified

Jack Winther (WPE6BJD), Moraga, Calif.

Fifty Countries Verified

John E. Fagyas (WPE2IQM), Buffalo, N. Y.
Walter T. Grubb (WPEØCSG), Dubuque, Iowa
Bob Zulinski (WPE8FAV), Berkley, Mich.
Dennis Rodman (WPE2JKN), Brooklyn, N. Y.
Larry Thompson (WPE8EKM), Cincinnati, Ohio
Wayne Benkinney (WPE8EEI), Flint, Mich.
Noel G. Harrison (VK3PEIH), Victoria, Australia
Ovide M. Brudo (WPE1EEX), Ware, Mass.

Twenty-Five Countries Verified

Tom White (WPE6EPB), Hollywood, Calif.
Leo Fleury (WPE2KUR), New York, N. Y.
James R. Wylder (WPE6FCL), Redding, Calif.
Tom Norman (WPE4GXY), Florence, S. C.
Dick Schier (WPE4HIO), Chattanooga, Tenn.
Robert Schultze (WPE9GOU), Whiting, Ind.
Edward Braytenbah (WPE3FLC), Kensington, Md.
John Sweeney (WPE8GDV), Drayton Plains, Mich.
Jim Martin (WPEØDJO), Minneapolis, Minn.
Kevin E. Roosa (WPE2KNZ), Saugerties, N. Y.
N. H. Lederman (WPE1EBZ), Dorchester, Mass.
Jay Bondell (WPE2LLS), N. Bellmore, N. Y.
James Boileau (WPE2LND), Maplewood, N. J.
Norman Kiel (WPE2LON), Bronx, N. Y.
Jonathon Hoyt (WPE1DRY), Clinton, Conn.
Frank Scolaro (WPE2LUZ), Yonkers, N. Y.
Thomas Giacopelli (WPE2KOQ), Tuckahoe, N. Y.
James J. Tutak (WPE2KRE), Jersey City, N. J.
Louis Diagle (VE2PE1GK), Laval Surlelac, Quebec, Canada
Gordon G. Cash (WPE4HFF), St. Petersburg, Fla.
Charles A. Dobbins (WPE8BEV), Detroit, Mich.
Joe Johnson (WPE8FVN), Cincinnati, Ohio
Bruce D. Drewett (WPE4GXG), Miami, Fla.
Bob Lindsey (WPE8FCM), Marietta, Ohio
Edward Jacobson (WPE2JEL), Westbury, N. Y.
Tom Palmer (WPE4GEL), Sanford, Fla.
David Leiboritz (WPE2JWF), Bronx, N. Y.
Steven Russell (WPE3EWZ), Bethesda, Md.
Wade Smith (WPE3FGX), Wayne, Pa.
Julian Jorstad (WPE6DGO), Seaside, Calif.
David Hoopman (WPE9GJT), Fond du Lac, Wis.
Richard Williams (WPE2IJP), Far Hills, N. J.
Stephen Hawley (WPE4GXJ), Central City, Ky.
Charles S. Wackerman (WPE4HJI), Pollocksville, N. C.
William H. Osha (WPE9GQP), Fort Wayne, Ind.
Edwin Bolton (WPE2KWQ), Wayne, N. J.
Wayne Visocsky (WPEØDLW), Leavenworth, Kan.
Bill Pardue (WPE4FTL), Moravian Falls, N. C.
Thumper Peniston (WPE2LYS), Chester, N. J.

DX STATES AWARD RULES

Are you eligible to apply for a 20, 30, 40, or 50 States Verified Award? Here is a brief resume of the rules and regulations.

(1) You must be a registered WPE Short-Wave Monitor and show your call on your application.

(2) You must submit a list of stations (any frequency or service) for which you have received verifications, one for each state heard. You must also supply the following information in tabular form: (a) state heard; (b) call-sign or name of station heard and location; (c) frequency; (d) date the station was heard; (e) date of verification; (f) whether broadcast was a normal transmission for the class of station received, or a test. All of the above information should be copied from the station's verification. Do not list any verifications you cannot supply for authentication on demand. Do not send any verifications at this time. Should any verifications need to be sent in for checking, we will notify you and give you instructions on how to send them.

