Can't Sleep? Build Rainfall Sound Maker

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JANUARY 1965

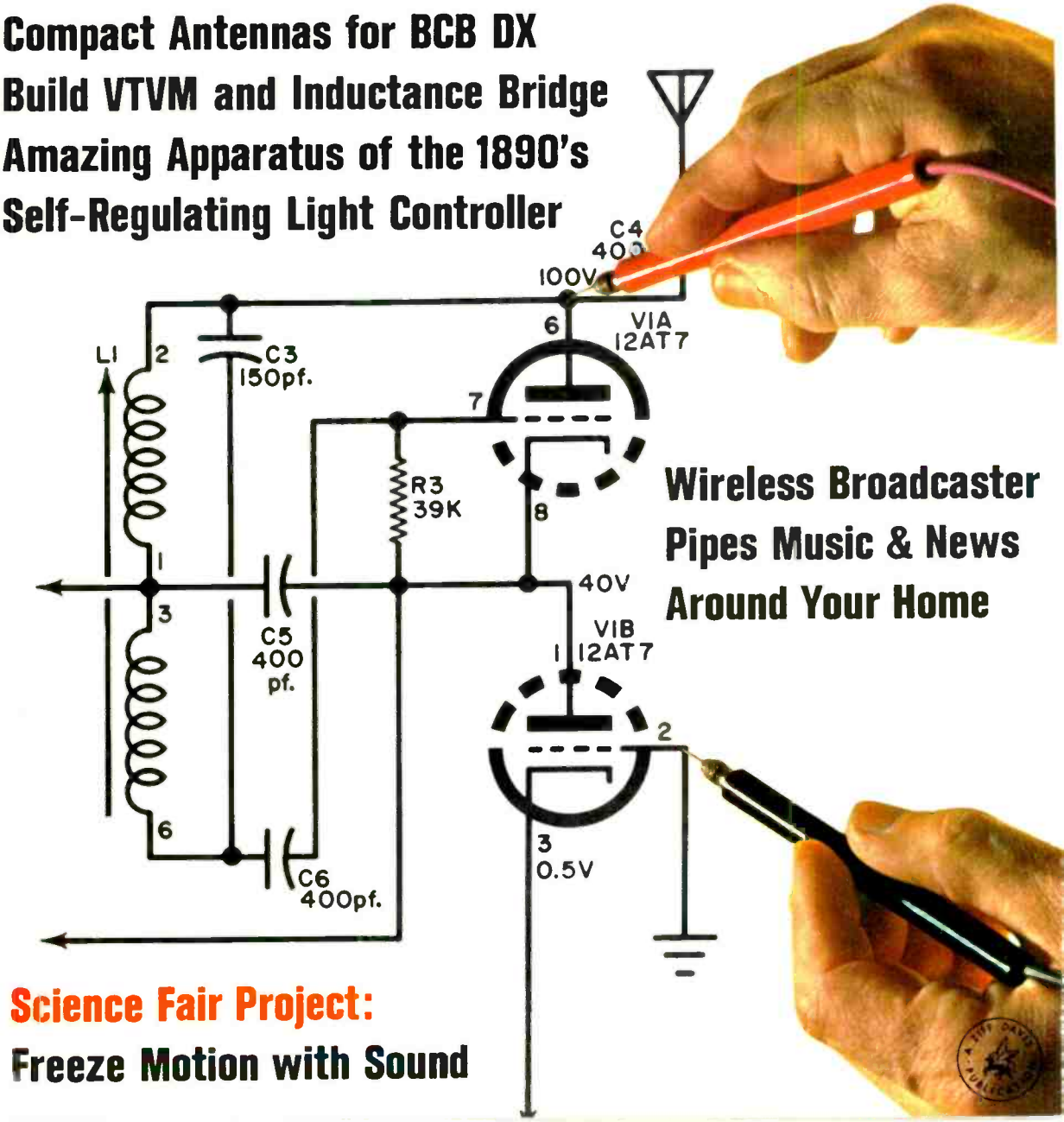
35 CENTS

Compact Antennas for BCB DX

Build VTVM and Inductance Bridge

Amazing Apparatus of the 1890's

Self-Regulating Light Controller



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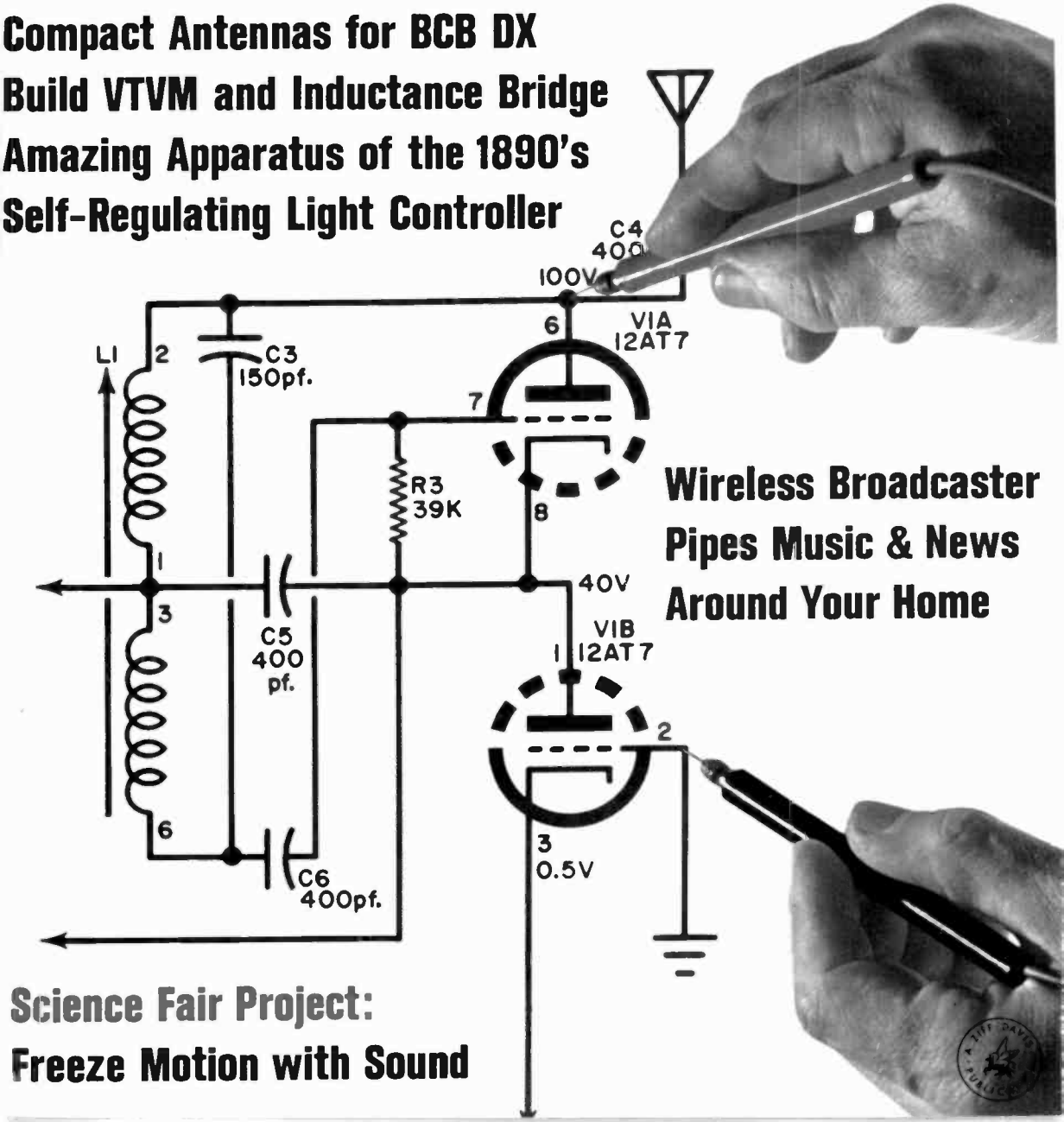

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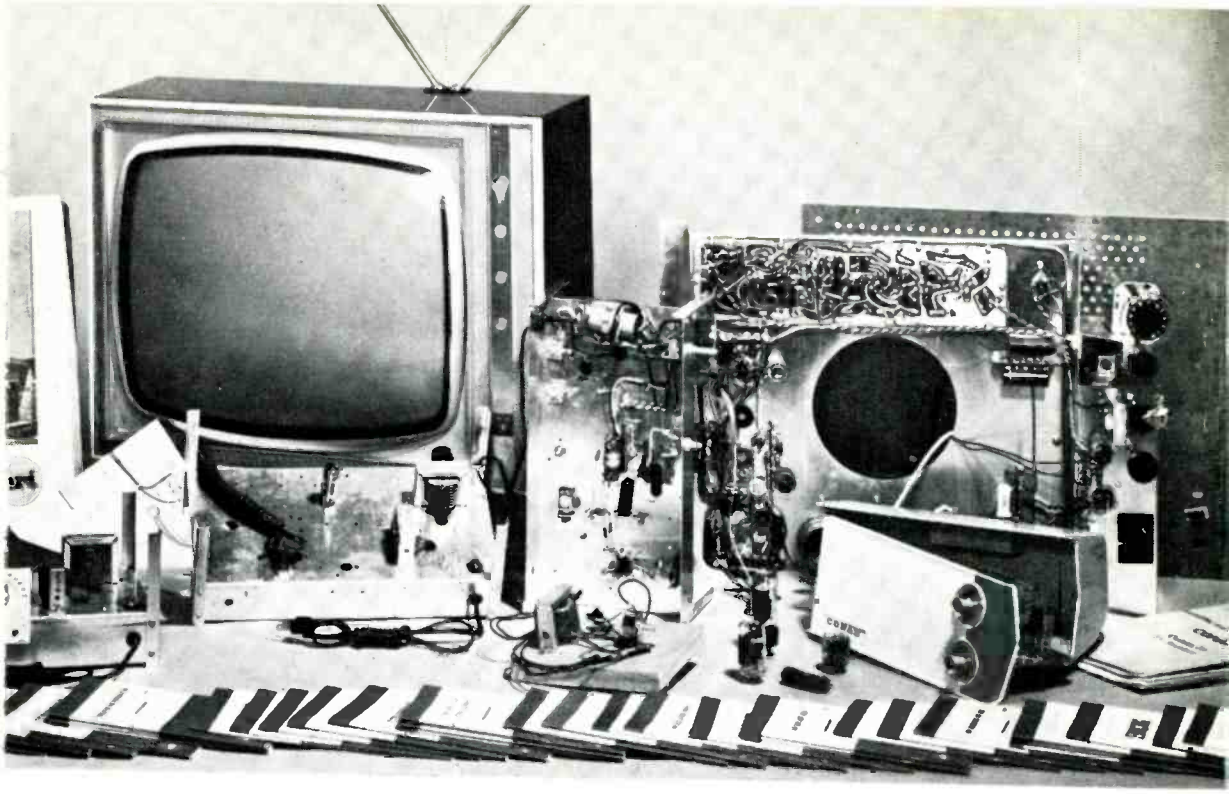

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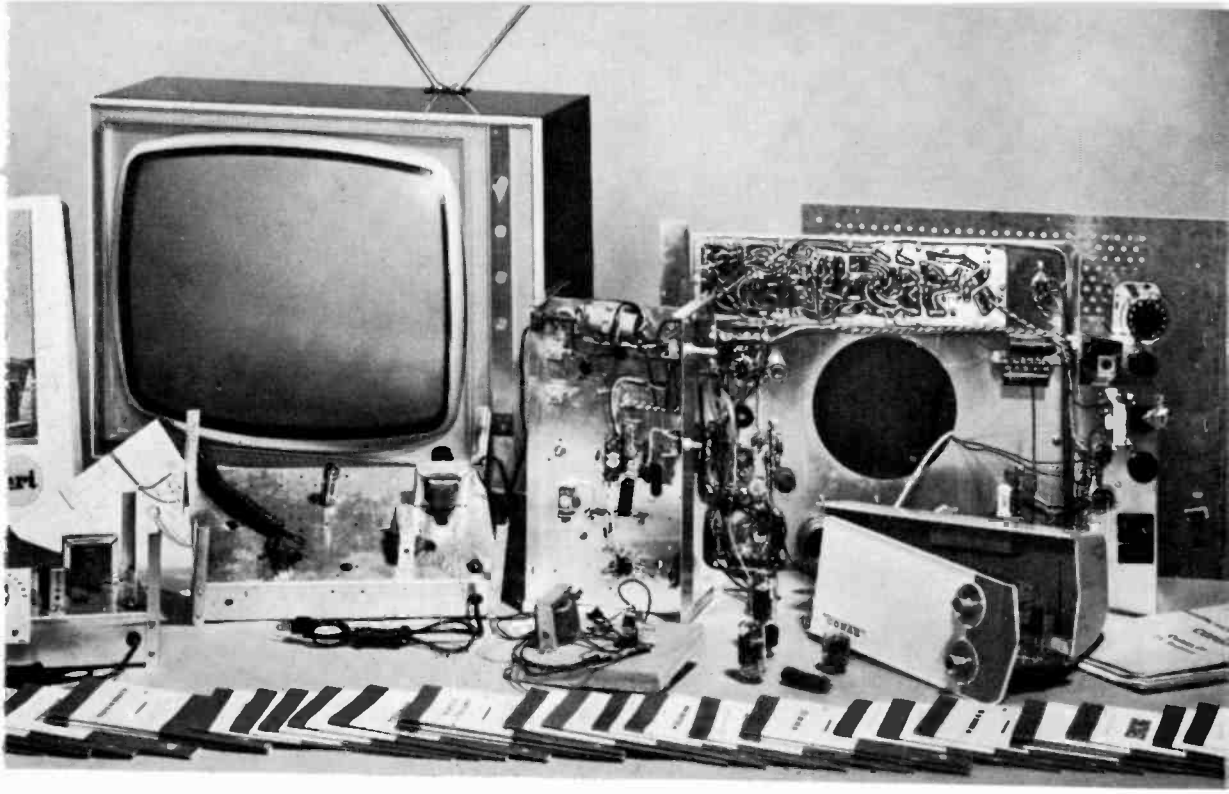

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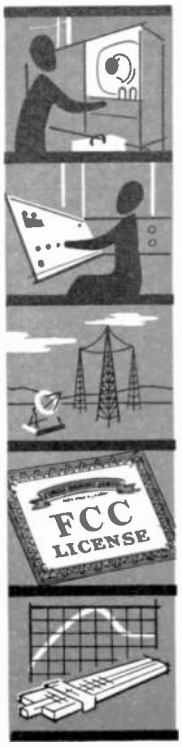

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POPULAR ELECTRONICS is Indexed in the Readers' Guide to Periodical Literature

This month's cover photo by Bruce Pendleton
Schematic by Andre Duzant

VOLUME 22 JANUARY, 1965 NUMBER 1

Special Feature

Construction Projects

Amateur, CB, and SWL

Electronic Features and New Developments

Departments

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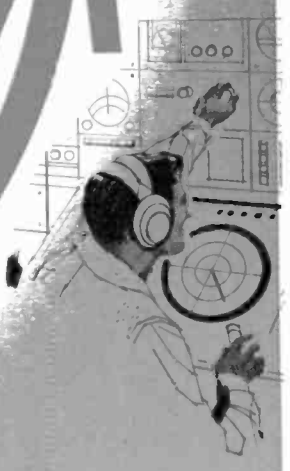

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POPULAR ELECTRONICS is published monthly by Ziff-Davis Publishing Company at 434 South Wabash Avenue, Chicago, Illinois 60605. January, 1965. Volume 22, Number 1. (Ziff-Davis also publishes Popular Photography, Electronics World, HiFi/Stereo Review, Popular Boating, Car and Driver, Flying, Modern Bride, Amazing, and Fantastic.) Subscription Rates: One year United States and possessions, $4.00; Canada and Pan American Union Countries, $4.50; all other foreign countries, $5.00. Second Class postage paid at Chicago, Illinois, and at additional mailing offices. Authorized as second class mail by the Post Office Department, Ottawa, Canada, and for payment of postage in cash.

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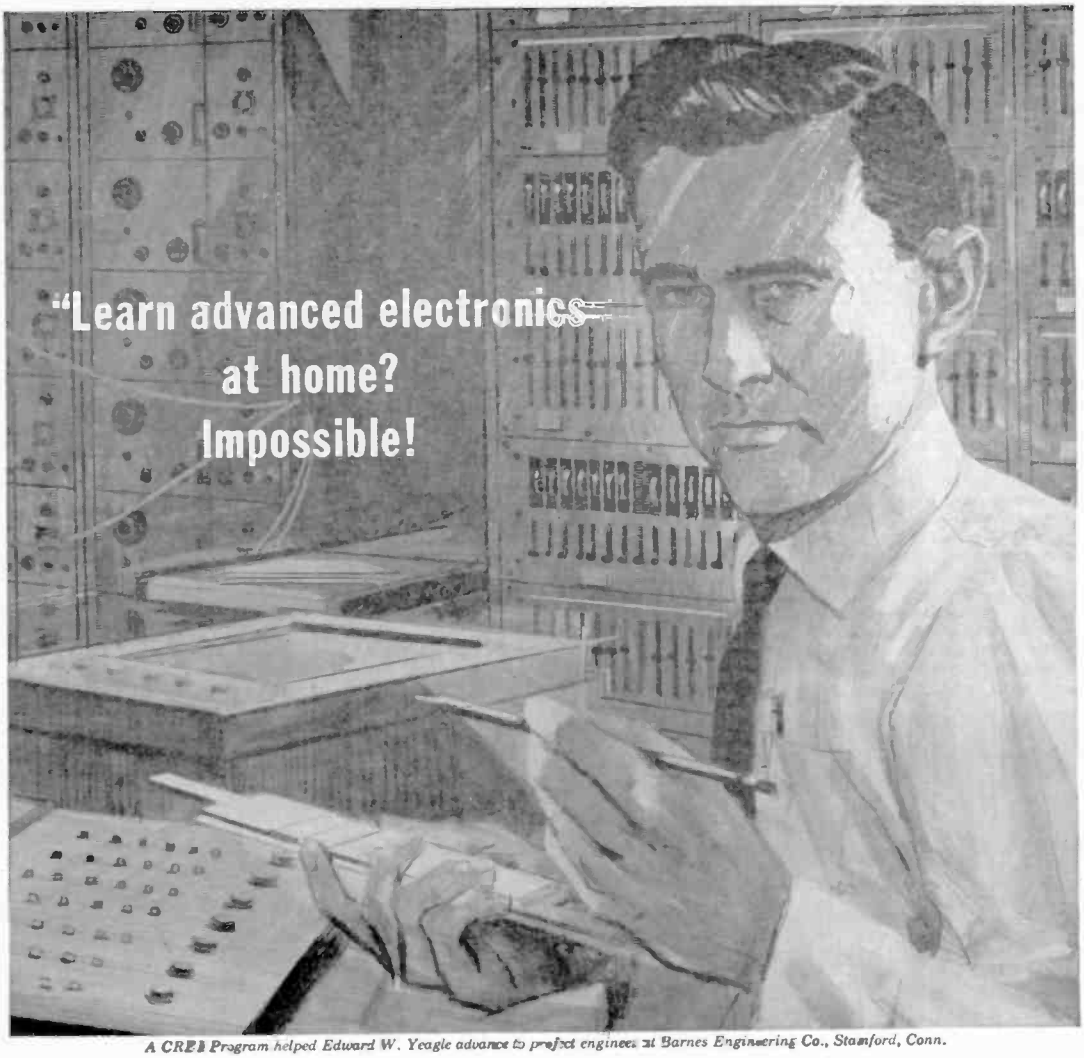

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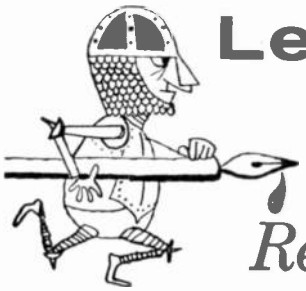

Letters *from our Readers*

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

Receivers for BCB DX

■ "Broadcast Band DX—Getting Started" (November, 1964) was most interesting, but technically misleading. A double- or triple-conversion receiver, or use of a preselector with a receiver, offers no advantage in BCB reception, DX or otherwise. The main purpose of double and triple conversion is to reduce spurious response due to image signals. Since the i.f. frequency of a BCB receiver is an appreciable percentage of the received signal, the image ratio is high and multiple frequency conversion is not needed. A preselector adds sensitivity and image rejection to a receiver. Sensitivity, low signal-to-noise ratio, is accomplished by reducing the noise generated within the receiver itself. Since radio noise below a minimum of 2 mc. is determined by atmospheric disturbances and man-made static, the signal-to-noise ratio of a receiver cannot be improved by preselection. The two most important considerations for BCB DX'ing are a well-designed antenna system and an accurately calibrated receiver with high i.f. selectivity.

WILLIAM F. DOHERTY, Electrical Engineer
Sacramento, Calif.

Yes and no, Bill. Yes, i.f. selectivity is important, and no, the purpose of double conversion here is not just to reduce image signals, although this is important at higher frequencies. The selectivity of an i.f. amplifier depends on its frequency—for example, a 50-kc. i.f. amplifier with four tuned circuits is roughly 2.16 kc. wide at 60 db down, while a 455-kc. i.f. amp with the same number of tuned circuits is about 16 kc. wide at 60 db down. The 85-kc. i.f. of the BC-453 described in the article is about 6.5 kc. wide at −60 db, a considerable improvement over a single-conversion receiver with a 455-kc. i.f. The term "preselector" (a preamplifier with selectivity) was loosely used in the article; we would prefer "preamplifier" or just "r.f. amplifier." Regardless of the term used, a well-designed one will improve the signal-to-noise ratio (and hence the sensitivity) of an inexpensive BCB receiver with mixer input, and possibly that of some older communications receivers.

We Get Tears In Our Ears . . .

■ The reader who wrote that England does not and never did own the Sandwich Islands is only partially correct, as is the Letters Editor ("Letters from Our Readers," October, 1964). A small portion of the land on which the Captain Cook Monument now stands was either given or sold to England many years ago. The land is located on the west side of the island of Hawaii on the shores of Kealakekua Bay, the site where Cook was killed. From time to time, British ships visit the

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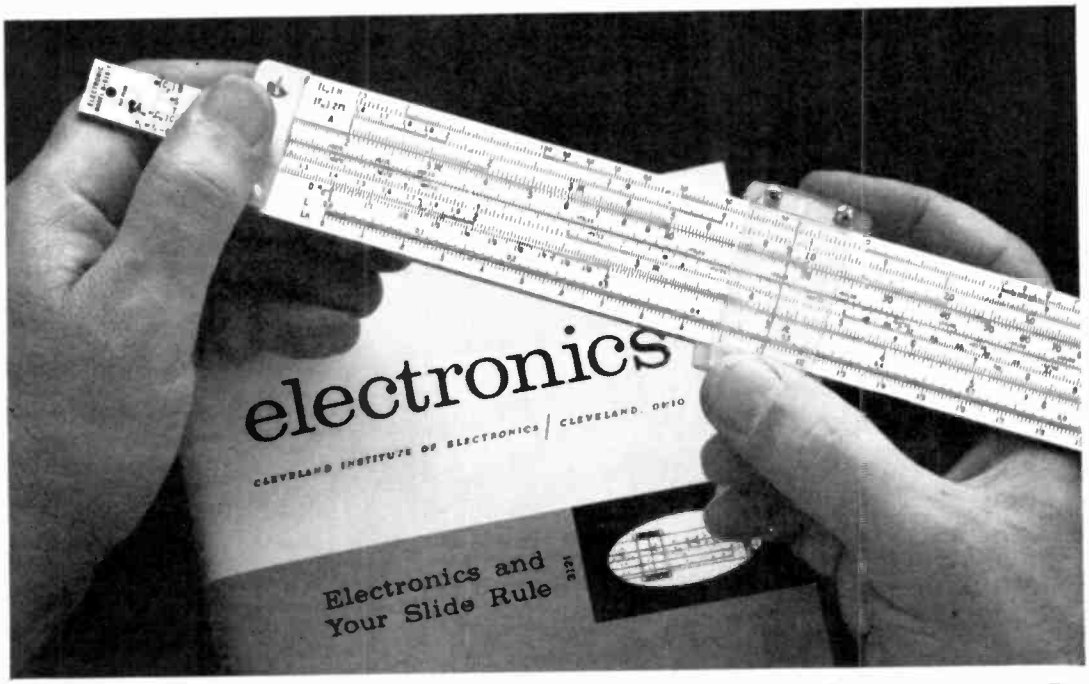

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Letters

(*Continued from page 6*)

Captain Cook Monument to clean and maintain it. Cry, Letters Editor, Cry!

ROY S. BLACKSHEAR
Honolulu, Hawaii

Thanks for the interesting information, Roy, though that last sentence begins to remind us of the song entitled: "I Get Tears In My Ears From Lying On My Back While Crying Over You!" Readers who missed P.E.'s venture into the subject of the Sandwich Islands are referred to "Electronics Primer," August, 1964.

Circuit Boards for the FM-TV Booster

■ The circuit board for the FM-TV Booster ("An Easily Built FM-TV Booster," November, 1964) is available only from a single source, and you neglected to include the circuit template in the article. If we wanted to assemble kits, we would purchase kits.

JOHN T. WASDI
Fort Belvoir, Va.

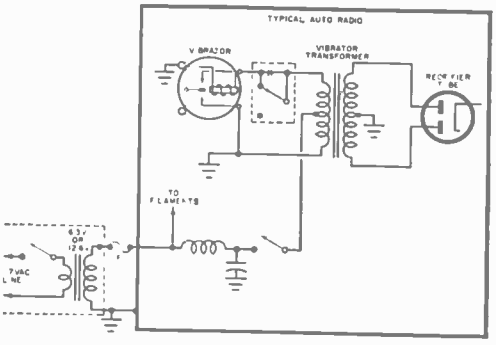
■ What good is a construction article if the printed-circuit board is too small to be seen clearly? I could make my own printed circuit if you would include a clear, full-size drawing—not just a photograph.

M. GILBERT
West Hempstead, N.Y.

Apparently there are more printed-circuit fans than we anticipated. For those who would like to etch their own PC boards, we are making available same-size photostats of the FM-TV Booster board at 50 cents a set. Write to: Editorial Department, Printed Circuits, POPULAR ELECTRONICS, *One Park Avenue, New York, N. Y. 10016. In the future, we will make every effort to include same-size layouts for PC do-it-yourself'ers.*

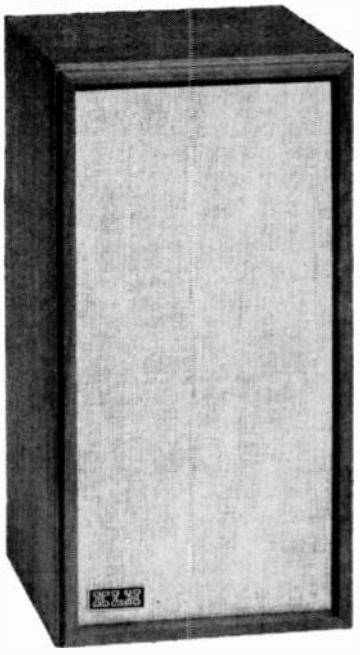
Auto Radio Conversions

■ The suggested use of old auto radios for DX'ing the BCB ("Broadcast Band DX—Getting Started," November, 1964) was interesting. The 117-volt a.c. power supply arrangements can be simpler, however, if the car radio has the usual nonsynchronous vibrator and rectifier tube. In this case, all that is needed is



a filament transformer with a voltage equal to the radio's original working voltage—6 or 12 volts—and with a current rating that equals or exceeds the radio's battery drain current (usually 6 or 7 amperes for a 6-volt set, half that for a 12-volt set). Connect

NOW from KLH . . .



The Model Seventeen

If you know what it takes to build a fine speaker system, you will truly appreciate KLH's new Model Seventeen. Here is a speaker that delivers a quality of performance we believed unattainable at a price we considered impossible just a few years ago. At $69.95*, the Seventeen brings together all of the know-how, all of the advances in speaker design which KLH has pioneered in the past several years.

Model Seventeen is an 8 ohm, full-range, two-way, acoustic suspension loudspeaker system. It has a 1¾" direct radiator tweeter with elastomeric suspension and a 10", long-excursion woofer. The enclosure is handsome oiled walnut — 11¾"W x 23¾"H x 8¼"D. The Seventeen is field serviceable. The grille cloth can be changed in a snap. The LCR crossover network is designed as an integral part of the system and permits an increase or decrease of 2.5 db in the high frequency level without acoustical 'shelving'. The Seventeen has, by far, the lowest harmonic distortion in the bass of any speaker in its price range.

But no description of the Seventeen, no matter how detailed, can tell you how it sounds. You've got to hear it. Only then will you be able to understand what an unusual achievement the Seventeen is, in high performance at low cost. The Seventeen is at your dealer's now. Listen to it. We think you'll agree it's the breakthrough speaker of the year.

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CIRCLE NO. 16 ON READER SERVICE PAGE

Letters

(*Continued from page 8*)

the secondary of this transformer between the battery lead and chassis, remove the vibrator, and ground to the chassis one of the terminals on the vibrator socket that connects to the vibrator transformer primary (see diagram). The vibrator transformer then steps the filament voltage up to the required B-plus.

CHARLES ERWIN COHN
Clarendon Hills, Ill.

Good idea, Chuck. We modified your diagram slightly to include the switch shown within the dotted lines. It breaks the connection to the vibrator, making it unnecessary to remove it when using a.c. power. A flip of the switch then makes it possible to revert to battery power. We showed a full-fledged d.c. supply in the article, as it can be used to power accessories like a Q5'er, as well as any type of radio.

Why, Why, Why?

■ It seems that a very large number of tube and battery voltages are 6.3 volts. Why not 5 or 10 or some other voltage?

THOMAS S. BRACKIN
Rockaway Township, N.J.

We dunno, Tom, unless it's because the lead-acid storage cell, original power source for tube-operated radios, puts out about 2 volts. The most common battery configuration for many years was three cells (ask any gas station attendant) which put out 6.3 volts under no load when fully charged. Try building a 5-volt lead-acid battery!

Speaker System for $2.64

■ I just finished "A Hi-Fi Speaker System for $7.61" (March, 1964), but used an 8" speaker in a bigger box instead of the 6½" unit specified. All I can say is "wow!" Oh yes, I paid just $1.98 for the speaker, reducing the cost by $4.97.

GREGORY PIETRUCHA
Chicago, Ill.

Since you don't elaborate on that "wow," Greg, we'll assume that you have either the world's best—or the world's worst—$2.64 speaker system.

CB Dilemma—Comments

■ There is a legal and logical answer to the dilemma ("The CB Dilemma—A Solution," November, 1964). The FCC has . . . permitted the unlicensed use of transmitters with an input to the final stage not exceeding 100 mw. With some ingenuity and good receivers, these transmitters could be the answer to all the unhappiness . . . Think it over. And leave the incentive in amateur radio. I don't want to see Project OSCAR and competent hams forced to accept the QRM and lack of incentive that would result . . . Your neck, sir, is out—temptingly far—and I admire your courage.

MIKE JAQUISH, W4WJH
Tullahoma, Tenn.

■ I believe you could find a lot of backing for moving the CB'ers to 148 mc. and giving the Technician Class hams 11 meters. This should make everyone happy.

ED DISTEL, KØTTV
Lakeland, Minn.

■ Let's find out if they (CB'ers) can clean up their own house before we get carried away and invite them

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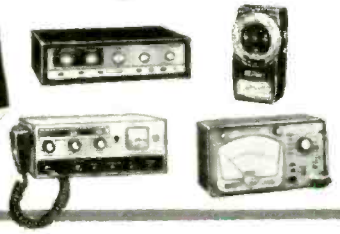

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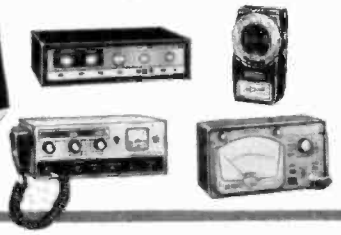

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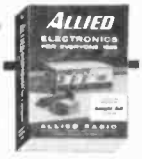

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CIRCLE NO. 2 ON READER SERVICE PAGE

Letters

(*Continued from page* 10)

into someone else's home. According to one FCC official with whom I had a discussion on communications problems, the only solution to the dilemma is for persons using the Citizens Radio Service to demonstrate a complete knowledge of the regulations and a desire to conform to them . . .

R. C. WHITE
Redondo Beach, Calif.

■ . . . Just suppose we start turning over some of our highways to people who do not care to pass a driving test. Or why not grant everyone a college degree regardless of whether he goes to college or not? Are you in favor of the manufacturers furnishing free equipment to this special group of private citizens since they should have something for nothing . . . ?

MADELL B. REYNOLDS, K4AAO
Huntsville, Ala.

■ We, the members of the Miami Amateur Radio Club, wish to disagree with the solution proposed to the CB dilemma . . . We would like to request that any box-top, green stamp, something-for-nothing license not be referred to as amateur or ham radio . . .

MIAMI AMATEUR RADIO CLUB
Miami, Okla.

And still, the CB Dilemma persists. For more thoughts on the subject, see page 64

Out of Tune

Zener Receiver Muter (*August*, 1964, *page* 88). Diodes *D1* and *D2* have a zener voltage of about 3.9 volts each. Long before this voltage is reached, most receivers will block —not mute. Also, forward current in one diode prevents zener action in the other. It's back to the TR switch we go.

Electronics Metal Quiz (*October*, 1964, *pages* 75 and 95). Due to an oversight, "Nichrome" was not credited as the registered trademark of the Driver-Harris Company.

Sick? Let a Computer Do the Diagnosis (*November*, 1964, *page* 47). The mathematician in the lower right photo was called "Mr. Kirkpatrick." He is actually Mr. Lawrence Fitzgerald. Our apologies to both gentlemen.

Prolong Projector Lamp Life (*November*, 1964, *page* 60). The power-handling capacity of the negative-temperature coefficient resistor mentioned in the text is inadequate to handle the load placed on it by a projector lamp. Use of a "Surgistor," such as Wuerth Type 8050-4 (250-400 watts) or Type 8035-5 (300-500 watts), is recommended to prolong lamp life. -30-

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

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

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CIRCLE NO. 27 ON READER SERVICE PAGE

BREAKTHROUGHS

Brief news flashes on recent important developments in the field of electronics

● A simple, effective radar technique for checking whether or not radio programs beamed behind the Iron Curtain are reaching their targets —and for determining the best frequency and antenna to use for a given target—has been revealed by Dr. Robert B. Fenwick of Stanford's Radioscience Laboratory. The technique is based on the fact that a short-wave signal, strongly propagated by the ionosphere over a one-hop path, returns as a weak echo over the same path back to the transmitting site. Time and frequency changes and bounce angle of the received echo then make it possible to calculate the source of the echo. Confirmation of the effectiveness of the method was achieved in tests between Munich and Istanbul—a distance of 1000 miles. Under favorable conditions, short pulses 2.5 kc. removed from the main frequency of a *Voice of America* transmitter in Munich were received back in Munich after being monitored in Istanbul . . .

● Color TV tubes 100 percent brighter than those produced in the past may be a possibility if a new red phosphor developed by Westinghouse finds widespread use. Currently, the brightness of the green and blue phosphors used in color tubes is limited so these colors will not outweigh the red; this places a limit on overall screen brightness. The new red phosphor, composed chiefly of two rare earths, yttrium and europium, will end the problem, it is claimed . . .

● An ultra-sensitive electrocardiograph which detects and records signals from an unborn heart, providing evidence of fetal life as early as the twelfth week of pregnancy, is being produced by The Magnavox Company. So refined is the unit that it detects the microvolt pulses coming from each beat of the fetal heart. By means of these tiny signals, fetal life can be shown even in the absence of fetal heart tones or sounds. The machine can be used to diagnose multiple pregnancies—twins, triplets, or even quadruplets—as well as for normal maternity care, adding to its life-saving potential . . .

● An amazing computer that operates entirely by compressed air has been developed by Univac Division of Sperry Rand Corp. Although the experimental fluid-operated digital computer has only a four-word memory and is completely non-electronic, it incorporates all basic computer

(*Continued on page 20*)

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I laughed when Fred Williams, my old high school buddy and fellow worker, told me he was taking a Cleveland Institute Home Study course in electronics. But when our boss made him Senior Electronic Technician, it made me stop and think. Sure I'm glad Fred got the break . . . but why him . . . and not me? What's he got that I don't. There was only one answer . . . his Cleveland Institute Diploma and his First Class FCC License!

After congratulating Fred on his promotion, I asked him what gives. "I'm going to turn $15 into $15,000," he said. "My tuition at Cleveland Institute was only $15 a month. But, my new job pays me $15 *a week* more . . . that's $780 more a year! In twenty years . . . even if I don't get another penny increase . . . I will have earned $15,600 more! It's that simple. I have a plan . . . and it works!"

What a return on his investment! Fred should have been elected most likely to succeed . . . he's on the right track. So am I *now*. I sent for my three *free* books a couple of months ago, and I'm well on my way to Fred's level. How about you? Will you be ready like Fred was when opportunity knocks? Take my advice and carefully read the important information on the opposite page. Then check your area of most interest on the postage-free reply card and drop it in the mail *today*. Find out how you can move up in electronics too.

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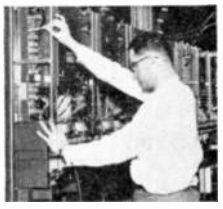

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BREAKTHROUGHS

(*Continued from page* 14)

components—memory, arithmetic, control, and input/output sections—and serves to complement and demonstrate the functioning of its electronic brothers. Basically, the computer makes use of the "wall effect"—the tendency of a fluid (either gas or liquid in this context) emerging from a jet to flow alongside a wall placed at one side of the jet. When the jet is directed into the V-shaped junction of two passages, the passage it flows through can be controlled by initially directing it into one passage or the other with a small puff of air. Using this principle, flip-flops, inverters, and AND, OR, and NOR gates can be constructed. The operator feeds data and instructions to the machine by simply covering small air jets on the control panel with his fingers . . .

• **Astronauts on the surface of the moon may talk to each other and to earth via a ring of 15 communications satellites circling the moon, according to engineers of ITT Intelcom, Inc. Because the moon is small, astronauts only a small distance from each other would be below the horizon, ruling out line-of-sight radio communications. And because the moon lacks an ionosphere and atmosphere, modes of propagation familiar to earth would not be possible. The solution seems to be a series of small moon satellites . . .**

• The strongest continuous magnetic fields yet generated by man have been produced by scientists at the National Magnet Laboratory using a giant water-cooled magnet. Fields up to 225,000 gauss have been reported by the Air Force which operates the Laboratory, and by MIT which operates the Cambridge, Mass., facility. At peak field, the magnet draws more than 10 million watts of electrical power; cooling requires 2000 gallons of water per minute . . .

• **A laser beam may be used to measure "earth tides" caused by the moon. Although the moon sends the earth's crust, as well as its oceans, into daily gyrations as a result of gravatational attraction, the movement is so slight that it is difficult to measure. Neal D. Newby, Jr., of North American Aviation's Autonetics Division would take continuous measurements between two points a few miles apart. A laser beam at the first point would be directed at a reflecting mirror at the second. Changes between the points would alter the frequency relationship between the outgoing and incoming beams proportional to the movement of the earth's crust . . .**

—*W. Steve Bacon*

There are 72 reasons why you will want this exciting book of electronics projects:

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- Electronic Stop Watch
- Plug-In Transmitter Crystal Switch

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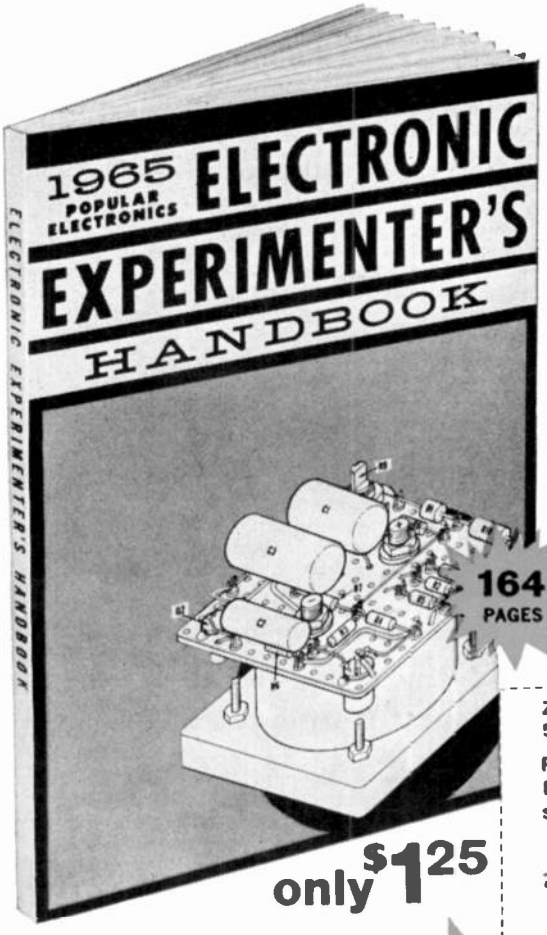

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New Products

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.

