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DECEMBER 1963

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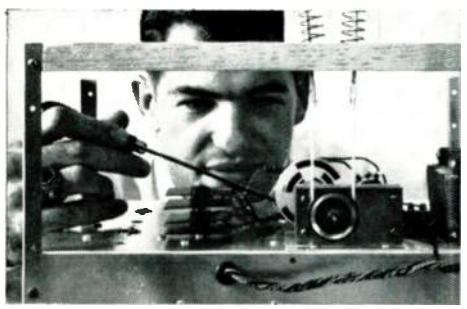

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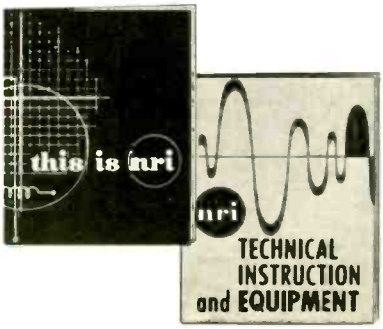

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VOLUME 19 DECEMBER 1963 NUMBER 6

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Amateur, CB, and SWL

Electronic Features and New Developments

Departments

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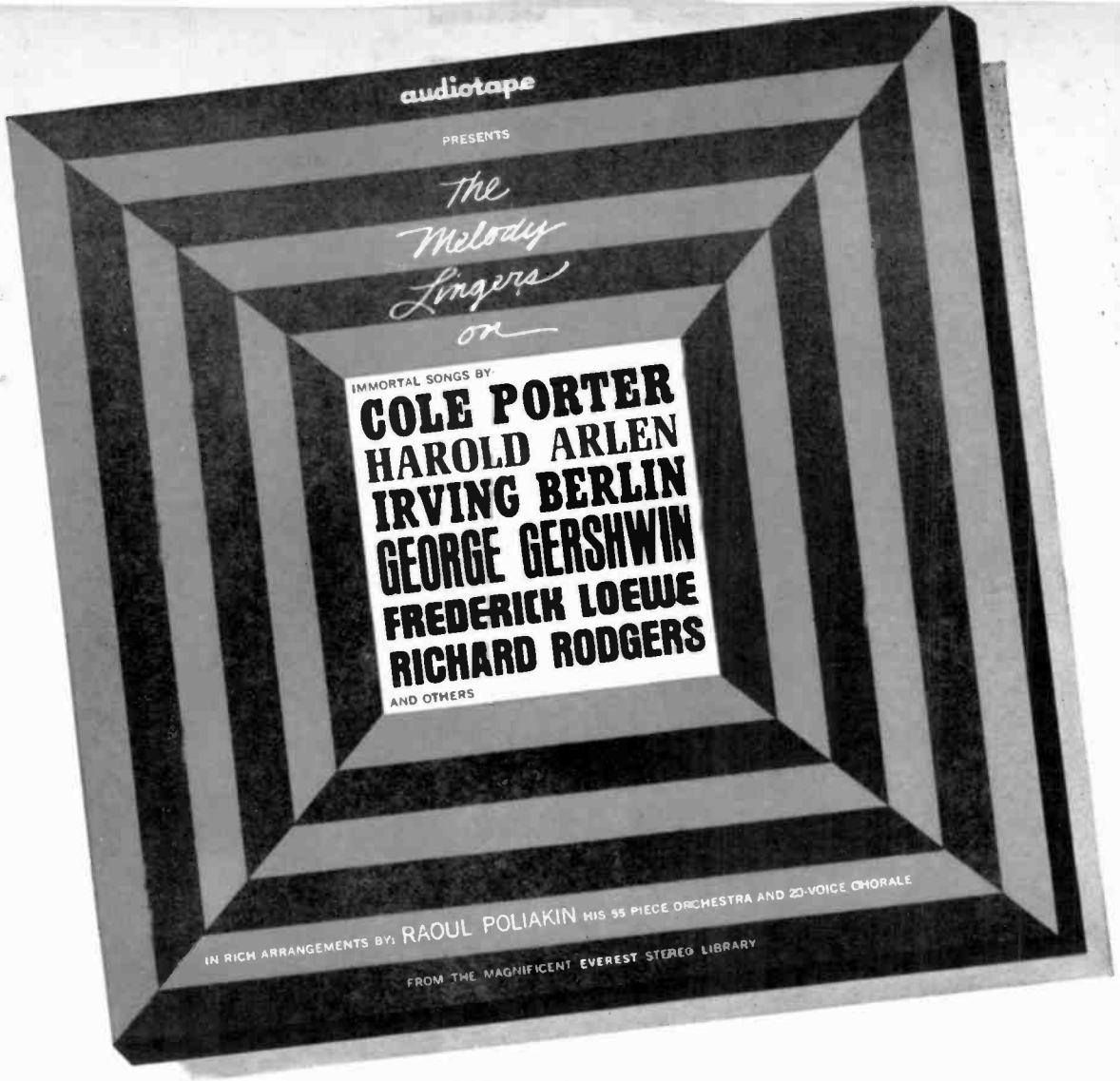

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FCC Report

By ROBERT E. TALL
Washington Correspondent

THE FCC PROPOSAL that the Class D Citizens Radio Service be permitted to use two additional frequencies—27.235 and 27.275 megacycles—along with the various other radio services, has finally been dropped. The move was originally conceived by the FCC back in February, 1962, along with a number of other changes in allocations involving two-way mobile radio communications services, mostly in the 25-42 mc. band.

In completing action on the proposal this fall, the Commission decided that the present allocation of the two frequencies "should be retained rather than permitting the Citizens Radio Service to share in their use." The agency noted that a review of current authorizations on these frequencies "shows substantial usage" which might be "severely impaired" if the CB service were brought into the picture. Also, "there is a serious question as to how much usage the Citizens Radio Service would be able to make of these frequencies in light of existing operations."

Filing Fee Situation. After virtually ignoring FCC matters during the first half of the year, Congress buckled down to some intensive study of the Commission's operation in several areas during the past month or so, including consideration of the agency's plan to set up a system of collecting fees in connection with applications for radio station licenses. Under the FCC's plan, each application for a license in the Citizens Class B, C, or D Services would have to be accompanied by a check for $8 from the applicant.

Most of the radio organizations in the country were up in arms about the plan, but in late September the Commission announced that it was going ahead with the program, in an action denying 17 formal petitions which asked the agency to call it off. This announcement stung Representative Walter Rogers (D., Tex.) into action on the floor of the House of Representatives, where he charged that the FCC had not been given authority by Congress to make such a move, and urged that Congress "promptly act so as to make it crystal clear that further attempts to encroach

FCC Report

(*Continued from page* 6)

upon the powers of Congress will not be tolerated."

Other Congressmen, off and on, have made statements to the effect that they did not care for the FCC's plan, but real action was promised by Representative Rogers' statement since he is the Chairman of the House Interstate Commerce Communications and Power Subcommittee, and he publicly announced that his subcommittee would hold hearings in the matter.

Amateur License Forms. As was done earlier in the case of the Citizens Radio Service, the FCC has now made revisions in its Amateur Radio Service application forms to make possible machine processing of the applications. The Commission combined FCC Forms 610 and 610A, used when applying for licenses for amateur operation, amateur station, amateur club station, and amateur station under military auspices.

The revised Form 610 is to be used when applying for any of these types of licenses, including new, modified, or renewed authorizations. Applications filed on older versions of the form (May, 1963, and before) will not be accepted after November 30, 1963, the FCC said.

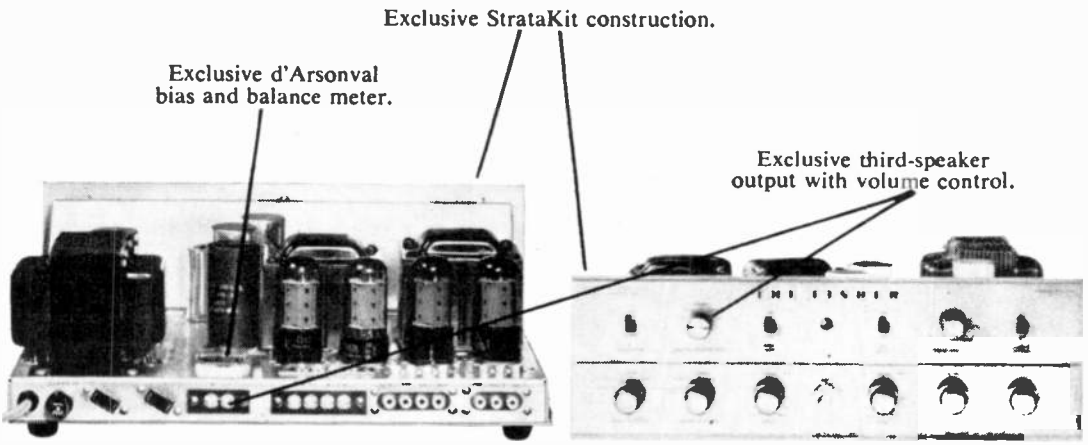
Public Safety Radio Monitoring. The "unauthorized use and divulgence of public safety messages," the FCC declared in a public notice, "is a violation of Section 605 of the Communications Act and may subject the licensees and others involved to criminal prosecution." Radio broadcast stations were the principal offenders mentioned by the FCC, but its warning is also applicable to Citizens Band licensees who who may be monitoring police or fire radio transmissions.

The Commission said it is "disturbed" by the receipt of complaints, "fortunately not numerous," that the activity of some radio stations "in monitoring and divulging to the general public the content of police and fire radio transmissions has resulted in interference with the work of police and fire departments contrary to the requirements of public safety."

Radio licensees of the Commission, the agency said, "should contact officials of the public safety agencies whose radio transmissions are desired to be monitored in order to obtain the necessary authorization and to ascertain the conditions under which use and divulgence are appropriate," and anyone wishing to monitor the transmissions "must give all due consideration to the considerations imposed." —30—

"Well worthy of the Fisher name, both in performance and in ease of construction...Beautifully packaged and 'instructed'...Excellent specifications, and the performance equals or exceeds the specs."

—AUDIO MAGAZINE



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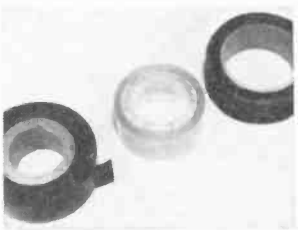
Tips and Techniques

USE PRESSURE-SENSITIVE TAPES THE WAY THE EXPERTS DO

Do you have much use for sticky tapes as insulation, or to hold things together? To save your fingernails, turn back the sticky side a quarter-inch or so on its self when you finish with the roll. Next time you'll pick up the end from the roll easily, and you can snip off and discard the doubled end. When using rubber or plastic tape, stretch it slightly as you work, and the job will be tighter and smoother. When using cloth tape, lay the new roll flat and make two light cuts across both "ends" of the roll so it won't ravel at the edge. Store tape flat, and away from heat and high humidity.