(3) A fee of 50 cents (U.S. coin) must accompany the application to cover the costs of printing, handling, and mailing. This fee will be returned in the event an applicant is found to be ineligible. Applicants in countries other than the U. S. may send the equivalent of 60 cents (U.S.) in coins of their own country if they wish. Please do not send International Reply Coupons (IRC's) when applying for an award.

(4) Apply for the highest DX award for which you are eligible. If, at a later date, you are eligible for a higher award, then apply for that award.

(5) Send your application, verification list, and fee to: Hank Bennett, Short-Wave Editor, P. O. Box 254, Haddonfield, N. J. 08033. Do not include an application for a Short-Wave Monitor Certificate (you are not eligible for any of the awards until you have a Short-Wave Monitor Certificate in your possession). Reports, news items, or questions should be mailed in a separate envelope.

Cruz de la Sierra, 4823 kc., has been heard after a one-year silence from 2030 to 2200 or later with Latin American vocals, time checks, and ID's.

Brazil—*R. Alvorada,* Londrina, is a new station on 3345 kc. Programs feature long non-stop musical periods, and they request reports. The s/off is 2200. Other stations currently reported include *R. Record,* Sao Paulo, 11,965 kc., around 1950 with records; *R. Bandeirantes.* Sao Paulo, 11,925 kc., at 2000 with Latin American music; and *R. Nacional Brasilia,* Brasilia, 11,720 kc., at 1915 with classical music.

Brunei—*R. Brunei* has been testing on 4865 kc. and requesting that reports be sent to the chief engineer. The station verified by airmail and said that the use of 4865 kc. would continue after the testing was completed. The best signals are from 0700 to 0930 s/off.

Burma—Rangoon is heard on 5045 kc. from 0915 with news. The schedule reads 0900-1100.

Canada—The Dominion Observatory station, CHU, Ottawa, is now giving the voice announcements in Eng. and French. The station operates on 3330, 7335, and 14,670 kc.

Chile—Station CE595, *Emisoras Nuevo Mundo,* Santiago de Chile, is a new outlet on 5950 kc. with a reported s/on at 0956.

R. Presidente Balmaceda operates CE960, 9600 kc., 10 kw.; CE597, 5975 kc., 1 kw.; and CE130, 1300 kc., 10 kw. Reports are appreciated and should go to Calle Nueva York 53, 7th Floor, or to P. O. Box 13650, Santiago. Daily s/on is at 0500; there is an Eng. ID just prior to 0000 s/off.

Colombia—*R. Horizonte, Emisora Colombiana,* Bogota, 5970 and 540 kc., operates at 0530-0000 with an Eng. newscast at 1745 and 2345, daily except Sunday. Also recently logged: *R. TV Nacional de Colombia,* Bogota, 4945 kc., from 1945 to 2322 s/off with news and classical music, all-Spanish; *R. Santa Fe,* Bogota, 4965 kc., at 2323-0100 with pop Latin American music; *R. El Sol,* Cali, formerly on 6115 kc. and now in the 5100-5150 kc. area, heard weakly at 2020-2102.

Costa Rica—*R. Popular,* San Jose, 6220 kc. (varies to 6252 kc.) is a new outlet of *Sistema HB* which includes *R. Reloj* on 6206 kc. They are heard to 0000 s/off with music and sports programs and a time check every five minutes.

Cuba—Havana was noted on 8460 kc. from 1320 to 1332 s/off with talks and request for reports.

Ecuador—Stations recently heard include: HCBJ2, *R. El Mundo,* Guayaquil, 4747 kc., at 2100-2300 with music and ads; HCRI1, *Centro Radiofonico de Imbabura,* Ibarra, 5053 kc., at 0200 with special festival program; HCOB5, *R. Ondas Azules,* Cuenca, 5105 kc., with music and anmts to 0153 s/off, returning to the air at 0700; and HCDF1, *Radiodifusora La Voz del Norte,* Ibarra, 5850 kc., usually good from 2000 to 2300 s/off with music, returning at 0630. All of the above programs were in Spanish.

France—If you haven't received a verification from Paris, send your report to this address: *Radiodiffusion-Television Francaise,* 116 Avenue du President Kennedy, Paris 16eme, France.