"CW" CODE MONITOR

Galaxy Electronics' new "CW" monitor allows the amateur operator to hear his "fist" by generating a pleasing audio tone simultaneously with the keying of the transmitter. A tone volume and pitch control are provided. Featuring a stable transistorized oscillator and diode keying circuitry, the monitor comes complete with cable and standard plug for the transmitter jack. It will operate with all transmitting equipment having less than 400 volts on the key. A 9-volt #216 Eveready battery (or equivalent) is required. Price of the monitor, $29.95.

Circle No. 75 on Reader Service Page 15

FOUR-SPEED REVERSIBLE DRILL

Comparatively low in cost, and featuring reversible operation in all four speeds, the industrially-rated ½" "All Drill" introduced by *Wen Products, Inc.*, is believed to be the first of its type in the power tool field. Double reduction gears and electronic speed control are combined to provide four high-torque speeds of 630, 730, 2200, and 2400 rpm with no load. Speed changes are made easily with a gear shift control located conveniently on the side of the motor housing and the electronic speed control on the back of the man-sized handle. A double safety switch is provided for motor reversing: flipping one switch turns off the universal motor, while flipping the second switch reverses the drill. The "All Drill" can also be used with almost any attachment. Price, $44.95.

Circle No. 76 on Reader Service Page 15

FOUR-CHANNEL PREAMPLIFIER-MIXER

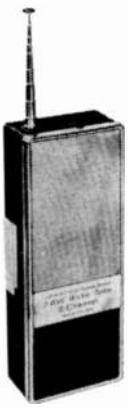
The Model RA-637 transistorized preamplifier-mixer available from *Olson Electronics Inc.*, can be used as a straight preamplifier for a microphone or magnetic phono cartridge, or to mix up to four input signals from

a high or low level source. Each of the four inputs has a selector switch, and individual volume controls permit you to blend and mix the signal as you wish. The Model RA-637 is equipped with a VU meter and master gain control, plus bass and treble tone controls. Price, $39.98.

Circle No. 77 on Reader Service Page 15

CB WALKIE-TALKIE

A 2-watt, 2-channel unit capable of covering a 10-mile range over favorable terrain has been added to the *Lafayette Radio Electronics* line of CB walkie-talkies. Thirteen transistors and two diodes are incorporated in the HA-300. The receiver employs a superheterodyne circuit with one r.f. and two i.f. stages, push-pull audio output, and a variable squelch control. A special receptacle allows an external mobile or ground station antenna to be plugged in. The HA-300 is supplied with crystals for channels 10 and 15, rechargeable self-contained batteries, a plug-in battery charger, earphone and leather case. Price, $99.95; two for $194.95. Extra crystals are $4.50 a set.



Circle No. 78 on Reader Service Page 15

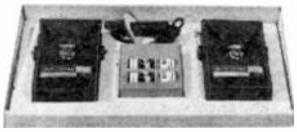
SOLID-STATE STEREO COMPONENTS

Stereo/hi-fi fans will be interested in the new solid-state component line recently introduced by *Electro-Voice, Inc.* It includes a 40-watt and an 80-watt stereo control amplifier, a 40-watt and an 80-watt stereo FM receiver, and a stereo FM tuner, all transistorized. The two stereo control amplifiers and the amplifier sections of the two stereo receivers incorporate a special tone control circuit: any amount of bass and treble boost selected by the tone controls is proportionally reduced as the volume is increased, permitting the user to select any degree of loudness

$399.95

TRAVEL-PAC MK I

Includes 2 Duo-Comm 120's
2 Leather carrying cases
1 Battery charger
4 Rechargeable batteries
Attache kit carrying case



DUO COMPACT
$349.95

Contains 2 Duo-Comm 120's
2 Rechargeable Batteries
1 Battery Charger

$499.95

TRAVEL-PAC MK II

Includes 2 Duo-Comm 120's
2 Leather carrying cases
1 Battery charger
4 Rechargeable batteries
2 Lapel Microphones
2 18" Center loaded antennas
1 18" Clip-On mobile Antenna
Attache kit carrying case

Reach the 'peak' in PEOPLE-TO-PEOPLE communications instantly... anywhere you like with a "Travel Pac" communications system ...and you can select the system that's tailored to your needs. "Travel Pac" communications pay for themselves. If you're on the go... specify the communications system that goes with you...

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CIRCLE NO. 26 ON READER SERVICE PAGE

New Products

(*Continued from page 22*)

compensation he wishes. Excellent performance characteristics at lowest practical cost to the customer are claimed. Prices range from $112 for the 40-watt control amplifier to $397 for the 80-watt receiver.

Circle No. 79 on Reader Service Page 15

FM MULTIPLEX TUNER KIT

The new *Scott* LT-110B FM multiplex tuner kit features a silver-plated tuning section for maximum sensitivity and reliable performance, switchable a.g.c. for improved subcarrier signal, and front-panel-mounted tape recorder output jack. Sensitivity is 2.2 μv.; signal-to-noise ratio, 60 db; harmonic distortion, 0.8%; drift, 0.02%; and frequency re-

sponse, 20 to 20,000 cycles ± 1 db. The kit comes in Scott's special Kit-Pak container, which acts as a self-contained worktable, and with a full-color instruction book and Part-Charts. All critical and difficult sections are prewired and pretested at the factory. Price, less than $140.00.

Circle No. 80 on Reader Service Page 15

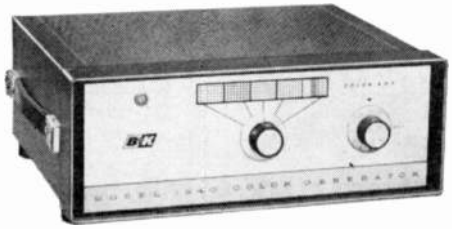
2-WATT-INPUT CB TRANSCEIVER

Twenty times more powerful than most hand-held transceivers, and weighing only 2¾ pounds, *Raytheon*'s TWR-6 Citizens Band unit features a full 2 watts input. Two crystal-controlled channels are available. The TWR-6 employs 13 transistors, 2 diodes and a thermistor for reliability and minimal battery drain. A meter on the side of the set shows the amount of charge in the self-contained nickel-cadmium batteries, which can be easily recharged from any household outlet. Other features include an automatic noise limiter and an adjustable squelch. Price, about $119.50. Accessories: battery charger, $14.75; carrying case, $9.95.

Circle No. 81 on Reader Service Page 15

PORTABLE COLOR GENERATOR

In-home color TV servicing is now practical with the new portable color generator for the TV technician which is available from *B&K Manufacturing Company*. Designed to make possible quick, easy, and accurate convergence and color adjustments, the Model 1240 provides a crystal-controlled keyed rainbow color display on the TV screen to test color sync circuits and the range of hue control,



and to align the color demodulators. Suitable for operation on channels 3, 4 or 5, it connects directly to the TV antenna terminals. Its r.f. output is more than 5000 μv. The unit is power-transformer-operated and line-isolated to prevent shock hazards. Price, $134.95.

Circle No. 82 on Reader Service Page 15

TRANSISTORIZED ORGAN KIT

You don't have to be an electronics wizard to build the *Heath* Model GD-983 organ (the simple-to-perform steps require no special skills, knowledge or tools), and even a beginner can play it. The GD-983, a kit version of the Thomas "Coronado" BL-3 organ, has 17 true organ voices, two full-size 44-note keyboards, and a 13-note heel and toe pedalboard, range C through C. Other features include: color-tone attack, repeat and sustain percussion; reverb; a built-in two-speed Leslie rotating speaker plus a two-unit main speaker system which uses 12" speakers; and a new stereo chorus control. The Model GD-983 comes with a factory-assembled, walnut-finished hardwood cabinet and matching bench. Price, $849.00.

Circle No. 83 on Reader Service Page 15

ELECTRONIC MARKING KIT

Hundreds of frequently used titles, words, codes, letters and numerals are preprinted on dry transfer sheets in a new electronic marking kit recently introduced by *Chart-Pak, Inc.* Images can be transferred to any dry surface, smooth or rough, flat or curved, simply by rubbing the transfer sheet lightly with a pencil, burnishing tool, or ball point pen. Each "Deca-Dry" marking kit contains thirty 3" x 6" sheets (with wax-free backing) bound in a hard-cover loose-leaf binder—which comes

Turner's noise cancelling 333

TOPS FOR CB

Now you can get a deluxe professional communications microphone for use on CB — and at CB prices, too. The new Turner Model 333 CB Microphone is also ideal for amateur, marine and all other mobile communications.

A professional "noise cancelling" microphone, it features the shielded Koiled Kord that's so long lasting it's used on police cars, taxicabs, etc. High impact cycolac case. Voice response: 300-3000 cps. Just $21.50 list.

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909 17th Street N.E., Cedar Rapids, Iowa
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Export: Ad Auriema, Inc., 85 Broad Street, New York 4, N. Y.

See your Turner Distributor, listed below. He has the 333 in stock.

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Selectronic Supply
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Elmar Electronics
Palo Alto
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Carousel Electronics
Guaranteed Two-Way Radio
San Jose
Quement Electronics
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Edison Electronics Supply
COLORADO
Denver
Burstein-Applebee Co.
Fistell's Electronics Supply
Ward Terry & Company
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CIRCLE NO. 33 ON READER SERVICE PAGE

NEW PRODUCTS

(*Continued from page* 24)

in a durable storage case. The "Deca-Dry" kits are available in four standard colors: black, white, red, or blue.

Circle No. 84 on Reader Service Page 15

"COMPONENT-QUALITY" PHONOGRAPH

Billed as a "component-quality" phonograph, the *Benjamin* "Stereo 200" incorporates the "Miracord 10," a 36-watt solid-state stereo amplifier, in a cabinet no larger than would be required for the amplifier alone. The power rating is 18 watts per channel (IHF); distortion, less than ½% at rated output; frequency response, 10 cycles to 22 kc. ± 1 db; power

bandwidth, 30 cycles to 12 kc. at 1% distortion. There are separate bass, treble, volume and balance controls, a mode selector, auxiliary inputs for tuner or tape, and tape output jacks. The Stereo 200 will drive any pair of quality speakers with medium to high efficiency. Price, $229.50 including stereo-magnetic diamond cartridge, walnut cabinet with Plexiglas lift-cover. Matching Benjamin "208" speakers are available at $49.50 each.

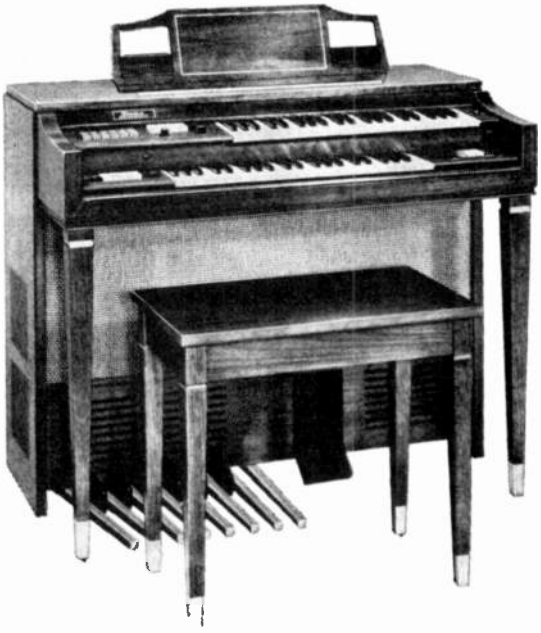
Circle No. 85 on Reader Service Page 15

SOLID-STATE COMMUNICATIONS RECEIVER

Transistors are used throughout the *National Radio Company*'s HRO-500 communications receiver to insure reliability, eliminate performance deterioration resulting from tube aging, and provide instant operation from turn-on without warm-up drift. The HRO-500 covers the entire VLF and HF spectrum from

5 kc. to 30 mc. in 60 synthesized channels, each 500 kc. wide, and dial calibration is accurate to 1 kc. Frequency is determined by a phase-locked crystal synthesizer which eliminates the need for multiple crystal oscillators for high-frequency oscillator injection. The HRO-500 will also operate from 12-volt batteries, with a current drain of 200 ma. Price, about $1000.00.

Circle No. 86 on Reader Service Page 15



World's Best Buy In Electronic Organs!

GD-983

$849.00 including bench $125 dn., as low as $27 mo.

Full Features... No Extras To Buy... Saves Hundreds of Dollars New Heathkit®/Thomas "Coronado" Transistor Organ!

Every Organ Feature You've Ever Dreamed Of! • 17 beautiful organ voices . . . Diapason 16′ & 8′, Bass Clarinet 16′, Trumpet 16′, English Horn 8′, Violin 8′, Oboe 8′, Bourdon 16′, Flute 8′, Flute D'Amour 4′, Quint 5-1/3′, Saxophone 8′, French Horn 8′, Cello 8′, and Chimes — all at the simple touch of a tab! • Two full-size 44-note keyboards • Built-in 2-speed rotating Leslie plus 2-12" Main speakers • 28 notes of chimes • 13-note heel & toe pedal board, range C thru C • New Stereo chorus for exciting "stereo" effects • Color-tone attack, repeat & sustain percussion . . . the only organ to give you all 3 • Treble accent tab • Reverb • Manual balance • Pedal volume • Expression pedal • Headset outlet for private play • All-transistor 75-watt EIA peak music power amplifier • Transistor tone generators . . . warranted for 5 years • Pre-tuned Tone generator . . . for easily tuning organ, no special "ear" needed • Luxurious Hardwood Cabinet & bench . . . handcrafted with walnut finish.

No Extras, Nothing More To Buy! Everything you need for complete playing versatility is included. There are no speakers, amplifiers, no other "hidden necessities" to add as with other organ kits. It's *all* there at *one* price . . . even the bench!

Saves Hundreds Of Dollars! Save more than $400 over the factory assembled version. And you could pay as much as $1000 more for other brands, and still *not* enjoy as many features!

It's Truly A Professional Organist's Dream With A Beginner's Simplicity! And yet, you don't have to be an electronic wizard to build it, nor a professional organist to play it. Famous Heath "Engi-nuity" has reduced assembly to simple steps that require *no* special talents, tools or knowledge. And the famous Thomas "Musical Fun Book" is included to start you playing many favorites fast! A special recorded 48-lesson course is also available that lets you learn at your leisure . . . regular $50 value, only $19.95!

Pay As You Play! Only $125 dn., as little as $27 a month. Get *free* catalog for full details — now!

Kit GD-983, organ & matching bench, 290 lbs.... $125 dn., as low as $27 mo.....$849.00

WORLD'S LOWEST COST 2 MANUAL ORGAN
HEATHKIT/THOMAS "LARGO"

• 10 true organ voices • Variable Repeat Percussion • Two 37-note keyboards • 20-watt peak power amplifier • 13-note heel & toe bass pedals • Walnut cabinet
Kit GD-232A, organ only, 158 lbs.....$349.95

HEAR IT YOURSELF!
Convince yourself by sending for a 7", 33⅓ demonstration record! Order No. GDA-983-2 for Deluxe GD-983 organ, GDA-232-5 for low-cost GD-232A organ. Each record 50c. Do it now!

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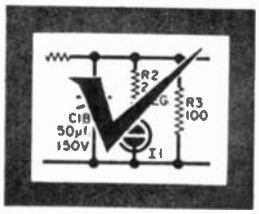
CIRCLE NO. 11 ON READER SERVICE PAGE

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 other readers. Because we get so many inquiries, none can be acknowledged, and POPULAR ELECTRONICS reserves the right to publish only those items that are not available from normal sources.

Schematic Diagrams

Clough Brengle Model OAE receiver analyzer, circa 1942. Tests tubes and capacitors and measures output voltage, current and resistance. (Robert W. Conway, 3411 Cedar St., Austin, Texas)

Freed-Eisemann Model T 2550 TV receiver, ser. 31417, circa 1955. (Erik W. Olson, 4 Claremont Rd., Scarsdale, N.Y.)

RCA Model 46X13 receiver, circa 1939. Tunes AM and s.w. bands. Has 5 tubes. (Dwight Hammer, 1539 Whitcomb Ave., Des Plaires, Ill. 60018)

GE Model H-116 receiver, ser. 1087. Has 11 tubes. (James McKinney, 1608 S. Braddock St., Winchester, Va. 22601)

Zenith Model H511-G receiver, ser. Y-182372, circa 1945. Has 5 tubes. (David Stanowski, 108 Wilshire Dr., Wheeling, Ill.)

Philco Model 42-355 receiver, code 121, circa 1942. Tunes AM, FM and s.w. bands. (Kenneth Peinelt, 7250 Githens Ave., Pennsauken, N.J.)

Philco Model 41-608 receiver, code 122. Tunes BC and 8.9 to 12 mc. bands. (Paul A.J. Truskowski, 125 Young Ave., Cedar Grove, N.J.)

Hickok Model 180X signal generator, ser. 1-5767. (R.L. Livingston, 17208 S. Downey, Bellflower, Calif. 90706)

Freed-Eisemann Model 32 radio-phono combination, circa 1947. Tunes AM, FM and s.w. bands. Has 20 tubes and magic eye (Albert W. Alley, 4130 N. Keystone, Chicago, Ill. 60641)

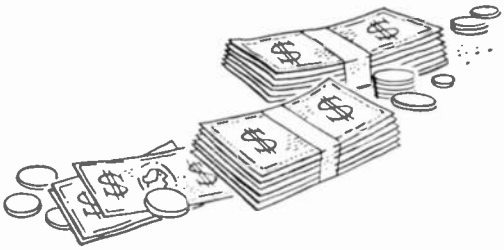
Dumont Model 274 oscillograph. (Lt. Col. C.H. Watson, 1147 Arthur Dr., Lawton Bluff, Charleston, S.C. 29407)

Philco Model 40-180 receiver, code 121, circa 1938. Tunes BC and s.w. bands. Has 7 tubes. (Don Miner, 4803 Winifred, Wayne, Mich.)

Stromberg-Carlson Model 1210-M-2, AM, FM, phono, wire recorder combination, series 12. Has 11 tubes. (Barry Premeaux, 6237 Marywood, Lansing 10, Mich. 48910)

(*Continued on page* 30)

Regardless of what you pay for other Color TV



it can't perform as well as this one...

and yet a Heathkit® set costs as little as $399!

Exclusive Heath Features For Unequalled Performance! That's right. No matter how many of your hard-earned dollars you pay for another brand of color TV, *none* can equal the performance of the Heathkit All-Channel, High Fidelity 21" Color TV! Why? *All* color sets require minor periodic adjustments to maintain peak picture performance. The Heathkit GR-53A is the *only* set with a "built-in service center" that provides facilities for perfect picture adjustments. Heath's simple-to-follow instructions and detailed color photos show you exactly what to look for and how to achieve it . . . quickly, easily! You become the expert! Results? Beautiful, true-to-life color pictures day in and day out . . . and *no* costly color TV service calls for simple picture alignment.

But don't take our word for it. See the special articles on the Heathkit GR-53A in the May issue of **Popular Electronics,** June issue of **Radio-TV Experimenter,** February issue of **Popular Mechanics,** April issue of **Science & Mechanics,** and the August issue of **Radio-Electronics.**

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CIRCLE NO. 37 ON READER SERVICE PAGE

Operation Assist

(*Continued from page* 28)

Philco Model 16X receiver, circa 1935. Tunes 0.55 to 22 mc. on 4 bands. Has 11 tubes. (John V. Swiecick, 4724 N. Springfield Ave., Chicago, Ill. 60625)

PYE Model P.T.C. "Walkie-Phone" transceiver. Has 8 tubes. (Michael Casham, Box 215, Stitsville, Ontario, Canada)

Imperial Model TP-54 multitester. Made in Japan. (Henry T. Maager, Coloma R. 1, Wis.)

DeForest Crosley Model 8D721 receiver, ser. B64575. Tunes BC and s.w. bands. Has 7 tubes. (Bill Gilmour, 19 Edgewood Ave., Hamilton, Ont., Canada)

Emerson Model 514 receiver. Tunes AM and s.w. bands. Has 6 tubes. (Jeff Shipley, 120 W. Jefferson, Clinton, Ill.)

Atwater Kent Model 20 receiver. (Steven Longe, Box 23, Waldo, Wis.)

Marconi Model 203 receiver, circa 1942. Tunes 490 kc. to 49 mc. Has 6 tubes. (Marc J. Regamey, 11828 65 St., Edmonton, Alberta, Canada)

RCA DeWald Model 544A receiver. Has 4 transistors. (Guy Federkow, RR 1, Niagara-on-the-Lake, Ontario, Canada)

McMurdo Silver "Masterpiece III" receiver, circa 1936. (George Mohan, RR 4, Box 129, Terre Haute, Ind.)

Superior Model 1240 tube tester, circa 1940. (Ole H. Tollefsrud, Gardner, N.D.)

Jelectro Model QRP-60 transmitter. Covers 80- to 10-meter bands. Made in Japan. (Hal Stephens, 3014 Janet St., Redding, Calif. 96001)

Atwater Kent Model 20 receiver, ser. 123400, circa 1925. (R.H. Koehler, 5627 S. Elaine Ave., Cudahy, Wis. 53110)

Sparton Model 1160 receiver, ser. 240676. (Allen L. Andersen, 7945 83 Ave., S.W., Portland, Ore. 97223)

Silvertone wire recorder, chassis 110.466-1. (Thomas Lager, 250 So. Ave., Jim Thorpe, Pa.)

Bendix Model 1217D receiver, circa 1946. Tunes AM, FM, and s.w. bands. Has 14 tubes. (Steven Gottlieb, 5847 Thrush Drive, Houston, Texas 77033)

Stewart Warner Model 325 receiver, serial E 16066, circa 1924; has 5 tubes and tunes 200 to 550 meters on 3 bands. **Showers** "Consola" Model 20 receiver, ser. 7917; battery-operated, has 5 tubes and tunes on 2 bands. (Robert E. Kachakian, 34 Brown St., Haverhill, Mass. 01830)

Magnavox AM, FM, s.w. tuner, chassis CR217A. Has 9 tubes. (Don Fisher, 24 Overlook Rd., Ardsley, N.Y. 10502)

Noblitt-Sparks Model 522 receiver. Has 5 tubes. (Orville Weyrich Jr., 6619 Chilton Lane, Dayton 59, Ohio)

Browning Laboratories Model BL-300 signal system, ser. 17. Has 16 tubes. (Gary Borton, 40892 Harper Lake Rd., Hinkley, Calif. 92347)

Atwater Kent Model 10 receiver, circa 1936. Tunes 550 to 1550 kc. and 1550 kc. to 3 mc. (John Saunders, 1617 Vivian St., Shreveport, La. 71108)

Special Data or Parts

RCA Model AR 1300 receiver, patented June 15, 1909. Intensity coil and schematic needed. (George H. Satterlee, 38 Pawling Ave., Mechanicville, N.Y. 12118)

Philco Model 7030 dynamic tester. Operating instructions needed. (H. Opel, Box 316, Melbourne, Ky.)

Superior Model 670 "Super Meter," circa 1945. Values of parts and schematic wanted. (Juan E. Isern, 118-A Flores St., Santurce, Puerto Rico 00911)

Atwater Kent Model 4560 receiver, circa 1925, with breadboard layout. A and B battery hookup information needed. (Clarence Cain, 125 Church St., Bridgeton, N.J.)

RME Model 99 communications receiver, with 12 tubes. Servicing information and schematic wanted. (Larry Eddy, 733 28th St., South Bend, Ind. 46615)

(*Continued on page* 32)

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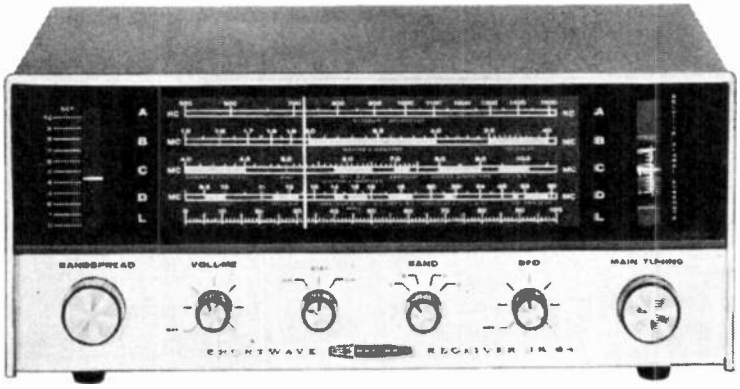

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CIRCLE NO. 11 ON READER SERVICE PAGE

Operation Assist

(*Continued from page* 30)

Federal Model 59 and Model 61 battery radio receivers, circa 1924. Operating instructions needed. (Earle A. Young, 450 Magee Ave., Rochester, N.Y. 14613)

US Radio Model 99A AM superhet receiver. Tube line-up wanted. (Gary Clark, 537 W. Diamond Ave., Hazleton, Pa. 18201)

Atwater Kent Model 10 receiver. Breadboard set of r.f. coils needed. **Federal** Model 58. Front panel wanted. (Harry Cap, 190 Beach St., Bridgewater, Mass.)

RCA Model 7T1 receiver; tunes BC and s.w. on 3 bands; has 6 tubes. Instructions on how to build new power supply wanted. (W.W. Barnes, 425 S. Parkway, El Dorado, Ark. 71730)

Philco Model 42-380 receiver, code 121; tunes BC and s.w. on 3 bands; has 8 tubes. Power transformer, parts source, and schematic needed. (Bobby Jay Tanner, R.D. #1, Box 38, Englishtown, N.J. 07726)

Philco Model 38-116 receiver, code 125; tunes on 5 bands; has 15 tubes. Schematic and manual wanted. (Michael J. Grutsch, Box 135, O'Neill, Nebr. 68763)

Plymouth receiver, model unknown, ser. 21447; tunes BC and s.w. bands; has 5 tubes—one 6D6, others unknown. Tube layout and schematic wanted. (Joe C. Howlett, 307 Goulburn Cres, Ottawa 2, Ontario, Canada)

Sylvania Model 500 sweep-signal generator. Manual wanted. (Louis Smotek, Greensville P.O., Ontario, Canada)

Solar Model CE capacitor analyzer. Schematic and manual needed. (Mac G. Grigsby, 1203 N.W. 4th Ave., Gainesville, Fla.)

Gamma receiver made in France, circa 1930; tunes l.w. and s.w.; has 2 A410N's, 1 A441N, 1 A415 and 1 unknown tube; works from power source of 4, 40, and 120 volts. Information on replacement tubes, power supply, and schematic needed. (Lt. Col. D.R. Deniston, Hqs. EUCOM (J-3), APO 128, New York, N.Y.)

Collins Model 51J3 receiver, circa 1952; tunes 500 kc. to 30 mc.; has 18 tubes, 500-cycle mechanical filter with 500-kc. i.f. plug-in adapter needed. (Herschel Groves, 3569 Creek Rd., Cincinnati 41, Ohio)

Hickok Model 510-X tube and multi-tester. Schematic and info to test current tube types needed. (W.L. Salomon, 333 Goodhill Rd., Kentfield, Calif. 94904)

Crosley Model 50 receiver; tunes BC and s.w. on 5 bands, 201A tubes, schematic and other available data wanted. **Crosley** Model 715 and **RCA** Model U105 3-band receivers. Service data and schematics wanted. (Samuel M. Kincaid, Rt. 6, Box 8, Alderson, W.Va. 24910)

Philco Model 37-89 receiver; tunes BC and s.w. bands; has 5 tubes. Schematic and source for parts wanted. (Mike Breneman, R.D. #1, Millersville, Pa.)

Miller Model 522 coil. Both coil and data wanted. (Herbert Savran, 5113 11th Ave., Brooklyn, N.Y. 11219)

Atwater Kent Models 44 and 55C receivers. 45 tube, speaker, power transformer, schematic and parts source needed. (Earle Philhower II, Box 3, Yardville, N.J.)

Stewart Warner Model 445-A receiver; has 8 tubes. 4-gang variable capacitor with dial plate wanted, and date of manufacture. (Joseph R. Kenski, 407 W. Rowland, Madison Hts., Mich.)

RCA "Radiola" Model 28 receiver, circa 1925; has 8 tubes. 7 UX-199's and a UX-120 needed, and parts source. (Bob Moors, 1736 Kimberly Dr., Sunnyvale, Calif. 94087)

Atwater Kent Model 40 receiver, ser. 2771980, circa 1923. **Silvertone** Model 4641 receiver, ser. 414012, circa 1930; tunes AM and s.w. bands. Schematics, alignment data and tube sources needed. (Raymond F. Reece, 1706 Jacobson Blvd., Bremerton, Wash.)

Atwater Kent Model 20 receiver, circa 1924; has 5 01A's (long pin). Tubes, schematic, and technical data needed. (Thomas Galetto, 2657 Benny Way, Rancho Cordova, Calif. 95670)

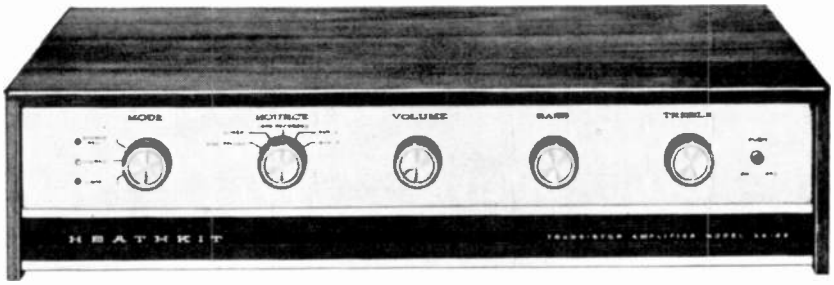
Weston Model 722 analyzer, type 6. Instruction manual and schematic wanted. (Cecil F. Allen, 15 Mayer Ave., Buffalo 7, N.Y.)

Readrite Model 430 tube tester. Operations manual and schematic wanted. (Harvey L. Coonts, Box 266, Moab, Utah)

-30-

"Until just recently, I have been somewhat skeptical about low-priced transistor amplifiers. However, after testing and listening to the Heath AA-22, I feel it is time to revise my opinion."

JULIAN D. HIRSCH, Hi Fi/Stereo Review, Nov. '64



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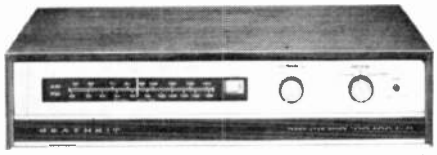

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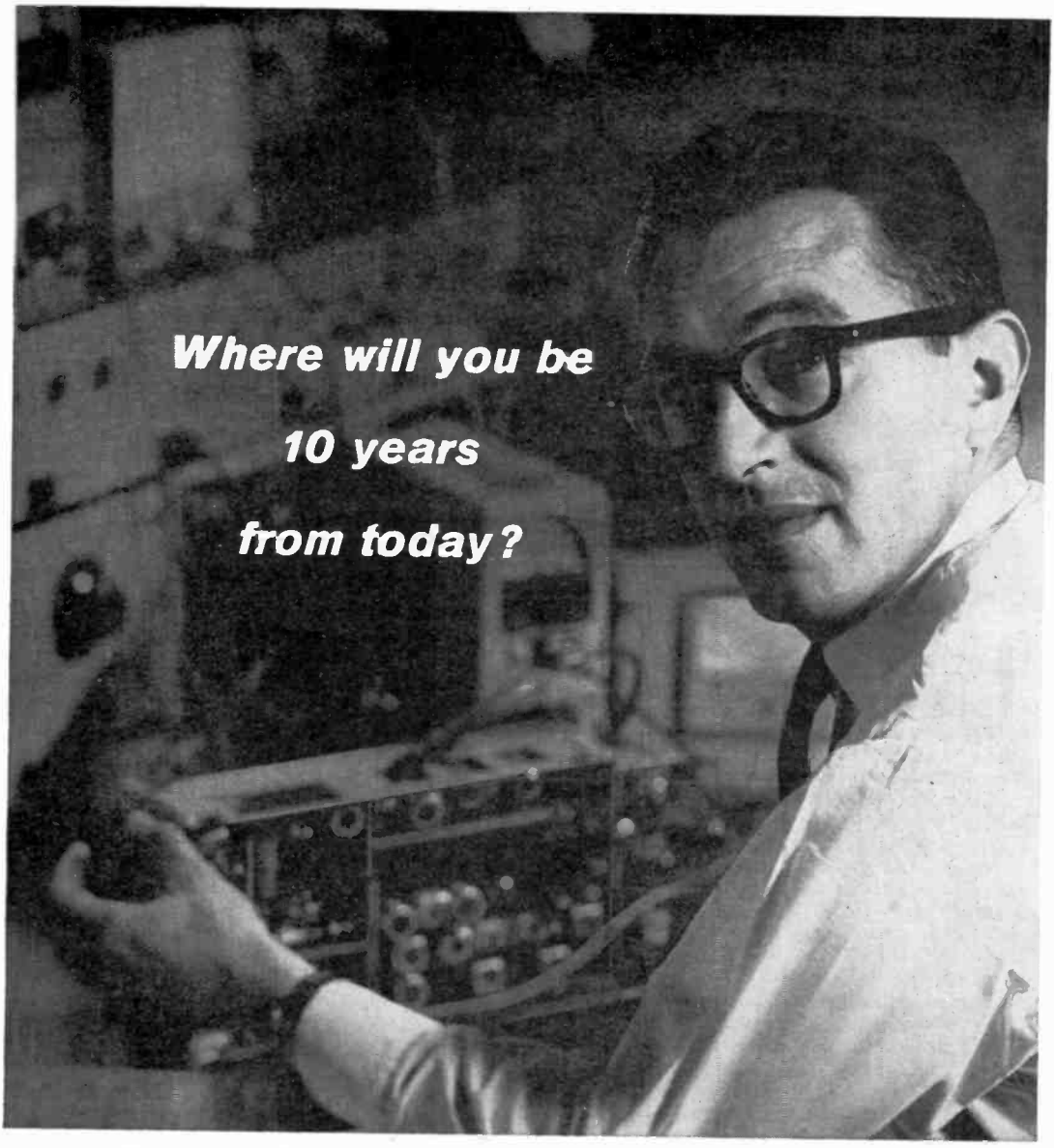

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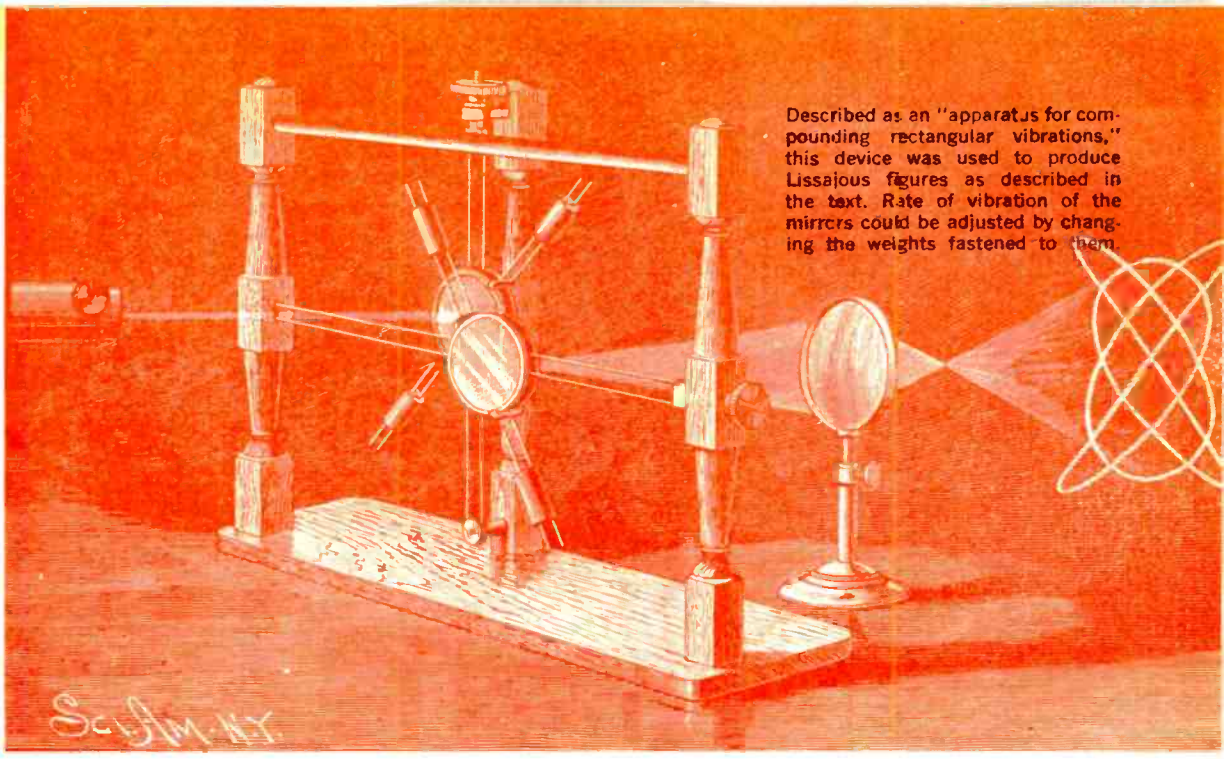

Described as an "apparatus for compounding rectangular vibrations," this device was used to produce Lissajous figures as described in the text. Rate of vibration of the mirrors could be adjusted by changing the weights fastened to them.

AMAZING APPARATUS OF THE GAY NINETIES

Although they lacked the accuracy of their modern counterparts, the instruments of grandfather's day showed surprising ingenuity

By CARLETON A. PHILLIPS

HAVE YOU EVER WONDERED what experimental science was like around the turn of the century—before the days of the amplifier, oscilloscope, vacuum-tube voltmeter and the other scientific paraphernalia commonplace in today's laboratory? In an age that lacked so many things we take for granted, it seems incredible that a science of any standing existed at all. Exist it did, however. Where we now use precision instruments manufactured by the thousands, thanks to our advanced technology, the experimenters of grandfather's era painstakingly fashioned measuring devices

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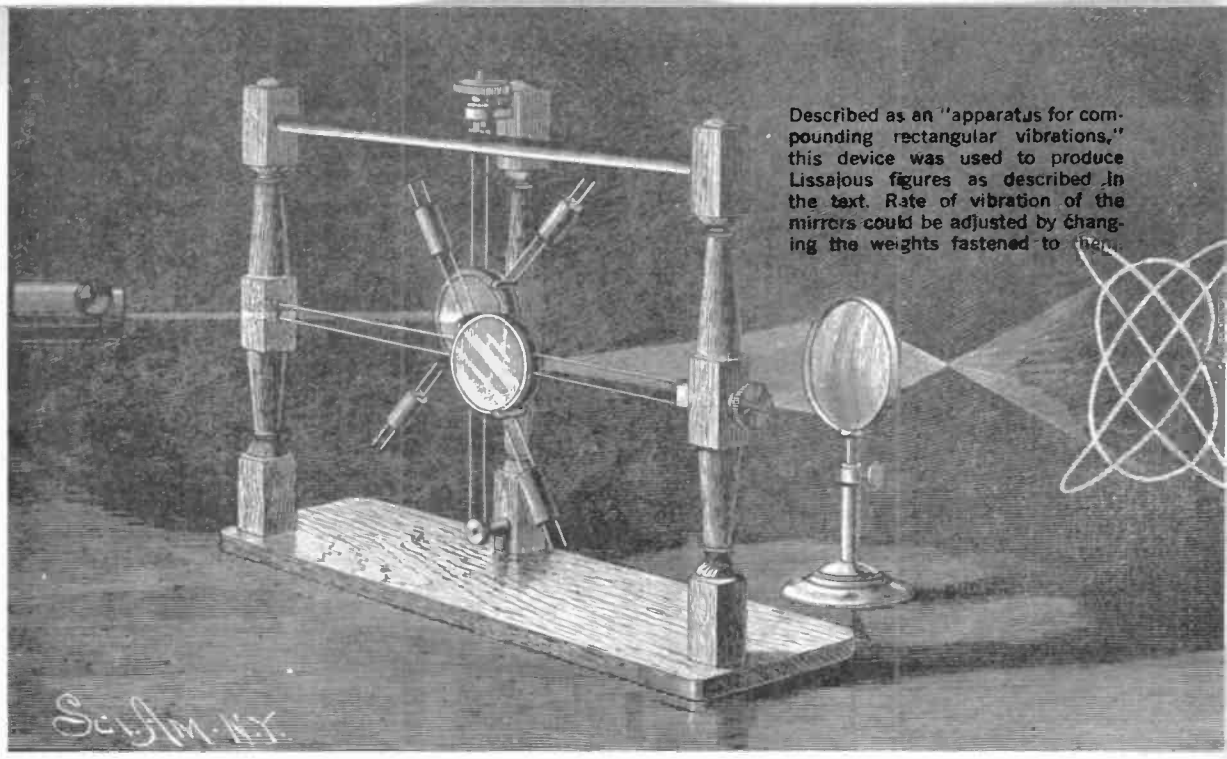

Described as an "apparatus for compounding rectangular vibrations," this device was used to produce Lissajous figures as described in the text. Rate of vibration of the mirrors could be adjusted by changing the weights fastened to them.