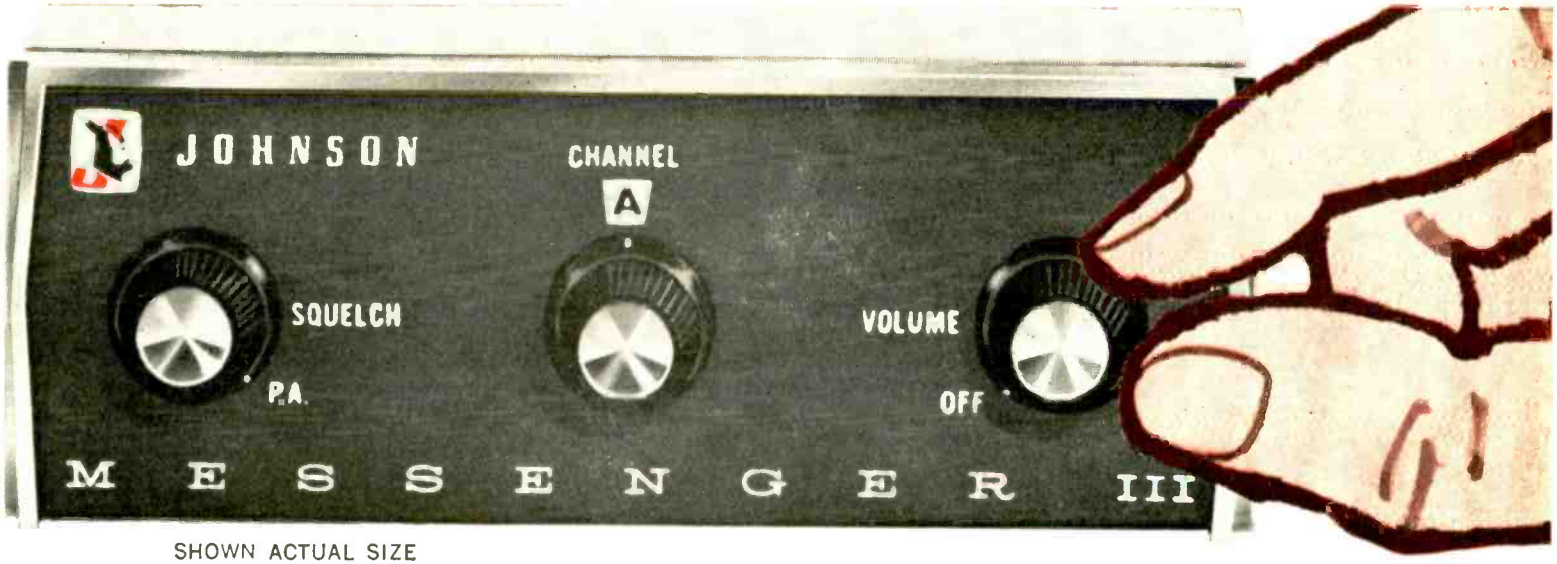
—E. G. Louis

QUICKLY IMPROVISED MICROPHONE STAND

Those inexpensive crystal and ceramic microphones usually come without any stand or other means of mechanical support. In a pinch, you can improvise a mounting with a rubber suction cup —widely sold in auto and ten-cent stores—having a machine screw in the boss. Drill and tap a hole in the rim of the microphone case, taking care not to damage the sensitive element. Put a nut on the screw first, screw the microphone on, and back the nut up against the shell as a lock nut. Now you can mount the microphone on any smooth surface, and the resilience of the support will provide vibration isolation.

—John A. Comstock

(Continued on page 12)



SHOWN ACTUAL SIZE

NEWEST!
MOST VERSATILE!
MOST POWER OUT!

The 11 Channel "Messenger III" will change every idea you ever had about what a Citizens Band unit should offer! Tiny, all transistor, it's really quiet, really hot! Interchangeable for base or mobile—use it as a full 5-watt battery powered portable pack set or a 3-watt PA system. Other transistor-type units equalled but didn't exceed the performance of tube-type units—but the "Messenger III", with an aero-space transistor developed for the "Relay" communications satellite, delivers more power output with maximum legal input! Double conversion receiver with high 1st IF provides excellent spurious and image rejection. Set-and-forget "Volume" and "Squelch" controls make it possible for the first time to work "close-in" or at extended range with your initial settings. Furnished with dynamic microphone with "full-grip" push-to-talk bar. Full line of accessories available for selective calling, portable field pack, or public address use!

See "Messenger III" at your distributor's or write for full color literature.

Catalog No.	Net
242-150 "Messenger III"	$189.95
250-823-1 AC Power Supply	$29.95

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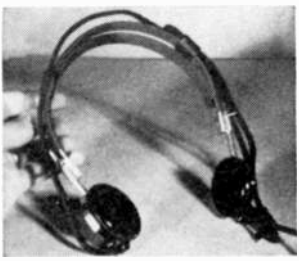
Tips

(*Continued from page* 10)

REDUCE HEADPHONE CORD ENTANGLEMENT

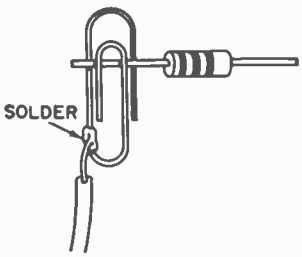
Headphone cords of the standard pattern that hang with the apex of the Vee under your chin often snag things on the desk or knobs on equipment with disastrous results. If your phones are of this type, don't despair. Just tape the cord from one earpiece along the headband as shown, and tape the Vee part and the slack cord from the other earpiece in a neat bundle on top of the headband.



—Robert E. Kelland

HAYWIRE TEST CLIPS FOR EMERGENCY USE

If you find yourself in need of spring clips in a hurry, the lowly paper clip can be pressed into service as a temporary substitute for the real thing. Use the copper-clad kind if they're handy, but either sort will do. Just solder a wire lead to the end of the clip opposite the end that opens, as shown, and slide the clip over the wire to be contacted.



—Irving B. Wheeler, Jr.

IMPROVE LOW-COST AMPLIFIER PERFORMANCE ON TUNER INPUT

Miniature audio amplifiers such as the Lafayette PK-544 offer an easy way to boost low-cost tuner output. Unfortunately, high distortion results when the output of some tuners like the Lafayette PK-633 is applied directly to the amplifier input, regardless of the amplifier gain setting. The cure is to insert a resistor in series with the off-ground lead of the tuner output. Cut and try, starting with a .47-megohm, ½-watt resistor, reducing the value until the distortion barely reappears on the strongest station. Then go back to the next larger value.

—Rufus P. Turner

The sound from this new Shure cartridge is awesome in its vitality & clarity

A NIGHT-AND-DAY DIFFERENCE

From the very first prototype, the sound from the new Shure Series M44 Stereo 15° Dynetic Cartridge was incredible. Even skeptical high fidelity critics have expressed unconcealed surprise at the audible increase in brilliance, clarity, transparency, presence, fullness and smoothness of this amazing new Shure development. A close analysis of its performance reveals startling differences in this cartridge—although not extraordinarily improved in the "usual" areas of frequency response (still a virtually flat 20-20,000 cps) or in compliance (25 x 10^{-6} cm/dyne)—rather it is in the distortion measurements where Shure engineers have achieved a highly significant and dramatic reduction of *75% to 90%* in IM and harmonic distortion from even such admirably distortion-free cartridges as earlier versions of the Shure Stereo Dynetic. Further, cross-talk between channels has been effectively negated in the critical low frequency and mid ranges . . . providing superior channel separation throughout the audible spectrum.

SCRATCH-PROOF RETRACTILE STYLUS

And, as if that were not enough, the new 15° cartridge incorporates a totally efficient retractile stylus that momentarily retracts whenever excessive forces are applied to the tone arm. It cannot scratch records—even if bounced onto the record or dragged across the grooves.

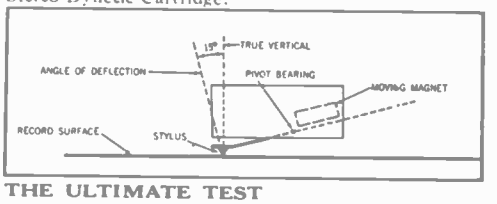
PERFECTION IS A MATTER OF DEGREE

It has been known for some years that a difference between the angle used to cut stereo records and the angle of the stylus of the cartridge used to play them would result in an increase in IM and harmonic distortion audible on certain records. With widely different cutting angles employed by the record companies, the effective angle of the playback cartridge stylus had of necessity to be a compromise so as to provide the best possible results from records of all makes.

Recently, industry attention was focused on this problem by a series of technical articles ascribing the difference in effective vertical angles between the cutter stylus and the playback cartridge stylus as a cause of distortion and urging the adoption of a standard effective angle to which records would be cut.

Major record companies have now begun to use an effective cutting angle of 15°, which is the proposed standard of the RIAA (Record Industry Association of America) and EIA (Electronic Industries Association.)

With the emergence of the single standard effective vertical tracking angle for cutting records, Shure engineers immediately began what seemed on the surface the seemingly simple but in actuality the arduous and exacting task of converting their formidable Stereo Dynetic cartridge to the 15° effective tracking angle. It couldn't be done. So Shure designed this radically new moving-magnet cartridge that will track at an effective angle of 15°. Graphically, this is the kind of cartridge geometry involved in the new Shure Series M44 15° Stereo Dynetic Cartridge:



THE ULTIMATE TEST

You must hear this cartridge to appreciate the totality of the sound improvement. It will be instantly recognizable to the ear without the necessity for elaborate test instruments or A-B listening tests—although we assure you, instruments and A-B tests will more than substantiate our claims.

M44 SERIES SPECIFICATIONS

	M44-5	M44-7
Frequency Response:	20-20,000 cps	20 20,000 cps
Output Voltage at 1000 cps (Per Channel, at 5 cm/sec peak velocity):	6 millivolts	9 millivolts
Channel Separation (at 1000 cps):	Greater than 25 db	Greater than 25 db
Recommended Load Impedance:	47,000 Ohms	47,000 Ohms
Compliance:	25 x 10^{-6} cm/dyne	20 x 10^{-6} cm/dyne
Tracking Range:	¼ to 1½ Grams	1½ to 3 Grams
Inductance (Per Channel):	680 millihenries	680 millihenries
D.C. Resistance (Per Channel):	550 Ohms	550 Ohms
Stylus:	.0005" diamond	.0007" diamond
Stylus Replacement:	N44-5	N44-7
Cartridge Price, Net (Including stylus):	$49.50	$44.50
Replacement Stylus Price, Net:	$21.75	$16.75

Monophonic Styli:

Model N44-1—For monophonic LP records, with .001" diamond $16.75 net
Model N44-3—For 78 rpm records, with .0025" diamond $14.25 net

SHURE

Stereo 15° Dynetic®

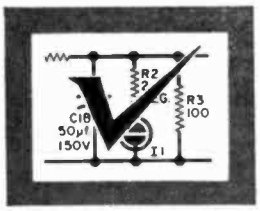
SERIES M44 SCRATCH-PROOF CARTRIDGE WITH RETRACTILE STYLUS

the new standard in distortion-free hi-fi cartridges

LITERATURE: Shure Brothers, Inc. 222 Hartrey Avenue, Evanston, Illinois

Manufactured under U.S. Patents 3,055,988; 3,077,521 and 3,077,522. Other Patents Pending

Operation Assist



THROUGH THIS COLUMN we try to make it possible for readers needing information on out-dated, obscure, and unusual radio-electronic 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 to OPERATION ASSIST, POPULAR ELECTRONICS, One Park Avenue, New York 16, N.Y. 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. And don't send return envelopes; your response will come from fellow readers. Because we get so many inquiries, none can be acknowledged, and POPULAR ELECTRONICS reserves the right to publish only those requests that normal sources of technical information have failed to satisfy.

Schematic Diagrams

Philco Model 42-360, BC and s.w. receiver, about 1939. (Greg Jones, 576 Radcliffe Ave., Pacific Palisades, Calif.)