Germany (East)—*R. Berlin International* has been testing on 9600 kc. at 2000-2130 and on 6080 and 9560 kc. at 1445-1545. Other reports indicate still another test xmsn on 9620 kc. around 2315, dual to 6080 and 5970 kc.

Ghana—Accra is noted in Eng. at 1550-1635 on 11,800 kc., at 1635-1655 on 9545 kc., and at 1650-1715 on 6070 kc.

QSL Cards For You?

The SWL QSL Bureau is currently holding QSL cards for the following WPE Monitors. If your WPE registration is listed here, send a stamped, self-addressed envelope to Mr. LeRoy Waite, 39 Hannum St., Ballston Spa, N. Y. 12020, and your card(s) will be forwarded to you.

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WPE3CIM		WPE4FUM
WPE3CQF	WPE4CIA	WPE4GXJ
WPE3FFJ	WPE4CVN	WPE4RX

Gilbert & Ellice Islands—Station VRTW2, Tarawa, is operating on 6055 kc. at 2330-0130 daily except Wednesdays and Fridays in native languages, and at 0230-0530 Thursdays in English.

Guatemala—Station TGRY, *La Voz de San Raymundo*, 4920 kc., is particularly anxious to receive reports. If you can write your report in Spanish, all the better. Send it to: Senor Victor Manuel Garcia Rojas, TGRY, San Raymundo. This station is heard best around 2300-0100.

Ivory Coast—Abidjan, now on a new frequency of 3243 kc., is strong from 0100 s/on

Beacon Stations

There has been a marked increase in the number of reports being received on the beacon stations in the 1500-1700 kc. range. During this period of low sunspot activity, we will list a number of these stations that you may be able to log with careful tuning and patience. For the most part, they are low-powered and do not operate continuously. They identify in slow-speed Morse code by call-sign. The listing below is by frequency in kilocycles, and it includes stations in Central and South America; additional stations will be listed next month.

1600 ASC, Ascension, Bolivia, 300 watts
SLSU, Sucre, Bolivia, 200 watts
1620 CEP, Concepcion, Bolivia, 350 watts
1630 APB, Apolo, Bolivia, 100 watts
1638 IAC, La Quiaca, Argentina, 250 watts
PRN, Tapurucuara, Brazil
ZYL, Labrea, Brazil
1640 JSE, San Jose, Bolivia, 350 watts
1648 PUI, Tefe, Brazil, 75 watts
1688 PRJ, Benjamin Constant, Brazil, 50 watts
PUD, Eirunepe, Brazil
PVG, Cucui, Brazil
PVN, Porto Velho, Brazil, 75 watts
1708 PUB, Carauari, Brazil
PVK, Altamua, Brazil
1710 SNG, San Ignacio, Bolivia, 350 watts

to past 0200; there is a newscast in French at 0145. The 11,820-kc. outlet has been noted from 1845 to 1900 with a news period in French at 1855.

Korea (South)—Station HLK55, Seoul, is noted on 11,950 kc. in Spanish to Latin America at 2330-0000 and in Eng. in the General Service at 0230-0300. News is aired at 0230.

Malaysia—*R. Malaysia*, Singapore, 11,940 kc., is heard at 1000-1130 in Eng. with news at 1030 and 1100. Another Eng. xmsn is noted at 1730 and the dual channel for both xmsns is 4985 kc. Another outlet on 9740 kc. is heard at 0854-1000 in English.

Mauretania—A new QSL card from *R. Mauretanie*, Nouakchott, lists this schedule: (weekdays) 3222 kc. at 0130-0300 and 1300-1730; 6035 and 9610 kc. at 0700-1000; Sundays at 0230-1800; Saturdays to 1830. The 4855-kc. channel is no longer used.

Mozambique—Rarely heard is CR7BX, *R. Clube de Mocambique*, 7210 kc., at 0630-0705. No positive ID has been logged. The program

consists mostly of Portuguese operatic and classical guitar music.

New Zealand—Wellington has Eng. to the Pacific Islands at 0100-0345 on 9540 and 11,780 kc.; to Australia at 0400-0645 on 9540 and 6080 kc.; and to Antartica on Sundays only at 0315-0345 on 6080 kc. Reports go to P. O. Box 2396, Wellington.