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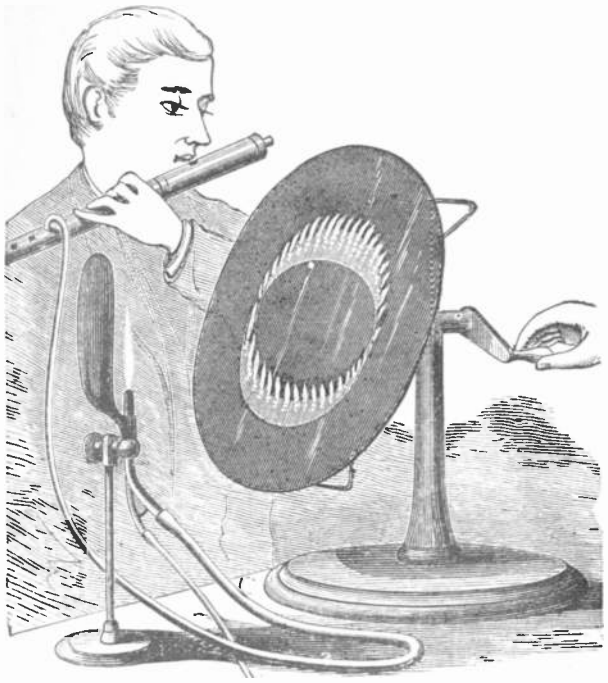
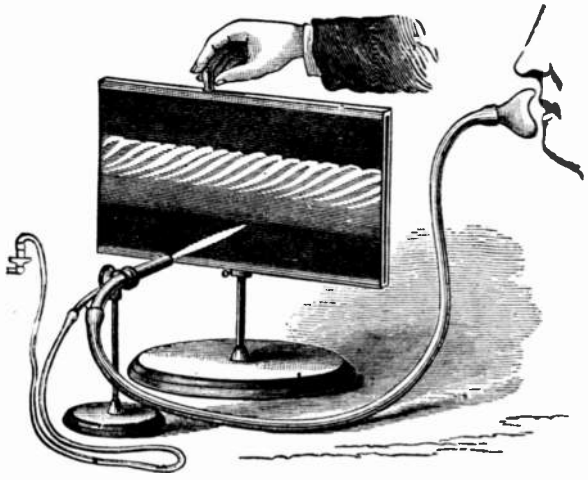




Two types of vibrating flame apparatus are shown at left. The top engraving shows a flame modulated by a flute; the minute vibrations of the flame are reproduced by a rotating mirror turned by a hand crank. A variation, the device directly at left uses a speaking tube and mirror is moved in a horizontal plane.

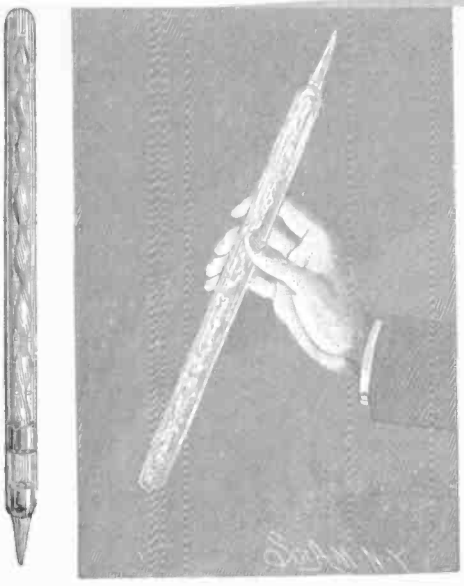
of wood, glass, metal, and string with an ingenuity born from necessity. Despite the fact that intuition must have played a large role in interpreting results, it is intriguing to note the many worthwhile experiments that were conducted with the crude—yet amazing—apparatus of the Gay Nineties.

The Patterns of Lissajous. Today, the name Lissajous, used to refer to oscilloscope patterns, is part of the jargon of all electronic technicians. The term had its origin with Jules A. Lissajous, a 19th century French scientist who discovered the patterns and their scientific significance in analyzing waveforms and determining frequencies.

The apparatus employed by Lissajous, however, was a far cry from the modern oscilloscope which produces patterns electronically. It consisted basically of two small mirrors facing each other and held in place by rubber bands. The rubber bands holding one mirror were stretched in a vertical position, while the other mirror was suspended by rubber bands fastened horizontally.

A beam of light was directed upon the mirror facing it. After reflecting back to the second mirror, the light beam was next focused by a convex lens to form a small spot on a wall or screen. Each mirror was struck lightly, causing one to vibrate horizontally and the other vertically. When the mirrors vibrated at the same rate, either a straight line, an elipse, or a circle was projected on the screen. The rate of vibration was changed by the addition of small adjustable rods and weights. The greater the difference in vibration between the two mirrors, the more complex the projected pattern, as shown in the drawing on page 39.

The "Speaking Flame." To show the waveform and characteristics of sound, experiments were conducted with the help of such (to us) unorthodox apparatus as rotating mirrors and vibrating flames. One of the simpler pieces of equipment consisted of a funnel-shaped mouthpiece attached to a hose. The hose, in turn, was fastened to a specially designed gas burner. Although the flame of the burner was influenced by a

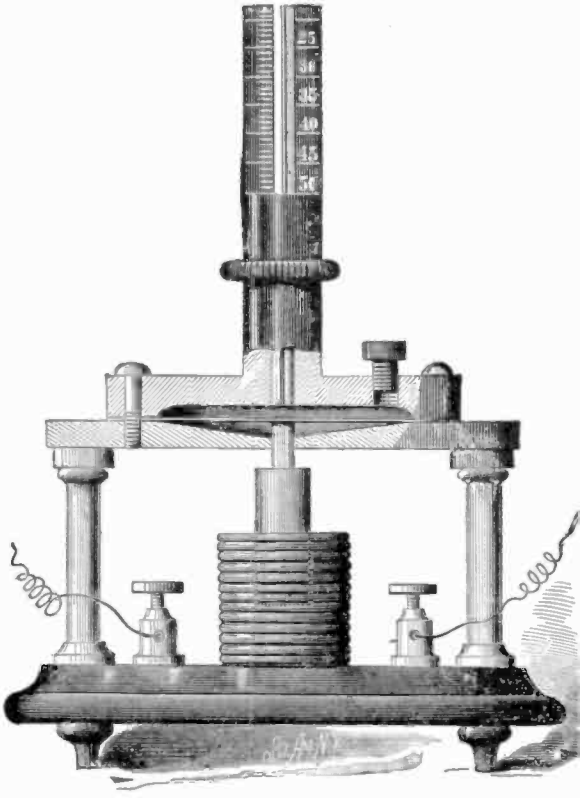


The self-exciting Geissler tube used static electricity to produce momentary flashes of light. One version of the device, which was evacuated and partially filled with mercury, found application as a sea-going marker buoy.

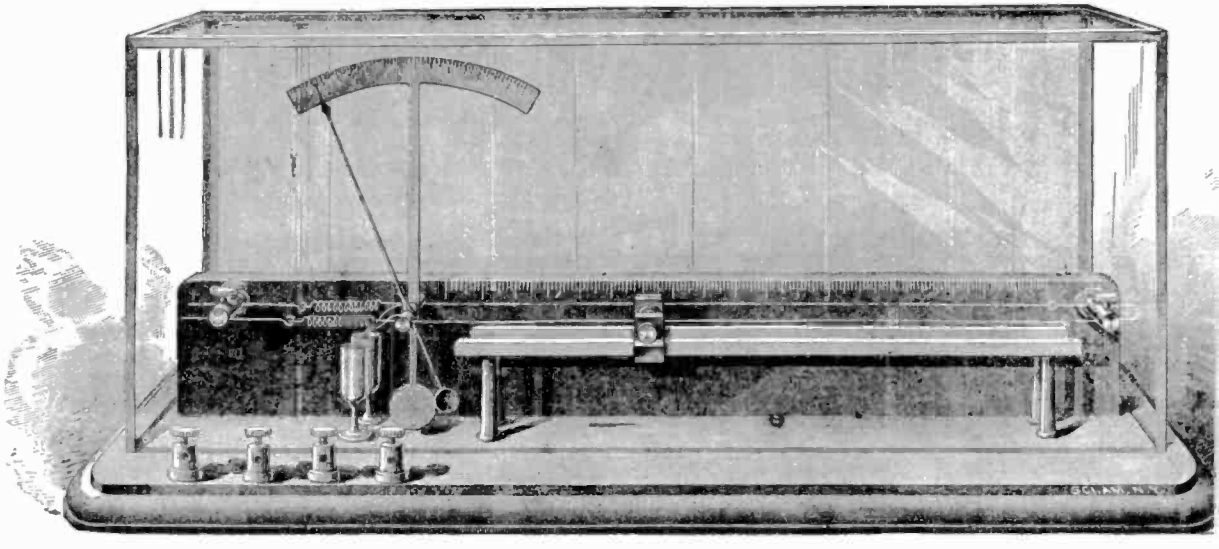
sound transmitted into the funnel, the minute vibration of the flame was indiscernible when viewed directly. The modulation of the flame could, however, readily be seen when reflected from a rotating mirror.

Another experiment along the same line was billed as the "speaking flame." This, too, used a speaking tube device consisting of a mouthpiece attached to a hose which, in turn, was fastened to the base of a specially designed gas orifice. A funnel-shaped resonator was attached over the burner to complete the device.

The sound waves that reached the burner through the speaking tube acted directly upon the base of the flame, causing the flame to reproduce sound. With the flame turned off, no appreci-



In crude ammeter above, current flowing through coil pulls a movable core down, activating a diaphragm and causing mercury in tube to fall. Device below is expansion voltmeter; it depends on linear expansion of a thin platinum wire when voltage is applied. Wire is coupled to pointer in front of scale.



AMAZING APPARATUS OF THE GAY NINETIES

able amount of sound was emitted from the resonator, thus proving that the flame itself was emitting the sound.

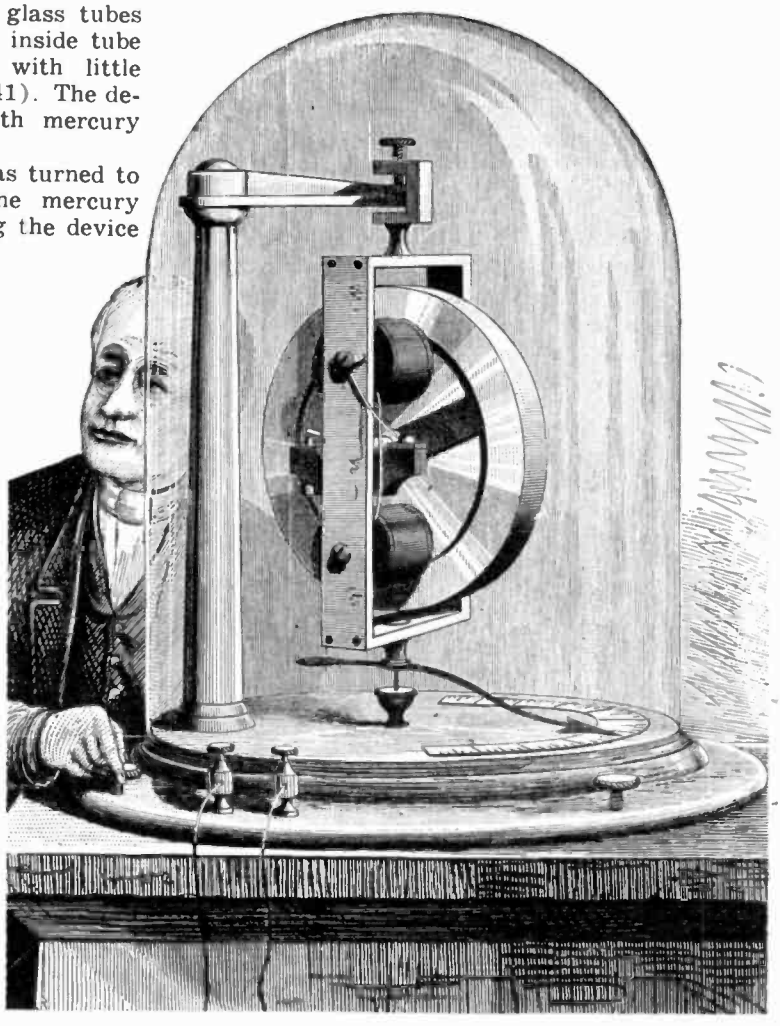
Electrical Experiments. In the field of static electricity, there were such devices as the electroscope, the electrophorus, Wimshurst machine, Leyden jar, etc. Many of these devices are used presently in some of the experiments conducted in modern-day schools. Not so well known, however, is the self-exciting Geissler tube. This device, depending upon static electricity for its operation, consisted of two glass tubes arranged concentrically; the inside tube was beaded and provided with little knobs (see drawing on page 41). The device was partially filled with mercury and the air evaporated.

When the Geissler tube was turned to a perpendicular position, the mercury ran down the inside, causing the device to emit light momentarily. This was due to the static electricity produced by the movement of the mercury upon the inside surface of the glass. The beading on the inside tube impeded the fall of the mercury, preventing it from breaking the glass when it reached the bottom of the tube. Surprisingly, a practical use was found for the Geissler tube: A limited number of self-luminous marker buoys were constructed on the Geissler principle.

Experiments in dynamic electricity were not out of the ordinary at the turn of the century; the equipment, however, such as the expansion voltmeter or the ammeter (which employed a diaphragm and mercury), seems weird and cumbersome by today's standards.

Basically, the expansion voltmeter depended upon the linear expansion of a thin platinum wire when an electric current was applied to it. The platinum wire was coupled to a needle or pointer that was arranged in front of a graduated scale. The ammeter consisted of a coil with a movable core inside it, the core being mechanically coupled to a diaphragm. The diaphragm, in turn, controlled a column of mercury similar, in nature, to a mercury thermometer.

(*Continued on page* 101)



Several types of gyroscopes were used for classroom demonstrations of the earth's rotation, among them the battery-powered version shown at right. Other units were powered by steam or with a crank.

FREEZE MOTION WITH SOUND

Like to try your hand at the fascinating field of high-speed photography? All it takes is a simple trip unit and a strobe

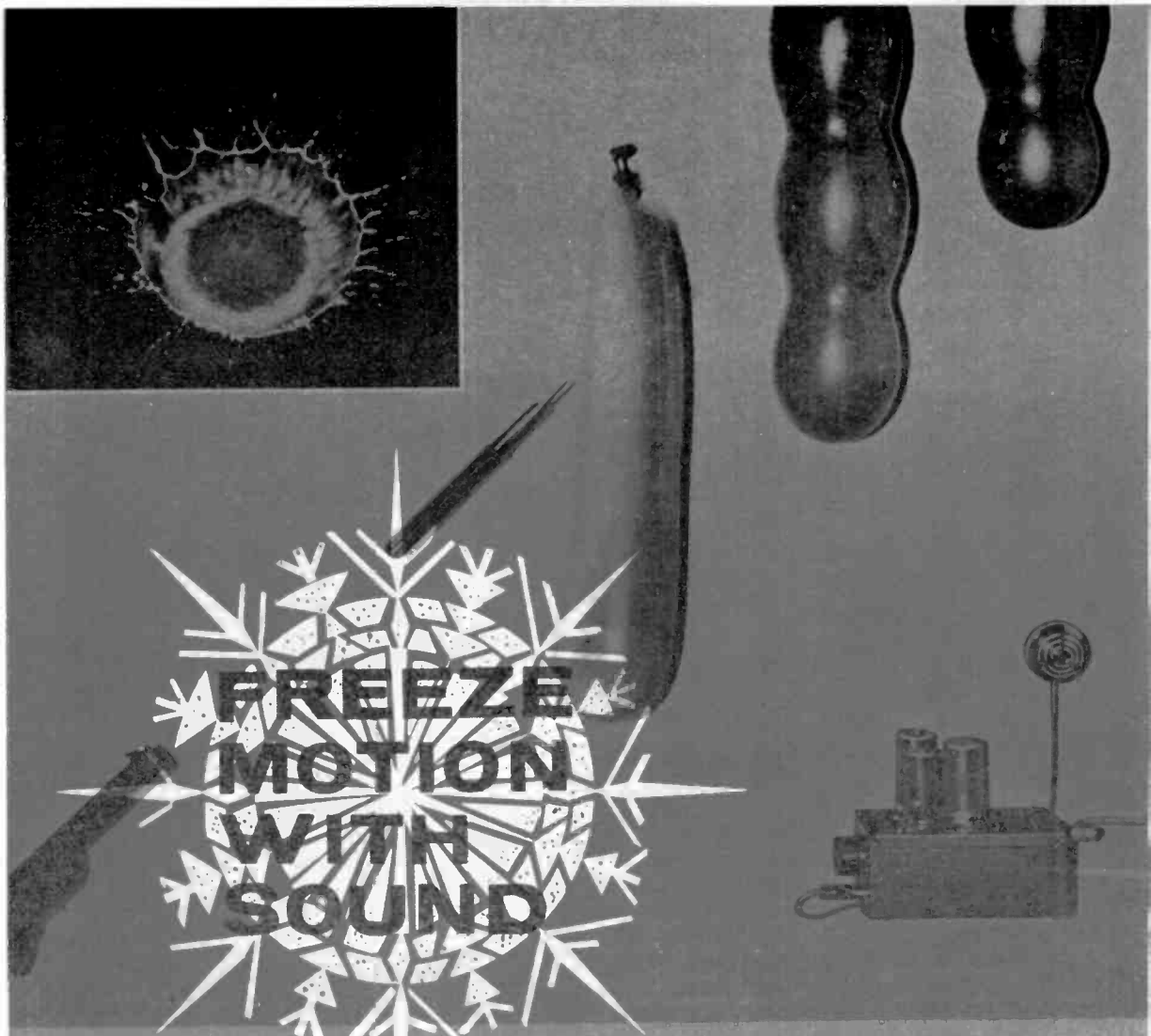
Sound-actuated unit (lower right) flashes strobe as first balloon, struck with dart, bursts. Insert shows drop of milk hitting black background; mike was 10" away; sensitivity of trip unit reduced to just half.

By ROY E. PAFENBERG

HAVE YOU ever wondered just exactly how glass breaks, liquids splash, balloons burst, or a ball bounces? The electronic flash trip unit featured here will answer these and a host of other intriguing questions that can only be explored through the use of high-speed photographic techniques.

Adaptable to almost any camera and electronic flash, this simple sound-actuated unit provides a means of obtaining unusual and striking photographs. The experimenter, research worker, or technician will find it a valuable low-cost laboratory accessory, and the student can use it as the ideal basis for a science project and/or science fair exhibit.

Although the fact is not widely known, the 1/1000 to 1/2000 second flash duration of the conventional hobby or professional electronic flash unit is fast



FREEZE MOTION WITH SOUND

Like to try your hand at the fascinating field of high-speed photography? All it takes is a simple trip unit and a strobe

Sound-actuated unit (lower right) flashes strobe as first balloon hit with dart, bursts. Insert shows drop of milk hitting black background; mike was 10" away—sensitivity of trip unit reduced to just half.

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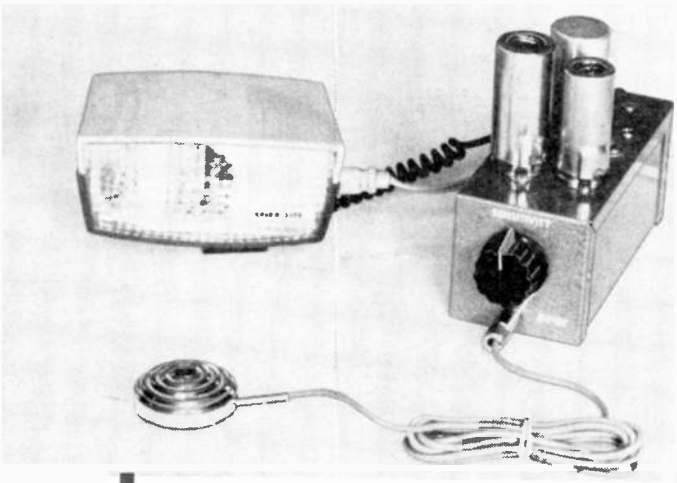


Trip unit fits neatly in 2¼" x 2¼" x 5" box; since layout is compact, it's best to copy author's model. Strobe light is the inexpensive unit described in text.

enough to capture all but the highest speed events on film. The problem is one of timing. With the method described here, sound produced by, or associated with, the event to be photographed is used to trigger the electronic flash. Since the camera shutter must be open, photography is done in subdued lighting or in a darkened room. After the flash captures the high-speed event on film, the shutter is manually closed.

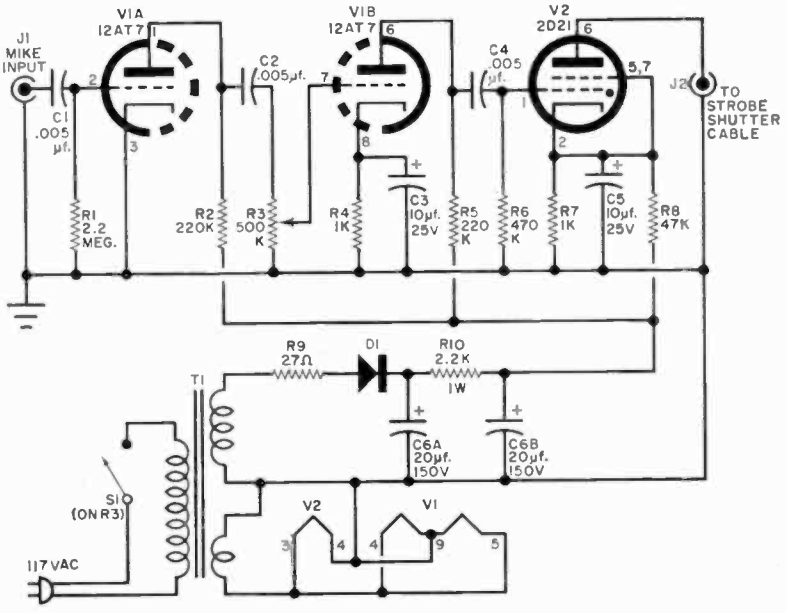
The exact instant the flash occurs relative to the noise that actuates it can be controlled by the way in which the microphone is positioned. Since sound travels relatively slowly, placing the microphone close to, or away from, the object will introduce an adjustable time delay.

Construction. In essence, the flash trip unit incorporates two stages of audio amplification (a single 12AT7) that triggers the 2D21 thyratron in response to sounds picked up by the microphone (see "How It Works," page 46). Since a thyratron acts like a switch or short-circuit when it conducts, it fires a flash unit connected to *J2*.

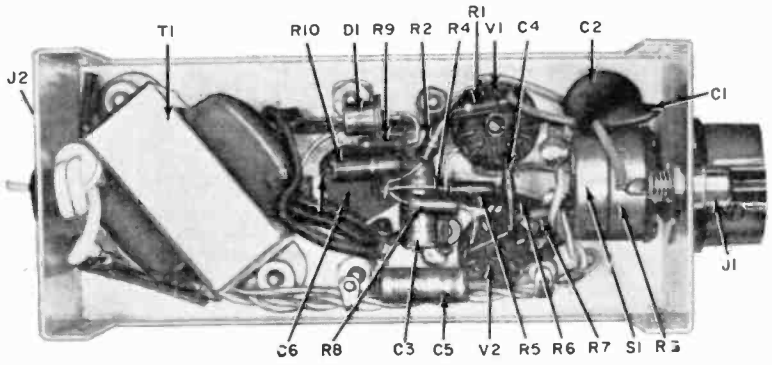
Although the sound-actuated trip unit may take any form that gives due consideration to layout, wiring, and the shielding requirements of high-gain amplifier circuits, the prototype unit is neat, compact, and rugged. The two tubes (*V1* and *V2*) and tab-mounting filter capacitor *C6* are mounted on top of the 2¼" x 2¼" x 5" Minibox used as a chassis, while the power transformer fits inside and as close to the back as possible. Sensitivity control *R3* and mike input jack *J1* are at the front of the box; output jack *J2* (for connection to the

PARTS LIST

C1, C2, C4—0.005-μf., 500-volt ceramic disc capacitor
C3, C5—10-μf., 25-volt electrolytic capacitor
C6—20/20-μf., 150-volt dual electrolytic capacitor
D1—500-ma., 400-PIV silicon diode
J1, J2—Phono jack, single-hole mounting type
R1—2.2-megohm, ½-watt resistor
R2, R5—220,000-ohm, ½-watt resistor
R3—500,000-ohm potentiometer, audio taper, with s.p.s.t. switch S1
R4, R7—1000-ohm, ½-watt resistor
R6—470,000-ohm, ½-watt resistor
R8—47,000-ohm, ½-watt resistor
R9—27-ohm, ½-watt resistor
R10—2200-ohm, ½-watt resistor
S1—S.p.d.t. switch; part of R3
T1—Power transformer: primary, 117 volts; secondaries, 125 volts @ 25 ma., and 6.3 volts @ 1 amp (Stancor PS-8416 or equivalent)
V1—12AT7 vacuum tube
V2—2D21 thyratron tube
1—2¼" x 2¼" x 5" Minibox
1—7-pin miniature tube socket with shield
1—9-pin miniature tube socket with shield
1—Crystal lapel microphone (or similar)
Misc.—Knob, terminal strips, solder lugs, hardware, grommets, a.c. line cord, wire, solder, etc.



Two stages of audio (V1a and V1b) amplify mike input to trigger 2D21 thyratron (V2).

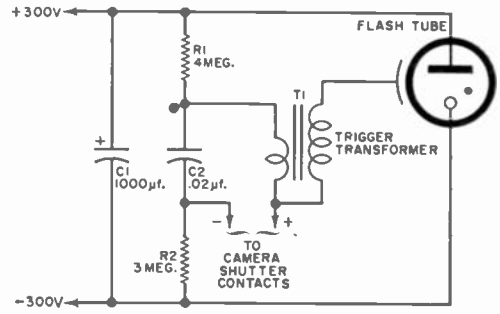


Locate T1 as close to the back of box as possible; note location of tube sockets, and mounting hole for C6. Jack J2 (for strobe connection) is hidden at rear of box.

strobe shutter cable) and the a.c. line cord entry are at the rear.

Two two-lug terminal strips are used—one for mounting silicon diode *D1* and the other for terminating the a.c. line cord. Chassis ground connections are made to soldering lugs installed under the tube socket mounting screws. Use insulated hookup wire for connecting the a.c. switch and filament circuits; the balance of the wiring can be done point-to-point using component leads. It's a good idea to use spaghetti on the leads as required to avoid possible shorts.

With the components mounted and wired, carefully check your work before installing the tubes and applying power. Check to see that the tube filaments light, and measure the B-plus at the



Flash shutter contacts are polarized. Check with a voltmeter, and connect positive side to V2's plate.

junction of *R10-C6b*. It should be slightly in excess of 150 volts. Finally, check for a reading of approximately 3 volts at pin 2 of the 2D21. Secure a crystal microphone such as the Lafayette Radio 99 G 4510 and terminate its cord in a phono plug.

The Flash Unit. The small schematic on this page is a simplified diagram of a typical electronic flash. Normally, the camera shutter discharges capacitor *C2*—charged through isolating resistors *R1* and *R2*—through the primary of trigger transformer *T1*. The very high voltage pulse produced by *T1*'s secondary is applied to the external starter anode of the flash tube, partially ionizing the gas inside it. The energy stored in *C1* flows through the ionized gas, producing an intense flash of light. In this application, the shutter leads from the flash unit are connected to *J2* of the trip adapter. The cord and connector are wired so that the positive terminal from the flash is connected to the 2D21 plate.

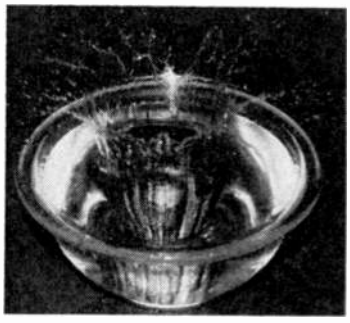
Almost any electronic flash unit will work with the trip unit, so if you already own one or can borrow one, you're in business. If you must buy one, remember that a.c. power will be required for the trip unit, so it would be foolish to pay extra for a battery-operated flash. Small but adequate a.c.-operated flash units are quite reasonable—the unit shown in the photo on page 44 is available from Spiratone, Inc., 135-06 Northern Blvd., Flushing 54, N.Y., for $12.95 plus postage.

Take a close look at the camera shutter on your flash unit, and secure an extension cord to fit it. Cut the camera fitting off of the other end, strip the wires, and turn the flash unit on. Touch a voltmeter set to a high range to the bared leads, and observe the polarity. Connect the positive lead of the cord

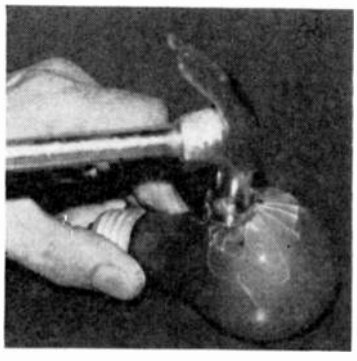
(*Continued on page* 112)

HOW IT WORKS

As shown in the schematic on page 45, the input signal from a high-impedance crystal microphone is amplified by a conventional 12AT7 (*V1*) twin-triode audio amplifier. A sensitivity control, *R3*, is provided between the first and second audio stages, and serves to determine the input signal level required to trigger *V2*, the 2D21 thyratron trigger stage. This stage serves as an electronic switch to close the contacts of the electronic flash unit. The firing circuit voltage developed in the flash is used as the plate supply voltage for the 2D21. Resistance network *R7-R8* biases the cathode of the 2D21 to a positive value of approximately 3 volts. When the positive peak of the audio signal applied to the control grid of the 2D21 appreciably exceeds the cathode bias, the tube conducts or fires, triggering the flash unit. The power supply is entirely conventional. The 6.3-volt winding of *T1* supplies filament voltage to *V1* and *V2*, while the output of the 125-volt winding is rectified by *D1* and filtered by *C6-R10* to supply bias voltage and 150 volts of B-plus for the audio amplifier plate circuits.



Mike was one foot away for photo of golf ball falling into bowl of water. Fracture pattern of bulb is seen below; despite its looks, it exploded violently.



Wireless Re-Broadcaster

Broadcast music or sound from your hi-fi, FM tuner, or TV set to every AM radio in the house—all it takes is a simple one-tube unit

By KEN DOBLER

REBROADCAST anything that comes out of a loudspeaker. You can get FM programs on all the AM radios in your home. Television sound and music from your tape recorder or phonograph can be heard on the kitchen radio. Your portable transistor radio can become another listening end of a paging or intercom system. You can remote-monitor your CB, amateur or short-wave receiver on any AM radio within range of the Wireless Re-Broadcaster (*WRB*). The *WRB* can be attached to the speaker leads of any program source (*PS*).

The speakers at the *PS* can be switched off or left on while you are rebroadcasting. When the *WRB* is shut off, the *PS* is not affected in any way and will function in a normal manner. The *WRB* is also equipped with a *Modulation* level control and a visual *Level* indicator to handle the high-level signals taken directly from loudspeaker leads, and can function properly over a wide range of input signal strengths.

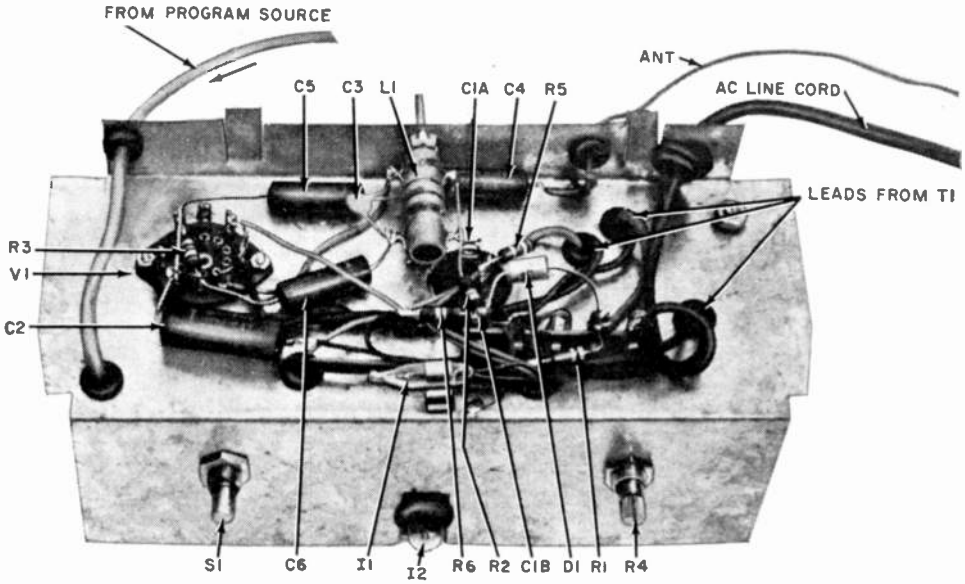
The circuitry is easy to understand and easy to put together. Parts are standard, few in number, and readily available. Use only enough antenna length to transmit a signal to your own sets. Part 15 of the FCC regulations and a neighbor's complaint can put an end to your rebroadcasting days if you cause interference. So keep it down and find a spot

Wireless Re-Broadcaster

Unique use of "S"-type fuse clip is shown below: it's soldered directly to the chassis and holds neon lamp I1. Grommets protect wires at various feedthrough points. Lamp I2, also grommet-held, can be moved up or down to line up with opening in front panel.

PARTS LIST

C1a/C1b—40-μf., 150-volt, and 25-μf., 25-volt dual electrolytic capacitor
C2—0.047-μf., 200-volt capacitor
C3—150-pf. ceramic disc capacitor
C4, C5, C6—400-pf., 400-volt capacitor
I1—NE-2 neon lamp
I2—NE-51 neon lamp
L1—Oscillator coil (Miller 71-OSC, or equivalent)
R1, R6—100,000-ohm, ½-watt resistor
R2—10,000-ohm, ½-watt resistor
R3—39,000-ohm, ½-watt resistor



on the band that doesn't conflict with a regular broadcast program.

A dual-triode vacuum tube (12AT7) is used as an oscillator and series modulator. A series modulator can be recognized by the fact that the plate voltage supply is in series with the modulator and modulated tubes. The unit is powered by a half-wave power supply isolated from the a.c. line by *T1*.

Construction. A wooden cabinet (8" x 4" x 4") can be made and stained to match existing furniture. The chassis is fabricated from a piece of sheet metal cut and bent to the proper shape. A separate chassis pan and front panel could be put together instead.

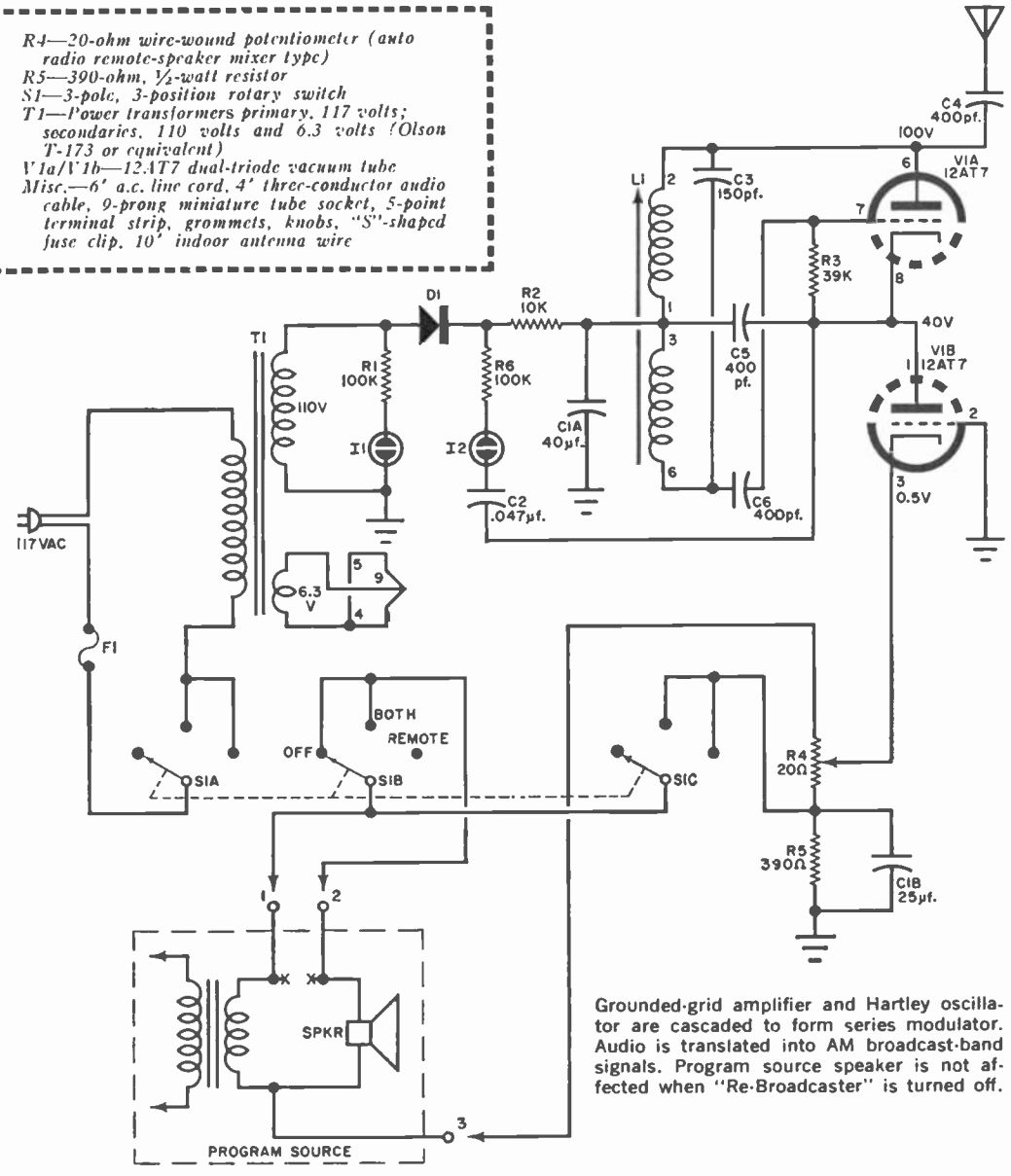
Cut a notch rather than a hole in the front panel for the neon lamp modulation *Level* indicator. The outer groove of the grommet holding the lamp can now act as a runway to grip the sides of the slot. The lamp can then be moved up or down to line up with an opening in the cabinet. Lettering on the cabinet's Masonite front panel can be done with a ⅛" plastic lettering guide over a strip of gold writing foil.

Wiring is not critical; just check all connections before turning on the power. An "S"-shaped fuse clip makes a convenient holder for the neon "off-on" indicator. Solder the clip directly to the chassis, so that it is upright and the upper opening faces the front. Insert the lamp into the upper opening.

Keep the antenna lead down to 10 feet to avoid difficulty with FCC regulations.