Freed-Eisman Model 746, 5-tube BC receiver, early '20's. (F. E. Stillman AO818078, 108-2 Summit Dr., Minot AFB, Minot, N.D., 58704)

Midwest Radio TV-receiver, ser. 0220082, using 12LP4A, no other data. (L. E. Williams, Rte. 1, Windsor, Miss.)

Fairbanks Morse Model 68, 6-tube table model radio, BC and s.w., about 1938; **Model 15BR-1535A** AM/FM/phono, ser. 448610, maker and date unknown. (Paul Smith, 121 W. Rogers Ave., Hartford, Wis.)

BC-625-A transmitter, Signal Corps surplus, also operating data. (Joe Horner, 2901 Jackson St., Amarillo, Texas, 79109)

Freshman Masterpiece 5-tube radio, battery-powered, #B 111848, no other data. (Neal Klausner, 14465 Summerfield Rd., Cleveland 18, Ohio)

Kolster Model K-120 8-tube BC receiver, made by Brandes. (Robert M. Miller, 107 N. Long Dr., Rockingham, N. C.)

Sylvania Model 548 BC set, with clock, probably made in 50's. (M. Karsin, 18 N. Woodford St., Worcester, Mass., 01604)

Thordarson Model T-31 WO8 70-watt audio amplifier, about 1940, ser. 21074. (Edward Pallanti, 77 Rentell Rd., Hamden 18, Conn.)

Kent tape recorder, Model 501, about 1961, also maker's address. (Alex Rychalsky, 22 Carroll Court, Bridgeport, Conn., 06607)

(*Continued on page* 20)

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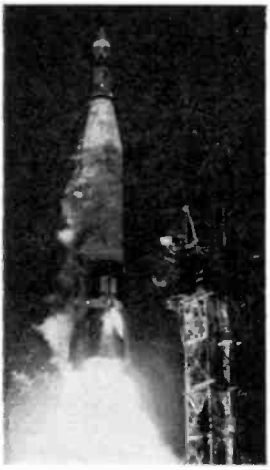

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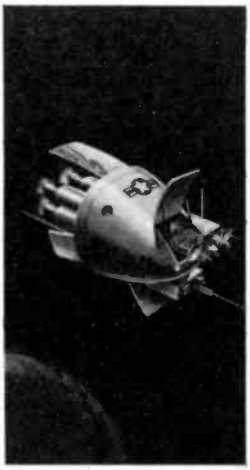

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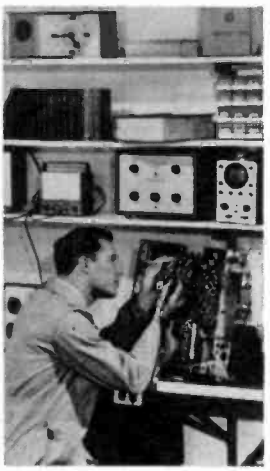

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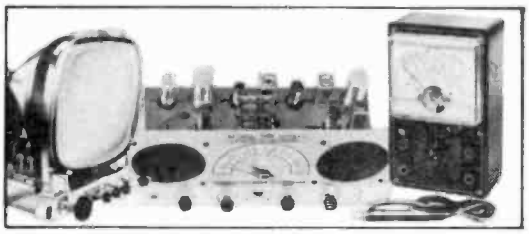

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Operation Assist

(*Continued from page* 14)

Harristahl 8-meter mobile transmitter, Model ME-6 (or NE-6). (J. A. Diefenbach, Box 782, Lincoln AFB 18, Nebr., 68518)

Bosch Model 595, floor style, 4-band receiver, no date. (Arthur W. Brown, 88 Governor St., E. Hartford, Conn.)

Stromberg-Carlson 11-tube, 5-band radio, i.f., BC and s.w. bands. (W. Golden, 8909 S. Dante Ave., Chicago 9, Ill.)

Magnavox Model CR152, 11 tubes, 3 bands, BC and s.w., about 1945. (D. Smith, 227 Wayside, San Antonio, Texas)

Philco code 121, chassis 59 BC receiver, no date. (John W. Rater, Fontanelle, Iowa)

Crosley Model 715, 7 tubes, BC and s.w., about 1933. (John Kuschell, 9170 Abington, Detroit, Mich.)

Silvertone 4-band receiver, chassis 101.657, about 1950. (B. Boehme, 3038 Oak Forest, Houston, Texas, 77018)

Zenith Model 100, ser. N415042, no other data. (Patrick Katzka, 1477 Wishon Ave., Fresno 28, Calif.)

Ranger Examiner tube tester, Model 440, ser. 1544.; **Ranger** Examiner signal generator, Model 540, ser. 1842; both made about 1935, no other data. (Steve Gordoni, 9044 Constance Ave., Chicago, Ill., 60617)

Philco Model 42-390, code 121, 8-tube, BC, s.w., FM radio. (S. E. Palmer, 309 E. Norman Ave., Arcadia, Calif.)

Special Data or Parts

Espey Model 581, 8 tubes, BC and two s.w. bands, ser. 18645, any technical data. (Don Rex, 2556 Georgetown, Toledo 13, Ohio)

Simpson Model 333 tube tester, any technical data; **R9A/APN-4** Loran receiver, operating and maintenance manuals. (Alan Mark, P.O. Box 372, Pembroke, Mass.)

Ultrason Model U-300 ultrasonic generator, ser. 109, made by Televiso Prod. Co., any technical data. (J. R. Metler, 7336 N. Waukegan Rd., Niles 48, Ill.)

Airline Model 62-192, 12-tube, 3-band radio, ser. H-53X82-2C, made 1935, any technical data. (Thomas Lynch, 143 Woodgate Dr., Boonville, N.Y.)

Ambassador Series 200 AM/FM radio, using 12AT7, 6BJ6 (3), 6BH6, 12BE6, 19TS, and 50L6, any technical data. (Calvin Doyle, 3203 W. Martin St., San Antonio 7, Texas)

BC-342-N Army surplus receiver, any technical data, also tubes. (Ronald Ellison, P.O. Box 3735, APO 231, New York, N.Y.)

Masco Model 500 tape recorder, output transformer wanted, or suitable replacement. (Peter Piasecki, 124 Morningside Drive W., Bristol, Conn.)

Tuska Type 225 receiver, 3 tubes, ser. 13698, any technical data. (John M. Vaughan, Box 156, York Springs, Pa.)

O-12/UPM-1 i.f. signal generator, surplus, using 6C5 and 6J6, any technical data. (Bill Svendsen, 1904 N. Dekum, Portland 17, Ore.)

Atwater Kent Model 20 receiver, about 1925, using five UX-201A and CX-301 tubes, any technical information such as battery data. (David E. Smith, RD 2, Box 260, New Hope, Pa.)

GE Model T-709, BC and s.w., pre-WWII, has push-button and manual tuning, power transformer needed, schematic, and any other data. (David A. Rogers, 500 Kepler St., Gretna, La.)

Zenith Model S 702351, 10-tube BC and s.w. radio, any technical data, and type 1232 tube. (Steve Stanich, 1022 N. Berwick, Indianapolis 22, Ind.)

Goodyear Wings Model 741, 3-band radio, series A, about 1937, case needed. (Jerry Barton, 26828 Fort Meigs Rd., Perrysburg, Ohio)

Tuska Radio Apparatus Co., Type 225, ser. 2412, 3-tube, 6-band battery-operated radio, patented 1914(!); any technical data, C-300, UX112A tubes, and also third tube—if type known. (Greg Dockter, Goodrich, N.D.)

-30-

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You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment.

Many thousands of individuals of all ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

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You will receive all parts and instruction necessary to build 20 different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, instruction Manuals, hook-up wire, solder, selenium rectifiers, volume controls and switches, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C.-type Questions and Answers for Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

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

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

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

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

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

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

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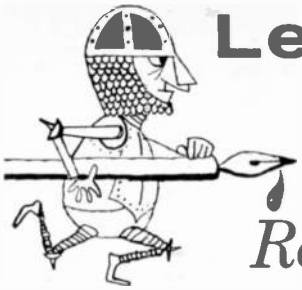

Letters *from our Readers*

Address correspondence for this department to: Letters Editor, POPULAR ELECTRONICS, One Park Avenue, New York 16, N. Y.

What's What Nonsense Box?

■ In building the "Nonsense Box" (July, 1963), I decided to incorporate an idea that was used in the "What's What Light," featured in the same issue. I wired magnetic and mercury switches in parallel, inserted them in the positive battery lead, and mounted them inside the "Nonsense Box." My "Box" is even more erratic than the original, and the mercury switch acts as an on-off switch when the box is placed on its side.

MIKE COGGIOLA
Albany, Calif.

"Inductaphons" Aid Hard-of-Hearing

■ I have just had my attention drawn to the article entitled "Build the Inductaphons" in the May, 1963, issue. Before this article appeared, I had written a similar article which subsequently appeared in another magazine. Both articles failed to mention the important fact (it was edited out of mine) that the people most likely to benefit from such an installation are those with a hearing loss, for whom I originated this idea back in 1928. Most hearing aids are already equipped with an "Inductaphon" in that they have a telephone listening feature—a small pickup coil which is substituted for the mike by means of a small switch. Thus, all that's required is a loop connected to a TV set, hi-fi, etc.

S. HAMILTON
Victoria, B.C., Canada

It Ain't Necessarily So

■ You insist on promoting CB radio as a hobby, and some of your articles subtly encourage the ingenuous CB'er to dig into his own transmitter—a violation of Section 19.71, Part C, of the FCC Rules. Now the CB'er is interested in super modulation, ways of increasing power without getting caught, antennas with fantastic gain, and working DX. POPULAR ELECTRONICS and other publications which have hopped on the band wagon have made the CB the lazy man's ham band.

C. MROZ, WA2LDC
Eden, N.Y.

If WA2LDC would take the time to read this publication (we find it hard to believe he has done so to date), he would note that POPULAR ELECTRONICS *does not advocate experimenting*

with or modifying a CB transmitter. (There have been articles on modifying a CB rig for use by licensed hams on the 10-meter ham band—perhaps he is referring to those?) Articles for CB'ers are designed to help establish better 11-meter communications under the regulations established by the FCC. POPULAR ELECTRONICS *has never encouraged so-called CB "hobby" interests, and those interested in two-way radio as a hobby have been urged, in print, to secure an amateur license.*

Related Projects Built

■ Congratulations on publishing a fine selection of circuits. To date I have built a power supply (Variable Voltage . . . You Pick It," January, 1963), the "Add-On S-Meter" (February, 1963), a Q-multiplier ("Citizens Band Q-Multiplier," *1962 Electronic Experimenter's Handbook*), "The Signal Monitor" (May, 1962), and the VFO in the December, 1961 issue ("Across the Ham Bands," page 74). All of the circuits work fine, and are inter-related. The power supply provides filament and B-plus voltages for the S-meter and Q-multiplier. The monitor and VFO will be used in the future when I pass my General exam. I blame you completely for letting the electronics bug bite me.

TED RUBENSTEIN, WPE2JRY
Brooklyn, N.Y.

You sound like a veteran projecteer, Ted. By the time you get your General, you'll certainly have a thorough knowledge of circuits and construction techniques. Good luck!

Single-Sideband Tuning Tips

■ Thanks for the information in the November, 1962, issue on tuning SSB signals ("Across the Ham Bands," page 75). Although my receiver is the regenerative type, I found that by tuning carefully with the bandspread and then slowly advancing the regeneration control SSB signals become understandable. Usually you have to retune with the bandspread while advancing the regeneration. This method works quite well.