Niger—*R. Niger*, Niamey, 3260 kc., opens at 0030 with a chant. A newscast in French is given at 0100. The dual channel is 5020 kc. The 6060-kc. outlet has finally been verified after six attempts; it can be heard on Sundays with native music from 0200.

SHORT-WAVE ABBREVIATIONS

anmt—Announcement	QRN—Atmospheric interference
B/C—Broadcasting	QSL—Verification
Eng.—English	R.—Radio
ID—Identification	s/off—Sign-off
kc.—Kilocycles	s/on—Sign-on
kw.—Kilowatts	VOA—Voice of America
N.A.—North America	xmsn—Transmission
QRM—Station interference	xmtr—Transmitter

Paraguay—*R. Paraguay*, Asuncion, is heard often on 6015 kc. from 0457 s/on to past 0545; news in Spanish is given at 0500, and there may be a *VOA* newscast at 0515 some days. *R. Encarnacion*, Encarnacion, 11,947 kc., has news in Spanish at 1900-1910, "Noches en Paraguay" at 2030-2100, and a national news bulletin at 2100-2110.

Peru—*R. Nacional del Peru*, Iquitos, has moved from 9610 kc. to 9855 kc. and is "rough copy" from 1900 to 2300. Station OCX4M, *R. Pasco*, Cerro de Pasco, 6128 kc., operates all night with music of the Andes and many dedications. Rarely heard and always weak is OAX7T, *R. Sicuani*, Sicuani, 4836 kc.; it was picked up at 2150-2235 with Spanish request music.

Ruanda—The schedule for *Deutsche Welle*'s relay station in Kigali is as follows: 7225 kc. at 2330-0000 in Eng., at 0000-0100 in French, at 0105-0135 in Eng., at 0135-0150 in Hausa, at 0150-0225 in French, at 0455-0555 in Swahili, and at 0600-0700 in Banrya-Rwanda; 7260 kc. at 1055-1115 in Swahili, at 1115-1210 in Eng., at 1215-1515 in German, at 1520-1550 in Eng., and at 1550-1650 in French.

Surinam—Overseas reports claim that the license of AVROS, Paramaribo, 15,406 kc., was withdrawn for unknown reasons and that the station now buys time from other stations. Paramaribo has been noted on 15,450 kc. at 0725 with what seemed to be a commercial-type program beamed to Curacao.

Switzerland—Rarely heard is Berne's 6050-kc. outlet, HEI22. It was picked up recently at 2228 with Spanish to Central America.

Turkey—Some changes in Ankara's schedule: Eng. is now broadcast to S. & S. E. Asia at 0915-0945 on 17,820 kc. and to England and Europe at 1700-1730 on 15,160 kc. French is now broadcast at 1430-1445 and German at 1300-1315 on 15,160 kc.

U.S.A.—The *VOA* says that the test stations operating in Yuma, Ariz., and Dallas, Texas *(KK2XEZ)* were portable stations being checked out before shipment to overseas

points. The Yuma equipment is now operating in Monrovia, Liberia.

U.S.S.R.—*R. Minsk* opens in Byelorussian at 1630 on 5940 and 5970 kc.; s/off is at 1730. Kiev operates in Eng. to N.A. on Mondays, Thursdays, and Saturdays from 2140 on 7180, 7210, 9660, 11,680, and 11,960 kc., and from 2310 on 7180, 7210, and 11,910 kc.; the xmsns are usually 20 minutes in length. Yerevan operates in Eng. only at 1520-1525 on 9725 kc.; the station opens at 1430 with chimes, and except for the short Eng. xmsn, the program is in Armenian.

Clandestine—The "Kiss Me Honey" station has been noted in New England areas around 1030 on 11,695 kc. *R. Peyk-e-Iran*, last reported as being on 11,400 and 11,695 kc. around 0930-1030 is now noted on 11,410, 9560, and 11,695 kc. around 0930-1310 in French or Persian. *Voice of Free Africa* (reported in Cairo) has been heard announcing as *Sawti ya Africa Hurru* during the 1200-1240 xmsn on 17,805 kc.