How It Works. Signals taken from the speaker circuit of a *PS* are fed to the *Modulation* level control, potentiometer *R4*, through switch *S1b* and *S1c*. More or less signal (depending upon the control setting) is passed to the cathode of the modulation portion of the tube (*V1b*). Triode section *V1b* is hooked up as a

R4—20-ohm wire-wound potentiometer (auto radio remote-speaker mixer type)
R5—390-ohm, ½-watt resistor
S1—3-pole, 3-position rotary switch
T1—Power transformers primary, 117 volts; secondaries, 110 volts and 6.3 volts (Olson T-173 or equivalent)
V1a/V1b—12AT7 dual-triode vacuum tube
Misc.—6' a.c. line cord, 4' three-conductor audio cable, 9-prong miniature tube socket, 5-point terminal strip, grommets, knobs, "S"-shaped fuse clip, 10' indoor antenna wire



Grounded-grid amplifier and Hartley oscillator are cascaded to form series modulator. Audio is translated into AM broadcast-band signals. Program source speaker is not affected when "Re-Broadcaster" is turned off.

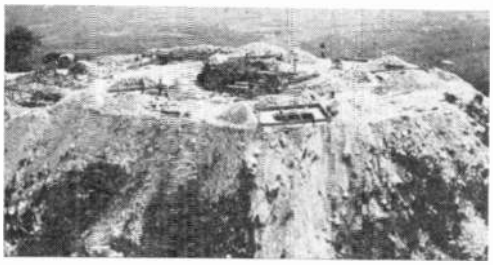
grounded-grid amplifier. The grounded grid shields the input from the output circuit and prevents oscillation. Input signals applied to the cathode vary cathode potential with respect to the grid in "step" with the signal. This action varies and controls current flow through the tube, making the tube work like an ordinary amplifier.

Triode section *V1a* functions as part of a typical Hartley oscillator. The tuned tank circuit consisting of coil *L1* and capacitor *C3* is across the grid and plate of this triode while the signal at the coil's tap is at cathode potential. Capacitors *C5* and *C6* serve as d.c. blocks. The values of the components in the tank circuit determine the generated frequency. Varying the adjustment of coil *L1* will enable you to select a quiet spot on the AM broadcast band.

The generated radio frequency in tube section *V1a* is amplitude-modulated by

(*Continued on page* 100)

Mountaintop Flattened for TV



THE ENTIRE top of a mountain at Ajangote in Ghana, Africa, has been "decapitated" to make room for a high tower designed to support TV transmitting antennas. and buildings to house transmitting equipment. The elevation of the new station will be great enough to insure TV coverage over a large portion of the surrounding area, including the principal city of Accra.

The project, under the direction of the English Marconi Company, is scheduled for completion this spring. Work is also under way on two other TV stations to be located at Kumasi and Sekondi-Takoradi, a TV studio center at Accra, a radio station at Ejura, and a microwave network which will carry six high-quality music channels between Accra, Kumasi, and Ejura.

The new stations will substantially increase Ghana's radio-TV facilities.

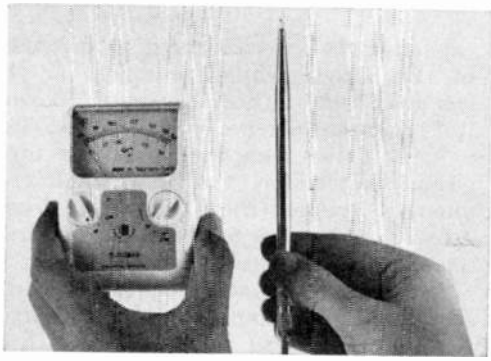
—Hans F. Kutschbach

Monument Honors Transmitting Tube

A UNIQUE monument honoring a transmitting tube that lived for "260 years" has been erected by engineering personnel of *Radio Liberty* at the organization's transmitting site in Lampertheim, Germany. The tube, known as "B18," is a steam-cooled 50,000-watt type that lasted 32,459 hours beyond its normal life expectancy of 7000 hours. This corresponds to a human life span of approximately 260 years.

Visitors to the monument are greeted by an electronically triggered briefing in English, Russian, and German, which gives details about the privately sponsored network's around-the-clock broadcasts to the Soviet Union. Shown alongside the monument are William D. Edwards (left), station manager, and William B. Nielsen, assistant station manager.

Electronic Medical Thermometer



A NEW application has been found for the temperature-sensitive thermistor, a semiconductor. Braun Electronic, a West German firm, has put it to work in a medical thermometer that accurately gauges a patient's temperature in seconds. Named "Tastomed," the device has a probe which is held under the patient's tongue, and a meter calibrated in Centigrade and Fahrenheit. U.S. representatives: Electro-Physical Instruments of Ogdensburg, N.Y.

—Hans F. Kutschbach

The Sleep-O-Mat

Create the sound of softly falling rain with an unusual unit that generates white noise

By ROBERT M. VOSS

WORN OUT from the nervous turmoil of a hard day? Have trouble sleeping? Live in a noisy location? If you have any or all of these problems, the "Sleep-O-Mat" may be the answer. Strangely enough, it fights mental fatigue and extraneous noise *with* noise—a special kind of noise that is akin to the sound of waves at the seashore, a waterfall, or rain on the roof. The term for this kind of noise is "white" noise, or—to use a better name—white sound.

While white noise or sound really has no hue, it is analogous to the color "white." Just as white light is made up of all the visible colors, white noise consists of all audible sound frequencies in all possible phase relationships.

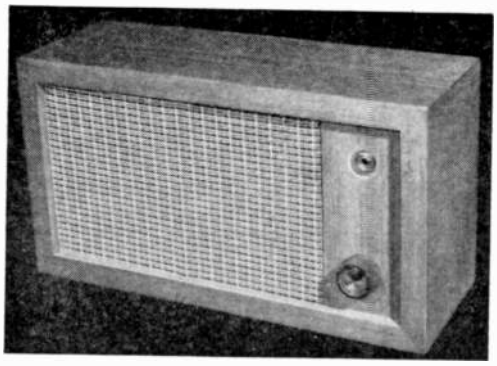
One of the recent developments in semiconductor research has been the development of diodes which, when biased at a specified voltage and feeding a specified load, produce white noise through various bandwidths, with some types going far into the radio frequencies. One unit, the SD-1W/PE manufactured by Solitron Devices, Inc., covers the audio range, and is used as the basis of the Sleep-O-Mat.

As an additional bonus, the Sleep-O-Mat's high-quality audio amplifier and speakers can also be employed as a phonograph or tuner amplifier. Simply plug a program source into the jack on the front panel, and substitute soft, soothing music for the white noise.

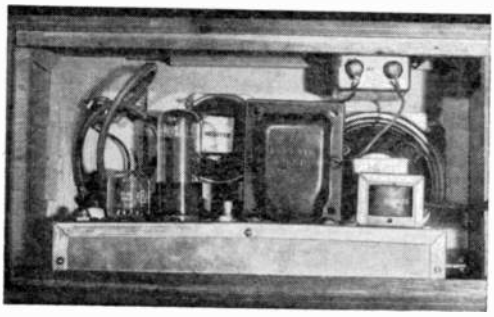
How It Works. Basically, the Sleep-O-Mat consists of white noise diode *D1* followed by a conventional audio amplifier, the entire chassis being mounted inside the cabinet of the speaker system it drives. A single 6C10 compactron tube furnishes three stages of voltage amplification in one envelope (*V1a*, *V1b*, and *V1c*). The power output stage, *V2*, is a 6K6GT, chosen because it delivers more than enough power with very little plate current. But enough current passes through this tube and cathode resistor *R13* to develop a high enough potential to bias the white noise diode.

A compensated control is used instead of an ordinary volume control, since white noise is most effective when all

THE SLEEP-O-MAT



Small speaker system forms housing for Sleep-O-Mat; loudness control R7 and phono jack J1 are mounted on front. Long narrow chassis fits in back of speakers (photo below). Tubes V1 and V2 are at left, power and output transformers at right. Chassis size depends on the enclosure selected for the unit.



the frequencies are of equal intensity. With an uncompensated control, some frequencies are attenuated at different settings, particularly so on the low end. Potentiometer *R4* is not compensated and should be adjusted to maximum or near maximum setting and left there. Control *R7*, which actually performs the function of volume level control, is better able to run from high to low level because of its compensation. Hum is even more objectionable in the presence of white noise than it is with most musical sounds. The hum-bucking potentiometer in the filament circuit and the filters in the power supply reduce hum to minimum levels.

Construction. Although the output from the Sleep-O-Mat can be fed to almost any external speaker, building the unit into a small, inexpensive speaker system makes for a neat, compact unit that fits nicely on a night table or bookcase headboard. The author used a Calrad speaker system measuring 13" x 7" x 4¾" on the outside. Other similar small speaker systems such as the Heathkit AS-41 can also be used, or you can build your own cabinet, but cabinet size will determine the chassis dimensions.

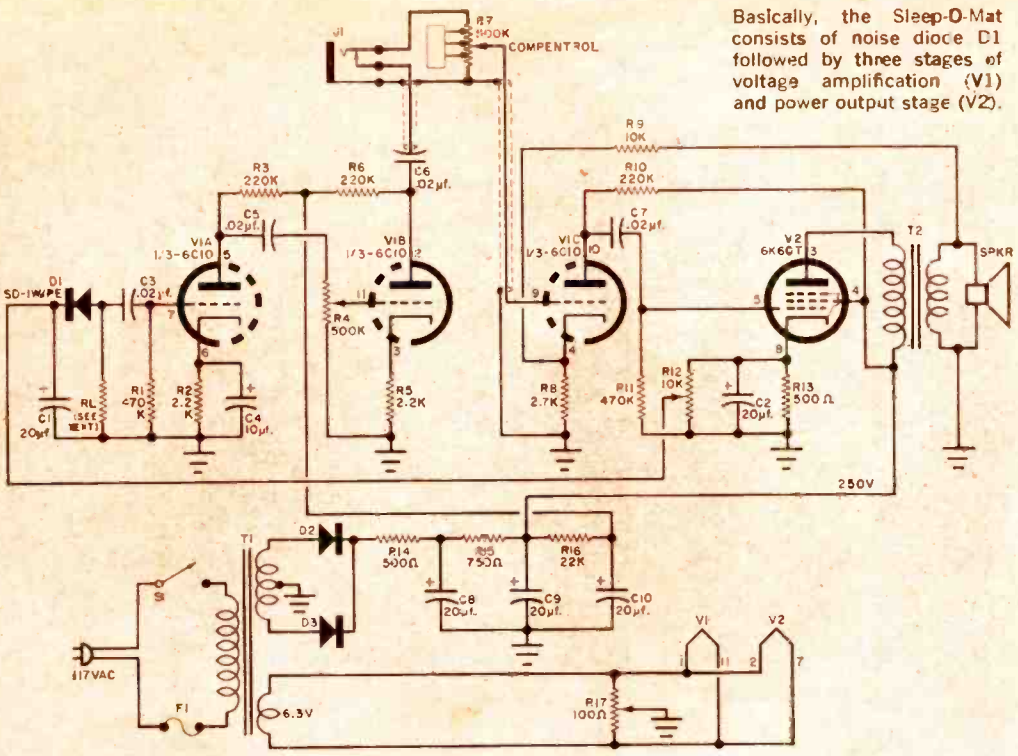
A long, narrow chassis measuring 1½" x 2" x 10" fits nicely into the Calrad speaker system, allowing room for the protruding speaker magnets. It is suggested that an even larger chassis be selected if cabinet size permits, since the author's compact layout makes wiring somewhat difficult. As shown in the lower photo on this page, straight-line arrangement of components was used.

Level control *R4*, one of the three screwdriver adjust pots in the Sleep-O-Mat, is mounted at the extreme left of the chassis (as viewed from the back). Following, from left to right, are *V1*, *V2*, potentiometer *R12* (which adjusts the bias voltage on the white noise diode), power transformer *T1*, and output transformer *T2*. Hum-bucking pot *R17* is hidden behind *T2*, as are the grommet-lined holes for the a.c. line cord, the speaker leads, and the leads to *S1* (part of control *R7*). Shielded cable leads to *R7* and *J1*, both mounted on the front panel, are brought out through holes adjacent to *V1*'s socket.

With the exception of the fuse holder mounted on the right end of the chassis, all remaining components are positioned underneath the chassis. Since layout will largely be determined by the shape and size of the chassis, no detail is given on the prototype unit. Generally, however, care should be taken to isolate the low-level input stages from the output. Also, it is best to locate the power supply away from *V1* and *V2*.

Adjustment. Bias voltage for the white noise diode is given in a table of specifications that comes with it. Although the operating point is not overly critical, it is best to adjust potentiometer *R12* with a voltmeter so bias voltage will be exact. Similarly, load resistor *RL*—150,000 ohms in the author's unit—will be specified and should be within 5% or so of the given value.

A word of caution is in order: Occa-



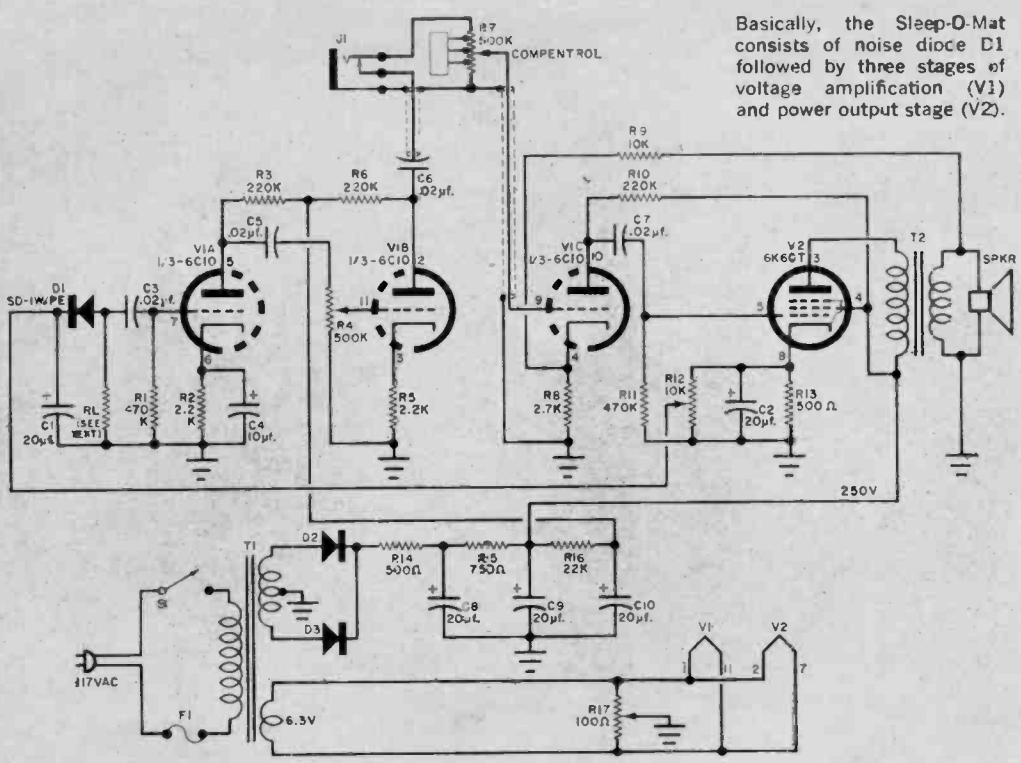
Basically, the Sleep-O-Mat consists of noise dioce D1 followed by three stages of voltage amplification (V1) and power output stage (V2).

PARTS LIST

C1, C2—20-μf., 50-volt electrolytic capacitor
C3, C5, C6, C7—0.02-μf., 400-volt paper capacitor
C4—10-μf., 3-volt electrolytic capacitor
C8, C9, C10—20-μf., 350-volt electrolytic capacitor
D1—SD-1W/PE white noise diode (Solitron Devices, Inc., 500 Livingston St., Norwood, N.J.; $10.00)
D2, D3—800-PIV, 500-ma. silicon diode (1N560 or equivalent)
F1—¼-ampere fuse in fuse holder, type 3AG
J1—Standard phone jack, normally closed
RL—As specified for D1—see text
R1, R11—470,000-ohm, ½-watt resistor
R2, R3—2200-ohm, ½-watt resistor
R3, R6, R10—220,000-ohm, ½-watt resistor
R4—500,000-ohm potentiometer, audio taper, screwdriver adjust
R7—500,000-ohm loudness control with switch (Centralab C1-60 "Compentrol" or equivalent)
R8—2700-ohm, ½-watt resistor
R9—10,000-ohm, ½-watt resistor
R12—10,000-ohm potentiometer, linear taper, screwdriver adjust
R13, R14—500-ohm, 5-watt wire-wound resistor
R15—750-ohm, 5-watt wire-wound resistor
R16—22,000-ohm, ½-watt resistor
R17—100-ohm, ½-watt potentiometer, linear taper, screwdriver adjust
S1—Part of R7
T1—Power transformer: primary, 117 volts; secondaries, 460 volts @ 50 ma., and 6.3 volts @ 2.5 amperes (Stancor PC-8418 or equivalent)
T2—Output transformer: primary, 7000 ohms; secondary, 4 ohms (Stancor A-3878 or equivalent)
V1—6C10 compactron tube
V2—6K6GT tube
1—Speaker(s) and cabinet—see text
1—Chassis to fit cabinet—see text
1—12-pin socket for V1
1—Octal socket for V2
Misc.—Terminal strips, wire, hardware, knob, etc.

sionally diodes will deliver enough noise in the supersonic region to overload the following stages. When this happens, the white noise output increases to a certain point when the level control is advanced, then whistling is heard, and finally dead silence as the amplifier blocks. A small capacitor—47 pf. or so—across *RL* will cure this problem. If whistling or other forms of oscillation are heard *independent* of the settings of the gain controls, the amplifier feedback loop is out of phase; in this case, reverse the secondary leads on *T2*. To adjust *R17*, ground pin 7 of *V1* and turn *R7* up full; this grounds the signal from *D1* so *R17* can be set for minimum hum.

While the Sleep-O-Mat is not a cure-all for insomnia, most persons find it very soothing if not sleep-inducing. Try it as a companion the next time you relax after a hard day's work. —30—



PARTS LIST

C1, C2—20-μf., 50-volt electrolytic capacitor
C3, C5, C6, C7—0.02-μf., 400-volt paper capacitor
C4—10-μf., 3-volt electrolytic capacitor
C8, C9, C10—20-μf., 350-volt electrolytic capacitor
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D2, D3—800-PIV, 500-ma. silicon diode (1N560 or equivalent)
F1—¾-ampere fuse in fuse holder, type 3AG
J1—Standard phone jack, normally closed
RL—As specified for D1—see text
R1, R11—470,000-ohm, ½-watt resistor
R2, R3—2200-ohm, ½-watt resistor
R3, R6, R10—220,000-ohm, ½-watt resistor
R4—500,000-ohm potentiometer, audio taper, screwdriver adjust
R7—500,000-ohm loudness control with switch (Centralab C1-60 "Compentrol" or equivalent)
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R9—10,000-ohm, ½-watt resistor
R12—10,000-ohm potentiometer, linear taper, screwdriver adjust
R13, R14—500-ohm, 5-watt wire-wound resistor
R15—750-ohm, 5-watt wire-wound resistor
R16—22,000-ohm, ½-watt resistor
R17—100-ohm, ½-watt potentiometer, linear taper, screwdriver adjust
S1—Part of R7
T1—Power transformer: primary, 117 volts; secondaries, 460 volts @ 50 ma., and 6.3 volts @ 2.5 amperes (Stancor PC-8418 or equivalent)
T2—Output transformer: primary, 7000 ohms; secondary, 4 ohms (Stancor A-3878 or equivalent)
V1—6C10 compactron tube
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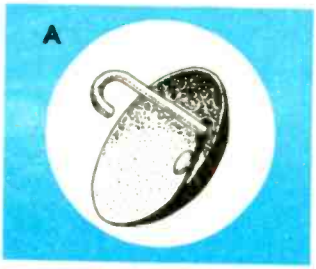
While the Sleep-O-Mat is not a cure-all for insomnia, most persons find it very soothing if not sleep-inducing. Try it as a companion the next time you relax after a hard day's work. -30-

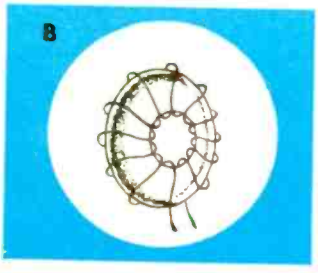
ELECTRONIC GEOMETRY QUIZ

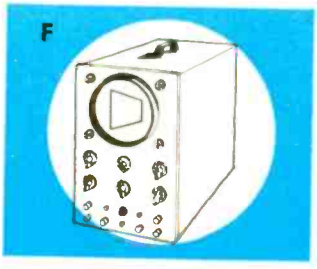
By ROBERT P. BALIN

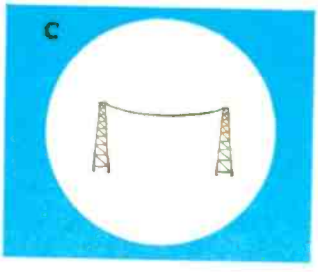


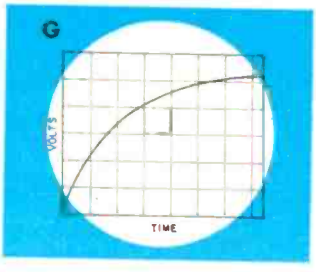
Often electronic components and circuits are named after their geometrical form or their characteristic behavior curve. Examples are rhombic antennas, cosine deflection yokes, sine- and square-wave generators, etc. See if you can match the names of the curves and solids (1-10) at right with the drawings of their applications (A-J).

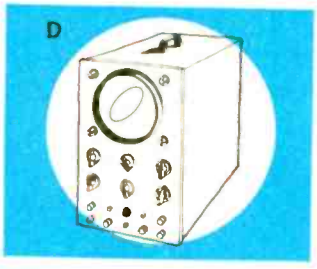
(*Answers on page* 104)

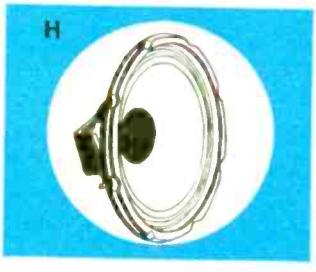


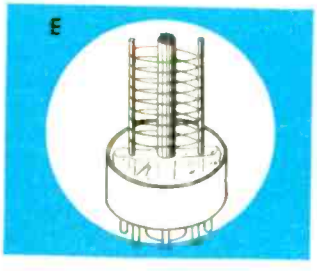












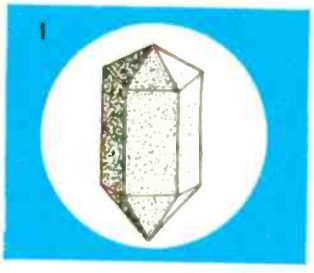
1 Cardioid ____

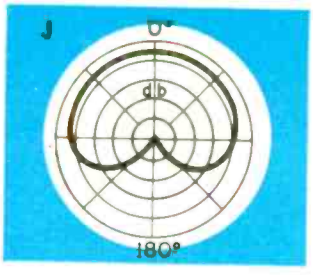
2 Catenary ____

3 Cone ____

4 Ellipse ____

5 Exponential ____





6 Helix ____

7 Paraboloid ____

8 Polyhedron ____

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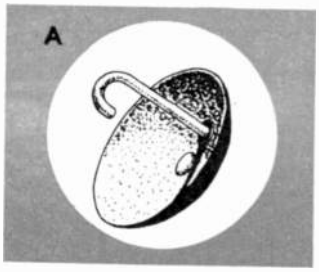
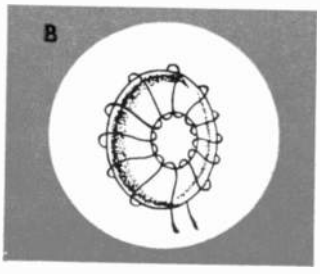
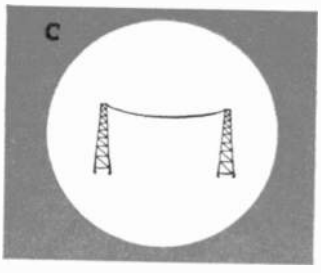
10 Trapezoid ____

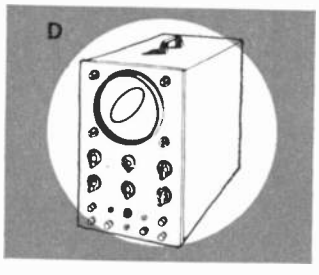
ELECTRONIC GEOMETRY QUIZ

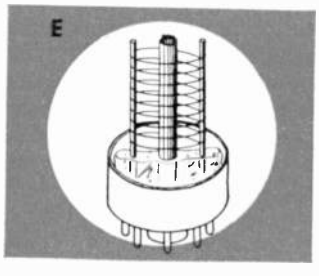
By ROBERT P. BALIN











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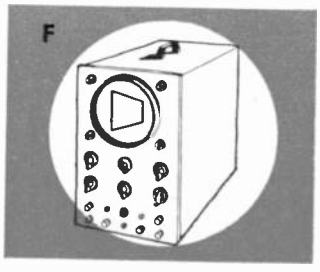

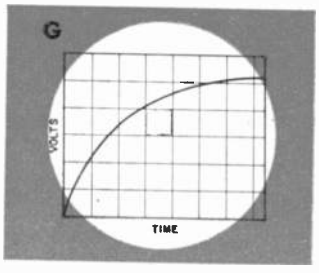

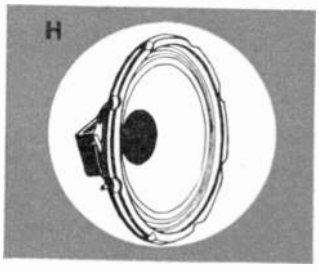

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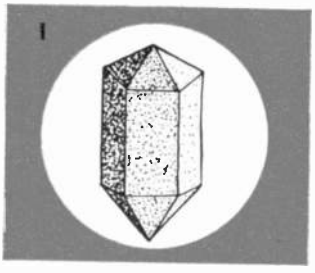

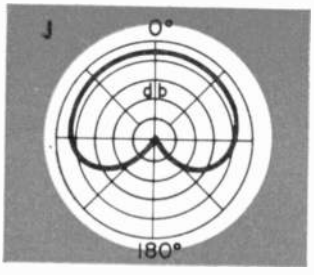

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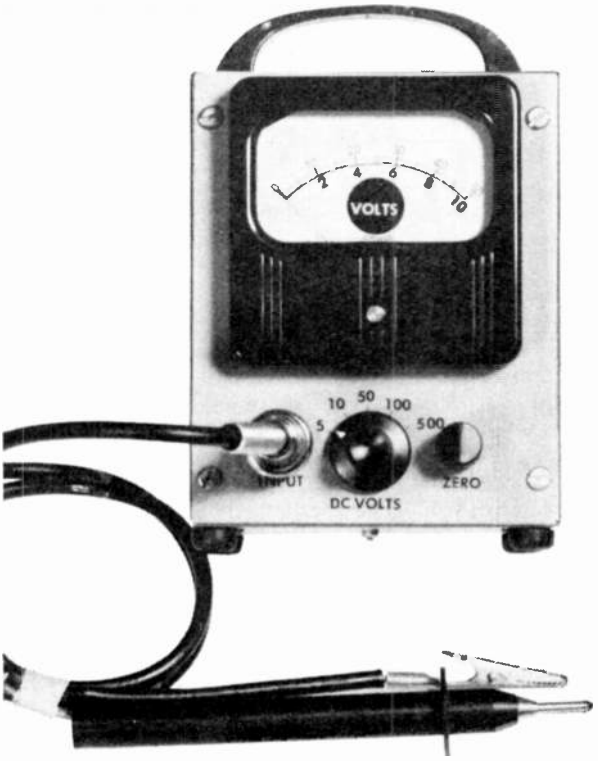


MINIATURE VTVM

Unit measures voltage in a.g.c., grid bias, oscillator and other high-impedance circuits without loading

By RYDER WILSON

ONE of the most useful test instruments in the electronics enthusiast's workshop is the vacuum-tube voltmeter. The VTVM enables the experimenter to measure small voltages accurately, especially in high-impedance grid bias, a.g.c., detector and oscillator circuits. Unlike the 1000- or 20,000-ohms-per-volt voltmeters which present different resistances on different ranges, the miniature VTVM to be described here has a constant resistance of 10 megohms on all ranges.

The miniature VTVM is a low-cost construction project and operates economically on batteries. It can measure d.c. voltages in five or six ranges, depending on whether a 5- or 6-point switch is used. Up to 500 volts can be measured directly; audio, r.f. and other a.c. voltages can also be measured with the demodulator probes. The miniature unit is completely self-contained in a 5" x 4" x 3" metal utility box and has a large, easy-to-read, reasonably-priced, 50-μa. meter movement.

How It Works. A CK6088 subminiature beam-power-pentode vacuum tube (*V1*) is "triode"-operated in a d.c. bridge circuit. The quiescent voltage drop across resistor *R8* is balanced out by applying just enough bucking voltage to zero the meter. You simply adjust potentiometer *R11* for a zero meter reading. Potentiometer *R9* serves as a current limiter and calibrator for the meter circuit.

A positive d.c. voltage applied to the grid of tube *V1* through resistor *R7* causes a proportional up-scale deflection. The more positive the grid, the more the tube conducts and the greater the voltage drop across resistor *R8*. The greater the voltage drop, the greater the deflection of the meter. The rotary switch (*S1*) specified in the Parts List selects one of the five voltage ranges from 5 to 500 volts. Precision $\pm 5\%$ resistors are used in the input voltage divider network. The VTVM's accuracy is dependent upon the selection of the proper value of resistors, as well as the quality of the meter movement.

If you can get a 6-position, single-circuit switch that will fit, you can wire the input voltage divider as shown in Fig. 3, to get a very desirable 1-volt range. Actually, no change in the arrangement of the resistors in this circuit would have to be made to accommodate the 6-position switch. Jack *J1* would be connected to the first contact which would become the position for the 1-volt range. All other positions would

MINIATURE VTVM

follow in the same consecutive order as in the 5-position switch.

Because of its d.c. operation, the miniature VTVM is relatively stable and free of drift. It does not require constant resetting of the zero control.

Construction. The interior view of the VTVM shows the layout of the various components. The tube (*V1*) is held in place by a cable clamp. The circuit board is mounted on the meter terminals. Resistors *R7*, *R8*, *R9* and filament battery *B2* are mounted on the board. Resistors *R1* through *R6* are mounted, turret style, directly on *S1*. (See Fig. 6.)

Position the meter as close as possible to the top of the case to allow room for the range selector switch and panel markings. Zero-adjust control *R11* and tube *V1* are then positioned to avoid interference with other components. Place battery *B1* on the bottom of the case and hold it in position with a suitable friction clip.

The d.c. probe shown with the meter is made from a 2′ length of 52-ohm coaxial cable and a test prod connected to the center conductor. An alligator clip and a short length of insulated wire are connected to the shield inside the probe handle. In use, the test prod point is connected to the positive side and the alligator clip to the negative side of the voltage to be measured.

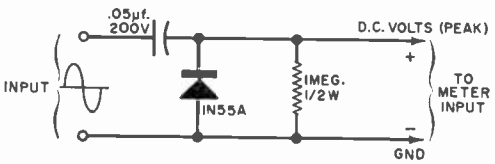


Fig. 2. Demodulator probe measures low a.c. peak voltages. Capacitance of probe leads acts as filter.

Calibration. Any known source of voltage can be used to calibrate the VTVM. A simple setup is shown in Fig. 5. However, before turning the instrument on, check for mechanical zero of the VTVM's meter. Next, set the range-selector switch to the 5-volt scale and adjust zero control *R11* until the switch just clicks on. The meter will probably read about 1.25 volts. Continue turning *R11* slowly, clockwise, until the meter reads zero. Do this with the probe connected to the meter and the alligator clip on the test prod's point, to prevent readings of stray voltages.

Adjust the 1000-ohm potentiometer on the calibrator rig to 5 volts, and apply the probe. Adjust calibrating potentiometer *R9* for full-scale deflection (the 5-volt mark on the VTVM). By successively reducing the input voltage to 4, 3, 2 and 1 volt, linearity of the meter can be compared with the meter in the test circuit. A slight nonlinearity may be observed as the input voltage is decreased, with an approxiate error of ±0.1 volt at the low end of the scale.

Fig. 1. The voltage drop across the cathode resistor is in proportion to voltage being measured. The more positive the applied voltage to the grid, the greater the voltage on the resistor.

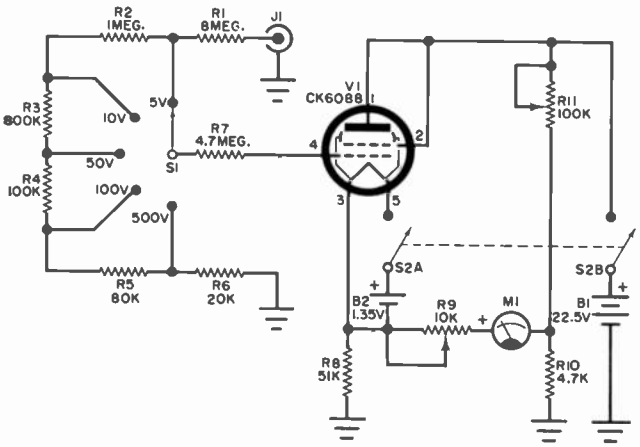
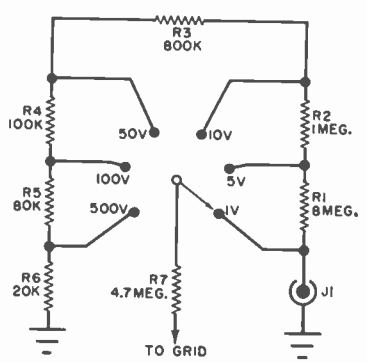


Fig. 3. Alternate hookup of voltage divider provides extra 0- to 1-volt range.



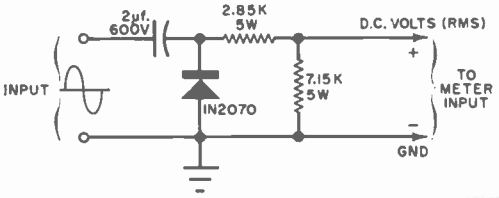


Fig. 4. Divider in demodulator probe delivers about 70% of peak voltage to meter circuit to enable direct readout of r.m.s. voltages.

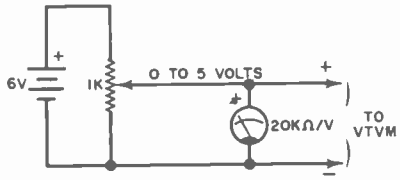


Fig. 5. Variable voltage divider circuit used to calibrate the miniature VTVM.

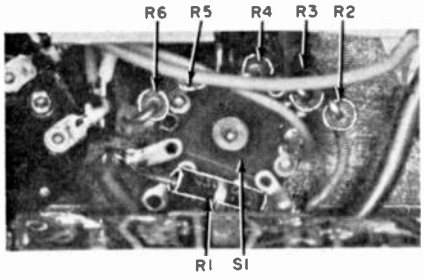
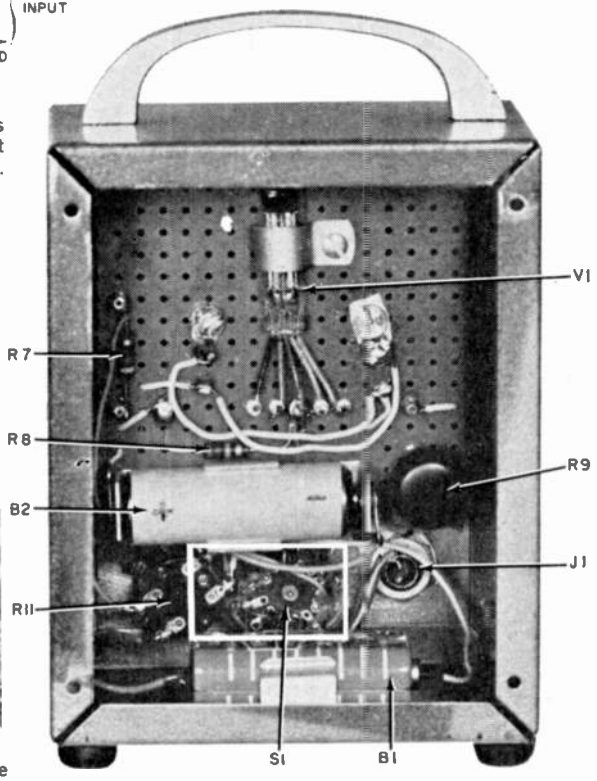


Fig. 6. Preassemble the resistors and the switch in "turret" fashion before mounting.

Fig. 7. Position meter as high as possible in case. Mount circuit board directly to back of meter.



PARTS LIST

B1—22.5-volt battery (NEDA No. 215)
B2—1.35-volt mercury cell battery (Mallory RM-12R or equivalent)
J1—Single-contact, male, panel-mounted mike connector
M1—0-50 microammeter (Lafayette 99 G 5042 or equivalent)
R1—8-megohm, ½-watt resistor (selected from 8.2-megohm stock)*
*R2—1-megohm, ½-watt resistor**
R3—800,000-ohm, ½-watt resistor (selected from 820,000-ohm stock)*
*R4—100,000-ohm, ½-watt resistor**
R5—80,000-ohm, ½-watt resistor (selected from 82,000-ohm stock)*
*R6—20,000-ohm, ½-watt resistor**
R7—4.7-megohm, ½-watt resistor
R8—51,000-ohm, ½-watt resistor
R9—10,000-ohm miniature potentiometer
*R10—4700-ohm, ½-watt resistor**
R11—100,000-ohm miniature potentiometer with d.p.s.t. switch (S2)
S1—2-circuit, 5-position switch (Lafayette 99 G 6164 or equivalent; use only 1 circuit)
S2—D.p.s.t. switch (on R11)
V1—CK6088 vacuum tube
1—5" x 4" x 3" metal utility box
Misc.—Probe tip, wire, battery clamps, etc.
*Resistors are ± 5% or better

If a greater error occurs, it could be due to a poor tube, or nonlinearity of the calibrator meter.

Use the same procedure only to check the VTVM on the other voltage scales. Actually, this is not necessary; once one scale is calibrated, all the other scales take their proper relative position. Significant errors on the other ranges would be due to employing wrong values (one or more) for resistors *R1* through *R6*. When the calibration is completed, the meter is ready for use.

Higher voltages applied to the tube's grid, beyond a certain point, have less and less effect on tube current, and at saturation have none. The meter cannot be subjected to "burn-out" currents no matter how high the voltage being tested or how low the selected voltage range on the meter. But don't poke the unit into a 16,000-volt circuit without a suitable high-voltage probe! -30-

By LETA FOSTER IDE

MIKE R. FONIC, chief technician for Happy Henry's Hi-Fi Hippodrome, went to see his doctor.

"What's the matter, Mike?" the physician asked. "Watts your current problem?"

"Doctor, I'm only half a life!" Mike moaned. "I'm off my feed. Got no capacity. Fact is, I'm in a breakdown."

"Oh come now," the doctor protested cheerfully. "It can't be that bad. A little component aging, perhaps. But what do you expect in your voltage? How's your pulse rate?" He reached for his patient's wrist.

"But Doc," Mike insisted, "I tell you I'm a terminal case. I'm short-circuited."

"Nonsense, Mike," the doctor replied. He pushed a thermometer into his patient's mouth, probed deeply into his diaphragm, and examined his solenoids.

"It's nothing of specific gravity," the doctor concluded. "Your resistance is low, your temperature point is up, and your heart pulsations are somewhat erratic. How long has this condition persisted?"

"Faraday. And Faraday about two weeks ago."

"Then it's only intermittent. Something must be bugging you either at the office or at ohm. How's your ohm life?"

"Terrible, Doc, terrible. It's my wife's Ant Enna. She's driving me hard."

"She's visiting you?"

"Yeah. She comes with high frequency and leaves with reluctance."

"I see," the doctor said. "Then for all practical purposes the situation is static? And she bugs you, eh?"

"Yeah. It's her constant interference. And her impedance. And her loud voice."

"She's a loud speaker, is she?"

"You said it, Doc! A real woofer."

"Can't you tuner down? Ask her to reducer volume?"

"Not that old baud. She isn't about to modulator voice."

"You've tried to rectifier?" the doctor asked.

"Sure. I can't controller."

The doctor reached for his prescription pad. "Well . . . I'll give you something to anodize your nerves and get your feed back." He scribbled on the pad. "Here. This should reduce your sensitivity. Take two quartz every three hours."

"Thanks, Doc," Mike said. "I node you could fix me up."

"Yes, over a short range. But these

She Wore a Red Germanium

are just palliatives for your hysteresis. What you need is a long-range schematic to clear up the Ant Enna problem."