ISAAC A. DAVIDIAN, WPE6EDS
Fresno, Calif.

■ A helpful hint in tuning single-sideband signals is to put a vernier dial or large tuning knob on the receiver's BFO shaft. Try it, and you'll see how easy it is to bring in SSB.

MARTIN MANDELBERG, WPE2IZY
Emerson, N.J.

Thank you, Martin and Isaac, for the ideas. Both should make SSB tuning easier, especially with receivers lacking elaborate features.

Fast Relay Demonstrates Weightlessness

■ I needed a fast-acting photocell relay to trip a camera flash for a science fair demonstration on "Weightlessness in a Falling Body." The flash had to stop and "freeze" a jar falling from a height of 13 feet. The relay—which really came through—used the circuit designed by Malcolm Green which appeared in the December, 1962, "Transistor Topics." My partner and I won a first in the Senior Physics Division at the district level, and went on to win a first at the state level. I would like to thank everyone concerned for this little piece of equipment which helped us go so far.

JOHNNY FUTCH, WPE4BMR
Nashville, Ga.

Congratulations on your two "firsts," Johnny. We're pleased to learn that the photocell relay circuit helped you build a winning project.

"Starved Circuit Amplifier"—R&D?

■ The "Starved Circuit Amplifier" (July, 1961, page 69) and its modification, "Add Vitamin L . . ." (November, 1962, page 74) seem like a good start for an R&D (Research & Development) project for P.E.'s readers. A modification I would like to present—I incorporated it into my unit—is the addition of one resistor, which just about doubles the volume. I had noticed that the volume of the amplifier was greatest just before the tube heaters were fully warmed up. So, adding a 3-ohm, 5-watt resistor in series with the heaters really put me in business.

W. E. BRUHNKE, W4EQT
Fort Lauderdale, Fla.

It looks like vitamin L plus vitamin R equals a stronger and healthier amplifier. But how many vitamins can you feed a "Starved Circuit" before it's no longer starved?

Master Magnet an Award Winner

■ I want to thank POPULAR ELECTRONICS and author Walter B. Ford for the "Master Magnet" (September, 1962). My magnet won a prize in our school science fair.

How about an article on how to build (or buy) an *inexpensive* computer instead of the $1500 job described in the June, 1963 issue ("From Surplus, A Bargain Computer")?

STEVE ROBERTS
Jeffersontown, Ky.

Congratulations on completing the project and winning an award, Steve. (Incidentally, Steve is an up-and-coming sixth grader, just ten years old.) We'll certainly keep an eye out for interesting computer projects—unfortunately, though, cost rises with complexity.

(*Continued on page 24*)

Letters

(*Continued from page* 23)

Rabbit Ears for Stereo FM

■ After reading "TV's Best Guarded Secret . . ." (August, 1963) I tried adjusting my rabbit ears antenna to the lengths recommended for the channels in our area and was amazed by the improvement in reception. The only question I have is how should I adjust rabbit ears for FM? They seem to improve my results, especially with stereo.

EDMUND D. MITCHELL
Portland, Ore.

The proper length, Ed, would be 32 inches at the low end of the band (88 mc.), and 26 inches at the high end (108 mc.). Although adjustment should not be too critical, you can easily estimate the right length for any station in between given the above figures.

DX'ing the BCB: More Letters

■ I have logged 489 stations on the medium waves, including 35 states, six Canadian provinces, and 12 countries. Best catches are WPTW, Piqua, Ohio (250 watts); KAIM, Honolulu (5000 watts), and KYA, San Francisco (1000 watts). I have also logged every clear channel station in the country, *Radio Americas,* and *both* VOA stations in Florida.

JACK DARDEN
Irving, Texas

■ In addition to articles on DX'ing the broadcast band, you might include construction projects and technical information on making BCB receivers more sensitive and selective.

MICHAEL KALMAN
Wethersfield, Conn.

Look for the first of several articles on BCB DX'ing and related topics in the January or February issue of POPULAR ELECTRONICS.

Out of Tune

2-Meter Simple Superhet (*September,* 1963, *page* 43.) Center lug of control *R9* connects to pin 1 of *V3* as shown in schematic; this is not quite clear in the pictorial. Capacitors *C4, C8, C9, C10,* and *C11* are 47-$\mu\mu$f. ceramic disc or tubular units, not 47-μf. units as in Parts List.

MPX Meter (*November,* 1963, *page* 43). The battery and meter polarities are reversed in the one-transistor schematic of the MPX Meter. The negative battery terminal should go to *Q1*'s emitter. —30—

How do you advertise a product when legitimate claims are unbelievable?

"A really good component stereo system for $109.00? Preposterous! Ridiculous! Absurd!"

We honestly hesitate to use the same old superlatives. Instead, we offer a dizzyingly daring LISTENER'S GUARANTEE. You prove for yourself—the new CONAR Custom "300" complete stereo system—for only $109.00—is a real breakthrough into professional quality. You go ahead and *build* the stereo amplifier. If what you hear doesn't astonish and please you, return the whole system within thirty days, *built-up amplifier* and all. We'll *refund every penny!*

But maybe we're not so daring. Just foxy: First, there's your personal assembly handbook—so clear you can make a fascinating "dry run" without touching a part. Then there's the layout of the amplifier—so clean there are no multiple hard-to-get-at connections. If you're all thumbs, your wife can build it in a few hours—more or less. And to be real sneaky, the tricky little job of mounting a stereo cartridge correctly in a tone arm is done before the components reach you. Instant music. You just plug your components into your handsome, just-built amplifier, and you're hooked. (If hard bitten audio men could care less about a $109.00 complete stereo system *until they heard ours*, what can you do but join the experts? Their comments dazzled and delighted us.)

Here are the components we tease you with: a Custom "300" complete stereo amplifier kit with a beauty of a baked enamel steel case; two completely assembled speaker enclosures 24 x 12 x 10, ready to finish to match your home's decor, ¾" thick acoustic wood, beige with metallic gold grille cloth; diamond cartridge by Electro Voice; record changer with heavy duty 4-pole constant speed motor complete with oiled walnut base; plus all necessary phono and speaker cables.

The CONAR Custom "300" complete stereo system is for you if you're a beginner in audio kit building with a wife sitting on the budget . . . an audiophile who wants to forget compulsive up-grading and buy records with abandon . . . or just a plain unbeliever who can't pass up a challenge.

Unbeliever, especially, we love you . . . the CONAR Custom "300" complete stereo system—including the amplifier you BUILD—must astonish and please you or every cent back. AN OFFER UNMATCHED BY ANY OTHER KIT MANUFACTURER—could anything be fairer? So why not order today?

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Division of National Radio Institute
3939 Wisconsin Ave., Washington, D. C. 20016

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Address.....

City.....Zone....State.....

(Custom "300" is shipped exp. chgs. coll.)

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R-E-G-E-N-C-Y . . .

Just in case you had thought of giving me anything this nice . . . but, of course, a cigar lighter would be o.k. too.

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use an "x" ☐

New FLIGHT MONITORADIO AIRCRAFT RECEIVER

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POP'tronics Bookshelf

AMATEUR RADIO CONSTRUCTION PROJECTS

by Charles Caringella

Chuck Caringella, a frequent contributor to POPULAR ELECTRONICS, has assembled eleven new (previously unpublished) transmitter-receiver projects in this book. Roughly half of them are intended for operation on 40 or 80 meters, half for 2 or 6 meters. The transmitters are all low-powered and the receiving converters all crystal-controlled. Emphasis is placed on good engineering design, ease of construction, and foolproof operation. Any Novice, Technician, or General Class ham lacking extensive experience should be able to get on the air with one or more of these units at minimum expense.

Published by Howard W. Sams & Co., Inc., 4300 W. 62 St., Indianapolis 6, Ind. 136 pages. Soft cover. $2.50.

GE SILICON CONTROLLED RECTIFIER HOBBY MANUAL

Just as the title implies, this little book contains SCR circuits for hobbyists—the electronic experimenter, shop specialist, model railroad fan, photographer, etc. Fifteen projects complete with parts lists and pictorial wiring diagrams make up the bulk of the book, and two chapters on semiconductor operation are thrown in for good measure. A handy source of SCR circuits.

Published by General Electric Company, Box A, Auburn, N.Y. 76 pages. Soft cover. $1.00.

CB RADIO CONSTRUCTION PROJECTS

by Len Buckwalter

In your reviewer's opinion, this book is aimed at a very small audience. For a price

Bookshelf

(*Continued from page* 28)

of about 19 cents a project, the reader is given information on various CB accessories and operating aids he can build. Most of the projects are simple, some exceedingly so. All but four of them have appeared in one version or another in one of the electronics hobby-interest magazines in the past two years, three of the four being so simple that they are more in the "tip" rather than the "project" category. If you use CB and have absolutely no previous electronics knowledge, this book should be of value to you—it shows what can be done for a minimum investment in time and dollars.

Published by Howard W. Sams & Co., Inc., 4300 West 62 St., Indianapolis 6, Ind. Soft cover. 112 pages. $2.50.

AN INTRODUCTION TO HI-FI & STEREO

If you're contemplating an investment in hi-fi equipment—or if you're just tired of sitting and listening while your audiophile friends bandy about such terms as "channel separation," "damping," and "intermodulation"—this small publication is for you. A surprisingly large amount of information is packed in its 64 pages, and a few minutes spent with it will give you a good acquaintance with modern stereo hi-fi.

Published by the Institute of High Fidelity, Inc., 516 Fifth Ave., New York 36, N.Y. 64 pages. Soft cover. 25 cents.

Free Literature

A look at the new, 100-page 1964 Heathkit catalog makes one point clear: the Heath line of do-it-yourself electronics kits is expanding. Included are hi-fi units, color and black-and-white TV, electronic organs, tape recorders, and AM/FM radios—not to mention amateur and CB gear, marine radio equipment, automotive accessories, and test equipment. A "must" for the kit builder, the 1964 catalog is available from Heath Company, Benton Harbor, Mich., 49023. . . . Ask for a copy of Schober Organ's 20-page booklet describing their new transistorized "Recital," "Consolette II," and "Spinet" consoles, and you will also receive a special seven-inch record that will give you a taste of Schober Organ sound. A complete price list showing how much it costs to build your own organ is included. Write to Schober Organ Corp., 43 West 61 St., New York 23, N.Y. -30-

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- No costly compressors
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- CLAMP-ON CAN holds full quart
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- For 115V AC operation
- Fully guaranteed
- ALUMINUM DIE CAST HOUSING for light weight and rugged durability
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  Powerful GE motor and rotary action spin the paint at a steady 17,000 RPM . . . actually makes the Sloan-Ashland Paint Gun impossible to clog in operation!
- Reduces misting and overspray to a minimum. Eliminates 90% of usual masking! No more need to cover everything in sight.