Unidentified—A station is being reported on 2910 kc. at 0230-0345 in Eng. with pop music and jazz to 0300; news bulletins to 0305; more music to 0330; talks and music to 0345. At 0330, the time was given as "5:30." Heavy QRM and QRN prevented any chance for an identification. —30—

SHORT-WAVE CONTRIBUTORS

Francis Welch, Jr. *(WPE1CRV)*, Rochdale, Mass.
William Chapman *(WPE1DRZ)*, Middletown, Conn.
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Sheldon Klink *(WPE2JGG)*, Newark, N. J.
William Graham *(WPE2LMU)*, Binghamton, N. Y.
Electro-Education Club *(WPE2LVE)*, New York, N. Y.
Frank Mather *(WPE2LWW)*, Buffalo, N. Y.
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___	7AU7	.65	___	12AY7	1.44	___	12F8	.66	___	25DN6	1.42
___	7EY6	.75	___	12AZ7	.86	___	12FA6	.79	___	25EH5	.55
___	7Y4	.69	___	12B4	.68	___	12FM6	.50	___	25L6	.57
___	8AU8	.90	___	12BD6	.50	___	12FR8	.97	___	25W4	.68
___	8AW8	.93	___	12BE6	.53	___	12FX8	.90	___	32ET5	.55
___	8BQ5	.60	___	12BF6	.60	___	12GC6	1.06	___	35C5	.51
___	8CG7	.63	___	12BH7	.77	___	12J8	.84	___	35L6	.60
___	8CM7	.70	___	12BK5	1.00	___	12K5	.75	___	35W4	.42
___	8CN7	.97	___	12BL6	.56	___	12L6	.73	___	35Z5	.60
___	8C57	.74	___	12BQ6	1.16	___	12SF7	.69	___	36AM3	.36
___	8EB8	.94	___	12BR7	.74	___	12SK7GT	.95	___	50B5	.69
___	8FQ7	.56	___	12BV7	.76	___	12SL7	.80	___	50C5	.53
___	9CL8	.79	___	12BY7	.77	___	12SN7	.67	___	50EH5	.55
___	11CY7	.75	___	12BZ7	.86	___	12SQ7GT	.91	___	50L6	.61
___	12A4	.60	___	12CN5	.56	___	12U7	.62	___	70L7	.97
___	12AB5	.60	___	12CR6	.67	___	12V6	.63	___	117Z3	.85
___	12AC6	.55	___	12CU5	.58	___	12W6	.71	___	807	.75
___	12AD6	.57	___	12CU6	1.06	___	12X4	.47			
___	12AE6	.50	___	12CX6	.54	___	17AX4	.67			
___	12AE7	.94	___	12D4	.69	___	17DQ6	1.06			
___	12AF3	.73	___	12DE8	.83	___	18FW6	.49			
___	12AF6	.67	___	12DL8	.88	___	18FX6	.53			
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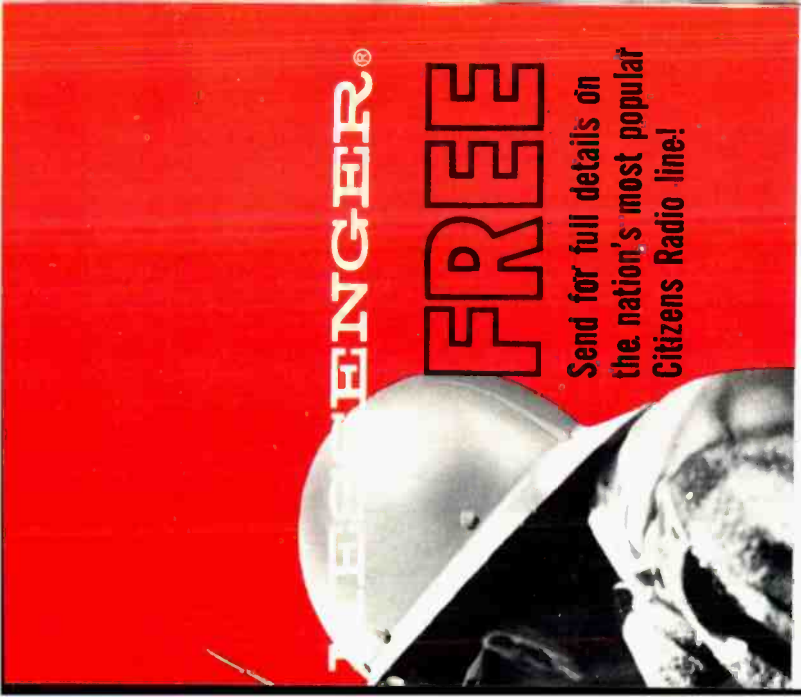