PERHAPS you've been using the wrong approach," the doctor suggested. "If you'll analyzer, I think you'll find that she behaves as she does because she's lonely and frustrated."

"SHE's frustrated?" Mike exclaimed. "What about ME?"

"Yes, yes, I know. She keeps you under high tension; but that's because she lives in a vacuum. Having no interests of her own, she channels her energies into disrupting your balance. I suggest you getter into a bridge circuit. Take her out to local receptions."

"You couldn't cell her on the bridge, Doc. Cards repeller. And I'm not about to take that old walkie-talkie to any reception."

"You see!" the doctor exclaimed "The trouble is, you resister. Instead of trying to suppressor, you should learn to acceptor."

"Resister! Suppressor! I can't even interrupter!"

"She isn't married, I take it?" the doctor asked.

"Naw. A typical old maid."

"I see. She's probably starved for affection. If you'd tweeter nicer, maybe you could transformer. Play a.c.-d.c. with her. Buy her joules."

"That's no good, Doc. I tried to overcome her bias when the wife and I were first married."

"You're positive, then, that the plan has no potential? Well . . . if you can't converter, and can't acceptor, the only alternative is to get rid of her."

"I've thought of that. There are times I'd like to decapacitator, but I don't know if I conduit. What if she puts up resistance?"

"Well . . . assault and battery isn't quite what I had in mind. There's a better way to transmitter. Simply conductor to the door."

"She wouldn't budge," Mike said gloomily.

"Well, then, here's another brain wave. If she's so noisy, she probably disturbs the other tenants. Try secondary emission. Call the management and let the superconductor."

"Naw! She'd raise such a howl, she'd get us all evicted. And if Antinode I'd called the super, she'd think up some way to get even."

"There must be some solution," the doctor said. "Let me think a moment . . . I have it! This old lady is at loose ends. What we should do is connector."

"I don't get you, Doc."

"I mean coupler. Marry her off."

"You're way off the beam, Doc," Mike protested.

"Your attitude is negative, Mike. Can't you engineer an induction?"

Mike thought it over. "Hmm," he said. "I sure would like to unloader." Suddenly his expression brightened.

"The idea gives you a charge?" the doctor asked.

"Positive! I can see the pictorial now! There's my boss, Happy Henry. He and Ant Enna are two of a kind."

"You think they deserve each other?"

"Sure, Doc. A matching pair! We pull a switch. Instead of both bugging me, they can bug each other. How's that?"

Mike beamed from ear to ear. Then his face fell.

"Do I detect a flat response?" the doctor asked. "Why the image rejection?"

"It won't work," Mike said glumly. "How am I going to make this hookup? Where's my lead-in?"

OH, come now, Mike," said the doctor. "Use your magnetism. Gen-

(*Continued on page* 105)

Equipment Report

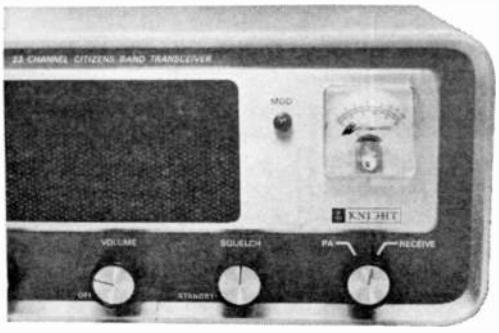
The Knight KN-2565 CB Transceiver

THE Knight KN-2565 transceiver is the fourth different model POP'tronics has reviewed with provisions for 23-channel transmit and receive. Sold exclusively by Allied Radio Corp. (100 N. Western Ave., Chicago, Ill. 60680), the KN-2565 is the second transceiver reviewed in the price range of $170 ($169.95, to be exact). The physical appearance of the KN-2565 is exceptionally clean and neat and the number of front panel controls has been reduced to a bare minimum. The only new or unusual control added to the unit is a switch that permits use of the modulator as a public address amplifier when coupled to an appropriate speaker.

On-the-air performance of the KN-2565 was up to what CB'ers normally expect from topnotch equipment. At this point your CB equipment reviewer began asking questions of the Allied Radio engineers, and came up with some interesting answers. Why doesn't the KN-2565 have a noise limiter switch or control? *In the KN-2565 such a control is unnecessary. The noise limiter is always working and since it is self-regulating the limiter does not interfere with speech quality.* What about the bandpass characteristics? *Allied has made an effort to reduce* cockpit troubles *by eliminating the noise limiter control and keeping the very top of the selectivity curve capable of catching those stations slightly off frequency. This is particularly important to the mobile operator who doesn't want to continuously retune.* What special features—other than the p.a. outlet —appear in the KN-2565? *A flashing modulation indicator has been added and the main tuning or bandswitching control moved to the left side of the box. Having it on the left side is more convenient for the automobile driver.*

To the above, your reviewer can add two other things he liked: a "standby" switch that keeps the filaments hot but disables the B-plus line, and the transistorized 12-volt power supply (no vibrator). —30—

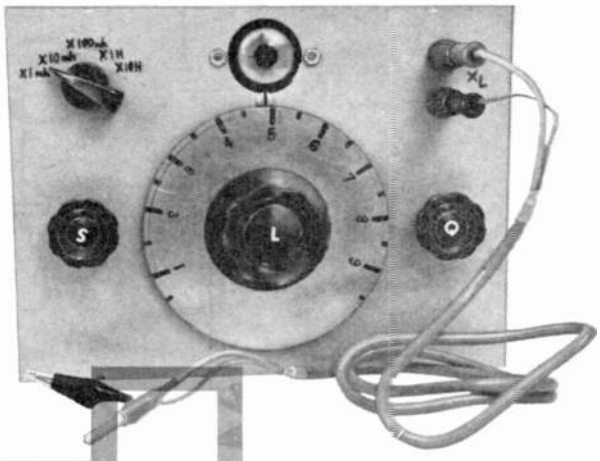
S-meter doubles in brass as relative power output indicator. Switch in lower right corner connects modulator output to p.a. speaker (not provided).



Circle No. 87 on Reader Service Page 15

BOX SCORE				
	Excellent	Good	Fair	Poor
Talk Power	✓			
Selectivity		✓		
Sensitivity	✓			
Squelch	✓			
Noise Limiting	✓			
Stability	✓			
Operating Ease	✓✓			

EXPERIMENTER'S L BRIDGE



Build this multi-range inductance tester to find unknown values of r.f., i.f., audio and filter coils and chokes

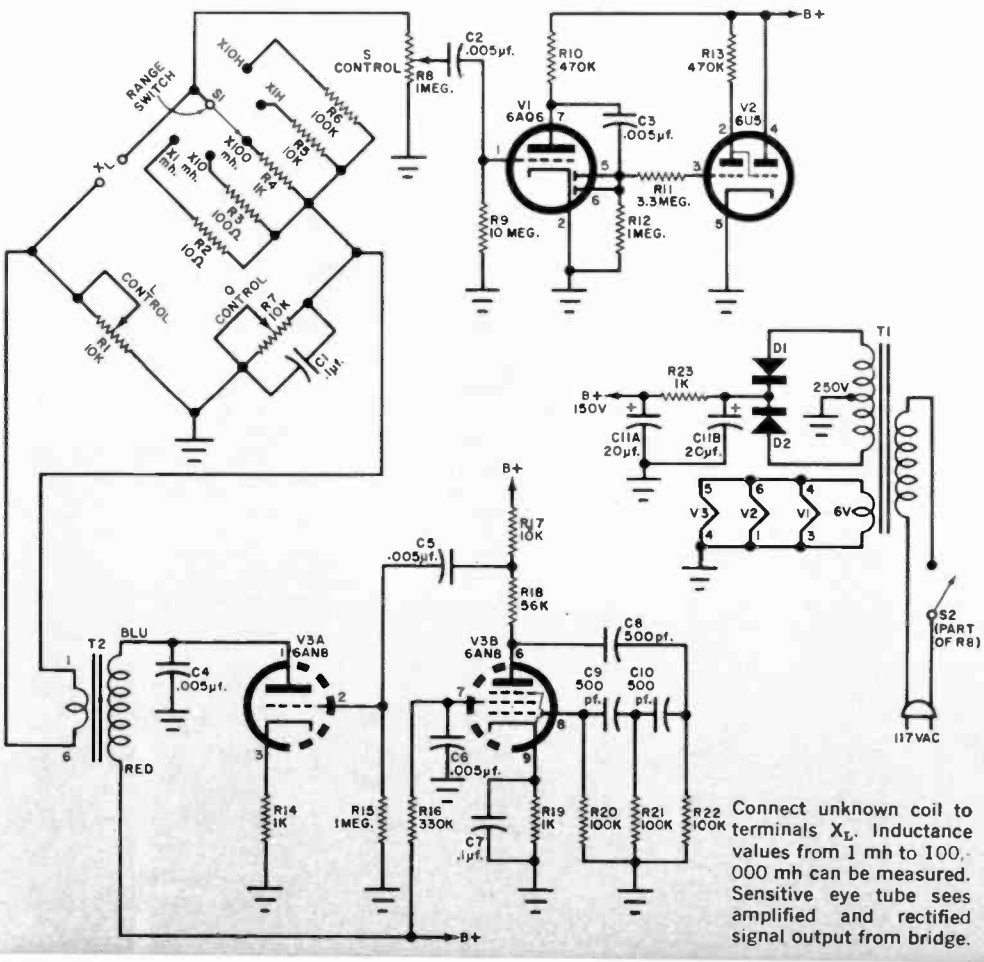
By CHARLES GREEN, W3IKH

INDUCTANCE measurements are not difficult to make, but they can fool you, especially if you have been using just an ohmmeter. A few shorted turns won't make enough of a difference to show up in a simple resistance test, yet it takes only one shorted turn to ruin a coil or choke. At times you may wish to know only if a part is good or bad. At other times you may be looking for a specific value. Either way, the "L Bridge" is a worthwhile addition to your line-up of test equipment.

In all fairness to the ohmmeter test method, it does quickly indicate open windings, shorts to iron cores and frames, and shorts between two different coils wound in close contact with each other, such as primary and secondary transformer windings. It can also spot relatively large changes in a coil's resistance, but it does all this under d.c. conditions. Most of the coils we use have to function in an a.c. circuit of one type or another.

An obvious improvement, then, would be to break away from d.c. and go to an a.c. procedure, applying an a.c. signal to an unknown inductance and determining its value by its performance in the test circuit. The easiest, cheapest way to do this is to employ a Maxwell bridge which uses an a.c. signal to measure inductance in terms of resistance and capacitance. The "Experimenter's L Bridge" is just such a unit with the ability to measure inductance values from about 1 mh to 100 h (100,000 mh) in five ranges.

How It Works. The test signal from the 1 kc. oscillator, the pentode section of *V3b*, is amplified by the triode sec-

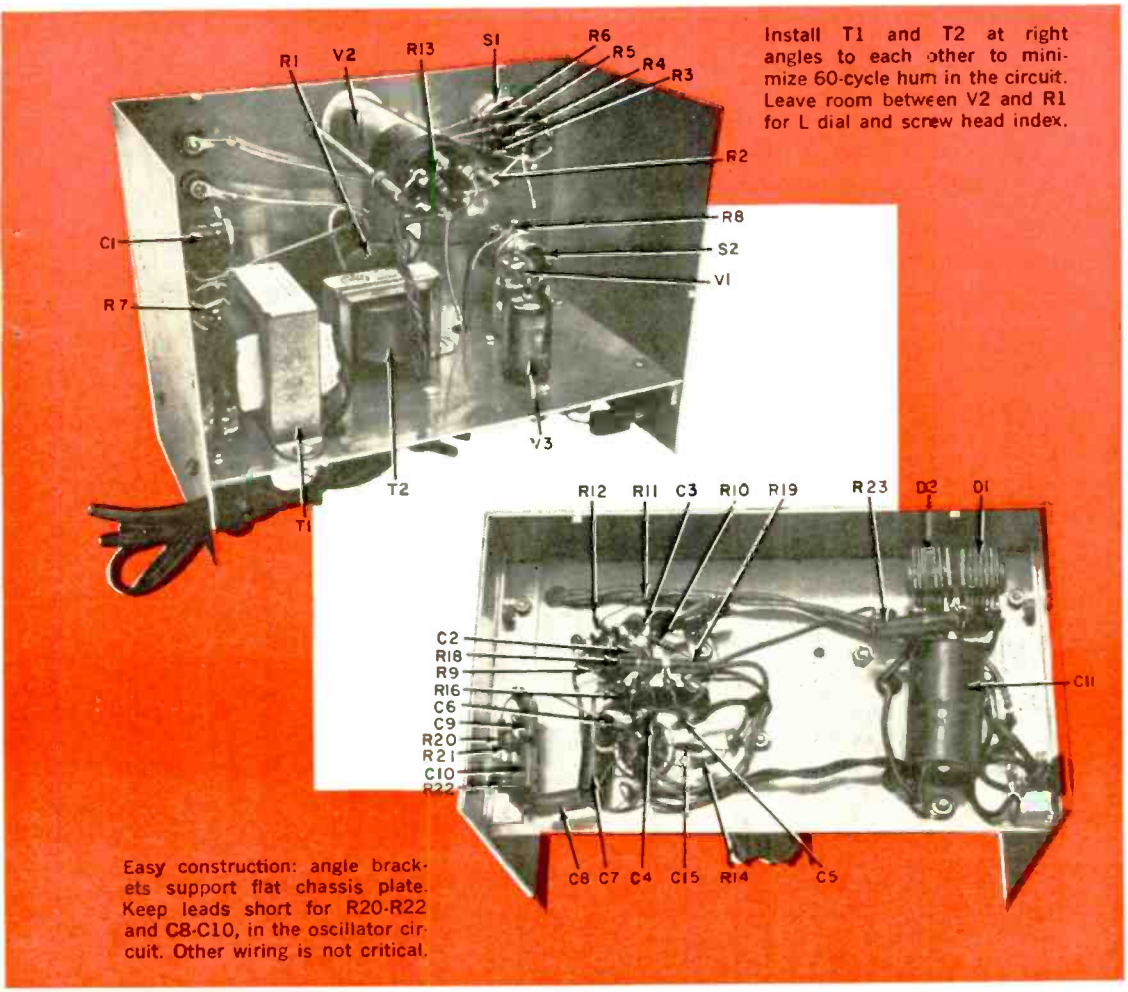


Connect unknown coil to terminals X_L. Inductance values from 1 mh to 100,000 mh can be measured. Sensitive eye tube sees amplified and rectified signal output from bridge.

PARTS LIST

C1, C7—0.1-μf., 100-volt capacitor, ±10%
C2-C6—0.005-μf., 600-volt ceramic capacitor
C8, C9, C10—500-pf., 1000-volt ceramic capacitor, ±10%
C11—20-20 μf., 150-volts-per-section electrolytic capacitor
R1—10,000-ohm wire-wound potentiometer, linear taper
R2—10 ohms
R3—100 ohms
R4—1000 ohms
R5—10,000 ohms
R6—100,000 ohms
} ½-watt resistor, ±10% or better
R7—10,000-ohm potentiometer
R8—1.0-megohm potentiometer with *S1*
R9—10 megohms
R10, R13—470,000 ohms
R11—3.3 megohms
R12, R15—1 megohm
R14, R19—1000 ohms
R16—330,000 ohms
} ½-watt resistor
R17—10,000 ohms
R18—56,000 ohms
} ½-watt resistor, ±10%
R20, R21, R22—100,000-ohm, ½-watt resistor, ±10%
R23—1000-ohm, 2-watt resistor
D1, D2—65-ma., 130-volt a.c. input, selenium rectifier (ITT 1234AII or equivalent)

tion (*V3a*) and is then transformer coupled by *T2* to the bridge. One leg of the bridge takes the inductor under test (X_L). A direct-reading inductance-calibrated dial on the *L* control *R1* in conjunction with the *Q* control *R7* is used to balance the bridge. The sensitive tuning eye shows degree of balance. The *S* control *R8* feeds more or less signal into tube *V1* and enables the eye to "look" into large or small signals without overloading the eye circuit. Range switch *S1* places any one of five resistors in the *S1, R2-R6* leg. The *C1, R7* leg consists of a 0.1-μf. capacitor paralleled by the *Q* control. The *Q* control balances out the resistance of the coil under test while the capacitor sets up a phase con-



Install T1 and T2 at right angles to each other to minimize 60-cycle hum in the circuit. Leave room between V2 and R1 for L dial and screw head index.

Easy construction: angle brackets support flat chassis plate. Keep leads short for R20-R22 and C8-C10, in the oscillator circuit. Other wiring is not critical.

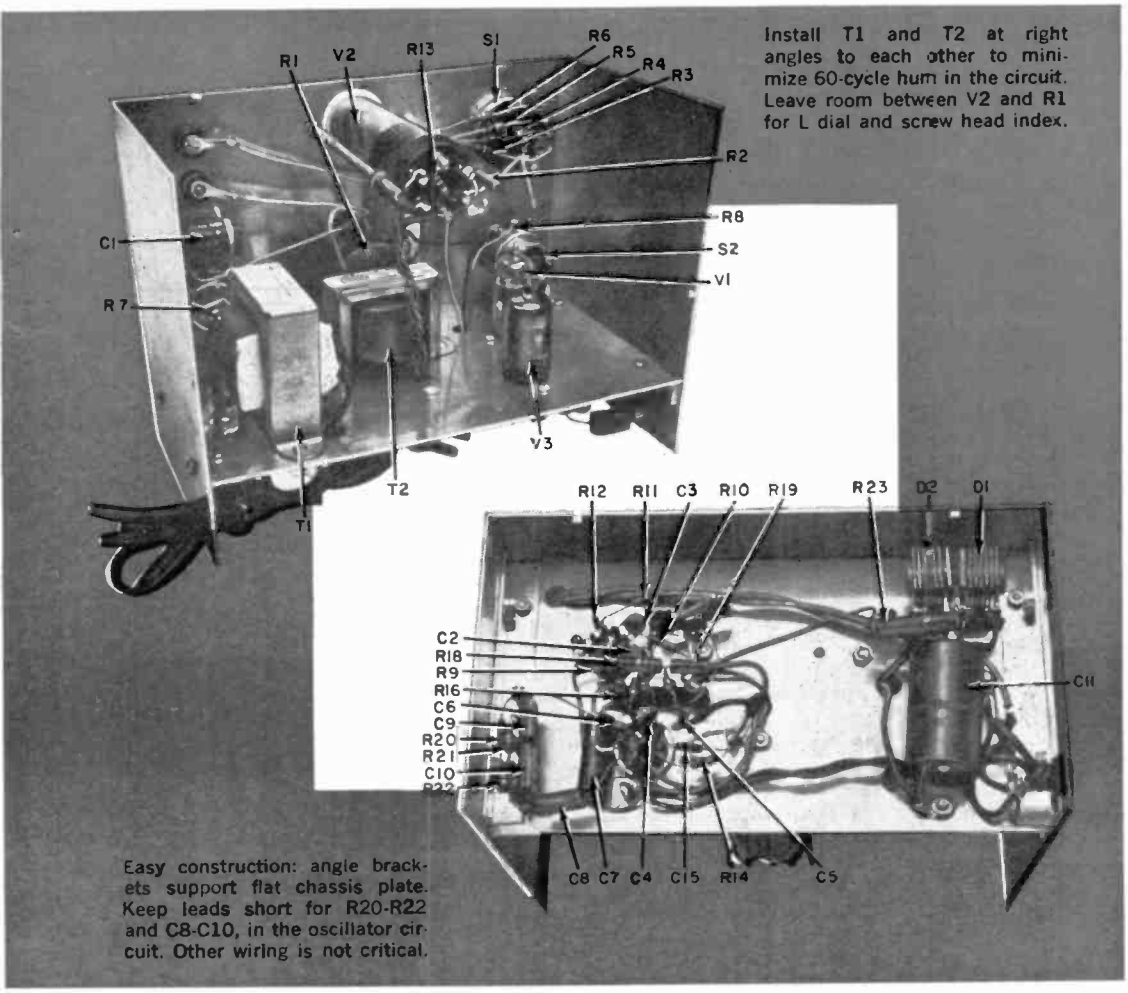
S1—1-pole, 5-position rotary switch
S2—S.p.s.t. switch (part of R8)
T1—Power transformer: primary, 117 volts; secondaries, 250 volts, CT @ 25 ma., and 6.3 volts @ 1 amp (Stancor PS 8416 or equivalent)
T2—Universal output transformer (Merit A-2902 or equivalent)
V1—6AQ6 tube
V2—6U5 tube
V3—6AN8 tube
1—4½" x 6" x 8" utility box (LMB #146)
1—4⅜" x 8" chassis, sheet aluminum
Misc.—Two 8-32x4" threaded rods, wire, etc.

dition to cancel the effects of lagging current caused by the coil. When reactance and resistance conditions across the X_L leg and the *S1*, *R2-R6* leg balance conditions across the *R1* leg and the *C1*, *R7* leg, no signal will appear at *R8*.

When the bridge is not in balance, a voltage appears across *R8*. It is amplified by *V1*, then coupled to the diode section of the same tube through *C3*, then rectified and direct-coupled to *V2*. The voltage is negative going and tends to close the eye. When the bridge is balanced, the tuning eye is wide open because the rectified voltage is then at a minimum. The values selected make it possible for each 1000-ohm division on the dial to indicate another *mh* on the lowest range. The five ranges are *x1 mh, x10 mh, x100 mh, x1 h,* and *x10 h,* as resistors from *R2* to *R6* are switched in respectively.

The *6AN8* oscillator (*V3b*) has an RC phase shift network consisting of *R20, C9, R21, C10, R22* and *C8* connected between plate and grid and forms a 180° shift in phase at 1 kc. It provides the positive feedback needed to maintain

(*Continued on page* 98)



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(*Continued on page* 98)

CB DILEMMA—REVISITED

Provocative response to suggested Communicator's license shows great interest in resolution of CB difficulties

PAGES 78 and 79 of the November issue of POPULAR ELECTRONICS were devoted to an editorial titled, "The CB Dilemma—A Solution." In this editorial the short history of CB was reviewed and the current status of indecision on the part of the FCC carefully analyzed. It was suggested, in view of the international treaty regulations pertaining to the use of the radio frequency spectrum, that thought be given to establishing a new class of license—the "Communicator's" license.

The Communicator's license would be similar to the present CB license, but would permit interstation contacts and pursuit of the art of radio communications as a hobby. It would, in effect, grant the CB'ers certain ham-type privileges. In the editorial, it was noted that somewhat similar licensing arrangements exist in Australia, England and New Zealand, and that it is presently within the power of the FCC to establish such a license classification in the United States.

Lopsided Reaction. The reaction to the editorial has—at this writing—been quite provocative. Many letters denouncing the idea have been received from licensed radio amateurs. Those against the idea were about evenly split. Half of the hams were horrified and the other half shocked. Both groups were quite vehement.

On the other hand, CB'ers greeted the idea of a legally constituted "hobby" band with apparent apathy. Either they are in favor of the Communicator's license or they don't think the FCC will do anything about the pending Part 95 rules changes. Nothing could be further from the truth—changes in the CB rules are bound to be made. It is quite safe to assume that restrictive changes in CB rules would already be in effect if people interested in CB had not petitioned the FCC for modification of the intended rules changes.

Whose 11-Meter Band? The negative reaction to CB by some hams is apparently predicated upon misinformation. Considerable credence is given the idea that the FCC "stole" the 11-meter band from the hams and presented it to CB'ers. To set the record straight—the 11-meter band was never allocated to hams. Operating permission to use 11 meters was given hams in the late 40's—strictly on a shared basis with diathermy, industrial heating, and other radio services. If you want to go back further, you'll find that 11 meters was once an experimental broadcast band, sporting such exotic calls as W9XAZ, W6XKG, etc. At present, the 11-meter band is allocated to CB'ers, some Business Radio services, and model-control device operators.

Where To From Here? In the public interest, an answer to the *CB Dilemma* should be found that will encourage more people to participate in two-way radio communications without upsetting the complicated systems of frequency allocations and with an eye towards obtaining maximum utilization of these allocations. As most of us know, control of the air waves is an international as well as a national responsibility. There should be an answer that can satisfy both international treaty requirements as to radio frequency usage, and the evident desire of hundreds of thousands of CB'ers who wish to pursue a hobby or be a member of a club whose altruistic goal is to be of service to the community.

POPULAR ELECTRONICS has offered a proposal that a "Communicator's" class of ham license be established. This may not be the only answer—there may be others just as good, or even better. To give our readers an opportunity to expound their ideas as to other solutions, the editors will compile and publish the best ideas received at these offices.

Keep in mind that it's in the public interest to find ways to obtain maximum benefits for the majority of the people who would like to have the privileges and benefits of two-way radio communications. —30—

2 Halos Stacked for 2 Meters

Easy-to-build high-gain antenna for fixed or mobile use

By BOB SARGENT

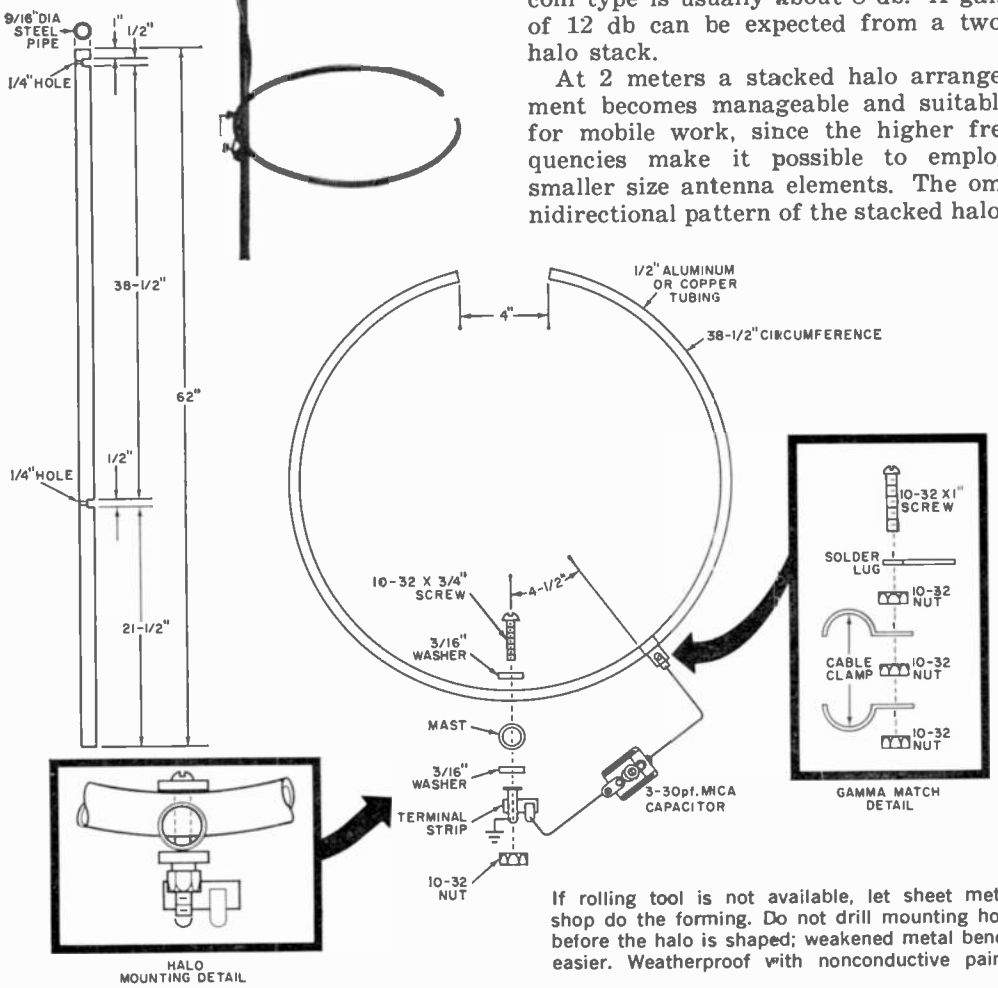
Right: Coaxial "T" connection ties the transmission line to both halos. Gamma match faces same way and is adjusted for minimum SWR.

Below: Cut slot just wide enough to accommodate halos. Mount pole so that the bottom halo is as high above the ground as possible.

HALO ANTENNAS are like ½-wavelength dipoles in many ways. They are cut to the same size, they are horizontally polarized, and they can be stacked for additional gain. However, the bidirectional characteristic of the dipole changes to an omnidirectional pattern when the dipole is curved to form a halo.

Horizontally polarized antennas favor horizontally polarized signals and are less susceptible to ignition noise and vertically polarized waveforms. Gain of a halo over a ¼ wavelength vertical Marconi type is usually about 8 db. A gain of 12 db can be expected from a two-halo stack.

At 2 meters a stacked halo arrangement becomes manageable and suitable for mobile work, since the higher frequencies make it possible to employ smaller size antenna elements. The omnidirectional pattern of the stacked halos



If rolling tool is not available, let sheet metal shop do the forming. Do not drill mounting hole before the halo is shaped; weakened metal bends easier. Weatherproof with nonconductive paint.

is particularly desirable for net control stations and for automobiles facing in different directions.

Construction. The halos should be spaced ½ wavelength apart, horizontally leveled and oriented in the same direction. See the diagram on the previous page for actual dimensions.

Carefully form the halos to prevent flat spots, kinks and just plain out-of-roundness. There are machines for this purpose, but for a small fee you can get a sheet metal shop to form the halos.

Bolt the halos securely to the mast cutouts as shown in the halo mounting detail diagram. Do not tighten enough to distort the mast or halo tubing, and use lock washers. Connect the halos to each other with 52-ohm coaxial cable. Stranded internal conductor transmission line is preferable to the solid conductor type to reduce breakage from vibration.

Two lengths of cable, each about 21" long, connect the halos. The center conductor on one end of each cable is attached to the terminal connected to the small mica capacitor on each halo. Connect each outer shield to the adjacent ground terminal. The other end of each cable is terminated in a PL-259 or equivalent type coaxial connector and screwed into an appropriate coaxial "T" fitting. The transmission line from the antenna to the transmitter is also screwed into this fitting.

Gamma Match. To construct the gamma match, install a clamp on each halo at a point 4½" to the right of center. The gamma match on each halo should be located on the same side of the mast.

The capacitors should be shielded from the weather. As a matter of fact, a coat of acrylic paint over the entire antenna and fittings will protect it from the elements. The wire forming the gamma match should follow the outside curvature of the halo. About #13 AWG tinned copper bus wire will do. Place nothing within the center of the halo.

An easy way to tune the antenna is with the aid of an SWR meter or field strength meter. Another method is to connect the halos to a receiver and adjust the gamma match for maximum volume or reading of an "S" meter if available. -30-

ODDS 'N' ENDS

Short-wave listeners tuning the 25-meter band have recently encountered a mystery station to end *all* mystery stations. Operating in the vicinity of 11,695 kc., it has been heard day after day between 0930 and 1310 EST. Its most unusual characteristic is the program—a single musical selection endlessly repeated without station breaks or other announcements.

The sole transmission is a Latin-beat version of a selection called "Kiss Me Honey." The beginning and ending of the piece are so dovetailed that the listener finds it impossible to determine the start or finish. *Where* the short-wave transmitter is located has been the big question, although most American and European SWL's are convinced that the transmissions originate in the Middle East.

According to our Radio Propagation Editor, Stanley Leinwoll, informed SWL's have finally concluded that "Kiss Me Honey" is a jammer station. Underneath its Latin-beat transmissions are those of a Communist-line rebel station calling itself *Peyk-e-Iran*. The programs from this rebel are directed against the Western-aligned Iranian Government. Although the exact locations of both the "Kiss Me Honey" transmitter and the rebel station underneath are in doubt, the rebel is assumed to be in northwest Iran, or near the Caucasus Mountains in the Soviet Union.

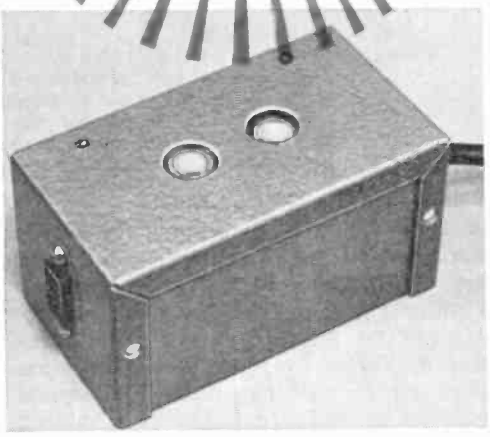
"Kiss Me Honey" apparently is a hastily assembled jammer brought into service by the Iranian Government.

Called the "world's first reversible highway," the new Seattle-Washington Freeway will use closed-circuit TV and radio control equipment to control, reverse, and divert the northward and southward flow of traffic around Seattle. The control equipment, furnished by Quindar Electronics, Inc., will enable highway operators to activate swing gates much like those used at railroad crossings, opening road lanes to traffic coming into the city in the morning and to traffic going out at night. The barriers stop traffic from entering the lanes in the wrong direction.

Self-Regulating Lighting Controller

Get even light even when day changes to night—build this automatic device

By EDWARD P. NAWRACAJ
and
FRED FORMAN



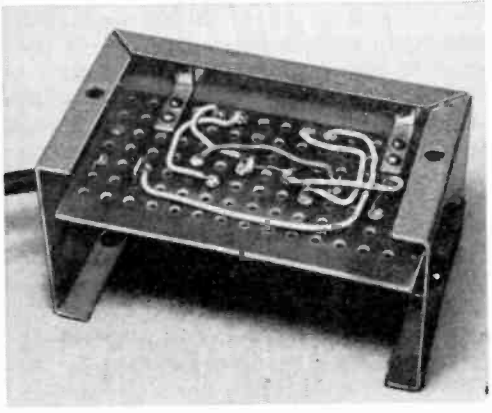
Point the "eyes" away from direct light to automatically compensate for varying ambient light levels.

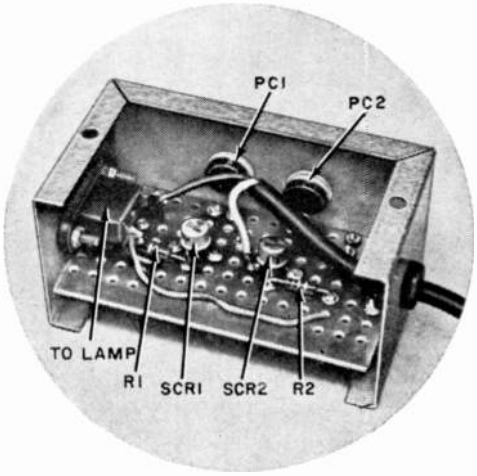
TURN off the lights and the regulated lamp goes on. Turn on the lights and the regulated lamp goes off. Let the overall ambient illumination vary between daytime and nighttime, and the regulated lamp will vary in intensity in the opposite way. The lighting controller "wants to see" the same amount of light regardless of how bright or dim the day or night, and will automatically compensate for varying levels of illumination. You can establish an average round-the-clock light level limited only by the power-handling capabilities of the controller.

How It Works. Photoconductive cells *PC1* and *PC2* are in series with resistors *R1* and *R2* respectively, and form simple voltage dividers to apply triggering voltages to the gates of silicon-controlled rectifiers *SCR1* and *SCR2*. When the ambient light level is low, the resistance of the photoconductive cells is high. Proportionally higher voltages are developed across the cells and applied to the appropriate SCR gate.

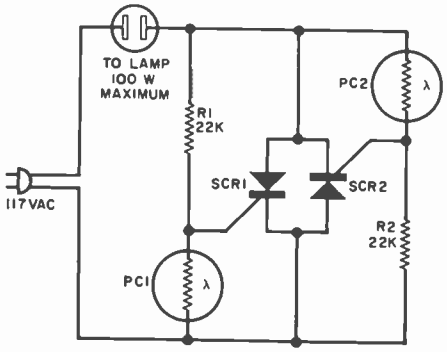
The SCR's fire when the gates and anodes are sufficiently positive with respect to the cathodes. The higher the

Simplicity of construction is the keynote of the controller. Only four components are on the chassis.





The two SCR's can be connected directly to the board and soldered into the circuit, or plugged into appropriate sockets. Avoid overheating the SCR's when soldering.



Brilliance of regulated lamp depends on how long each SCR is on.

positive voltages, the sooner the SCR's conduct, and the longer they stay on. The longer the SCR's stay on, the brighter the regulated lamp.

Once the SCR's conduct, the gates have no further control and conduction takes place until the anode voltage is removed or reduced below the holding point. This happens each time the 60-cycle line voltage reverses. When the line voltage reverses, the SCR that was on—or conducting—switches off, and the SCR that was off switches on. When ambient light levels increase, the resistance of the cells decrease, and so down goes the amount of control voltage applied to the gates of the SCR's.

The 22,000-ohm resistors establish a preset range of overall operation. Variable controls of about 50,000 or 75,000 ohms can be substituted to shift the range to satisfy most requirements.

Construction. Any available box—even a cigar box—can be used to house the controller. There is nothing critical about construction or location of the parts. Only four parts (the SCR's and resistors) are mounted on a perforated phenolic board used as a chassis. The cells are mounted on the case, as is the regulated lamp's socket.

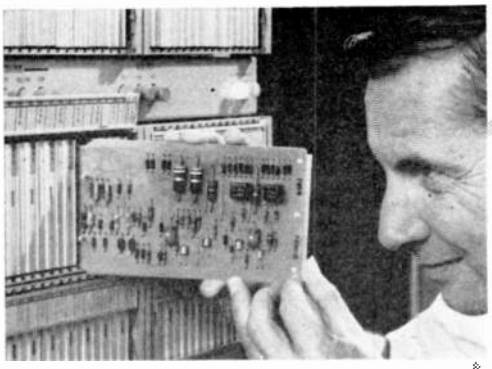
Aim the cells away from any direct light, including the regulated lamp, in order to get them to respond to ambient conditions. The regulated lamp will flicker on and off if you point it at the photocells. Differences in parts values, due to normal commercially accepted tolerances, may cause one photocell to do more work or be more responsive than the other. To prevent this possibility, you should use matching components.

The SCR's used by the author are RCA 2N3228's, costing less than $2 each (Motorola MCR 1304-4's and Texas Instruments TI 3012's will also work. The photocells are Clairex CI 505's at about $3 each (the Lafayette 99 G 6322 at 99 cents will serve as well). Resistors *R1* and *R2* are 22,000-ohm, ½-watt units. A 4" x 2¼" x 2¼" metal box and other miscellaneous small hardware are also needed.

The 2N3228, without a heat sink, has a 1.57-ampere maximum rating when it is conducting for half the time, as is the case when the controlled lamp is full on. With less than half conduction time, greater current-handling ability is possible. With a suitable heat sink, the same SCR can safely handle up to 5 amperes or about 585 watts of power.

Other Uses. Many other applications are possible for the controller. It can be used to activate a relay which, in turn, would switch on or off other types of loads, such as alarm devices, appliances, and motor-driven machinery. Larger lamp loads could also be turned on or off by such a relay.

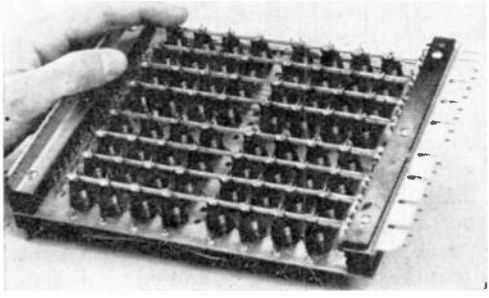
When the controller is used in this manner, however, it becomes a simple on/off triggering device, and you will not get varying and intermediate levels of illumination from the lamp. -30-



Heart of new telephone switching system is the "central control." Thousands of readily replaceable circuit boards have been specially developed to speed maintenance.

THE GREAT IMMORTAL MACHINE

Bell Telephone Labs has perfected an all-electronic switching system able to diagnose its own ills



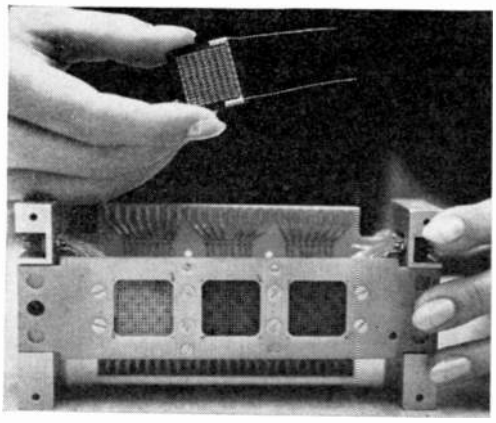
Electromagnetically operated reed switches replace conventional relays in the "No. 1 Electronic Switching System." These switches respond to commands from the central control and connect telephone subscribers to trunk lines.