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New Products

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PHOTO-ELECTRONIC WARNING SYSTEM

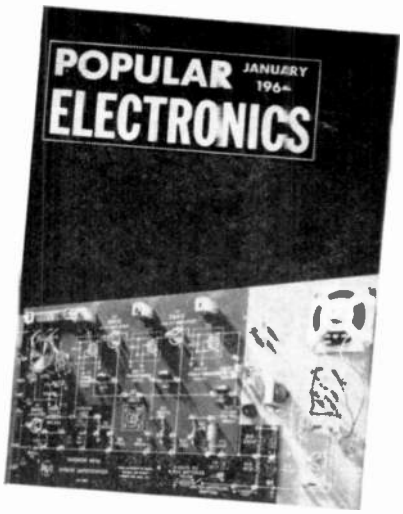
Lafayette Radio's PC-45 is a complete indoor warning or counting system. It consists of two units—a light projector and a receiver unit—which can be connected to (1) signal the arrival of anyone entering a room, (2) count people or merchandise, and (3) sound an alarm. The PC-45 has two

modes of operation: intermittent, for counting; and continuous, for alarm devices. Size of each unit: 3" x 4¼" x 4½". Price, $18.95 per 2-unit set. Optional electric bells, buzzers, and counters are available at addi-

(*Continued on page* 38)

WHAT'S COMING UP IN JANUARY

3 BONUS CONSTRUCTION PROJECTS FOR YOU



X-Line Tachometer:

Detailed instructions for building a transistorized tachometer using low-cost semi-conductors. Expanded scale of 0-5000 r.p.m., instead of 0-8000 r.p.m. enables easier readout. Can be built for less than $20. Special explanation about attaching this "X-Line" tach to any automotive ignition system (car or boat) with 2 or 4 stroke; 4, 6, or 8 cylinders.

Two-Tube Superhet For 80-Meter Ham Band:

Complete directions for building a superheterodyne receiver covering the 80-meter amateur band. The design requires only two vacuum tubes; all parts are inexpensive and readily available. The tuning is easy because of the large, smooth-action dial and the 80-meter band is spread across almost the whole arc of calibration, making it easy to pick out individual stations.

Build the WXCVR:

Construction plans for building a single transistor converter that you can set on the channel of your major nearby airport and follow the weather forecasts issued by the FAA. It can be attached to a regular broadcast-band AM receiver. This article includes list of airports that broadcast FAA forecasts.

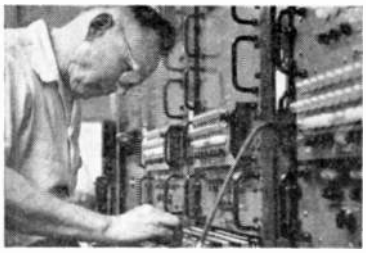
PLUS THIS EXCLUSIVE FEATURE:

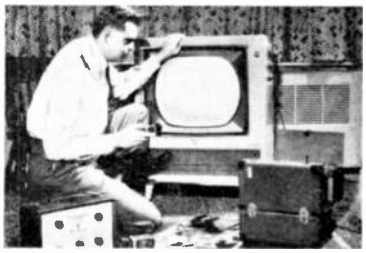
Can You Trust a Drugstore Tube Tester?

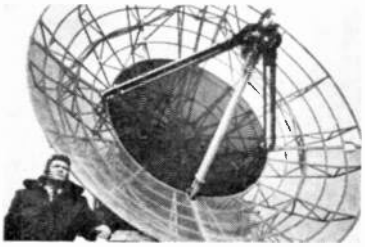
The friendly neighborhood drugstore has added a new twist lately: a place to test faulty tubes. How reliable are these tube testers? POPULAR ELECTRONICS assigned TV technician Art Margolis to find out. Here's the humorous answer to the whole question; complete with technical information and timely tips.

Plus more projects, more features and all regular departments

Be sure to get your copy of January
POPULAR ELECTRONICS On sale December 19th.







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New Products

(*Continued from page* 32)

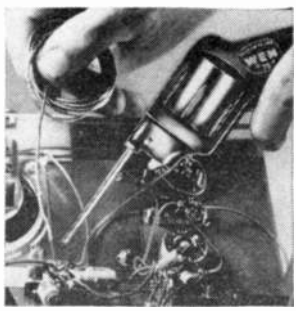
tional cost. (*Lafayette Radio Electronics Corp.,* 111 Jericho Turnpike, Syosset, L.I., N.Y.)

TRANSISTORIZED POWER CONVERTER

The Tripp-Lite "Power-Verter" 100 plugs into the cigarette lighter in your car, boat, trailer or plane, and converts the d.c. battery current to 60-cycle a.c. house current. It allows you to use your electric shaver, listen to FM or hi-fi, or operate a tape recorder or dictating machine. You simply plug the desired electric appliance into it. Transistorized, and with no moving parts to wear out, it operates even when the engine is not running. Input: 10 amperes maximum at 13 volts. Output: 125 watts intermittent, 100 watts continuous. The "Power-Verter" weighs 5½ pounds, comes with a 10′ cord and lighter plug. Price, $39.95. (*Tripp-Lite,* 133 N. Jefferson St., Chicago 6, Ill.)

ALL-PURPOSE SOLDERING PISTOL

Two new developments are incorporated in the Model 75 Wen soldering pistol: a heating element made of a high-temperature metal used in space research, and a thermal control which automatically regulates the wattage needed for different soldering jobs. The instant-heating, fast-cooling pistol produces the heat of a 100-watt device from a peak surge of only 50 watts, and has a normal draw of only 30 watts. No current is wasted. Housed in shock-resistant molded red plastic, it provides the versatility of the soldering pencil used for intricate jobs, yet has the capacity for heavier soldering work as well. Price, $4.95. (*Wen Products, Inc.,* 5810 Northwest Highway, Chicago, Ill.) —30—



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Speakers & Cabinets

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It's the world's most comprehensive BUYERS' GUIDE to the hi-fi market. Everything you need in sound is featured in the 180 product-packed pages of the 1964 STEREO/HI-FI DIRECTORY. It gives you the vital statistics – photos, prices, and performance data—on over 2000 components from 177 different manufacturers. It's the best way to see and compare speakers, enclosures, cartridges, changers, amplifiers, tone arms, FM tuners, tape recorders and FM antennas *before* you buy.

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The 1964 STEREO/HI-FI DIRECTORY is your indispensable guide to the total-sound market. It's on sale now at your favorite newsstand or hi-fi dealer's. Or fill in this coupon and we'll send you a copy.

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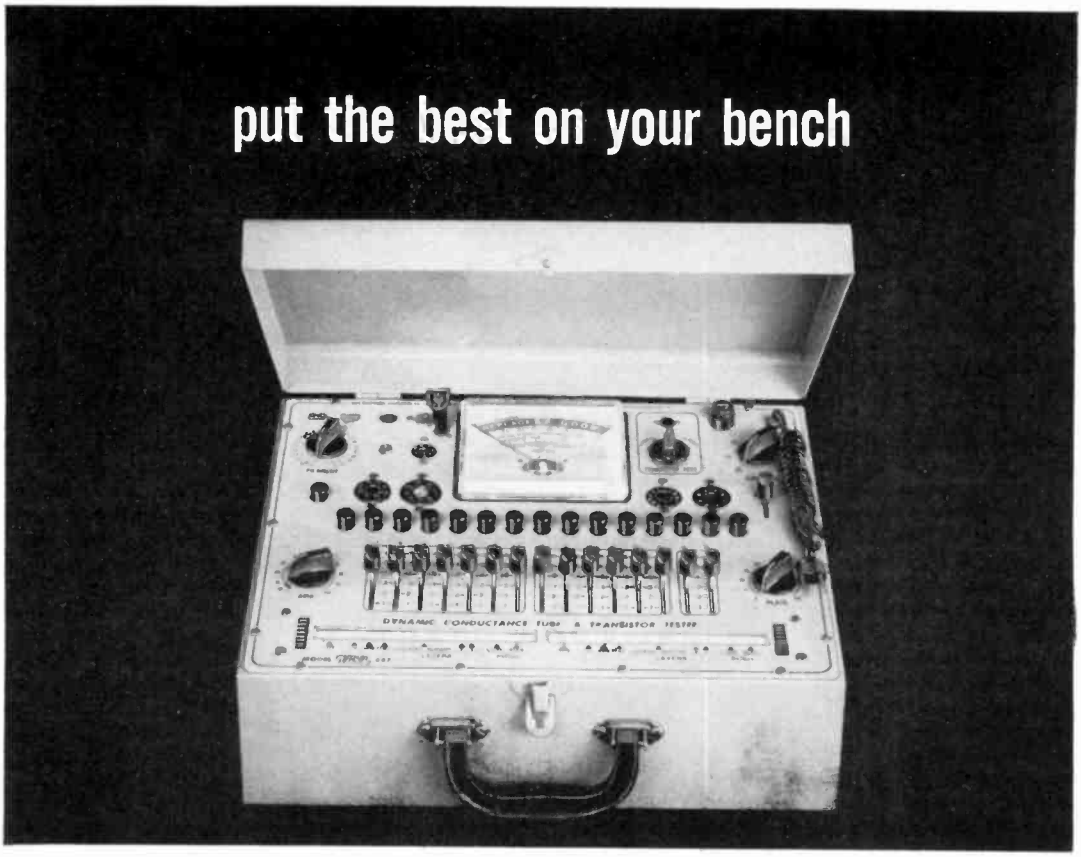
PE 1'23

put the best on your bench



EICO 667

dynamic conductance tube and transistor tester

The EICO 667 will earn money for you by catching the bad tubes an emission tester would miss. The 667 combines a mutual conductance test with a peak emission test to give a single reading of tube quality. Bad transistors can be spotted easily. Gain and leakage tests find the defective ones.

TESTS ALMOST EVERY DOMESTIC OR FOREIGN RECEIVING TUBE MADE. The EICO 667 checks 5 and 7-pin Nuvistors; 9-pin Novars; 12-pin Compactrons; 7, 9 and the new 10-pin miniatures; 5, 6, 7 and 8-pin subminiatures; octals and loctals. It will also check many low-power transmitting and special purpose tubes, voltage regulators, cold-cathode regulators, electron ray indicators, and ballast tubes. And by inserting pilot lamps into the special output in the center of the Novar socket you get an instant good-bad test of these lamps.

TESTS MADE UNDER ACTUAL TUBE OPERATING CONDITIONS. When one section of a multi-purpose tube is being tested, all sections are drawing their full rated current. Pentodes are tested as pentodes rather than combining all the elements for a simple emission check. Leakage between tube elements is read directly on a 4½" meter in ohms.

EICO 667 NEVER WILL BE OUTDATED. A new rollchart is prepared periodically. Data on one or two tubes, can be added by unsnapping the windows over the chart.

TRANSISTORS CHECKED IN TWO STEPS. First for leakage, then for Beta or current amplification factor. Both are read directly off the meter dial, and both n-p-n and p-n-p transistors can be checked.

FEATURES OF THE 667. Multi-circuit lever switch sets up plate, screen and control grid voltages rapidly. 13 pushbutton switches insert alternate tube elements for rapid leakage testing. 200-ma 4½-inch D'Arsonval meter is sensitive enough to give accurate readings even for tubes with low cathode current. 20 heater voltages cover all tube types including 300-, 450- and 600-ma series string tubes. Line voltage variations are compensated for by a line-adjust potentiometer **$79.95** kit, **$129.95** wired.