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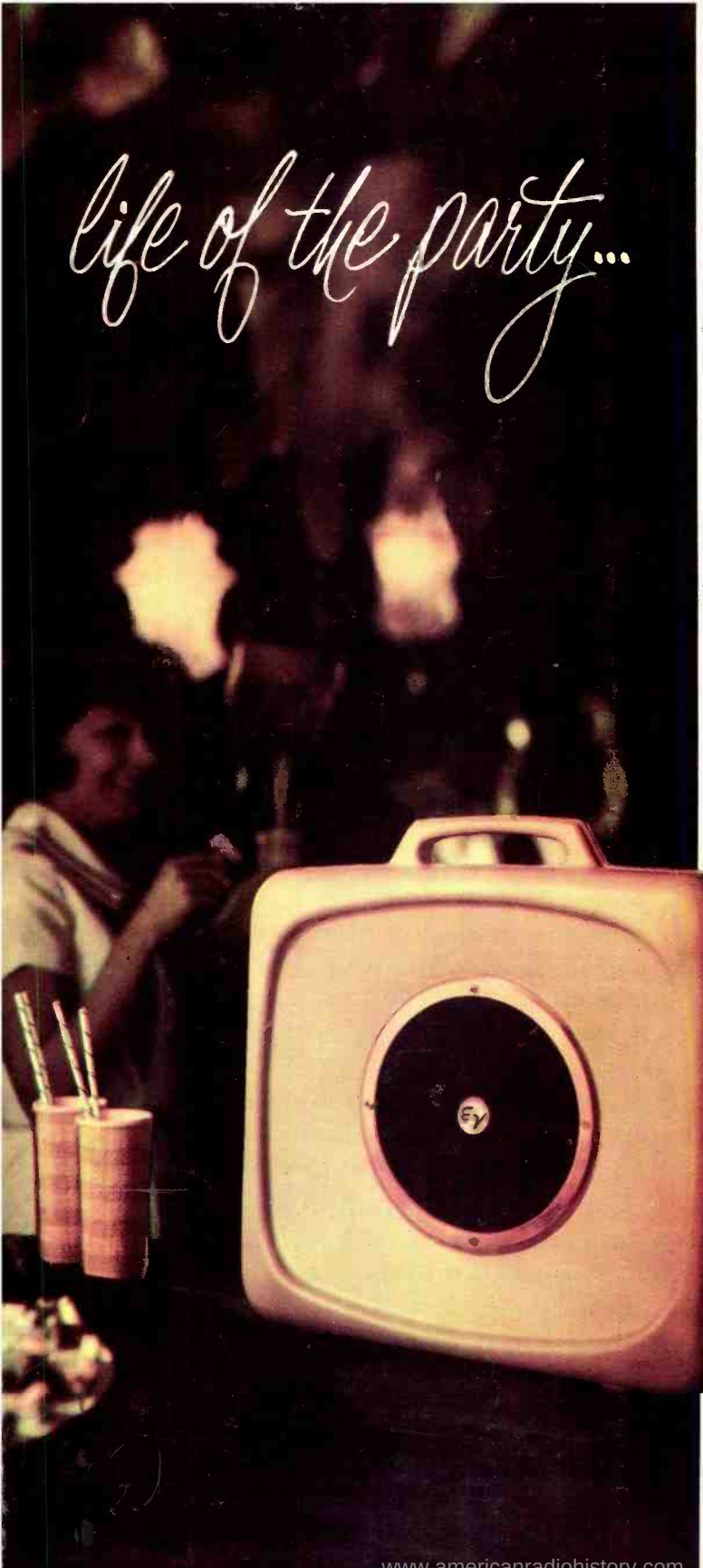

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