THE modern-day telephone is unlike any other electronic device offered to the general public. Barring natural calamities that tear down the lines, phone service must always be available even though users abuse the instrument and demand that phone companies provide new and unprecedented services. For example, phone subscribers want to know if someone is calling them while they are using the phone, and they also want to be able to talk to three or four different parties at the same time. Some home owners want a system whereby their phone calls will be automatically "forwarded" to another number.

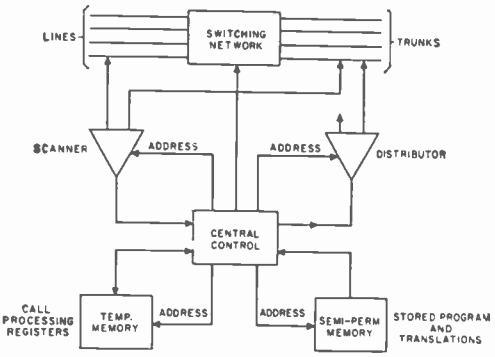
After spending about $100,000,000 of research money, Bell Telephone Laboratories, Holmdel, N. J., has perfected a telephone exchange that can do anything demanded of it—faster and with greater precision than even the best direct-dialing exchanges now in operation. Called the "No. 1 Electronic Switching System," a pilot model has been installed in Succasunna, N. J. Additional models are scheduled for installation throughout the United States in 1965—including replacement of the famous *PE*nnsylvania 6 in mid-Manhattan. A nationwide conversion to the No. 1 ESS is expected to take place within the next 35 years.

How It Works. In old-style telephone exchanges the basic equipment was left dormant unless activated by a subscriber. In the No. 1 ESS, this method of operation is abolished and the exchange continuously monitors the phone lines of all subscribers. This is done by a "scanner" (see diagram on page 70) that periodically checks incoming trunks and subscriber lines.

All lines are sampled ten times a sec-



Temporary memory in the No. 1 ESS is made up of Western Electric ferrite plates, each containing 256 holes carefully laced together with sense wires. Magnetic material surrounding each hole stores a binary code signal to record subscriber line usage and numbers of the called and calling phones.



Deceptively simple block diagram outlines the basic plan of the No. 1 ESS. Lines go to phone subscribers and trunks connect to other exchanges. Central control tells ("address") the scanner and distributor how rapidly to monitor incoming and outgoing calls. Description of the memory banks appears in text.

ond to see if the phone is off the hook and dialing has begun. When use of the phone has been detected, the scanner notifies the "central control" which then begins to store information about dialing activities in the "temporary memory." This memory bank can be described as a "call store" that keeps track of the number being dialed.

Once dialing is completed, the central control seeks an unused phone trunk and the desired connection is completed through the "switching network" and "distributor." All of the exchange activities are electronic and it takes but a few milliseconds to connect two phone lines.

A special feature of the central control is the semipermanent memory bank, which stores information about the subscriber whether or not he has paid his bill. It permits him to use abbreviated two- or four-digit dialing to often-called numbers instead of the former seven or ten digits, make conference calls, transfer and forward incoming calls to a different number selected by the subscriber, etc.

Self-Maintenance. As might be expected, the No. 1 ESS can operate without a human being within miles—as long as its batteries are charged. During special intervals between sampling the subscriber lines, the "Immortal Machine" (which is technically an information processing type of digital computer) tests itself. Information in the temporary memory is checked against that stored in a duplicate memory.

If any discrepancies are found, the machine notifies the central control and automatically goes into a diagnostic procedure. If a diode failure (for example) is found, the No. 1 ESS rings a human operator at a teletype printer and prints out the source of trouble. The human replaces the errant board, and the machine checks itself out to see if the problem has been solved.

This maintenance procedure is so foolproof that during a test with a prototype of ESS, two high school girls kept it running without breakdowns for several months. The longest period that even part of the machine was inoperative was only six minutes!

Statistics about No. 1 ESS are so huge as to defy human comprehension. Each No. 1 ESS can store 5,800,000 bits of information, organized into 131,072 words. Central control is built around 13,000 transistors and over 45,000 diodes. The transistors are of two basic types (diffused planar and epitaxial silicon) and all diodes are identical.

Developing ESS was the greatest single task undertaken by the Bell Telephone Laboratories. It started the same year as their engineers announced the transistor—and it hasn't ended yet. -30-

EXPERIMENTS WITH A CHEMICAL RECTIFIER

Here's a simple project for the beginner—one that's sure to bring back memories for the old-timer

By **CHARLES GREEN,** W3IKH

IT'S EASY nowadays to build d.c. power supplies that operate from the a.c. lines, but in the old days before the vacuum tube and semiconductor rectifier, things were a lot different. The chemical rectifier was the only device in common use that would supply enough power to charge storage batteries. It was also used as the rectifying element in B-plus supplies.

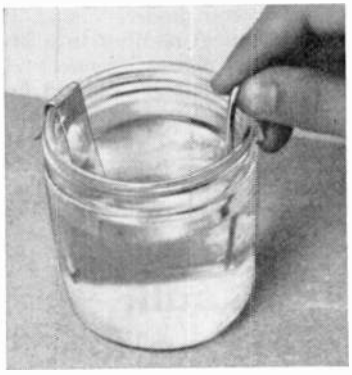
A chemical rectifier uses two metal electrodes in an electrolytic solution. When a.c. current is applied, a semiconductor film is formed, by chemical action, on one of the electrodes; the device then operates as a diode rectifier. If you'd like to observe the action of a chemical rectifier for yourself, there's an extraordinarily easy way to do so: build a working model. The author used a low-voltage chime transformer to minimize the shock hazard in the unit shown here; the rest of the components are common household items.

Building a Rectifier. In a clean glass jar about 3″ in diameter and 3½″ high (the author used a peanut butter jar), dissolve ½ ounce of household Borax in 8 ounces of water. Stir the solution until it is thoroughly dissolved. Cut a ½″ x 4″ strip from a clean tin can and position it in the solution by bending about 1″ of it over the edge of the jar. In the same way, hang a 4″ length of #8 aluminum wire over the opposite side of the jar.

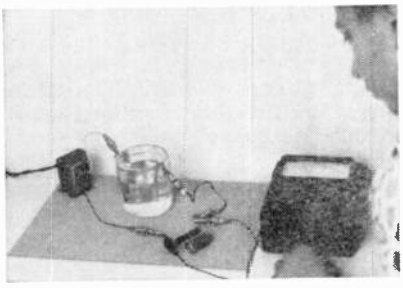
Measure the resistance between the two electrodes with a VOM, then reverse the meter leads and measure again. The author measured 40,000 ohms in one direction and 50,000 ohms in the other. The difference in resistance is due to the forming of a slight semiconductor film on the aluminum electrode caused by the action of the internal battery in the VOM.

For best efficiency, a semiconductor film must be formed by a relatively large electrical current over a relatively long period of time. This can be accomplished by connecting the chime transformer (*T1*) and a #57 pilot lamp in the circuit of Fig. 1.

The first step in making a chemical rectifier is to dissolve Borax in water—peanut butter jar is used.



Electrodes are made from a piece of tin can and a length of aluminum wire (above). Photo below shows completed circuit of Fig. 2 (next page).



Connect the transformer to the a.c. line. Lamp *I1* will light brightly momentarily, then gradually get dim as bubbles emerge vigorously around the aluminum wire electrode. This indicates that the semiconductor film is forming and raising the internal

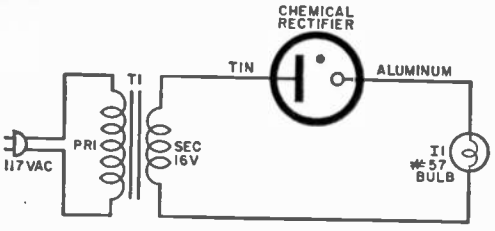
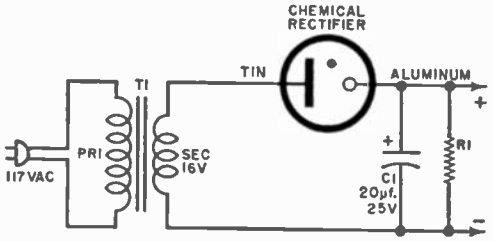


Fig. 1. Initially, semiconductor film is formed by connecting the rectifier to a #57 bulb. Use a 16-volt chime transformer for T1, such as Sears Roebuck No. 1407.

Fig. 2. Finished rectifier can be used in the same manner as a silicon diode, as shown here. Connect filter components, read output on d.c. VOM scale. Larger aluminum electrode increases current capacity.



resistance of the rectifier. Allow the circuit to operate for about 15 minutes, then disconnect the transformer from the a.c. line, taking care not to disturb the positions of the rectifier electrodes.

Checking Performance. Measure the resistance across the electrodes again, taking readings in both directions. The author measured 50,000 ohms in one direction and 5 megohms in the other. These resistances correspond to the forward resistance (low value) and back resistance (high value) of a conventional silicon diode.

To test the chemical rectifier in a standard diode rectifier circuit, connect it as shown in Fig. 2, again being careful not to disturb the electrodes. Connect *T1*, the 2500-ohm resistor (*R1*), and the 20-μf. capacitor (*C1*) as shown, and plug in the transformer. The author measured 14 volts d.c. across *R1*; this may vary between 13 and 16 volts, however. The test indicates that the semiconductor film has formed and the rectifier is functioning.

You may want to experiment further by using different sizes of aluminum wire, or sheet aluminum. The larger the surface area of the aluminum, the longer it will take to form a semiconducting film, but the larger the d.c. currents the finished rectifier will handle. -30-

Bathtub Caulk— A Miracle on the Electronics Bench

FOR some years, manufacturers of airborne electronics gear have been using a rubbery substance called "Silastic" to moistureproof and insulate holes through which wires pass, fill the backs of plugs, and to cover high-voltage terminals. The substance is spongy, stretches like a rubber band, but spreads like toothpaste.

Then "Silastic," Dow-Corning's answer to the bathtub caulk problem, hit the hardware stores. The author purchased a big tube ($2.95) for his electronics workbench and it quickly proved to be indispensable. The caulk is just squeezed out of the tube and onto wires or components, and allowed to cure for 24 hours. When dry, the excess can be cut away with a razor blade. Imagination seems to be the only limit on the number of uses for this substance.

● A spongy pad of caulk was bonded on both sides of a piece of TV twin-lead on which a window opened and closed. The TV antenna terminals also received a coating to prevent rust. "Silastic" was used in place of tape to seal a splice in the twin-lead—unlike tape, it does not unravel.

● A transistor was mounted to a board by inserting it in a glob of caulk. The component board was shock-mounted to a chassis in the same way. A tube socket was then shock-mounted and isolated from the chassis with "Silastic"—the leads from the socket pass through a hole lined with a caulk-formed grommet.

● To prevent vibration from being transferred to the baffle, an even surface gasket was formed around the mounting rim of a speaker using caulk. Nicks in insulated leads were filled, plugs sealed, and coax fittings protected. And, of course, you can even use "Silastic" around your bathtub!

—*R. C. Apperson, Jr.*

Transistor Topics

By **LOU GARNER,** Semiconductor Editor

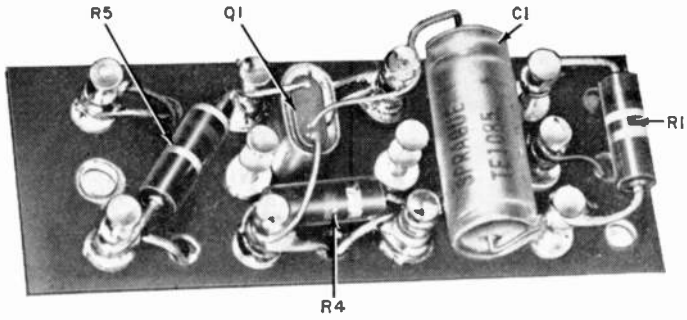
WITH THE START of the new year, it is once again time for your Semiconductor Editor to play his annual prediction game with the electronics industry. Before sticking out our editorial neck for 1965, however, let's review our batting average for last year. In January, 1964, we predicted:

- Development of a transistorized anti-collision radar system for passenger cars—*home run*—such a system was developed and demonstrated. As with most new developments, however, it probably will be several years before the system is available as a commercial product.
- Production of two new transistorized TV sets by major firms—*home run*—Emerson and GE introduced transistorized TV portables during the last quarter of 1964, joining Philco, Motorola and a number of Japanese firms in offering such receivers.
- Development of a transistorized color TV receiver—*home run*—not only was an engineering model of such a set demonstrated by a major U.S. firm, but a Japanese manufacturer, Yaou Electric Co., Ltd., started marketing a 9-inch portable receiver in the fall of 1964. Distribution of the Japanese set, which uses a modified form of the "chromatron" tube, probably will not begin in the U.S. until mid-1965.
- Introduction of special "experimenter" components and kits by several major manufacturers—*home run*—several firms, including the International Rectifier Corporation, the General Electric Company, and Transistors Unlimited, are offering inexpensive semiconductor components and kits suitable for hobbyist applications.
- Commercial production of moderate-priced solid-state lasers—*triple*—solid-state lasers are now available from several manufacturers at a fraction of their original prices, but they are still a little costly for hobbyist and experimenter use. Currently, a noncoherent solid-state laser is priced somewhat in excess of $100.00.
- Use of integrated microminiature circuits in consumer products—*home run*—as reported in our June, 1964, column, Zenith is now using a TI microminiature circuit in its premium-priced hearing aids.
- Development of a semiconductor air conditioner for automobiles—*home run*—several such units have been developed and engineering models demonstrated. Unfortunately, they are still relatively costly, and are not as yet competitive with compressor-type air conditioners.
- A tunnel diode for under $1.00—*triple*—the GE 1N3720 tunnel diode sells for 95 cents in manufacturer quantities and for only $1.80 net in single lots. We hope, one day, that at least one type of TD will be offered to experimenters at the "under $1.00" price.
- Introduction of a semiconductor phono cartridge—*strike-out*—unless we overlooked an announcement or trade advertisement, we missed the boat on this prediction.

Total score: one strike-out, two triples, and six home runs in nine times at bat!

Things to Come. In 1965 watch for: *development of a completely new type of semiconductor device;* progress in the development of organic semiconductors; *production of house power-line-operated transistorized radio receivers to compete in a market which has, until now, been dominated by vacuum tubes;* introduction of consumer thermoelectric-operated products; *production of UHF field-effect transistors;* development and production of a sensitive solid-state oscilloscope with a 50-mc. bandwidth; *expanding use of transistorized circuits in toys;* a new production technique for semiconductor manufacturing; *and development of an inexpensive transistor checker which "identifies" the transistor in addition to testing it.*

Transistor Substitutions. In cases where a specific transistor (or diode) is not available, one of the new "universal" types designed for general replacement applications may work satisfactorily in most experimental circuits. For example, the General Electric GE-10 is listed as an acceptable substitute for the 2N697, 2N1893, 2N1973,

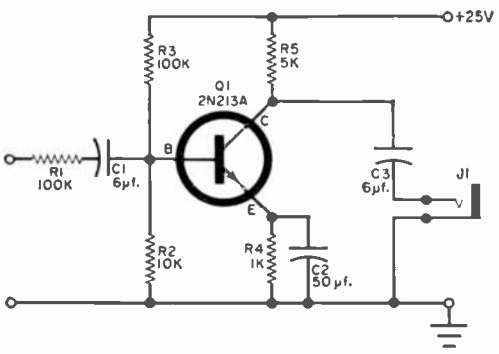


Small hand-wired board holds all components of impedance-matching device. Layout is not critical. Unit can be used as an external adapter or made part of permanent installation.

2N1974, 2N1983, 2N1984, 2N2194, 2N2712, 2N2923, 2N2924, 2N2925, 2N2926, 2SD33 and the 2SD75. Parts dealers equipped with substitution guides and cross-reference charts can make suitable recommendations.

Reader's Circuit. Tape recorders, p.a. mixers, communications receivers, audio preamps, and similar types of equipment often provide only a high impedance output for headphone monitoring. If a low-impedance headphone is connected to the equipment, the output signal level takes a nose dive. Reader Harold Reed (Hyattsville, Md.), faced with such a problem, devised the interesting circuit illustrated here. He wanted to couple a 600-ohm load to a 100,000-ohm source.

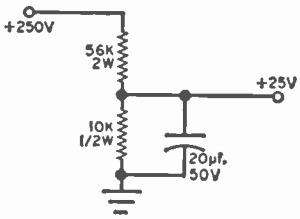
Harold's impedance-matching circuit uses a single *npn* transistor (*Q1*) in a common-emitter hookup. The input signal is coupled through series resistor *R1* and d.c. blocking capacitor *C1* to *Q1*'s base-emitter circuit. The transistor's base bias voltage is determined by voltage-divider resistors *R2* and *R3*. Emitter resistor *R4* serves as a stabilizer and capacitor *C2* bypasses audio frequencies to place the emitter at a.c. ground potential. An amplified output signal is coupled to output jack *J1* through capacitor *C3*.



Harold Reed's impedance-matcher enables use of low-impedance headphones in high-impedance audio circuits without excessive loading. A potentiometer in place of R5 could serve as a volume control.

In operation, the circuit's high input impedance is obtained at the expense of a signal loss across *R1*, but this loss is compensated for to some extent by the use of a high-gain transistor. (A 5000-ohm potentiometer can be used in place of resistor *R5* as a volume control for the headphone; one end of the pot would be connected to the battery, the other end to the collector, and the center connection would be made to capacitor *C3*.)

Voltage divider can be assembled to take advantage of B+ voltage and eliminate the battery in reader Reed's circuit.



Readily available components are used in Harold's circuit. The transistor, a Sylvania type, nets for less than $2.00. All resistors are half-watt units, and the two capacitors are 6-volt electrolytics. Jack *J1* is a standard open-circuit type.

The circuit can be assembled on a small piece of perforated phenolic 2" x ¾" board. Harold's model was wired as shown in the photo. Layout and lead dress are not critical, but good wiring practice should be followed, and all signal leads kept short. The completed board, together with a 22½-volt battery and an on-off switch can be mounted in a small container which can be handled like a probe and plugged into different preamps or tape recorders as needed.

Some builders may prefer to permanently attach the impedance-matcher to the equipment. Operating power can then be obtained directly from the equipment's B+ supply by using a proper voltage-divider circuit.

The voltage-divider shown in the small schematic provides a 25-volt source from a

(*Continued on page 97*)

Compact BCB DX Antennas

Attention to antenna design helps dig out those buried BC stations

By F. J. BAUER, JR., W6FPO

TRADITIONALLY, the rule applied to broadcast-band antennas has been "the longer the better." While this rule still holds, it is also true that when antenna length is already short compared to the wavelength of the signal being received (as is the case with most practical BCB antennas), a further reduction in length, within certain limits, has little effect on antenna efficiency.

Almost any single wire antenna of random length will give good results when used with one of the antenna couplers described in the June, 1964, issue of POPULAR ELECTRONICS ("Soup Up That AM Broadcast Receiver"). In the author's case, tests made with a 100-foot horizontal, a 50-foot horizontal, and a 33-foot vertical antenna showed little difference in performance when DX'ing the BCB with a medium-priced communications receiver.

"Loaded" Whip. Since most antennas for BCB reception are "short" anyway, why not "load" the antenna with an inductance above its center for greater efficiency? To try this idea, the author used a 9-foot whip mounted on a pole with a 24-foot down-lead making up the rest of a 33-foot vertical. An adjustable ferrite antenna coil was connected at the base of the whip as shown in Fig. 1, and the base of the antenna grounded. A transistor radio held near the antenna wire was used to resonate the antenna. The radio was tuned to a weak station at the high-frequency end of the band, and the coil slug adjusted for maximum volume.

To tune such an antenna across the broadcast band and also couple it to the receiver, one of the antenna couplers featured in the article mentioned above should be used, and is shown in Fig. 1 within the dotted lines. The capacitor used in the tuner is a 100-pf. mica unit, and the coil is simply another ferrite antenna coil. Tests with the loaded whip showed a very worthwhile improvement in signal strength—WMAQ, Chicago (670 kc.), for example, was three "S" units higher in Los Angeles with the loading coil in the circuit.

Loop Antenna Cuts QRM. What about adjacent-channel DX? If the strength of strong local stations can be reduced somewhat, it becomes possible to copy stations in the background. Wave traps were tried but were of little use. In some instances the trap acted more like an antenna than a trap, and merely aggravated the interference problem.

A loop antenna was considered next. If properly built, it would have reasonably good signal pickup and a sharp null at right angles to the plane of the loop. Its directional characteristics would make it possible to null out, to some extent, strong

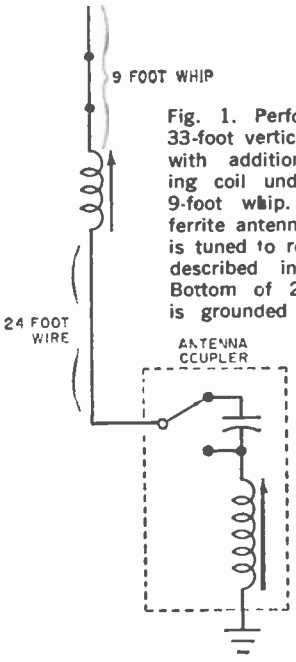


Fig. 1. Performance of 33-foot vertical improves with addition of loading coil under topmost 9-foot whip. Coil is a ferrite antenna type, and is tuned to resonance as described in the text. Bottom of 24-foot wire is grounded for tuning.

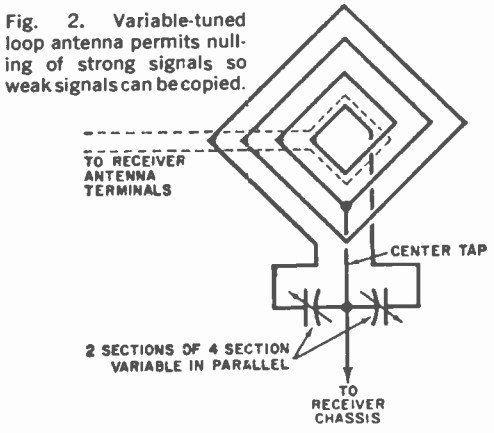
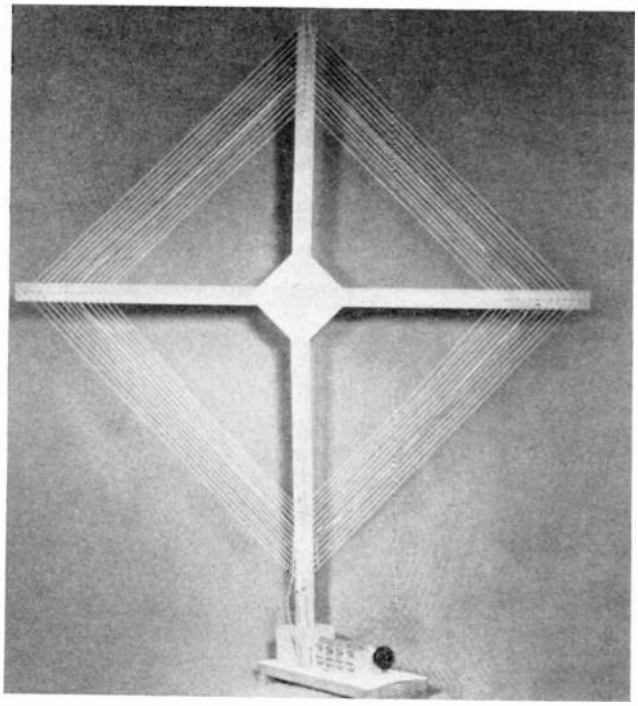


Fig. 2. Variable-tuned loop antenna permits nulling of strong signals so weak signals can be copied.



Crossarms of loop are made with ¼" x 1½" x 44" plywood strips—the vertical arm in one piece and the horizontal in two pieces. Join the three strips together with 6"-square pieces of plywood nailed and glued on each side of the joint. In the author's unit, the loop was mounted in a wooden block fastened to the base holding the tuning capacitor. The loop itself, which is wound 1" in from the ends of the arms, is supported with wire brads. The one-turn coupling coil is wound on the back of the arms opposite the center turn of the loop and as close to it as possible. Three connections are made to the receiver as shown in the diagram on page 75, two to the antenna terminals and one to the chassis. Note: do not ground the loop to the chassis of an a.c.-d.c. radio due to the shock hazard which might result.

ground-wave signals from local stations.

Although the author's loop looks like a throwback to the 1920's, it performs better than expected. In Los Angeles, for example, it is possible to reduce the signal of a powerful local, KMPC on 710 kc., to receive Chicago, WGN on 720 kc., with little or no interference. After playing around with this circuit for a while, you will often be able to separate and identify distant stations on the *same* frequency by rotating the loop antenna for a null on one of the signals.

Loop Construction. At its largest, the loop measures 42" across, and consists of 13 turns of stranded wire spaced ½" apart. Construct the crossarms of the loop as described in the caption above. To couple the loop to the receiver, wind a separate one-turn coupling coil on the back of the crossarms opposite the center turn and as close to it as possible.

The best way to tune the loop is with a salvaged four-section variable capacitor of the type used in older receivers. When you pair the sections by connecting them in parallel, the effective maximum capacity of the two resulting sections is well over 600 pf. A similar arrangement can be worked out by ganging two double-section TRF variable capacitors, which are readily available from most electronic parts houses.

Connect the capacitor sections as shown in Fig. 2, and make the three connections to the receiver (to the antenna terminals and ground). With the center tap disconnected, turn the loop for *minimum* signal on a strong local station. Next, place the center tap at approximately the center of the loop, and tune the variable for *maximum* signal. Adjust the tap for minimum signal, and, again, tune the capacitor for maximum. The variable capacitor is retuned as you tune across the broadcast band.

You'll be surprised at the improvement in your BCB DX score! -30-

A plan to honor Lee de Forest, the late inventor of the triode tube, by devoting a museum room to his effects is currently under way in De Forest's home town of Council Bluffs, Iowa. The inventor's widow has agreed to contribute some of her husband's apparatus to the museum, which would be established in a room at Council Bluffs' historic General Dodge House. Prominent in getting the project started is Art Trauffer, free-lance writer and longtime correspondent of De Forest, the man who is often called "the father of radio." Anyone possessing De Forest memorabilia is urged to contact Mr. Trauffer, Curator, Lee de Forest Room, 120 Fourth St., Council Bluffs, Iowa 51502.

Monthly Short-Wave Report

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

SHORT-WAVE STATION POPULARITY POLL

THIS ISSUE of POPULAR ELECTRONICS will reach the majority of our readers just in time for them to take part in the Short-Wave Station Popularity Poll which is being conducted by the International Short Wave Club of England. Every three years listeners are asked to vote to determine the five most popular short-wave stations in the world (short-wave broadcast stations only; votes for amateur, TV, medium-wave or other classes of stations are not accepted).

You make up a list of five stations, rating them in popularity from one to five. In determining the final score, five points will be given for each first choice, four points for each second choice, three points for each third choice, two points for each fourth choice, and one point for each fifth choice. You can vote for any station regardless of the country in which it is located.

Include a short note with your list explaining why you feel that your number one choice is the most popular station. It is expected, as in past years, that the stations at the top of the poll will award prizes for the best reasons given.

Send your list, together with your name and address, to International Short Wave Club, London, S.E. 16, England, mentioning that you read about the popularity poll in POPULAR ELECTRONICS. We suggest that you send it airmail for you have only until *December 31, 1964,* to cast your vote.

The results of the poll will be announced by the ISWC, and we will publish the names of the top five stations in this column as soon as we know them.

Volcano Radio. The following data was sent to us by Paul K. Reid, Jr., WPE4BKZ, Engineer in Charge of *Volcano Radio, The Voice of Ascension Island.* This station operates on 1600 kc. in the medium-wave band with a power of 250 watts (although the letterhead lists the power as 1000 watts). It is privately owned and operated by members of RCA and Pan American Airways who are stationed at the missile tracking facilities on Ascension Island, and is licensed by the Governor of St. Helena Island. Operations are maintained 24 hours daily, with all broadcasts in English. All reception reports will be answered; the address for reports is *Volcano Radio,* Ascension Island, Box 4187, Patrick Air Force Base, Florida 32925.

A Knight "Span Master" is the main DX'ing tool of Pat Hanes, Middletown, Ind. It's assisted by a transistorized tape recorder and a 150' antenna. Pat has QSL's from 13 countries out of 47 logged.

Ed Mohrman, WPE9FRF, in Chicago, Ill., uses a Knight R-100 receiver, plus a Lincoln 30-50 mc. receiver and an Elizabethian tape recorder. Ed holds DX Awards for 25 countries and 40 states verified.

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

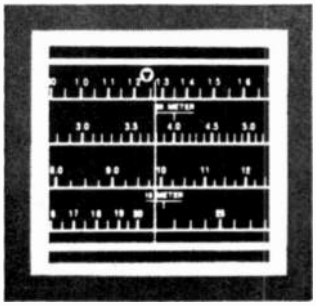
All of the stations below specifically beam English-language newscasts to the U.S.A. The times may vary a few minutes from day to day.

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	9700	1900, 2000, 2300
		7290	1630
Canada	Montreal	11,760, 9625, 5990	1800 (Caribbean)
		9625, 5970	0215, 0300 (W. Coast)
		5970	0800
Congo (East)	Leopoldville	11,755	1630
Congo (West)	Brazzaville	15,190	1430
Czechoslovakia	Prague	11,990, 9795, 7345 (also 15,285 at 2030; 11,990 at 2230)	2030, 2230
Denmark	Copenhagen	15,165	0730
		9520	2100
West Germany	Cologne	11,925, 11,795, 9735	1010
		9735, 9575, 6145, 5960	1955
		11,795, 9735, 9575, 6145	0000
Hungary	Budapest	9833, 9540, 6234	1930, 2030
		9833, 7305, 7215, 6234	2200, 2330
Italy	Rome	9575, 5960	1930, 2205
Japan	Tokyo	15,285, 15,135, 11,780	1900
Jordan	Amman	9555	2015
Lebanon	Beirut	9625	2130
Netherlands	Hilversum	11,730, 9590	1630 (exc. Sun.)
		9715, 6085	2330 (exc. Sun.)
Portugal	Lisbon	6185, 6025	2105, 2245
Romania	Bucharest	11,810, 9510, 7225, 7195, 6190, 5990	1730
Spain	Madrid	11,715, 9615, 6140	2200, 2100, 2000
Sweden	Stockholm	15,240	0900
		5990	2215, 2045
Switzerland	Berne	11,865, 9665, 9535	2015, 2315
Turkey	Ankara	15,165	1700
United Kingdom	London	17,870, 17,740, 15,410, 15,260, 15,180, 15,070	1600
		15,410, 15,260, 15,180, 15,070. 12,095, 11,780, 11,750, 9580, 9510, 7130, 6195, 6110	1800
		12,095, 11,780, 11,750, 9580, 9510, 7130, 6195, 6110 (also on 3952.5 at 2000)	2000, 2200
U.S.S.R.	Moscow	9700, 9680, 9660, 9650, 9640, 9620, 9610, 9570, 7440, 7390, 7360, 7310, 7290, 7240, 7170, 7150 (may not all be in use at any one time)	1730, 1900, 2000, 2100, 2300, 0040
Vatican City	Vatican City	11,740, 9645, 7250	1950

Mr. Reid also advises that there is a homer beacon on the island operating on a frequency of 350 kc. with a power of 2500 watts. Using the call ASN, it was designed to be rich in harmonics and, therefore, can be heard on 700 kc., 1050 kc., and higher frequencies. It is also on the air 24 hours daily. While no reporting address was given for ASN, readers hearing it and wishing to try for a QSL might send their reports to Mr. Reid with a request that they be forwarded to the station.

Not Bona-Fide QSL's. A few weeks ago a considerable number of "QSL cards" were received by LeRoy Waite of Ballston Spa, N.Y., from a UB5-49532 in Ukrainian Russia for distribution to SWL's in this country. Most of the cards had no address

(*Continued on page* 106)



Across the Ham Bands

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

DEATH MESSAGES VIA AMATEUR RADIO—YES OR NO?

IN VIEW OF amateur radio's tradition of supplying emergency communications in time of need, what would you do if the next time you answered your telephone a voice blurted out, "Something terrible has happened. Can you use your ham radio to notify so-and-so that his son (daughter, wife, or brother, etc.) has been killed and to come home immediately?" Would you accept the message?

Actually, before you can answer this question intelligently, you need to know whether regular commercial means of communication are available. If they are, you should decline to handle such a message—or any urgent message with a time limit—unless there is a compelling reason for doing so. In declining, you should courteously explain that amateur message handling is a voluntary service with no guarantee of delivery, or that delivery might be delayed through no fault of anyone concerned; therefore, the message should be sent through commercial facilities.

But what do you do if the caller protests that amateur radio is the only way to get the message through? In such a case, you should not hesitate to do everything in your power to handle the message. But even then, your Amateur Radio Editor and most responsible amateur traffic handlers believe that true emergency messages should be transferred from amateur to commercial circuits as soon as possible, and the originating station should so specify when transmitting the message.

A rather common occurrence in which amateur radio can sometimes help goes like this: Someone is traveling cross-country in an automobile and an emergency develops back home, and no one knows exactly where to contact him. Under such circumstances, a ham might volunteer to send messages addressed to the state and local police departments in the states through which the man is supposed to be traveling and attempt to get them into the appropriate amateur state traffic nets as soon as possible. The messages might read something like, "Please intercept John Johns, driving a two-tone blue, 1963 Ford convertible, Indiana license CQ-1246, traveling west. Tell him to call home immediately."

But the originator of the message should also be advised to contact the local law-enforcement agencies, state police, local

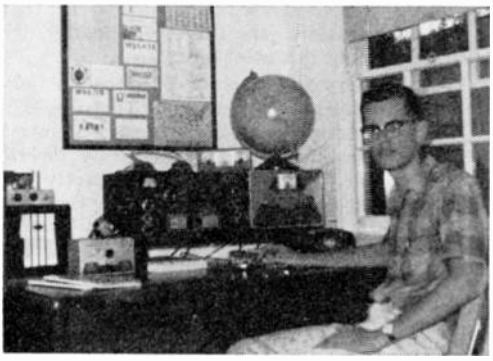
Amateur Station of the Month

Using low power (less than 75 watts) to home-brew and kit transmitters, Gary Gariott, WA9FMQ, Hortonville, Wis., has made over 1500 phone and c.w. contacts in 51 countries. His antennas are four: an 80-10 meter "trap" dipole, 40-meter dipole, 2-element 20-meter beam, and an 8-element 2-meter beam. WA9FMQ will receive a one-year subscription to POPULAR ELECTRONICS for submitting the winning photo for January in our Amateur Station of the Month contest. If you would like to enter the contest, send us a clear picture of your station —preferably showing you at the controls —together with some data about your ham career. All entries should go to: Herb S. Brier, Amateur Radio Editor, P. O. Box 678, Gary, Indiana 46401.

police, sheriff, etc.—and ask them to send similar bulletins to other law-enforcement agencies tied into their radio and teletype networks. Some law-enforcement agencies are not equipped or willing to do this, but others are very cooperative. Also recommend that the person contact the local chapter of the American Red Cross; this organization can provide information on how to get emergency messages to men with A.P.O. and F.P.O. addresses most rapidly.

You may wonder why we suggest that you be so free with advice on how to route emergency messages. The reason is simple: When an amateur is asked to handle an urgent message, he is being called upon as a communications expert and any suggestions he can give to help solve the problem will be much appreciated by the originator of the message.

Even more important than the relaying of messages is delivering them. Some responsible hams refuse to handle death messages when other means of communications have been open to the sender—and they have good reasons for this attitude. Other amateurs take the view that, once a message has been accepted and started on its way, it should be delivered as rapidly as possible. This is obviously a matter for individual judgment. But if the message is not going to be delivered, it should be returned to the sender—never allowed to sit without action.



Here's Bob Bly, Jr., a month after his Novice license came. Bob operates as WN6KHB in Riverside, Calif.

Ray Suchy, WN4UGC, of North Miami, Fla., hooks the big ones with his transmitter and his fishing rod.

FCC Notes. In late September, 1964, the U.S. State Department concluded the first agreement with a foreign country under the newly enacted Reciprocal Operations Bill PL-88-313. The country was Costa Rica, and the agreement permits licensed radio amateurs in the U.S. and in Costa Rica to operate amateur radio stations in each others' country. (Details on how to obtain the authorizations for such operations are not available as this is written.) Similar agreements with other countries are expected shortly.

In the past, FCC regulations have required that your old license be attached to an application for a new or modified amateur license, and the old license has been returned with the new one. Under present procedures, the FCC retains the old license to complete its records. But if you want to hold on to your old license for any reason, the FCC will accept a photocopy of it in lieu of the actual license when you apply for a new or modified license.

On September 30, in Docket No. 15640, the FCC proposed to modify amateur regulations, sections 97.9 (d)(1) and 97.27(a), to require new applicants for a Conditional Class amateur license to live at least 175 (instead of 75) miles away from a point where official FCC amateur examinations are held at least once every six months. The FCC emphasizes that the proposed modification will in no way affect renewal of presently valid Conditional licenses. Nor will it affect applicants eligible for such a license because of protracted physical disability, temporary overseas residence, or service in the armed forces. But with these exceptions, the new regulation—if adopted—means the virtual elimination of the Conditional Class license for new applicants at least within the continental United States, because there are very few locations not situated within 175 miles of an examination point.

(*Continued on page* 94)

On the Citizens Band

with **MATT P. SPINELLO,** KHC2060, CB Editor

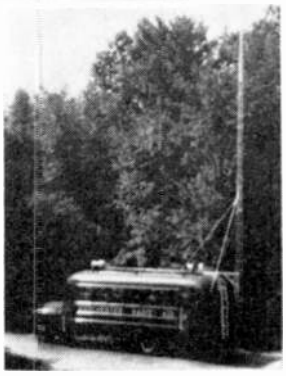
MEMBERS of Manchester Radio Aid, Inc., Manchester, N. H., may find that their organization is considered small, but only in number! Their 17-man emergency communications team, led by Charles Gassek, president, has purposely been limited in membership with the idea of maintaining a close-knit group with uniform operating procedures and discipline while working with civil defense, police, and other area authorities.

MOBILE EMERGENCY CENTER

All members are carefully screened to insure that those admitted are actually interested in helping the community and are *not* afraid of work. All private mobile units are required to carry a designated accumulation of gear to stand prepared in any emergency: first aid kits, flares, a flashlight, shovel, gloves, pen and paper, a compass, a blanket, fire extinguisher, watch, rope, extra gasoline, a jug filled with water, a wood block and, of course, CB gear in good operating condition.

To insure utmost effectiveness in such natural disasters as tornadoes, floods, earthquakes, searching for lost persons, or in any emergency where a communications problem exists, M.R.A. members tore into a project that started out as a large army bus. The unit now stands as a bright, shiny *mobile communications center.* An estimated 500 labor-hours were put into its construction, not to mention the many dollars tossed into the pot. The obvious advantage of such a "base station on wheels" is the ability to place a permanent (or semipermanent) communications facility within a disaster area for immediate and continual use in relaying pertinent information where needed.

Having an assigned call-sign of KBC8000, the new mobile center can be driven anywhere and left for a period of two weeks if necessary. Provisions on board (for a two-man crew) include bunk beds, food and cooking facilities, and light and heat provided by electrical power supplied by a 500-watt a.c. gasoline-driven generator. The communications console is equipped with two 23-channel International "Executive" CB transceivers in the rear of the bus and a third unit in the driver's compartment. A 2-meter Civil Air Patrol transceiver complements the CB equipment, and CB walkie-talkies are on hand as needed. A 60-watt public address amplifier also stands ready with speakers mounted on the roof of the bus (see photos above).



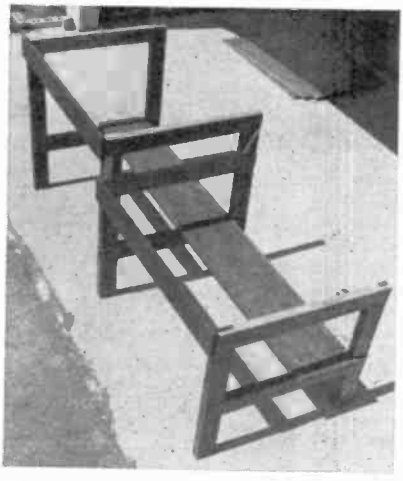
Once operated as an army bus, this vehicle is now known as KBC8000. It was converted into a mobile communications center by members of Manchester Radio Aid, Inc. Equipped with four transceivers, a p.a. amplifier, and living facilities for a two-man crew, it's ready to go at a moment's notice.