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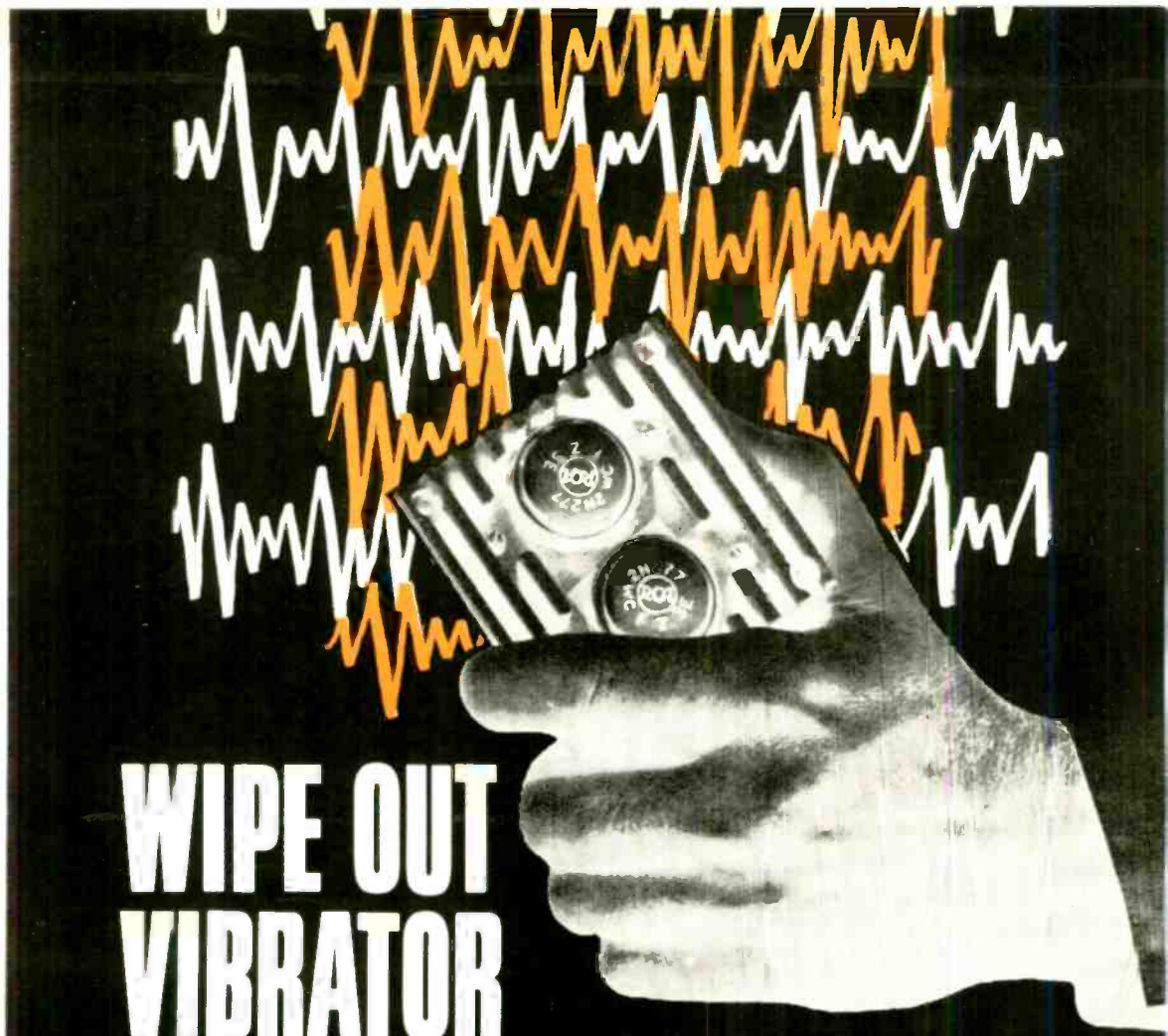


WIPE OUT VIBRATOR HASH

Cover Story Project

Replace that noisy, short-lived vibrator in your car or CB radio set with this plug-in semiconductor device and get longer life and noise-free reception.

By R. L. WINKLEPLECK

THE most troublesome component in your mobile transceiver—whether you're a Business Radio or Citizens Band operator—is the vibrator. This is the component which fails most often. Even at its best, it's electrically noisy, generating a steady background buzz that's noticeable through the speaker unless it is squelched out. When vibrator performance is marginal (an almost normal state), the noise is worse and B+ voltage is erratic. And vibrators are notorious for low-voltage failure, welded points, and blown fuses.

Once upon a time you had no choice—to operate mobile from a low-voltage d.c. supply, you had to take the vibrator along. Actually, the vibrator is an electro-mechanical marvel in many respects. It has performed yeoman service, but it's still the weak link in mobile radio and, today, it is no longer necessary.

Some modern two-way mobiles use transistor power supplies. They're good, but expensive. It's also possible to replace a conventional vibrator power supply

WIPE OUT VIBRATOR HASH

with one driven by transistors. This is laborious, costly, and usually involves replacement of the power transformer, which means loss of the dual 12-volt d.c./117-volt a.c. feature that is so desirable.

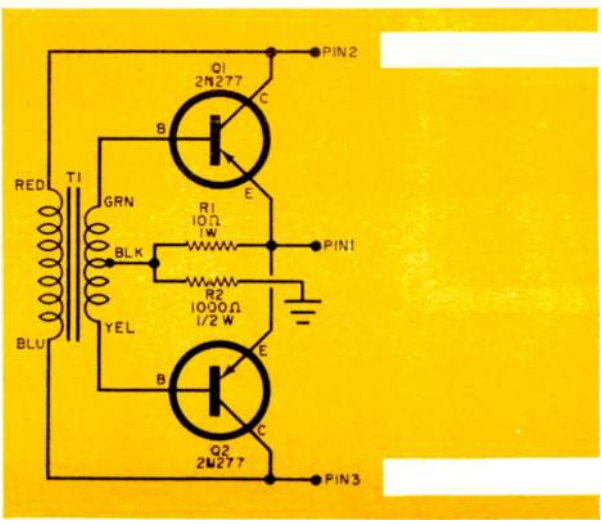
As an advantageous alternative, let's consider a transistorized replacement for the mechanical vibrator—a transistor substitute which plugs directly into the vibrator socket, and usually requires no such modifications to the rig as power transformer replacement or wiring changes. With no moving parts, it never falls prey to fatigue or wear, and if operated within ratings, it has a long, almost infinite life expectancy. As bonuses, it introduces very little electrical noise, no acoustic noise, and is more efficient in operation. Finally, it's simple to build, and it costs no more than two or three short-lived vibrators.

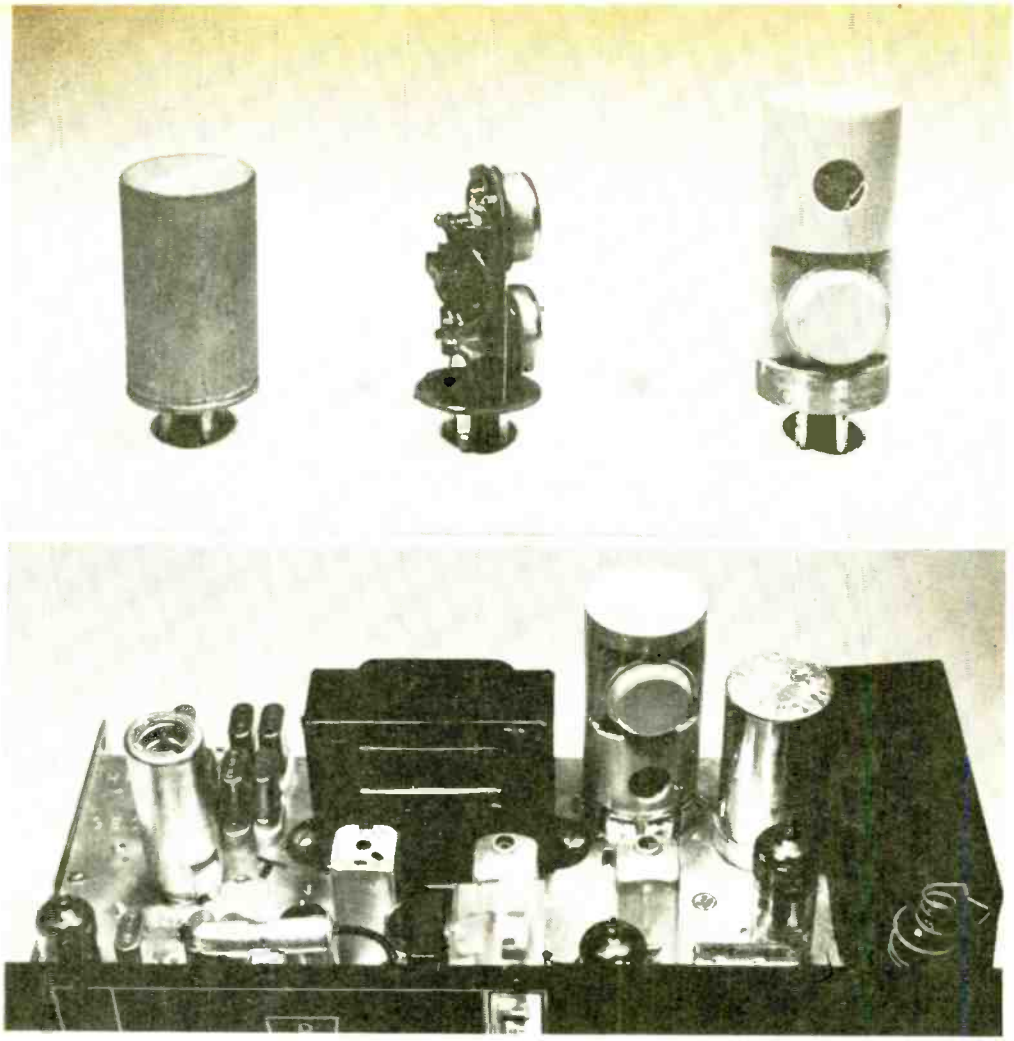
This attractive gadget consists of only two power transistors (you can buy them as surplus), two resistors, and a miniature driver transformer. The whole thing can be stuffed into an old vibrator can or, easier yet, can be assembled on a small scrap of aluminum, with a plug to fit the vibrator socket attached. The plug-in vibrator replacement is an easy one-evening construction project, as the brevity of the following list of parts shows. Transistors *Q1* and *Q2* are 2N277 *pnp* power units, *R1* is a 10-ohm, 1-watt carbon resistor, *R2* is a 1000-ohm, ½-watt carbon resistor, and *T1* is a transformer having a 20,000-ohm primary and 2000-ohm, center-tapped secondary, such as the Argonne AR-103 unit which is stocked by Lafayette.

How It Works. A glance at the schematic reveals the stark simplicity of the circuit. Essentially, it's nothing but a transistor multivibrator. The two transistors alternately conduct and cut off, producing an effect identical to that of the vibrating reed in the mechanical vibrator—but without sparking, point bounce and poor contact. The controlling drive for the transistors is provided by the transformer which, in turn, is driven by the transistors' output. Thus, once started, the oscillations are regenerative and continue as long as power is supplied.