The antenna system of the new mobile center is unique. Five antennas can be utilized at one time for permanent operation; two additional antennas serve while the center is mobile. The main working antenna is a Gam half-wave mounted atop a 60-foot telescoping tower, which, in a stowed position, is secured to the roof of the bus.

300 Aid in Emergency Search. On August 23, 1964, a relayed emergency message that began with a plea from a single CB'er snowballed into a network involving the commu-

(*Continued on page* 102)

Knock-Down Work/Op Bench

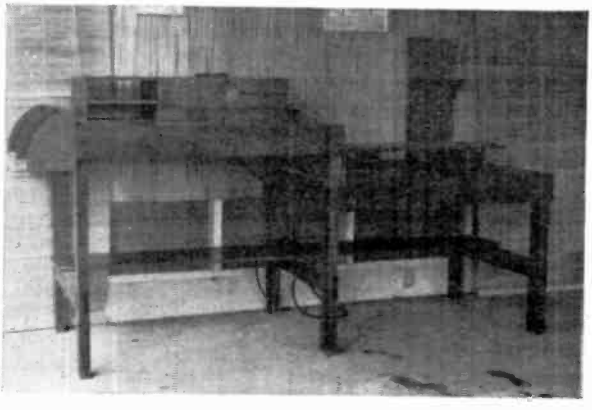


For the traveling ham—take it with you

BECAUSE the author is a U. S. serviceman, he is constantly on the move, and found this easily assembled and disassembled workbench a good way to keep up his hamming in spite of his travels. The bench is built from pine lumber and is stained and waxed. Only a screwdriver and some wood screws are needed to take it apart and put it together again. The upper level provides a stand-up or stool working area for construction projects, the lower level plenty of room for comfortable ham operation. Ample space is also available for storage of tools, papers, and books.

—R. W. Jones, W6EDG

The work/op bench in various stages of assembly. Use screws and shun glue, and you can easily take it apart for moving, set it up later on.



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OT-24	20-40 mc	CY-7T	±.0035%	$ 9.10
OT-46	40-60 mc	CY-7T	±.0035%	9.10
OT-61	60-100 mc	CY-7T	±.0035%	15.00
OT-140	100-140 mc	CY-7T	±.0035%	15.00
OT-160	110-160 mc	CY-7T	±.0035%	15.00

CRYSTAL FREQUENCY	CRYSTAL PRICE
20-60 mc	$ 6.90
60-100 mc	12.00
101-140 mc	15.00
141-160 mc	18.00

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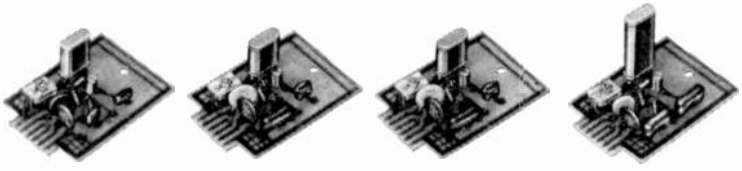

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Four transistor oscillators covering 70 kc - 20,000 kc. Trimmer capacitor for zeroing crystal. When oscillator is ordered with crystal the standard will be ±.0025%. Oscillator output is 1 volt (min) across 470 ohms. Power requirement: 9 vdc @ 10 ma. max.

OSCILLATOR TYPE	OSCILLATOR RANGE	CRYSTAL TYPE	TEMPERATURE TOL. —40°F TO + 150°F	OSCILLATOR (LESS CRYSTAL) PRICE
OT-1	70-200 kc	CY-13T	±.015%	$7.00
OT-2	200-5,000 kc	CY-6T	200-600kc ±.01% 600-5,000kc ±.0035%	7.00 7.00
OT-3	2,000-12,000 kc	CY-6T	±.0035%	7.00
OT-4	10,000-20,000 kc	CY-6T	±.0035%	7.00

CRYSTAL FREQUENCY	CRYSTAL PRICE
70-99 kc	$22.50
100-200 kc	15.00
200-499 kc	12.50
500-849 kc	22.50
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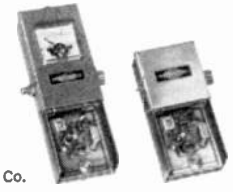

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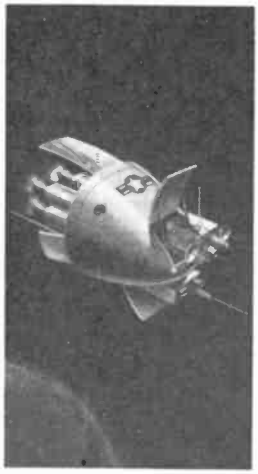

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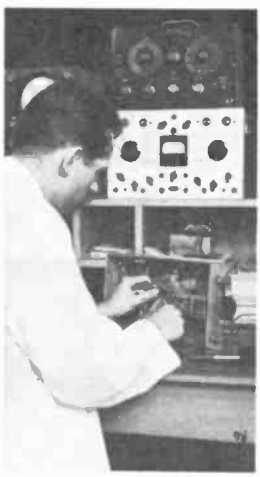

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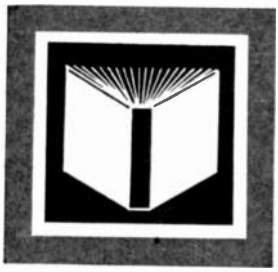

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In these days of rising costs, it's nice to know that someone is holding the price line. Probably the most valuable book on transistors that any POPULAR ELECTRONICS reader could want still sells for $2.00. Now available in a new seventh edition, the *Transistor Manual* has had 212 pages added to it, making the grand total 652 pages! There are some new subjects, and all of the older subjects have been revised and brought up to date. Of particular interest is the addition of a list of stores throughout the country that sell GE semiconductors. A MUST book for everyone.

Published by Semiconductor Products Dept., General Electric Company, Electronics Park, Syracuse, N. Y. Soft cover. 652 pages. $2.00 (direct or in many stores).

BASIC ELECTRICITY/ELECTRONICS (Five Volumes)

edited by Seymour D. Uslan

It is difficult to deny that "programmed learning" courses have a place in the sun. While the Editors entertain some misgivings as to the depth of the training one can obtain from such courses, they are indeed helpful when a modest knowledge of a broad spectrum of subjects must be gained in a short period of time. Programmed learning without follow-up has a tendency to make a participant a "jack of all trades —master of none." If these five volumes are accepted in this light, your Editors applaud them as examples of well-prepared learning courses—embracing the widest possible fields, from diodes to servo amplifiers. Particularly noteworthy is the format of each volume. Every left-hand page starts off with the answers to the questions asked at the bottom of the preceding right-hand page. This permits the student, or reader, to move along at a comfortably slow pace and to interrupt his learning at his convenience. The first volume (314 pages) covers the incredible range from "What Is Electricity?" to block diagrams of TV sets! The second volume (314 pages) delves into circuit operation; the third volume (224 pages) into tubes and transistors; and the fourth (256 pages) into test equipment. The last volume (224 pages) is on electricity, dealing principally with motors and generators. In summary, you can learn something about electronics from these volumes, and you can gain insight as to how equipment operates without exploring the intricacies of circuit design; but don't expect to go into the radio-TV repair business when you've finished reading these books.

Published by Howard W. Sams & Co., Inc., 4300 West 62 St., Indianapolis, Ind. Five soft-cover volumes. About 1330 pages. $19.95 per set; $4.50 per volume.

MODERN ELECTRONIC VOLTMETERS

by Sol D. Prensky

When the author states in the very first sentence of this book, "How the simple VTVM has grown!"—he's not kidding. In fact, the electronic voltmeter field has grown so big and diversified so fast that the TRVM (transistorized voltmeter) is now quite common, and new high-sensitivity instruments use special chopper circuitry. Only ten years ago, one of these didn't exist and the other was a laboratory dream. This book provides a well-balanced working knowledge of electronic voltmeters (VTVM's and TRVM's) from kits to $1000 lab instruments.

Published by John F. Rider Publisher, Inc., 116 West 14 St., New York 11, N. Y. Soft cover. 224 pages. $4.95.

ELECTRONIC PRECISION MEASUREMENT TECHNIQUES AND EXPERIMENTS

by Members of the Staff, Philco Technological Center, edited by John E. Remich

The laboratory technician is faced with numerous problems in servicing his test equipment. Repair of test equipment also means recalibration, for to be of any value, the accuracy of such equipment must be as nearly perfect as possible. This compilation embraces the whole field of electronics and many of the adjoining physical sciences niques. Assuming that the technician knows that utilize electronic measurement tech- how his test equipment operates, this book

summarizes calibration methods that should be used in checking the accuracy of scores of pieces of test gear. The recommended techniques were derived from the manufacturer's application notes and other sources.

Published by Prentice-Hall, Inc., Englewood Cliffs, N.J. 07632. 336 pages. Hard cover. $13.00.

THE RADIO AMATEUR'S HANDBOOK

by A. Frederick Collins
revised by Robert Hertzberg

If you took a second look at this book title, join the hundreds of others who will be astonished to find that the ARRL *Handbook* has a "title twin." Oddly enough, the first edition of this book predates the ARRL book, and it has been periodically brought up to date—this is the 11th edition. Bob Hertzberg has done his usual workmanlike job and this volume can be recommended to any electronics enthusiast interested in ham radio. Licensed hams might also investigate it with particular regard to "Appendix D," which outlines insurance requirements for ham stations.

Published by Thomas Y. Crowell Co., 201 Park Ave, South, New York, N.Y. 10003. Hard cover. 374 pages. $4.95.

Free Literature

Three new booklets for audio enthusiasts are currently available. A 20-page "Tape Recording Handbook" discussing the many uses of tape and the care and feeding of a tape recorder can be obtained from POFE Electronics, Dept. EF, 1716 Northfield, Muncie, Ind. 47304 . . . In a 6-page "Curve Comparator Guide" prepared by Audio Dynamics Corp., Pickett District Rd., New Milford, Conn., ten leading stereo cartridges are rated as to frequency response, separation between channels, and overall quality of reproduction . . . The Scott 20-page "Guide to Custom Stereo for 1962" contains articles on home decor with stereo, what to look for in choosing a tuner or an amplifier, how FM multiplex works, and the functions of the various components in a hi-fi system. The manufacturer's equipment is described and illustrated. For your copy, write to H. H. Scott, Inc., Dept. P, 111 Powdermill Rd., Maynard, Mass. . . . Also available free of charge is Catalog No. 8, entitled "Electronic Projects." Published by Henry Francis Parks Laboratory, Box 1665, Seattle, Wash. 98125, it lists 160 "professional projects" that you can build, with prices and short descriptions. —30—

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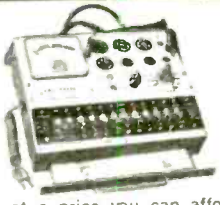

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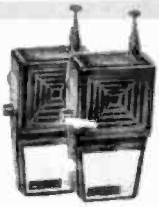

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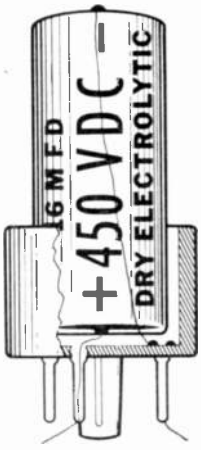
Tips and Techniques

MAKE YOUR OWN PLUG-IN CAPACITORS

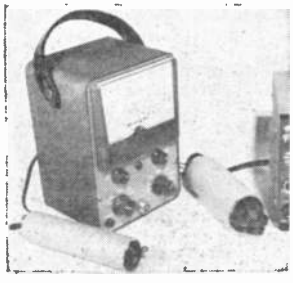
When building new equipment from scratch, you can make your own plug-in capacitors if space on the chassis permits. They will simplify replacement should it become necessary. First salvage the bases from old octal tube sockets, carefully removing all the old glass and cement. A hot soldering iron will clear the tube pins, and you can rewire the base to accommodate your capacitor. Just be careful to note the pin numbers and the correct polarity. With an octal socket wired to hold the plug-in capacitor, you can change capacitors without soldering or de-soldering—as easily as tubes.



—James V. Conklin

CARDBOARD CORD HOLDERS

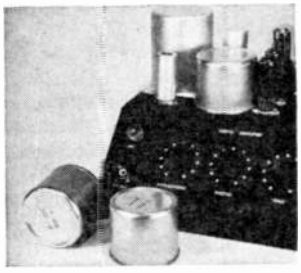
Electronic equipment line cords can be a problem when the equipment is not in use. If left to dangle, they may become tangled and knotted; if wrapped around the equipment, they may be cut by sharp edges and corners; if wrapped in tight bundles, they can develop sharp kinks with possible insulation breakage. Ordinary cardboard tubes from tissue or paper towel rolls or even cut-down mailing tubes can be used to store a line cord safely and neatly. Just coil the line in a loose 6"- to 8"-diameter circle, squeeze it slightly, and slip it into the end of the tube. When you want to use the equipment, pull out as much of the cord as is needed.



—Luis Vicens

PROJECT "CAN RAID" FILLS MANY ELECTRONIC NEEDS

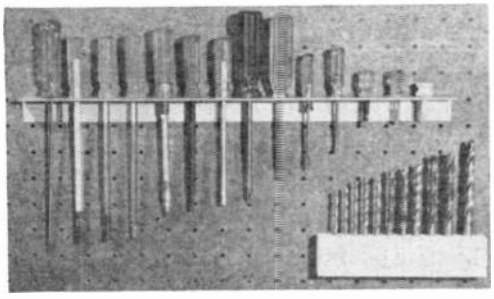
You'll find it worthwhile to raid the kitchen occasionally for drawn-aluminum cans. The squat types make excellent lightweight chassis for preamps, phono oscillators, etc., or, when secured to a wooden board, they can be used as containers for small parts. Some types will serve as small baffles for miniature loudspeakers or as cases for home-assembled microphones. They can also be fitted with spade bolts and employed as tube and coil shields. The narrower fruit juice cans make good probe or module housings and cylindrical light shields for photocells and sun batteries.



—Eugene Richardson

PEG-BOARD TOOL HOLDERS MADE FROM SCRAP MATERIALS

Peg-board tool holders can be made from readily available scrap materials, such as a convenient length of angle iron or aluminum. Along one side of the metal, drill a series of holes or slots to hold the tools. On the other side, fashion two peg-board hooks by hacksawing two slots about ¼" apart approximately 2" in from each end and bend to shape. These newly formed hooks should be spaced to line up with the peg-board holes. For an easy fit, use a file or grindstone to round off the edges and reduce the diameter of the hooks if necessary. A scrap block of wood can also be utilized as a tool holder, as shown in the photo.



—Carleton A. Phillips

Across the Ham Bands

(*Continued from page 80*)

News from Club Bulletins. Slats, KØATZ, the editor of *Round Table*, the Denver Radio Club bulletin, has some up-to-date information on the antenna case involving Mace Warner, WØJRQ, mentioned here last month. On September 15, the day before the case was scheduled for hearing in court, Andrew Bahlay, KØOOA, the Engineer in Charge of the Denver FCC office, became ill while discussing the matter with the district attorney, and died the next day. As Andy was WØJRQ's prime witness, the case has been postponed until January 25 of this year.

We have much better news to report on the case involving Charles A. "Butch" Seaman, K3IOP, also mentioned last month. Upholding the ARRL's arguments in his behalf, the FCC has fully restored all of K3IOP's operating privileges.

The September, 1964, issue of *QSA 5*, the club paper of the Marin Amateur Radio Club, San Rafael, Calif., offers an infallible, tongue-in-cheek method of classifying hams by their call-sign prefixes. Here it is, in abbreviated form: *WB*'s don't know anything, even though they may hold EE degrees, be members of the Institute of Radio Engineers, and members of the Quarter Century Wireless Association. . .*WA*'s are a small step above the *WB*'s. They can act as Net Control Stations and do similar jobs, but don't pay too much attention to their opinions. . .*K*'s sometimes say something worth listening to. . .*W*'s have worked everywhere and know everything. They are as clannish as a herd of buffalo. To one *W*, the only thing higher then another *W* is. . . *a ham with a two-letter call.* When you hear one, you naturally think of Mother and hear a distant band playing "There's a Star-Spangled Banner Waving Somewhere."

News and Views

Are you one of those hams who waits until the local TV station goes off the air before you get on the air? Then stay out of Nigeria! **Jim, 5N2JWC,** reports that as soon as the local TV station in Lagos goes off the air, the men at the power plant close down the generators and go to bed. Incidentally, the telephone company shuts down over the weekend, too . . . **David S. Hollander, WN61WX,** 13351 Malena Drive, Tustin, Calif., runs a Novice "kilowatt" (75 watts) to a Hallicrafters HT-40 transmitter. His receiver is a Hallicrafters SX-115, and the antenna is a Mosley NS-3. Of 41 states worked, Dave has QSL's from 37—including Hawaii and Alaska. Other DX worked: Mexico, Midway Island, and Argentina . . . **Steve Benedict, WN8NKE,** 2546 Cheswick Dr., Birmingham, Mich., worked 20 states his first few weeks on the air using a home-brew 5-watt transmitter. Now using a borrowed Heathkit DX-60, he has pushed the total all the way up to 22. A Hammarlund HQ-140X separates the wheat from the chaff. Dave probably didn't mean it that way, but his antenna is a secret weapon: he forgot to tell us what it is.

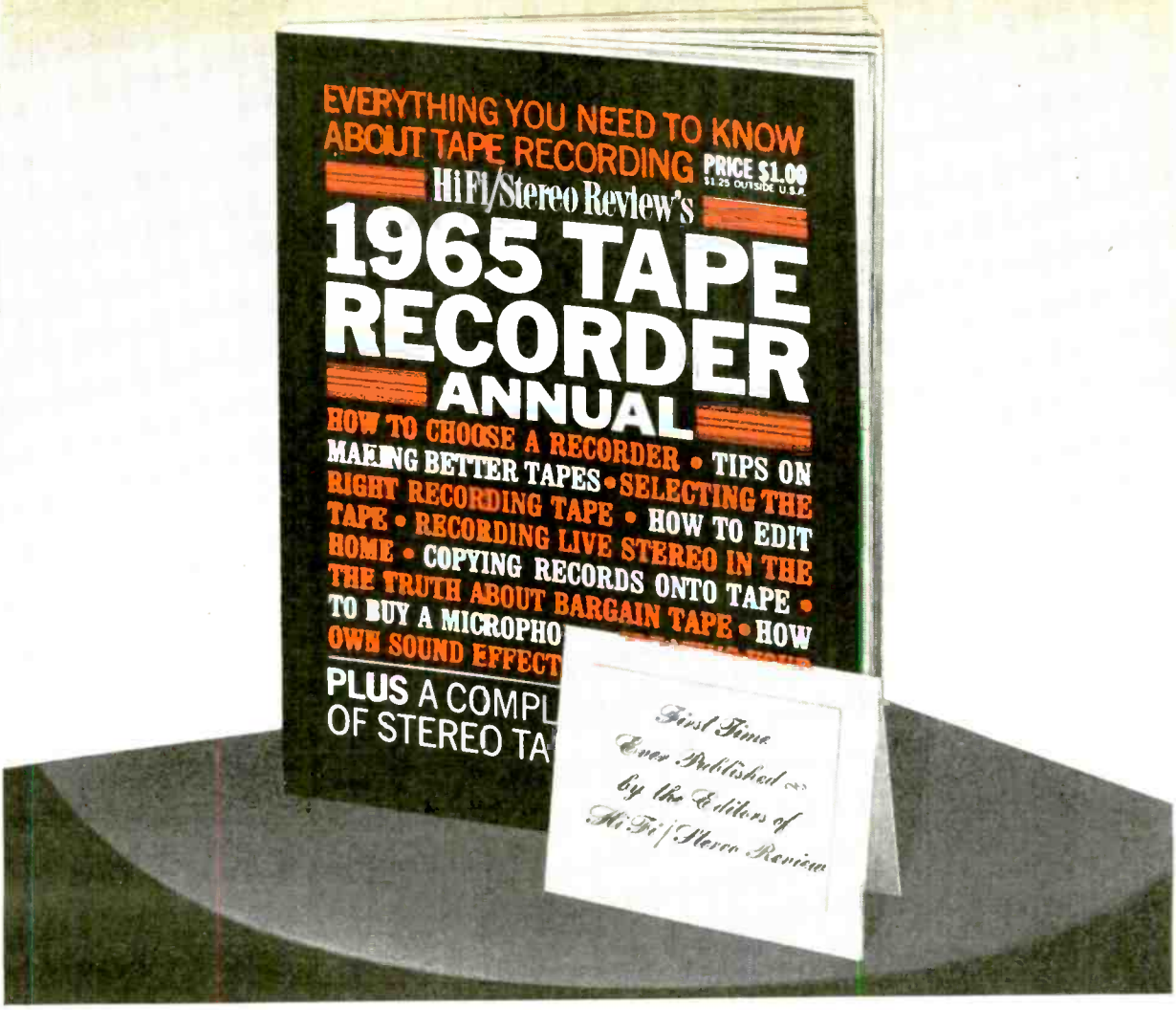
Bruce McNair, WB2NYK, 79 Woodland Ave., Fords, N.J., knocked off 330 contacts in his 95 days as a Novice. Thirty-two states are represented in this total—all on the 40-meter Novice anthill. A Knight-Kit 150A transmitter, Lafayette 320 receiver, and a Hy-Gain 14AVS vertical antenna comprise Bruce's equipment. As a General, WB2NYK works 80-, 40-, and 20-meter phone and c.w. He'll be glad to work you for a New Jersey card or for a Rag Chewers' Club nomination . . . **Mike Griffin, WN3AZI,** 715 Webb St., Aberdeen, Md., is most proud of his QSO with WN1AZI. Mike has 21 states and three Canadian provinces worked; although he QSL's every contact for which he can find an address, his percentage of returns is only 60%. Mike has pepped up his National NC-190 receiver with the preselector described in this column back in October, 1961 ("Improved Signal Booster," p. 76). He recommends it as "a real live gold-plated special for anyone who can't afford $400 for a receiver." His transmitter is a Knight T-60 feeding a 12'-high antenna . . . After operating portable for a year, **Ray Lincoln, WA4DOU,** 1607 Evans St., Morehead, N.C., is back home and is operating on 20-meter c.w. Using a Heathkit DX-40 transmitter with a single crystal and feeding a dipole antenna, 20' high, he has worked 21 states and 11 countries in a month. Ray receives on a Hallicrafters SX-140.

Dave Wolovitz, WN3ADS, 7567 Malvern Ave., Philadelphia, Pa., likes to rag-chew on 40 meters and DX on 15 meters. He uses a Heathkit DX-60 transmitter, a Hallicrafters S-85 receiver, and a Mosley V-4-6 vertical antenna to do both. He has exchanged the good word with 26 states, Canada, Puerto Rico, and Brazil . . . **Dave Buffington, WN5KCQ,** 205 N. Eisenhower, Midland, Texas, likes 40 meters. His home-brew 60-watt transmitter agitates the ionosphere with the aid of a 40-meter dipole 20' high. A Hallicrafters SX-101 receiver and a single transmitter crystal complete the installation. Dave has 19 states checked off in his logbook . . . **Larry Langevin, K1GXU,** 42 Prospect St., Ludlow, Mass., does most of his operating on single-sideband. He has a Hornet 3-element tribander beam on top of a 50' Rohn steel tower. A Heathkit "Apache" transmitter and SB-10 combination is connected to the station end of the coaxial feedline to the antenna. Larry receives on a Hammarlund HQ-170A and has a Gonset phone patch and a Johnson SWR bridge to round out the equipment on the operating desk. Two of Larry's most prized certificates are his WAS (Worked All States) and a Lion's Head Radio Club Certificate from South Africa.

CWO Wm. L. Patterson, USCG, K4PXY, 425 Lineberry Rd., Virginia Beach, Va., has come a long way—equipment-wise—since his Novice days, when he operated a Heathkit DX-35 and was probably the only Novice Maritime-Mobile station in 1957 and 1958. His equipment now includes a Johnson "Invader-2000" transmitter, a National NCX-3 transceiver, a Collins 75-S3A receiver, a Hornet tribander beam, and an 80-40 meter "trap" dipole antenna. Bill likes to rag-chew, but the Maritime Mobile stations usually keep him busy running phone patches around the Norfolk area. Besides his WAS and WAC certificates, Bill has also earned BPL (Brass Pounder's League) citations 12 times in recognition of his traffic-handling activities.

As usual, we close this month by inviting you to send us pictures and "News and Views" for *your* column. We will also appreciate receiving your club bulletin. Write to: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana 46401. 73,

Herb, W9EGQ



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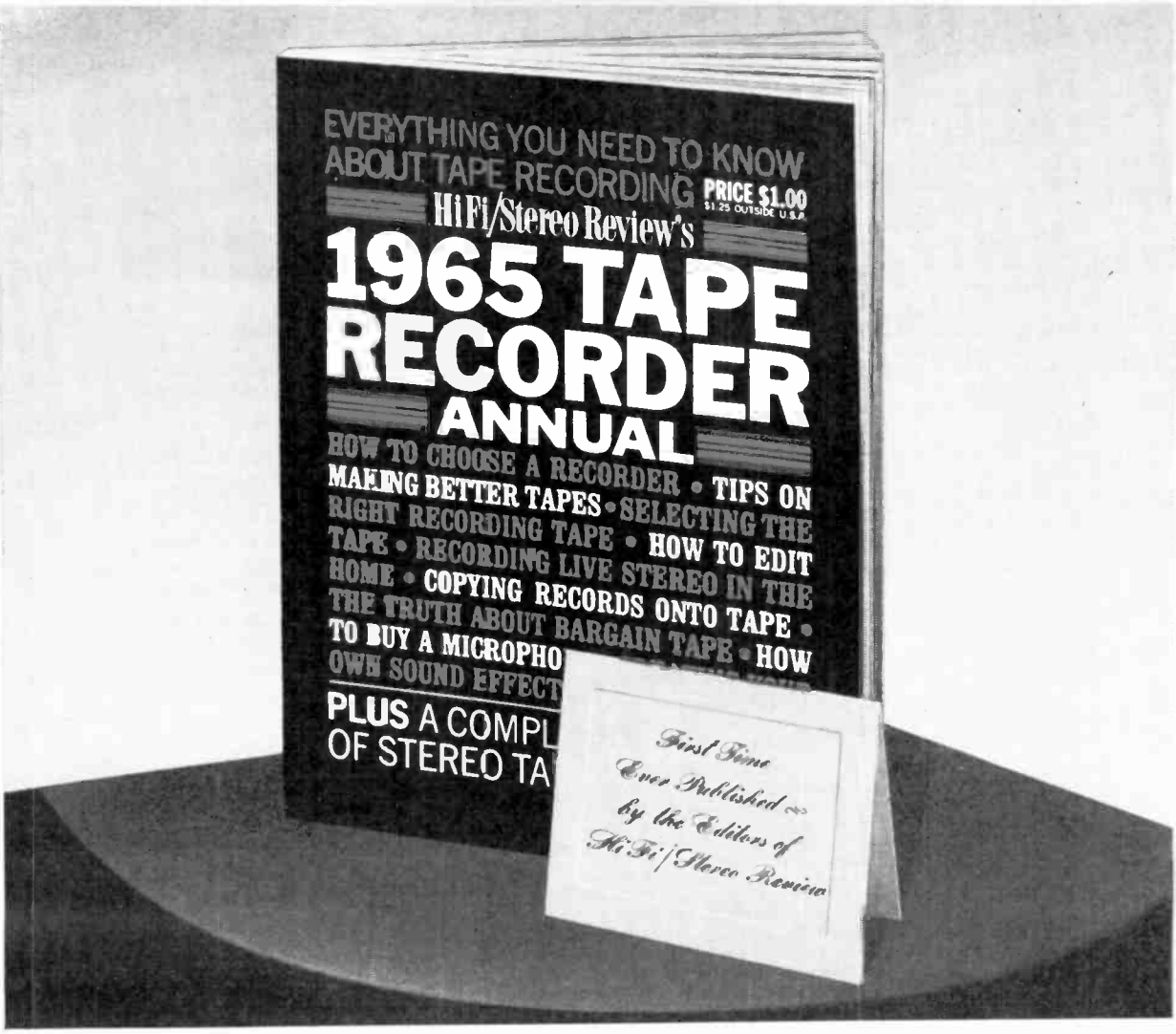

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1. Date of filing: Oct. 1, 1961.

2. Title of publication: Popular Electronics.

3. Frequency of issue: Monthly.

4. Location of known office of publication: 434 South Wabash Avenue, Chicago, Illinois, 60605, Cook County.

5. Location of the headquarters or general business offices of the publishers: 1 Park Avenue, New York, New York 10016.

6. Names and addresses of publisher, editor, and managing editor: Publisher, Phillip T. Heffernan, One Park Avenue, New York, New York 10016; Editor, Perry Ferrell, One Park Avenue, New York, New York 10016; Managing Editor, W. Steve Bacon, One Park Avenue, New York, New York 10016.

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8. Known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities: None.

9. Paragraphs 7 and 8 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner. Names and addresses of individuals who are stockholders of a corporation which itself is a stockholder or holder of bonds, mortgages or other securities of the publishing corporation have been included in paragraphs 7 and 8 when the interests of such individuals are equivalent to 1 per cent or more of the total amount of the stock or securities of the publishing corporation.

10. This item must be completed for all publications except those which do not carry advertising other than the publisher's own and which are named in sections 132.231, 132.232, and 132.233, Postal Manual (Sections 1355a, 4355b, and 1356 of Title 39, United States Code)

	Average No. Copies Each Issue During Preceding 12 Months	Single Issue Nearest To Filing Date Sept.
A. Total No. copies printed (net press run)	506,513	506,525
B. Paid circulation		
1. To term subscribers by mail, carrier delivery or by other means	271,801	281,000
2. Sales through agents, news dealers, or otherwise	121,187	118,800
C. Free distribution (including samples) by mail, carrier delivery, or by other means	7,527	6,330
D. Total no. of copies distributed. (Sum of lines B1, B2 and C)	403,815	409,130

I certify that the statements made by me above are correct and complete.

PHILIP SINE, Treasurer

The following satellites were in orbit and transmitting as this issue closed. The satellites are listed by frequency and by code name. Some satellites are mentioned several times since different frequencies are used for tracking and telemetry.

Vanguard 1*	108.012 mc.
Echo 2	136.020 mc.
Telstar 2	136.050 mc.
Alouette**	136.077 mc.
Explorer 18	136.111 mc.
Relay 1**	136.140 mc.
Relay 2	136.142 mc.
Explorer 21	136.145 mc.
Echo 2	136.170 mc.
OGO 1	136.170 mc.
Explorer 22	136.200 mc.
Tiros 8	136.233 mc.
Tiros 7	136.234 mc.
GGSE	136.319 mc.
Explorer 20**	136.350 mc.
Ariel 1	136.406 mc.
Syncom 2**	136.468 mc.
Syncom 3**	136.470 mc.
Ariel 2	136.558 mc.
Alouette**	136.593 mc.
Relay 2**	136.620 mc.
Relay 1	136.623 mc.
1963 38C (USA)	136.651 mc.
Explorer 20**	136.680 mc.
1964 40C (USA)	136.771 mc.
EGRS	136.803 mc.
Solar Radiation	136.886 mc.
Tiros 7	136.921 mc.
Tiros 8	136.924 mc.
Syncom 2**	136.980 mc.

*Transmits while satellite is in sunlight only
**Transmits only upon ground command

This listing does not include all of the satellites in orbit—many of which no longer are transmitting, or transmit erratic, very weak signals. Satellites of the Soviet Union generally use tracking and telemetry frequencies in the band between 19.990 and 20.010 mc. Exact frequencies of the Soviet satellites are broadcast by Radio Moscow immediately after launching. In orbit, but apparently not transmitting, are Cosmos 25, 31, 36, 38, 39, 40, 41, 42, 43, 44, and 48. Weak signals have been heard from Elektron 2 on 19.430 and 19.540 mc., according to some observers.

Transistor Topics

(*Continued from page 74*)

250-volt B+ supply. Appropriate resistors can be put together to achieve almost any desired step-down in voltage from any other B+ voltage source. Normal operation will not be affected; current drain is less than 2.0 ma.

Take care, when mounting the impedance-matcher in a.c. line-operated equipment, to keep it away from filament lines, power transformers, or other sources of hum.

Transitips. Most hobbyists take pride in their work. Whenever possible, they want their home-built equipment to have a professional appearance. This can be a problem when assembling miniature transistor equipment, since relatively few small cases or cabinets are available commercially. Standard-size metal name plates and dials create another problem: they are usually much too large for the majority of miniature applications. But a little ingenuity can go a long way towards solving both of these problems.

Many of the small commercially available prefinished aluminum boxes are excellent for small projects. If not available in the exact size and shape needed, they can be cut down or extensions added. An empty metal throat lozenge box, for example, when suitably refinished, can serve as a housing for a hearing aid, small receiver, or similar pocket-sized project. Metal tubes used as individual containers of expensive cigars can become excellent housings for signal tracers, signal injectors, and other probe-type instruments—the printed lettering on the tubes can be removed with a solvent or covered with enamel. And small plastic boxes are superb for housing miniature projects which do not have to be shielded.

Metal name plates and dials, normally too large for miniature projects, can often be trimmed and shaped to fit even the smallest case. Also, decals and pressure-sensitive labels can be applied to the curved surfaces of tubes or rounded boxes.

Appropriate-sized hardware is a desirable complement for small cabinets and will add a final touch of perfection to completed equipment. Miniature drawer pulls can be used as handles. Attractive control knobs can be made by filling small caps from bottles or toothpaste tubes with liquid Plastic Wood or cements which can be cut and drilled when dry—you simply drill a hole for the control shaft after the filler has hardened. Colorful miniature clock radio knobs can be fitted over projecting screws on screw-adjustable devices. And, finally, small strips of felt can be cut from an old hat and cemented to the bottom of a cabinet to substitute for non-scuffing feet.

Keep warm—and have fun. Until next month . . .

—Lou

Battery users may be interested in the new "Action Pack" marketed by the Alkaline Battery Division of Gould-National Batteries, Inc., St. Paul, Minnesota. Consisting of a pair of size D rechargeable nickel-cadmium cells and a charger suitable for operation on a standard 117-volt line, it sells for $5.95.

Experimenter's L Bridge

(*Continued from page* 63)

oscillation. To minimize loading effects on the oscillator, the signal is taken from the junction of *R17* and *R18*. The output transformer delivers approximately 4 volts to the bridge circuit, which varies with the range setting. The lower mh ranges place a heavier load on the output transformer and cause a drop in voltage. The power supply is a conventional full-wave rectifier circuit.

Construction. A 4⅜" x 8" chassis plate is held in place by two angle brackets about 1½" from the bottom of a 4½" x 6" x 8" utility box. The tuning eye socket is secured to the front panel by two *8-32* x 4" rods. A single-terminal lug for the other ends of the five resistors attached to the range switch is mounted on the rod nearest the switch. Connect the circuit leads to *R7* so that the resistance increases as the control is rotated clockwise. (Note: do not connect the *L* control (*R1*) until calibration is completed.)

The *L* dial is a 4" metal disc; a cardboard or plastic dial can also be used. A sheet metal screw positioned below the tuning eye and just above the dial and with the slot in a vertical position serves as an indicator. Paint or ink in the slot on the screw head to make it easy to see. Drill several rows of ¼" or ⅜" holes in the rear panel to allow for ventilation. Wiring is not critical, but keep the leads short in the phase shift network of *V3b*. Terminals X_L should be insulated from the front panel.

Calibration. An ohmmeter or multimeter with an 0-10,000-ohm range is needed for calibration. Rotate the still-disconnected *L* control to the full counterclockwise position. Connect the ohmmeter to the center and right terminals, looking at the control from the rear, the terminals pointed downward. The meter should indicate approximately zero resistance. Now rotate the *L* control clockwise and mark the dial at every 500-ohm point. Number the 1000-ohm positions. Use alternate long and short lines for easier reading, placing the long lines opposite the 1000-ohm points.

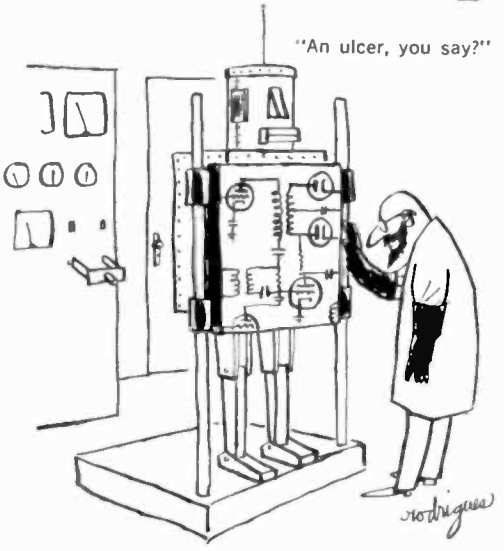
Disconnect the meter and hook up the same two terminals of the *L* control to the circuit. The left terminal should be connected to the center terminal for better control action.

Operation. Set the *S* and *Q* controls about midway and allow your newly made inductance bridge to warm up for a few minutes. Connect the coil to be tested to the binding posts and set the range switch to an appropriate range. Adjust the *S* control until the tuning eye is almost closed. Slowly rotate the *L* dial while watching the tuning eye for a sharp change from minimum to maximum and back to minimum again.

Adjust both the *L* and the *Q* control for maximum opening. Rock the controls to pinpoint the settings. Then rotate the *S* control clockwise to increase tuning eye sensitivity. The shadow will narrow. Again readjust the *L* and *Q* controls for maximum eye opening. The *L*-dial calibration mark multiplied by the range-switch setting indicates the inductance value.

When filter and audio chokes are measured, begin with the *Q* control at the full clockwise position. It will probably have to stay there. Several bridge balance indications may be found with low value r.f. chokes. Use the one with the largest amount of eye opening.

Accuracy of the bridge is determined by the precision of the components used and the *L* dial calibrations. -30-



Wireless Re-Broadcaster

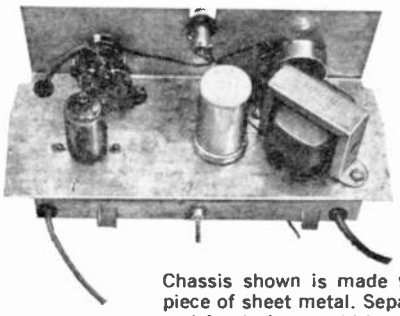
(*Continued from page* 49)

the signals from section *V1b* and then "piped" into the atmosphere by the antenna. Capacitor *C4* serves as an antenna coupler.

The modulation *Level* indicator circuit is also very simple. In the presence of an audio signal, plate voltage of triode section *V1b* varies with the applied signal. As the cathode goes more negative, the tube conducts more and plate voltage goes down; as the signal goes more positive, the tube conducts less and plate voltage goes up. Neon lamp *I2* "looks" at this varying plate voltage through capacitor *C2*. Resistor *R6* is a current limiter. When plate voltage goes down, the voltage across *I2* increases and "fires," provided that the applied signal is of the proper level. The lamp should flicker on and off in "step" with the program. Too high a volume level will cause the lamp to stay on, even during very low signal passages.

Transformer *T1* provides heater voltage to the tube as well as an isolated line voltage to the rectifier. Actually it is stepped down a bit from 117 volts to 110 volts. While the exact voltage is not critical, it is best not to deviate too much. Neon lamp *I1,* across the secondary of transformer *T1,* serves as a pilot light.

The B+ developed by half-wave rectifier *D1* and the filter components (resistor *R2* and capacitor *C1a*) is fed to the plate of tube *V1a* through the top half of coil *L1*. Both tube sections act as a dynamic voltage divider between B+ and ground. The exact distribution of voltage depends upon the way each section conducts.



Chassis shown is made from one piece of sheet metal. Separate pan and front piece could be employed. Tabs on apron act as backstops.

Installation. To connect the *WRB* to the *PS*, follow the schematic diagram. Connect line *3* to one side of the speaker. Open the lead going to the other side of the speaker at any convenient point and connect line *1* to the end closest to the output transformer, and line 2 to the end nearest the speaker. This completes the project, except for setting the frequency of the *WRB*.

Turn on the *PS* and an AM radio. If you are working alone, place the AM radio, the *PS,* and the *WRB* close to each other to cut down the leg work. Set the selector switch in the *Both* position and the *Modulation* level control in the fully counterclockwise position on the *WRB*. Turn up the program on the *PS* to a moderate volume level and advance the *Modulation* level control on the *WRB* until the *Level* indicator flashes in "step" with the program. Tune the radio to a clear spot on the dial and adjust the oscillator coil on the back of the *WRB* until the signal is heard in the radio. If you don't get the signal on one end of the band, try the other end.

When the selector switch is in the *Off* position, the *PS* operates normally. In the *Both* position, the *PS* operates normally and the *WRB* transmits the program. In the *Remote* position, the speakers at the *PS* are cut off, but the *WRB* continues to transmit the signals from the speaker line.

The *Modulation* level control need only be used when the selector switch is in the *Both* position. Its main function is to limit the amount of signal sent to the broadcaster when the *PS* volume level is high. In the *Remote* position, the *Modulation* level control should normally be turned fully counterclockwise and the *PS* volume adjusted for proper level.

Since too much bass can cause distortion, it is better to keep the bass control at a minimum setting during preliminary adjustments and then advance it for the most pleasing tone.

After becoming familiar with the operation of the controls and the best setting for your AM radio, you will find the *WRB* easy to operate, mystifying to friends, and loads of fun. —30—

Amazing Apparatus

(*Continued from page 42*)

The more current applied to the coil, the shorter the column of mercury. Current was read by marks or graduations engraved alongside the column.

The Gyroscope. Outside of a few minor applications, the gyroscope was principally a scientific toy during the early nineteen hundreds. Although the first versions of the gyroscope were a far cry from the extremely refined and perfected versions that are used in our modern guidance systems, considerable ingenuity was demonstrated in their construction. Some of the early gyroscopes were powered with a hand crank, others pneumatically. A few battery-powered models were available, as was a much rarer steam-driven type that generated its own power within its moving parts.

Although the physical sciences have made tremendous advances over the past sixty years, it is difficult not to find something to admire in the instruments of those who pioneered this progress. And, lest we feel too superior, the instruments we consider advanced today are bound to become the cumbersome curios of tomorrow. —30—

ODDS 'N' ENDS

Emergency communications work by both hams and CB'ers in the Jacksonville, Fla., area during and after hurricane Dora was the subject of a highly laudatory report submitted by an agent of the Federal Communications Commission, James W. Thomas. The report states that members of the two radio services remained on duty as long as 72 hours without rest during the hurricane and its aftermath, September 8-11, 1964. The emergency network, organized by the ARC and the Jacksonville Amateur Radio Society, handled as many as 12 calls for assistance per minute, dispatching mobile units to deliver medicine, food, water, and candles. Radio operators and other volunteers braved the storm to deliver the supplies. A hearty "well done!" to all.

On The Citizens Band

(*Continued from page* 81)

nications facilities of 300 CB'ers within a matter of four or five hours. News of this impressive assist has been forwarded to us by Roy A. Schultz, 18W6148, president of the Tri-County Five Watters, Marengo, Ill.

The lone CB'er announced that he needed assistance in locating a Mr. Gerald Moser, as a serious accident involving a member of his family had occurred. Word was immediately passed among members of the Tri-County organization, which encompasses the counties of McHenry and Boone in Illinois, and Walworth county in Wisconsin. The initial message transmitted during the early evening hours gave Mr. Moser's name, call-sign, the fact that he was thought to be en route home from Canada, and that his vehicle was equipped with CB gear.

Marengo is located approximately 75 miles northwest of Chicago. Starting from this area, the message handling quickly spread not only to base stations as far southeast as Indiana and far north into Wisconsin, but to mobile units traveling the John F. Kennedy Expressway in and out of Chicago and on the freeway that extends as far north as the Wisconsin dells.

There was always the possibility that Mr. Moser had changed routes, headed towards Chicago, or even lingered along the way. The participating CB'ers wanted more information. Several long-distance telephone calls were placed to friends of Mr. Moser to get the make, model, color and license number of his auto. With the additional information, beams, mobiles and base stations along the way made a concentrated effort, mostly northward.

Finally, in the vicinity of 11:30 p.m. that evening, word spread from northern Wisconsin southward into Illinois and southeast into Indiana that Mr. Moser had been located and informed of the emergency. Three hundred CB'ers hung up their mikes and chalked up another noble assist, making each a little more worthy of the communications privilege issued him.

Mr. Moser and the Tri-County Five Watters asked that their thanks be extended to the 300 who participated in the search by mention of the assist in this column. We add our thanks also!

Club Chatter. The Madison County Rescue Squad, Huntsville, Ala., has elected its officers for 1965: Ed E. Sims, president; Paul A. Baker, vice president; C. B. Womac, secretary; Billy Stone, treasurer; Bailey Boyd, first sergeant; Dewitt Fairbanks.

water lieutenant; Ben Hubbard, land lieutenant; and Clifton Moore, support lieutenant. The squad, formed in August, 1963, was established solely as a rescue organization and has no affiliation with any club or social group. Each member has completed the ARC advanced first aid course. In addition, the group has a registered male nurse, an ARC first aid instructor, paramedics and scuba divers. The group has purchased a boat, motor and trailer and four vehicles were donated by local individuals and merchants. Their main project at present is the completion of a headquarters building (also financed by public donations and merchants' contributions) having an assessed value of $19,000.00. Rescue efforts by the squad have been made in cases involving drownings, rabid animals, lost children and, recently, a manhunt for an escaped convict who abducted and murdered a young woman during his escape. The squad monitors channel 6 on a 24-hour basis as KDB7910, or may be phoned at 534-5218 for assistance.

Organized 10 months, the O.W.L. CB Club (initials signifying Ogle, Whiteside & Lee counties) has a membership upwards of 100 and makes its home in Dixon, Ill. Present officers are: Chuck French, president; Greg Urey, vice president; Shirley Schrock, treasurer; and Ethel Buccola, secretary. The association also has a five-man membership committee and a sergeant at arms. Secretary Ethel states that the group is active in civil defense activities; and that its latest success project was a jamboree with "an attendance of thousands!"

The Wapello County Citizens Band Association, Ottumwa, Iowa, was organized last August. This club has been designated the official civil defense radio group for the county. Temporary officers: W. G. Fleming, KGH1530, chairman and CD coordinator; Curtiss Riedel, KGH1530-U3, secretary; Gene Jackson, KGI9184, treasurer. Bob Allender, KLH1157, and Harry Carpenter, KLH3572, handle public relations. The club meets every second Wednesday and monitors channel 6. A jamboree is planned for this spring.

Members of Atlanta Contac Radio Association, Atlanta, Ga., have been commended for their participation in the Retarded Children Fund Drive by fund chairman Bobby Dodd, Georgia Tech coach. This was a second annual event served by Contac members. Participants donated several hours for three consecutive nights in this worthwhile cause. Results of the 1964 drive totaled $44,800.00.

The Bridgeton-Ears CB Radio Club, Sea-

hawk, N. J., has been organized for less than a year. Present officers: Rolland Keller, KCD3018, president; Carl Pierce, KCD3216, first vice president; Bud Matheny, KCD5424, second vice president; George Williamson, KCD1907, secretary; and Clarence Sockwell, KCD1929, treasurer. The group meets every second Saturday of the month.

Chili-Ogden-Riga-Klub (CORK), Churchville, N. Y., has announced its officers for 1965: Ken Robinson, president; Harold Potter, vice president; Jerry Oakley, secretary/treasurer; Leslie Pimm and Harold Beatson, directors.

I'll CB'ing you.

Matt, KHC2060

Geometry Quiz Answers

(*Quiz appears on page* 54)

1 - J CARDIOID pattern graphically shows typical directional response characteristics of many good microphones.

2 - C CATENARY curve is the shape assumed by a long-line antenna freely suspended between two towers.

3 - H CONE shape is the most common design for loudspeaker diaphragms.

4 - D ELLIPSE as seen on the screen of an oscilloscope shows the phase relationship between two signals that are essentially the same.

5 - G EXPONENTIAL curve shows graphically the typical charging rate function of a capacitor.

6 - E HELIX is the shape of the grid winding in many vacuum tubes. Certain antennas for telemetry applications also have a helix-shaped element.

7 - A PARABOLOID is the shape of "dishes" used as signal-focusing reflectors for microwave equipment.

8 - I POLYHEDRON is the form of multi-faced solid in which mineral crystals such as quartz are found.

9 - B TOROID is a doughnut-shaped coil used in computer magnetic memory cores, integrated circuits, and other high efficiency applications.

10 - F TRAPEZOID as seen on the screen of an oscilloscope can be interpreted to reveal the percent of amplitude modulation of a carrier signal.

She Wore a Red Germanium

(*Continued from page* 59)

erate his interest. Whenever you see him, booster. Then invite him ohm to dyne."

"Watthour?"

"Dinner at eight, let's say. Get your wife to break out her best diode plate in his honor."

"I get your drift," Mike said. "We'll feed the brute good. Ham and spaghetti. Sort of soften him up, huh?"

"That's it, Mike. Now, pretty the old gal up. Have her go out and get her hair coiled. Buy her a germanium. Then, at dinner, don't forget to broadcaster virtues . . . amplifier charms."

"But that isn't quite honest," Mike protested. "I could lose my job! The boss is strong on employee fidelity."

"What's a little distortion in a good cause?"

"I just don't know, Doc. Ant Enna can be a bad veractor."

"It'll work, Mike. Her trouble is, she's been repressed. Give her half a chance and she'll currector dissipation."

"You're a great guy, Doc!" Mike exclaimed. "I feel better already."

The doctor walked with his patient to the door, and in parting, clapped a jovial hand on his shoulder.

"Oscillator, alligator."

"Sure thing!" Mike replied. "Soon as I unloader, you and I are gonna go out and throw a big calibration!"

"After a while, crocodile!" -30-

Short-Wave Report

(*Continued from page* 78)

other than a WPE number, but Mr. Waite was able to forward a majority of them to their proper destinations.

Several of the recipients of these cards are under the impression that they are actually QSL cards for a Ukrainian short-wave broadcast station. Nothing could be further from the truth. They are from a short-wave listener in the Ukraine who evidently wants to swap SWL cards with registered WPE'ers. If you have received a card bearing the call UB5-49532, it *cannot* be counted as a bona-fide QSL from any station.

Current Station Reports

The following is a resume of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Eastern Standard and the 24-hour system is used. Reports should be sent to P.O. Box 333, Cherry Hill, N.J., 08034, 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.

Angola—The *Emissora Oficial* short-wave schedule reads as follows: daily at 0100-0400 on 4820, 6025, and 7235 kc., at 0600-1200 on 6025, 6195, and 7235 kc., and at 1200-1900 on 3368, 4820, and 6025 kc. The 4820-kc. channel, which apparently replaces the former 4955-kc. outlet, has been noted daily with an extended schedule; Portuguese was heard at 1430-1800 and also around 0100 s/on.

Australia—The ABC newscast at 0600 was logged recently on VLT4 (4890 kc., Port Moresby), VLI6 (6090 kc., Sydney), and VLW6 (6140 kc., Perth), but VLR6 (6150 kc., Melbourne) carried a different program at that time. All stations were operating in the Domestic Service.

Basutoland—The Basutoland government broadcasts half-hour news programs twice daily, at 2345-0015 and 1230-1300 on 3824 kc., on ZNF4V, Maseru, which is operated by the Roman Catholic School Secretariat.

Bechuanaland—Station ZNB, Mafeking, has been noted during its weekday xmsn at 0600-0700 on 6220 kc., dual to 5900 kc. The 6220-kc. xmsn may possibly be a relay by an amateur station. According to *R. Sweden*, ZNB will close down in February, 1965.

Bolivia—Station CP77, *R. Sararenda*, Camiri, is a new one which is incorrectly identified in the *World Radio TV Handbook's* 1964 summer supplement. It has been noted on 4742 kc. with usual Latin American programming and a few commercials regularly to 2200. At times it may operate as late as 2230. The power is 200 watts. Reports go to Mr. Hugo Eyzaguirre, Director, Casilla 20, Camiri, Bolivia. Despite the frequency on which this station was logged, it was announced as being on 4885 kc.

British Guiana—Station ZFY, *R. Demerara*, Georgetown, was logged on 760 kc., over WJR, Detroit, around 1832 with an Eng. commentary on plantation farming; the Eng. is heavily Caribbean-

accented and is hard to understand until one becomes accustomed to it. The short-wave outlet on 3265 kc. has not been heard recently.

Brunei—Brunei Broadcasting Service is announced as being on 4865 kc. but is actually 2 kc. lower. It is readable at times around 0500-0515 in Chinese; at 0800 with the theme "March On The River Kwai" followed by classical music; time pips, ID, and local & world news at 0815; sports results at 0825, drama at 0830; and a BBC report at 0900.

Cameroon—Recent schedule of *R. Yaounde:* Mondays to Fridays at 2330-0200 and 1100-1300 on 4972 kc. and at 0600-0900 on 6040 kc.; Saturdays at 2330-0200 and 1200-1800 on 4972 kc. and at 0600-1200 on 6040 kc.; Sundays at 0000-0155 and 1200-1800 on 4972 kc. and at 0200-1155 on 6040 kc.

Canada—Montreal has a new xmsn at 0715-0813 in Eng. to Europe on 17,820 and 15,320 kc., and to N. A. and the Caribbean on 5970 kc.; a newscast, which is part of their "Over The Back Fence" program, is given at 0800. Earle Fisher's mailbag is heard well on Sundays at 0715-0745 on 15,300 kc.

China—"Lessons in Spoken Chinese" are broadcast to Europe from *R. Peking* on Mondays and Wednesdays at 1605 on 6210, 7080, and 9457 kc. There is an Eng. broadcast to S.E. Asia at 0700-0800 on 7035, 9650, 11,800, and 15,060 kc. A xmsn in Italian was noted at 1430-1500 and 1530-1600 on 6290, 7340, 7450, and 9860 kc., and an Eng. xmsn to Australia and New Zealand was noted on 9457 kc. at 0430-0530 with good signals but a flutter fade.

The China Press Agency, Peking, with its unmistakable dictation-speed news read by female announcers has been operating on the following outlets: 3820, 4480, 4500, 4920, 5005, 5525, 5925, 6240, 7256, 7526, 9135, 9180, 9266, 9330, 10,172, 10,478, 10,660, 11,120, 11,205, 11,415, 11,522, 11,590, 12,125, 13,845, 14,415, 14,465, 14,820, 14,880, 15,575, 16,105, 16,270, 16,345, 16,435, 17,505, 18,375, and 19,260 kc. The ID as given in Chinese is *Chung Kuo Hsin Wen Kwang Po Tien Tai*. All of the listed stations operate with between 3000 and 20,000 watts power.

Congo (East)—Leopoldville now broadcasts in French at 0500-0800 on 9660 and 11,830 kc. and gives the ID *Ici Leopoldville, capital de la Republique Democratique du Congo.*

SHORT-WAVE ABBREVIATIONS

ABC—Australian Broadcasting Corporation	kc.—Kilocycles
anmt—Announcement	kw.—Kilowatts
BBC—British Broadcasting Corporation	N.A.—North America
c.w.—Morse code	R.—Radio
Eng.—English	s/off—Sign-off
ID—Identification	s/on—Sign-on
IS—Interval signal	VOA—Voice of America
	xmsn—Transmission
	xmtr—Transmitter

Dave Sprague, WPE7BCP, does his monitoring in Reno, Nevada, with a Knight R-100A and "Space Spanner" and a Hallicrafters SX-62 receiver. Dave also has a wealth of hi-fi equipment in his shack.

Congo (West)—*R. Congo,* Brazzaville, presently is scheduled at 2330-0130 and 1030-1600 on 3264 and 4843 kc., at 0600-0800 on 7175 kc., and at 1215-1350 on 9715 kc., according to a recent verification. (Can anyone explain why recent veries bear Republic du Tchad postage stamps?) The 15,190-kc. channel is noted from 1400 to 1500 with music and talks in English; a newscast is given at 1430-1445.

Ecuador—Station HCJB, Quito, has reportedly moved from 11,915 kc. to 11,755 kc., and from 17,890 kc. to 17,860 kc.; recent tuning, however, indicates that the 11 915-kc. channel is still in use. Station HCAJ2, *Radiodifusora del Ecuador,* Guayaquil, 4765 kc., is heard well at 2200-0000 with Latin American pop tunes and commercials; reports should go to P. O. Box 4144, Guayaquil. Station HCEM1, *Ondas Carchenses,* Tulcan, 6065 kc., was noted with Ecuadorian music at 2018, and was readable until 2130 when the VOA signed on.

Egypt—*Voice of the United Arab Republic,* Cairo, 9475 kc., is heard often at 1630-1730 with an Eng. xmsn to Europe.

France—Paris has extended its 0800-0900 xmsn on 17,765 kc. to 0930; Eng. is broadcast from 0800 to 0830 and from 0900 to 0930, French during the 0830-0900 period.

Germany (West)—*Deutsche Welle,* Cologne, now uses 6145 kc. (replacing 15,405 kc.), 9735, and 11,925 kc. at 1710-1720 with music to N.A. The outlet on 9530 kc., dual to 7175 kc., can be tuned with Eng. news and "Music For You" at 1610-1700.

Greece—A station believed to be *I Foni Tis Ellados,* Athens, signs on at 1330 following an IS played on a flute or clarinet. A woman announcer gives the ID and some anmts between musical selections that range from Greek folk songs to modern jazz. The station, on 9605 kc., is weak but

SHORT-WAVE CONTRIBUTORS

Barbara Bergeron *(WPE1AXD)*, Somerville, Mass.
Bernard Dodge *(WPE1CIQ)*, Waterbury, Conn.
Francis Welch, Jr. *(WPE1CRT)*, Rochdale, Mass.
Grove Calkins *(WPE1EFG)*, Newton, Mass.
Bob Lowry *(WPE1FMI)*, Lynnfield, Mass.
Mike Larkin *(WPE1FNO)*, Lexington, Mass.
Clifford Stott *(WPE1FNQ)*, West Springfield, Mass.
James Powers, Jr. *(WPE1FWE)*, Natick, Mass.
Bill Smith *(WPE1FZ)*, Uxbridge, Mass.
Robert Hayes *(WPE1HN)*, Waltham, Mass.
Edward Tepper *(WPE2APZ)*, Bronx, N. Y.
Irwin Belofsky *(WPE2BYZ)*, Brooklyn, N. Y.
Bob Steward *(WPE2FXC)*, Hamburg, N. Y.
Paul Cerza *(WPE2GVG)*, Poughkeepsie, N. Y.
Ben Stanilka *(WPE2IYW)*, Ticonderoga, N. Y.
Blake Wilson *(WPE2KDA)*, Glen Rock, N. J.
Robert Quade *(WPE2LIB)*, Rochester, N. Y.
Robert Gunderson *(WPE2LUM)*, Jersey City, N. J.
Marvin Jacobson *(WPE2MAO)*, Brooklyn, N. Y.
Robert Leipow *(WPE2MDC)*, Brooklyn, N. Y.
Bernard Green *(WPE2MNJ)*, Brooklyn, N. Y.
Douglas Lamerson *(WPE2MNN)*, Richmond Hill N. Y.
Bill Bulchis *(WPE2MNU)*, Hawthorne, N. J.
Robert Clayton *(WPE3EHS)*, Lancaster, Pa.
Wayne Blair *(WPE3FAZ)*, Altoona, Pa.
John Marx *(WPE3FWA)*, Greensburg, Pa.
Bruce Churchill *(WPE4EVD)*, FPO, New York, N. Y.
Roy Moore *(WPE4FWH)*, Hazard, Ky.
Sam Henley *(WPE4GOS)*, Blackshear, Ga.
Richard Tygrest *(WPE4GXB)*, Hopewell, Va.
Dennis Osborne *(WPE4GXE)*, Waynesville, N. C.
David Jones, Jr. *(WPE4HID)*, Albany, Ga.
Carl Copeland *(WPE4HNL)*, Thomasville, Ga.
Bobby Conder *(WPE4HQT)*, Winston-Salem, N. C.
Michael Level *(WPE4HVV)*, Hollywood, Fla.
Del Hirst *(WPE5CFU)*, Snyder, Texas
John Edelkamp *(WPE5DVA)*, Fort Worth, Texas
Roberto Nin *(WPE5DVO)*, Bayamon, P. R.
Julian Jorstad *(WPE6DGO)*, Seaside, Calif.
Dave Brown *(WPE6EMI)*, Woodland Hills, Calif.
Michael Smith *(WPE6FDC)*, Los Angeles, Calif.
Charles McGeorge *(WPE6FTX)*, Fontana, Calif.
Ken Andrus, Jr. *(WPE7AMW)*, Tonawanda, N. Y.
Charles Reinsch *(WPE7CCH)*, Kirkland, Wash.
Louis Stober *(WPE7OO)*, Tigard, Oregon
Fred Wollf *(WPE8CAU)*, Sandusky, Ohio
Jess Dyer *(WPE8COJ)*, Dearborn, Mich.
Gary Bourgois *(WPE8FOH)*, Kingsford, Mich.
Dave Bock *(WPE8FQD)*, Davis, Mich.
Russell Hawkins *(WPE8GDP)*, Lavergne, Tenn.
Dan Knepper *(WPE8HGR)*, Toledo, Ohio
Steve Fetter *(WPE8HSM)*, Newark, Ohio
R. D. Palmer *(WPE9AST)*, Decatur, Ill.
Dennis Eksten *(WPE9DT)*, Loves Park, Ill.
Lauris Young *(WPE9ERX)*, Elgin, Ill.
Don Richmond *(WPE9FKF)*, Lyons, Ill.
Larry Cotariu *(WPE9GPJ)*, Chicago, Ill.
John Markiewicz *(WPE9GRW)*, Madison, Wis.
John Drueke *(WPE9GUA)*, Belleville, Ill.
John Beaver, Sr. *(WPEØAE)*, Pueblo, Colo.
Carl Luckett *(WPEØDVN)*, Overland, Mo.
John Allen *(WPEØDXW)*, Pueblo, Colo.
W. D. Rodgers *(WPEØEX)*, Florissant, Mo.
Jack Perolo *(PY2PE1C)*, San Paulo, Brazil
Sam McLauchlan *(VE2PE1B)*, Gatineau, Quebec, Canada
Tim Kerfoot *(VE3PE1TH)*, Toronto, Ontario, Canada
Michael Inch *(VE7PE9Q)*, Summerland, B. C., Canada
Peter Downs *(VP9PE1K)*, Paget, Bermuda
Howard Blasczyk, Palatka, Fla.
Alan Campbell, Pittsburgh, Pa.
Reagan Cartwright, Jr., Houston, Texas
James Eudaily, Millers Creek, N. C.
John Fournelle Bethesda, Md.
Emile Gallant, St. Joseph, Mo.
Bob Hill, Boston, Mass.
Frank McCabe, Jenkintown, Pa.
Dennis McMahon, Brooklyn, N. Y.
Don Nausbaum, Merrick, N. Y.
Jim Preston, Reedsville, W. Va.
Red Serbek, Hialeah, Fla.
Mike Singleton, Janesville, Wis.
Walter Steur, Columbus, Ohio
James Tamilio, Woburn, Mass.
Jim Wade, Afton, Va.
Harold Williams, Seymour, Conn.
John Woodruff, Wellesley, Mass.
Nagasaki News, FPO, San Francisco, Calif.
Radio New York World Wide, New York, N. Y.
Sweden Calling DX'ers Bulletin

readable at times to 1357 when *Deutsche Welle* covers it.

Guatemala—Station TGNA can be noted in Eng. at 2200-2300 on 11,850, 9670, and 5952.5 kc. The power is 5 kw. Most of the programs are religious. They ask for reports to be sent to Box 601, Guatemala City.

There is a medium-wave outlet on 720 kc. Has anyone logged it?

Lebanon—Overseas programs from Beirut are scheduled to Africa on 11,770 kc. in Eng. at 1330-1400, in Arabic to 1500, in French to 1530; to South America on 9680 kc. in Portuguese at 1800-1830, in Arabic to 1930, and in Spanish to 2000; to N. A. on 9680 kc. in French at 2030-2100, Arabic to 2130 and at 2200-2230, in Eng. at 2100-2130, and in Spanish at 2230-2300. There are omnidirectional xmsns at 2330-0230 and 1115-1330 on 5980 kc. and at 0430-0900 on 9545 kc.

Malaysia—*R. Malaysia* is noted on 9750 kc. at 1030-1045 with music, to 1055 with a commentary, to 1110 with songs having Eng. lyrics, and to 1115 with a commentary. This xmsn is primarily in Indonesian.

Mozambique—The new schedule for *R. Pax*, Beira, reads: Portuguese weekdays at 2300-0030, 0430-0630, and 1030-1600, Sundays at 0000-1600; native language weekdays at 1030-1130, Sundays at 0700-0800 and 1000-1030. The frequencies used are 3952 (announced as 3960), 5025, and 7205 kc.

Netherland Antilles—By far the most heavily reported station in the history of this column is PJB, *Trans World Radio*, Bonaire. At press time the station was not yet operating on a definite short-wave schedule but tests had been logged as follows: on 5955 kc. at 0320-0520; on 6170 kc. at 2030-2200; on 9600 kc. at 2030-2300; on 9690 kc. around 2300; on 9705 kc. at 2100-2200; on 9755 kc. at 2030-2200 and 0555-0724; on 11,795 kc. at 1100-1135; on 11,895 kc. at 1200-1300; on 11,970 kc. at 1545-1605; on 15,165 kc. at 1500-1615 and 1645-1800; on 15,240 kc. at 1130-1250; on 15.295 kc. at 1300-1430; and on 15,435 kc. at 1130-1135. According to the Dutch magazine *Circuit*, the frequencies that will be used for scheduled service are 17,720, 15,440, 15,435, 11,970, 9730, and 9705 kc. The medium-wave outlet on 800 kc. continues to be reported from nearly all corners of the U.S.; the schedule for that outlet is 0330-0735, 1715-1830, and 2030-2200, with Eng. listed for the 0530-0735 and 2030-2200 periods. The "Happy Station Program" from *R. Nederland* is definitely aired on Sundays at 1940-2030.

Station PJA6, Aruba, has reportedly returned to 905 kc.

Netherlands—*R. Nederland*, Hilversum, has replaced 15,425 kc. with 9590 kc., dual to 11,730 kc., for the weekday Eng. program at 1555-1650.

New Caledonia—*R. Noumea*, 3355 kc., has been heard with French, peaking at 0500 and featuring modern pop tunes.

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, verfication list, and fee to: Hank Bennett, Short-Wave Editor, P. O. Box 333, Cherry Hill, N. J. 08034. 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.

New Zealand—*R. New Zealand*, Wellington, will use this schedule until further notice: To the Pacific Islands at 1200-1445 on ZL7, 6080 kc., and ZL18, 9520 kc., and at 1500-0045 on ZL4, 15,280 kc.; also at 0100-0345 on ZL7, 6080 kc. (on Sundays to 0300) and on ZL2, 9540 kc. To Australia at 1500-1730 on ZL18, 9520 kc., and at 1745-0045 on ZL21, 15,110 kc. (on Sundays the latter xmsn will not

be broadcast from 2100 to 2200); also at 0400-0645 on ZL2, 9540 kc., and on ZL7, 6080 kc. To Antarctica (Sundays only) at 2115-2145 on ZL3, 11,780 kc., and at 0315-0345 on ZL7, 6080 kc. To Samoa in the Samoan language at 0200-0230 (Tuesdays only) and to the Cook Islands and Niue in the Rarotongan and Niuean languages at 0245-0305 (Wednesdays only) and at 0300-0320 (Saturdays only); both on ZL7, 6080 kc., and on ZL2, 9540 kc. Reports are welcomed and should be sent to *R. New Zealand*, Box 2396, Wellington, C. 1, N. Z.

Nigeria—*Voice of Nigeria*, Lagos, is scheduled at 1200-1400 in Eng. on 15,295 kc., and from 1400 in French on 15,255 kc. English has also been observed on 11,900 kc. from 1300 to 1400, the xmsn opening with a newscast.

Peru—Station OAX4G, Lima, 6190 kc., was noted at 1940-2030 with a political speech.

Portugal—Seldom-logged *R. Renascenca*, CSB2, 6155 kc., was heard at 0103 with a clear ID in Portuguese and a prayer to the accompaniment of "O Little Town of Bethlehem." According to some sources, this station does not s/on until 0200.

South Africa—Paradys is heard from 0050 to 0120 fade on 9650 kc., with music to 0100, then an ID in Afrikaans followed by news in the same language, music to 0115, then a produce market report.

Southern Rhodesia—Gwelo, 3296 kc., has been noted with BBC news at 2300 and a short weather report at 2310. Dance music followed interrupted by many anmts and ads, readability quite poor.

Sweden—*R. Sweden*, Stockholm, has made changes in the Eng. programming to the U.S. The current schedule reads: 0900-0930 on 15,240 kc., 2045-2115 (to Eastern U.S.) and 2215-2245 (to Western U.S.) on 5990 kc.

U.S.S.R.—According to a Los Angeles newspaper, *R. Yerevan* is nonexistent. The article reads: "One of the most talked about radio stations behind the Iron Curtain is a nonexisting one. It is called *Radio Yerevan*. Yerevan is the fictitious source to which anti-regime jokes are credited. For instance, *R. Yerevan* reported that a Russian, on arriving in Hades was asked by the Devil which section he wanted to go to, the Communist or the Capitalist. 'The Communist,' he answered. 'I know the heating won't work there.'" All of which makes us wonder about the identity of the station that is being widely reported and verified. Can anyone confirm the nonexistence of this station?

Venezuela—Station YVKO, *R. Nacional de Venezuela*, Caracas, 6170 kc., has been noted after 2230 with long classical music periods. It signs off at

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.

Fifty Countries Verified

Paul Herman (WPE6EKB), Montebello, Calif.
Robert Kunitsky (WPE2HUF), Linden, N. J.
William G. Graham (WPE2LMU), Binghamton, N. Y.
Jan M. Dyroff (WPE3DSU), Norristown, Pa.
Howard D. Chapman (WPE9DJN), Chicago, Ill.
Jerry Haley (WPE4FNI), McMinnville, Tenn.
Grant D. Cooper (VP9PE1G), Smiths Parish, Bermuda
Marshall H. Cannell (WPE1FHL), Wellesley Hills, Mass.
Richard H. Grab (WPE2HYM), Elmhurst, N. Y.
Edward Tompkins (VE3PE1ZJ), Toronto, Ontario, Canada
Paul Brenner (WPE1EMD), Chestnut Hill, Mass.
Larry Standley (WPE4FZS), Gastonia, N. C.
John N. Brunst (WPE4BQ), Neptune Beach, Fla.
Ian Roberts (VK2PE2E), Newport Beach, Australia
Dick Schier (WPE4HIO), Chattanooga, Tenn.
Robert H. French (WPE8FGH), Bellaire, Ohio
Douglas Stark (WPE3FSX), Bethesda, Md.
Warren S. Studebaker Jr. (WPE8ACA), Cincinnati, Ohio
Bruce Eastwood (VK3PE1B), Terang, Australia
Charles F. Washburn (WPE1FO), Bangor, Maine
Daniel Dravet (VE2PE1EB), Montreal, Quebec, Canada
Thomas A. Giordano (WPE3EZQ), Philadelphia, Pa.
Jirair M. Moughamian (OD5PE1C), Beirut, Lebanon

Twenty-Five Countries Verified

Philip Berkeley (WPE1ENY), Swampsco, Mass.
Robert Sharkey (WPE3DYG), Pittsburgh, Pa.
Fred L. Parsons (VE3PE1ZI), Welland, Ontario, Canada
Andrew L. Benson (WPE3FTC), Philadelphia, Pa.
Robert Read (WPE4HPB), Atlanta, Ga.
John T. Reynolds (WPE8EJW), Martinsburg, W. Va.
R. Stephen Dildine, Jr. (WPE5CUO), Los Alamos, N. Mex.
John E. P. Draut (WPE2JVI), Bronx, N. Y.
Reg Williams (VE5PE5U), Portage la Prairie, Manitoba, Canada
James F. Bradley (WPE1FKP), Dover, Mass.
Robert A. Howell (WPE8GXG), East Lansing, Mich.
Harvey L. Goldberg (WPE2FUU), New York, N. Y.
Edward J. Semrad (WPE9GTP), Milwaukee, Wis.
Edward White (WPE3DVP), Chester, Pa.
Lewis J. Stommel (WPE6FKQ), Saratoga, Calif.
William Black (WPEØDZR), Kansas City, Mo.
Thomas Hart (WPE1EGH), Hyde Park, Mass.
Dennis Reid (WPE6FFD), Morgan Hill, Calif.
Bill Bulchis (WPE2MNU), Hawthorne, N. J.
Michael Mayeux (WPE5DXS), Baton Rouge, La.
Jim Russell (WPE9GYH), Monmouth, Ill.
Douglas Parker (WPE2LGH), New York, N. Y.
Wayne Grenne (WPE5DXZ), Shreveport, La.
Alan L. Michalek (WPE1CRM), Springfield, Mass.
Jack Lazarovic (VE2PE1GH), Montreal, Quebec, Canada
Charles N. Coombe (WPE2MOB), Trenton, N. J.
John A. Rasmussen (WPE3DGU), Kennett Square, Pa.
Tom Czerniak (WPE9HCF), South Bend, Ind.
Raymond G. Tipton (WPE3APC), Reisterstown, Md.
Steve Jafolis (WPE1FEP), Manchester, N. H.
David Glow (WPE1FKZ), Pepperell, Mass.
Merv W. Butler (ZL1PE1AF), Dunedin, New Zealand
Patrick Richardson (WPE9GLO), Chicago, Ill.
A. Eugene Newsome (WPE4HRZ), Winston-Salem, N. C.
David Paul (WPE3FKR), Philadelphia, Pa.
Michael Rugo (WPE8HOY), Youngstown, Ohio
Martin Granica (WPE2HGD), Hamburg, N. Y.
Chas. J. Matterer (WPE6DGA), San Leandro, Calif.
Robert Osowicki (WPE2LVD), Amsterdam, N. Y.
Johnny Simmons (WPE4HVC), Macon, Ga.
Lawrence A. Edler (WPE6FQV), Daly City, Calif.
Mike Ferguson (WPE8EET), St. Joseph, Mich.
Allan L. Tirevold (WPEØDBK), Terril, Iowa

Allan Tirevold, of Terril, Iowa, is a licensed amateur as well as a reporter for this column. His ham call is WNØHQQ (he hopes to have his General license soon); his SWL registration, WPEØDBK.

2330 after giving the complete schedule for the following day and a full ID.

A new station is YVRW, *R. Bocono*, 5010 kc., logged around 2000.

Vietnam (North)—Eng. broadcasts from Hanoi are scheduled at 2330-2345 and 0830-0900 on 11,840 and 9840 kc., at 0500-0530 and 1030-1100 on 15,116, 11,840, 11,760, 9840, and 9760 kc., and at 1100-1130 on 15,116, 15,044, 11,840, 9840, 9760, and 4684 kc. The address is: *The Voice of Vietnam*, 58 Quan Su St., Hanoi, North Vietnam. Check with your postmaster before mailing reports to this address.

Clandestine—*R. Portugal Libre* was noted from 1615 s/on to 1645 s/off on 9453 kc., entirely in Portuguese.

Utility Stations

In case you happen to wander from the normal broadcast channels and want to try logging a few countries that are not too commonly heard, you might check on the following stations:

Barbadoes—Stations ZNX, ZNX31, and ZNX51 all operate around 11,100 kc. with c.w. xmsns and some point-to-point telephone circuits. Reports go to Chief Engineer, Boarded Hall, Cable and Wireless West Indies Ltd., Bridgetown, Barbadoes.

Bermuda—Look for ZFD49, St. Georges, on 10,636 kc., which has frequent test xmsns beamed to New York between 0630 and 0830, especially at the beginning and end of each week. Another station is ZFD23, which broadcasts on 5725 kc., with 3000 watts.

Curacao—This country is easily heard via PJL9, 9846 kc., 3000 watts, with xmsns beamed to Surinam. A point-to-point station, PJL9 is located in Willemstad, and generally operates at 0630-0830. Reports can be sent to: Government Radio and Telegraph Administration, Box 103, Willemstad, Curacao, Netherlands Antilles.

Another station in Curacao is PJT, 12,800 kc., heard nights in contact with New York.

Surinam—*Paramaribo Calling*, PZB48, transmits on single sideband and directs telephone xmsns to New York on 17,676 kc. Reports should go to: Government Telephone & Telegraph Service, Gravenstraat 33, Paramaribo, Surinam.

Trinidad & Tobago—If you'd like to log Trinidad, check for ZBD48, 10,727 kc., on single sideband with 3000 watts. This station has occasional test periods. For verifications, write to B. G. Commissiong, Deputy Engineer (Wireless), Cable & Wireless West Indies Ltd., located in Port-of-Spain, Trinidad.

-30-

POPULAR ELECTRONICS

January 1965

ADVERTISERS INDEX

Freeze Motion With Sound

(*Continued from page* 46)

to the center conductor of a phono plug, and the negative lead to the shell. Connect the plug to *J2* on the trip unit.

Operation. Any camera can be used with the trip unit and flash as long as time or bulb exposures are possible. If your camera has only a bulb shutter position, you'll need a locking-type shutter release cable. A 35-mm. camera is ideal for use in high-speed photography. Fine cameras are available at reasonable prices, depth of field is excellent, film costs are low, and you can project your results in the form of 35-mm. color slides.

Set your experiment up in a room that can be darkened somewhat. While total darkness is not required, the lighting level must be reduced to the point where room illumination will not register on the film during the period the shutter is open. Install the electronic flash on the camera and mount the camera on a tripod. Focus the camera on the object to be photographed and adjust the camera iris for normal flash exposure of the film used at the object-to-flash distance. Follow the instructions supplied with the electronic flash for this setting.

Position the microphone near the object to be photographed—the distances given for the various photos shown in this article will give you a rough idea as to how mike placement affects results. Advance the sensitivity control on the trip unit until the noise developed by the event to be photographed triggers the flash. Now dim the lights, open the camera shutter, initiate the event, note that the flash fires, and close the camera shutter. If you want to record a time-graduated series, move the mike away from the object to be photographed in increments of a few inches and shoot a series of photographs.

The results that can be achieved with this simple piece of equipment are almost unbelievable. If the initial results are short of your expectations, keep experimenting. Make sure that extraneous noises are not tripping the flash prematurely. Good shooting! —30—

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

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

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

WPE-CB-QSL cards—Brownie-W3CJI—3111A Lehigh, Allentown, Pa. 18103. Catalogue with samples 25¢.

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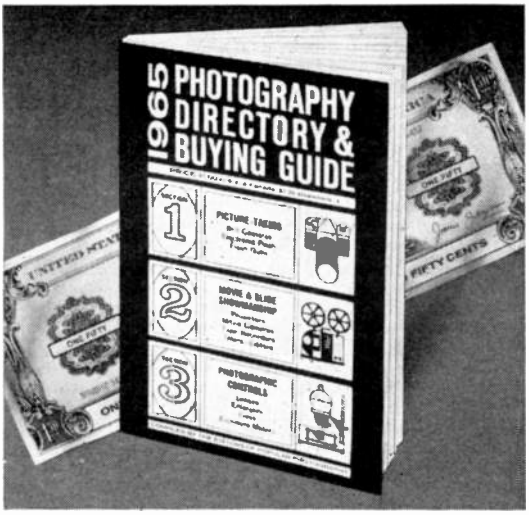

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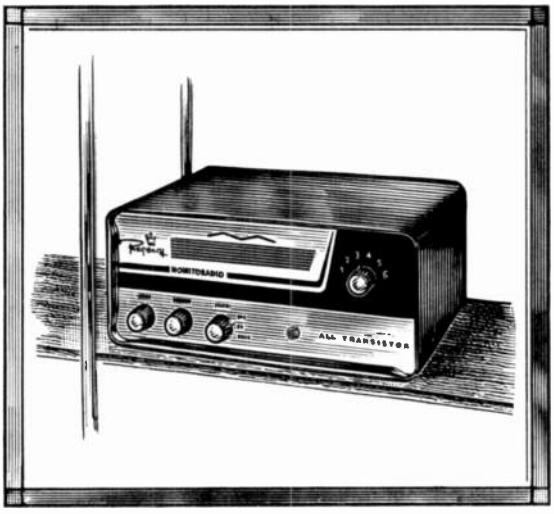

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