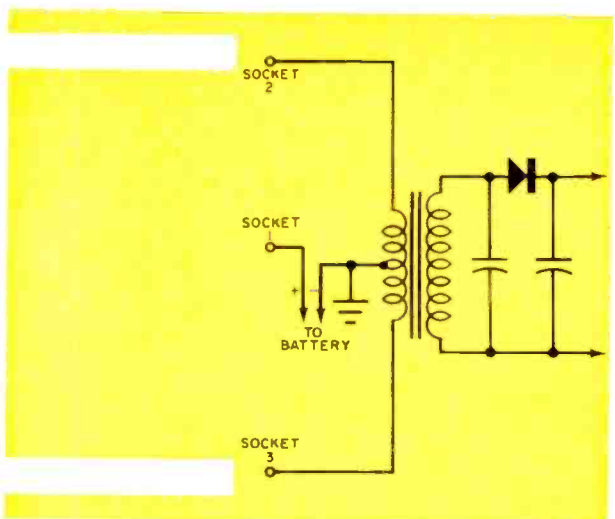
Note that the power transformer in the equipment becomes a part of the transistor multivibrator circuit. When transistor *Q1* is conducting, the flow of current follows a path from the grounded negative battery terminal into the grounded primary center-tap of the power transformer, through the upper half of the primary winding, via pin 2 in the vibrator socket to *Q1*'s collector, out its emitter and back through pin 1 to the battery positive connection in the set. On alternate cycles, the path is through

Schematic diagram and interconnection with existing power supply (below). Unusual transformer primary-driven circuit makes plug-in replacement possible.





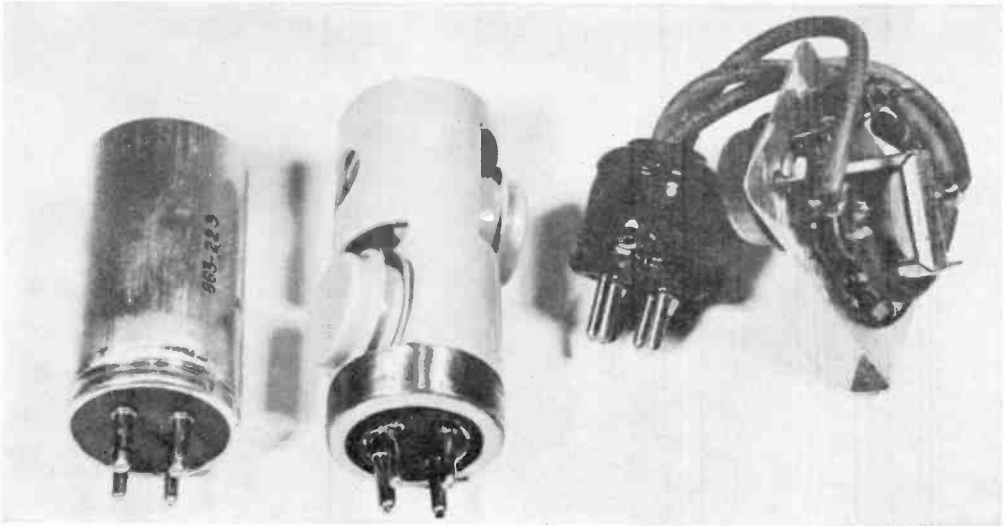
Physical mounting of vibrator substitute parts on the plug-in base can be varied as desired. Top illustration shows three different versions made by the author. If the design you use will exceed the vibrator diameter, make sure that clearance around the socket is ample, as in picture above.



the lower half of the power transformer primary and via pin 3 through *Q2*.

The circuit varies from the conventional in that driver transformer *T1* attaches via pins 2 and 3 to the *primary* of the power transformer. Circuits of this type usually take their drive from the power transformer *secondary*. The circuit used in this unit works just as well, and makes possible the plug-in feature.

For a better understanding of the operation, let's follow through one cycle, step by step. The unit is plugged in and power supplied. The voltage divider made up of resistors *R1* and *R2* places a small negative bias on both transistor bases via transformer *T1*'s secondary.



WIPE OUT VIBRATOR HASH

Three different mechanical configurations for the vibrator replacement unit are shown above. A test version built on a heavy-duty heat sink is shown at right, plugged into a Knight-Kit C-22 CB unit for performance tests in the lab; noise when receiving was strikingly reduced, and the large heat sink proved to be unnecessary.

This bias insures starting under load or unusual temperature conditions.

No two transistors are identical, so one (assume, in this case, *Q1*) starts to conduct before the other and current flows through one-half of the power transformer primary. The rising current through the upper half of the power transformer primary induces a rising voltage in the lower half that adds in series, and the total rising voltage is applied to the primary of *T1*. The voltage induced in the secondary of *T1* is connected to the bases of transistors *Q1* and *Q2*, with polarity that biases *Q1* "on" and *Q2* "off."

This condition continues until the magnetic flux in the power transformer core reaches saturation, and therefore stops rising. When this happens, the induced voltage applied to the primary of *T1* drops to zero, permitting the magnetic field in the *T1* core to collapse. This induces a voltage in the *T1* secondary of opposite polarity to the original voltage, and turns *Q1* off and *Q2* on. The entire process repeats in opposite polarity, with *Q2* conducting and *Q1* cut

off. This completes one cycle of square-wave oscillation, and the circuit continues to oscillate as long as power is applied.

The square-wave a.c. in the primary of the power transformer induces a high-voltage a.c. in the secondary, which is rectified and filtered exactly as if the square wave was the result of vibrator action. However, since there is no true make-and-break action of mechanical contacts, there are no severe transient "spikes" due to contact bounce, and no partial (high-resistance) circuit closures. As a result, the output is far more easily filtered than is the case when a vibrator is used, and electrical noise is greatly reduced.

Construction. The illustrations show the transistor multivibrator assembled on a small copper panel attached to an old vibrator base in such a manner that the vibrator can may be replaced over the unit for convenient handling. The cases of the transistors are electrically connected to their collectors, so mica washers must be used to insulate them from the panel. They must also be insulated from the can when it is replaced.

With this construction, the small space available requires use of a Stancor TA-34 transformer for *T1*. It will also be necessary to reduce the value of resistor *R2*, to compensate for the lesser drive of the smaller transformer, and it is suggested that either 270 or 330 ohms be tried.

When the components are mounted on a small panel or assembled in a short length of 1½" thin-wall conduit, the parts listed in text on page 42 are recommended. In each case the transistors are insulated from their mounting and the end of resistor *R2* is grounded to the rig's chassis. It may be attached to either the vibrator can or the conduit, to be grounded to the chassis by the vibrator hold-down clips. Only a very small mounting panel is necessary to dissipate the small amount of heat generated.

There's nothing critical about any component, nor about the arrangement. Many of the currently available *pnp* power transistors can be used as well as several different driver transformers. Those specified, however, are readily available and inexpensive, and they work splendidly. Since the leads from the transistor emitters and collectors are carrying several amperes, they should be somewhat heavier than ordinary hookup wire. In case of difficulty, be sure the transistor cases are not shorting to each other or to ground. If a transformer substitution has been made, the color code shown may not be correct, and you should try reversing either the primary or secondary leads.

Operation. The voltage used to operate the transistor multivibrator is not critical, and the unit can be used without modification on 6-, 12-, or 24-volt systems. And it's perfectly safe to start your car with the radio on—there are no vibrator points to weld closed. It is, however, necessary to have correct battery *polarity*. Pin 1 *must* connect to the positive lead, and the center-tap of the power transformer in the set *must* connect to battery negative. This is the arrangement followed with most mobile rigs used in vehicles with negative ground, but you should check this connection on your set's schematic.

If you find that the power transformer primary center-tap goes to battery positive (as it does in some models of Lafayette, Gonset, Polycom, and a few others), you can make a simple change which will permit the use of this transistor multivibrator without affecting set operation in any way. All you need to do is switch leads. Remove the ground from pin 1 of the vibrator socket, connect battery positive to this point, and ground the primary center-tap from which the battery positive connection was removed.

Some power transistors under load may "sing" a bit, that is, make a faint acoustic noise. With the engine off in a very quiet location, you may hear this "singing." However, the transistors never really BUZZ out loud. The output of the transistor multivibrator is a clean, spike-free square wave, easy to filter. The elaborate system required to filter the output of the mechanical vibrator will silence the transistor output to less than a whisper.

Replace your vibrator with this simple plug-in unit, and you'll be taking a big step toward quiet, maintenance-free, mobile operation. —30—

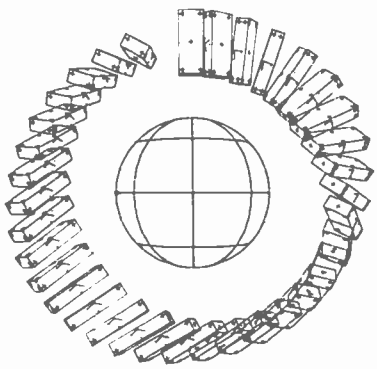
BREAKTHROUGHS

Brief news flashes on important developments in the field of electronics

PUNCH-THROUGH TRANSISTOR that acts as its own circuit breaker by passing momentary current surges without breaking down. Developed by the Army's Ft. Monmouth Research and Development Laboratory, the device was made possible by redesigning the transistor base structure. The "punch-through" feature can be built into any transistor for increased reliability, it is claimed.

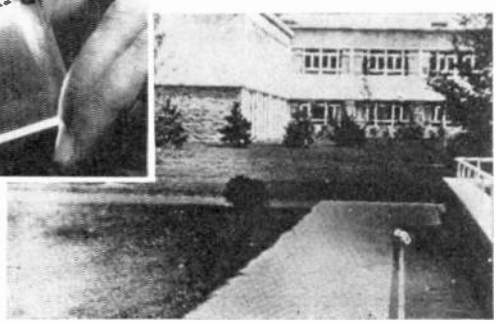
RUBBER ELECTRONICS DOME, to be an integral part of the bow of the Navy's newest sub-seeking destroyers, by B.F. Goodrich (see photo at left). Designed to house sensitive sonar "eyes" and "ears," the rubber is made so that a sound signal can penetrate through it completely undistorted.

TRANSEQUATORIAL VHF CHANNELS for communications may be feasible, according to an Air Force sponsored study done by ITT. Using conventional equipment and simple antennas, signals have been observed between 30 and 50 mc. and as high as 75 mc. crossing the equator over paths up to 3000 miles long. Signal strengths were close to the calculated free-space signal strength, strongly suggesting ray focusing.



COMPUTER-MADE MOVIES computed and drawn by an electronic data processing system (see drawing at left). Such perspective movies, in this case of a domino-shaped box, help scientists at Bell Telephone Laboratories visualize the motions of a communications satellite as it orbits the earth.

"CIRCUITRONS," vacuum tubes with integrated passive components built into them, as well as conventional parts, for protection against radiation. Developed by Sylvania, the "tubes" are designed as modular circuits to be used in satellites and in other environments where protection against radiation is important.



INSTANT PHOTOS utilizing electrostatically charged plastic film developed by heat alone, by General Electric. Called "Photo-Plastic Recording," the technique involves exposing the photoconductive film and heating it so microscopic depressions are formed corresponding to the pattern of the image. The film is then recooled so the depressions—making up the finished picture—are sealed in. The heating and cooling take a fraction of a second, and the film can be erased—simply by heating it again—and reused. At left, Dr. Joseph Gaynor, the inventor, displays a plastic slide. The photo at bottom was taken with the new film.

Build the reflectoflex SPEAKER ENCLOSURE

By JAMES D. REID

Fill the entire room with realistic, bright, hi-fi sound using this practical reflected-sound system

WHEN STEREO HI-FI first became popular, the ardent audiophile who wanted to show off his gleaming new equipment and fancy speakers would first carefully position a chair at "stereo center" and then ask you to sit down. Needless to say, the illusion—provided by recordings of locomotives, brass bands, and bouncing Ping-pong balls—was amazing, and seemed too good to be true. ☐ Music lovers quickly recognized that this extravagant separation of channels was, indeed, too good to be true, and as the stereo hi-fi art matured, a number of solutions to the problem, all of which eliminated the "stereo seat," came along. ☐ One method of getting rid of the center "gap" between the two channels is, of course, to use a center speaker. Another less expensive, simpler method, the one recommended here, is to use two speaker systems having good dispersion—systems that radiate the sound in all directions rather than in a narrow beam. The "Reflectoflex" speaker enclosure which you can easily build—one for monophonic use and two for stereo—is such a system. ☐ By aiming the speaker upward and "spraying" the sound off the inclined lid (or adjacent walls and ceiling if the lid is not used), it achieves a high degree of dispersion. The result is hi-fi sound with an airiness, an openness that must be heard to be appreciated. ☐ Some care should be taken in selecting a speaker for this cabinet. Because more high-frequency energy is absorbed when the sound is reflected rather than directed at the listener, a coaxial speaker with a highly efficient tweeter is recommended. Even so, some treble boost at the amplifier may be desirable. ☐ An alternative would be to use a woofer or full-range speaker with a separate horn tweeter and the crossover network recommended by the manufacturer. The tweeter could

reflectoflex

Light, airy sound fills the room when it's dispersed by reflection from cabinet lid (as above). Two enclosures can be constructed for use with stereo setup.

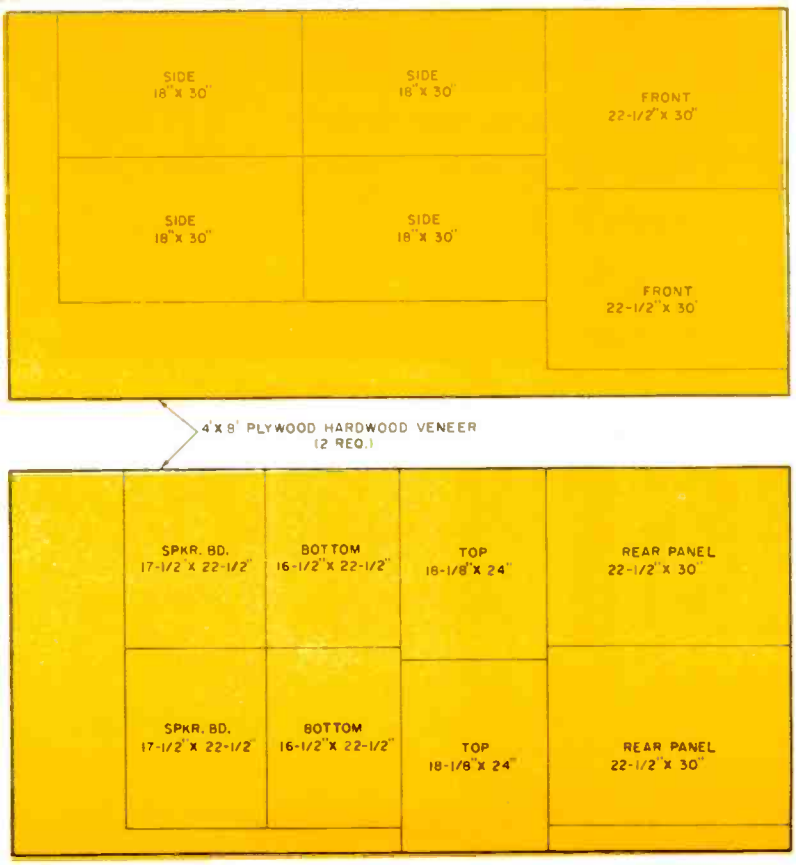
be mounted between the holes shown for the "brilliance" control and the port.

Ports and Port Sizes. Whether or not you need a port depends on the free-air resonance of the speaker you use. If a low resonant frequency speaker (below 35 cps) is available, the port is not cut, and the Reflectoflex is then a sealed box or "infinite baffle" system. If the resonant point is higher, the speaker is positioned off-center on the speaker mounting board, and a circular port cut to match the resonance of the cabinet to that of the speaker (the bass reflex principle).

If the cone resonance of the speaker is 50 cps, the port should be 5¼ inches in diameter; for a resonance of 45 cps, 4½ inches; for 40 cps, 3½ inches; and for 35 cps, 3 inches. The manufacturer of the speaker should be able to furnish information as to its free air resonance point.

Building the Reflectoflex involves little

All sections for two enclosures can be cut from two 4' x 8' sheets of plywood as shown at right. Ordinary, interior grade plywood can be used instead of the veneered type. Other materials include hardwood strips for inside bracing and outside trim, a piano hinge, glue, and wood screws.



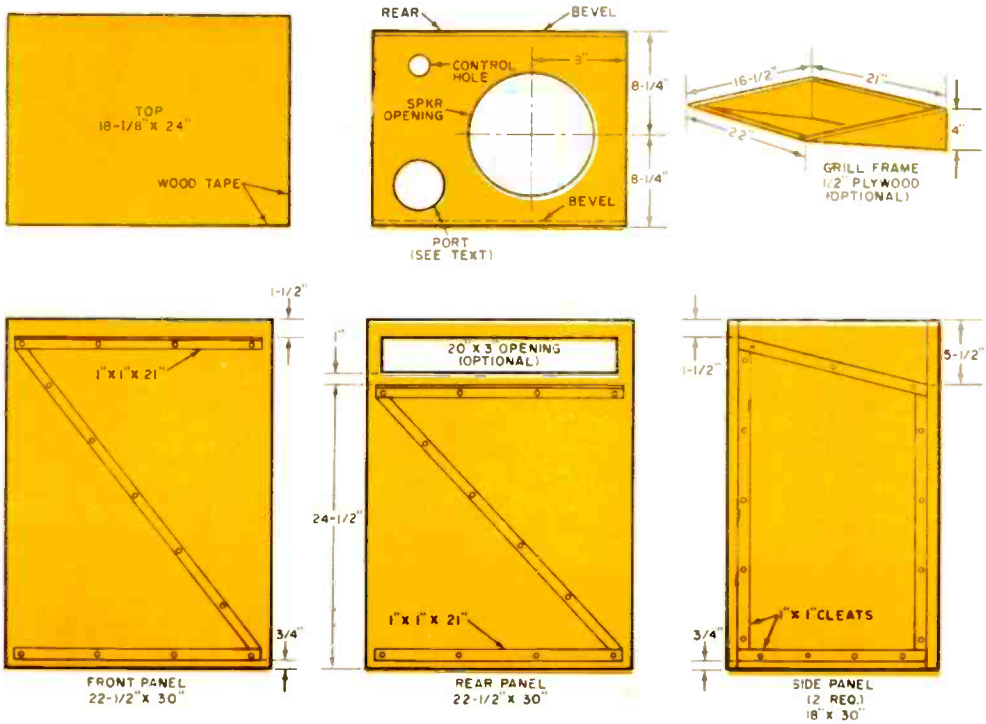
more than making a rigid box from sheets of ¾" plywood or Novoply as shown in the drawings below. The author used hardwood surfaced plywood for good appearance. Hardwood cleats (strips), 1" x 1", are glued and screwed to the side panels, and the front and rear panels secured to them with glue and 1½" #8 screws countersunk from the outside. The resulting holes are covered with 1" x 1⅛" strips of hardwood. After applying a bead of glue to all interior joints, staple a 2"-thick layer of fiberglass to all four side and bottom surfaces as acoustic padding.

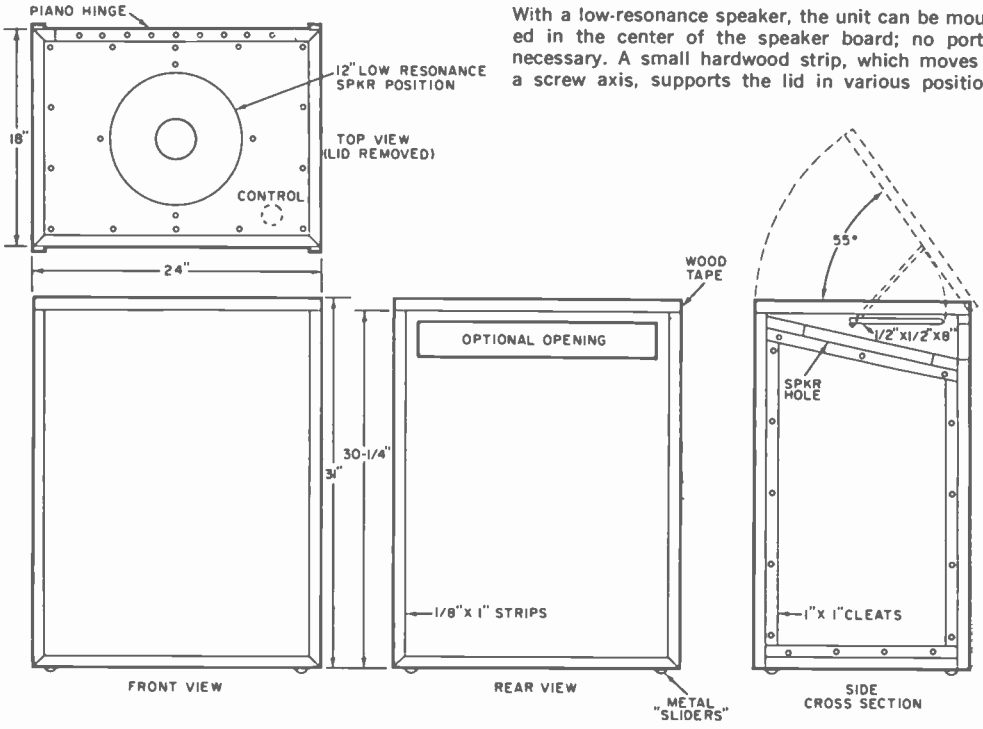
The enclosure lid is attached to the rear panel with a 22" length of brass piano hinge, and is held open with a simple prop made from a ½"-square piece of hardwood rounded at one end. Shallow holes drilled in the underside of the lid provide for alternate positions so that the lid can be adjusted for best sound reflection. The lid should be given a "hard" finish, several coats of shellac, varnish, etc., to increase its sound reflecting properties.

Interior view of Reflectoflex enclosure.

The speaker board is beveled at front and rear, and the underside lined with

Interior panel details for the enclosure are shown below. The control hole is for a "brilliance" control if used. The 1" x 1" cleats are hardwood strips used for bracing, and are glued and screwed from the inside. The front and rear panels are set in between the two side panels, and screwed from the front and back. The screw holes can be filled or covered with hardwood strips

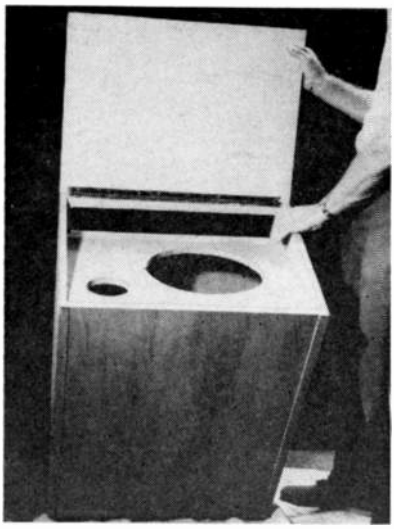




With a low-resonance speaker, the unit can be mounted in the center of the speaker board; no port is necessary. A small hardwood strip, which moves on a screw axis, supports the lid in various positions.

a strip of sponge rubber to provide an airtight joint when screwed in place. While a grille is not needed, the speaker can be attractively covered and protected by stapling a grille cloth to a simple frame that fits into the top (see drawing on page 49). The completed frame is held in position by two dowels at the rear and two screws at the front.

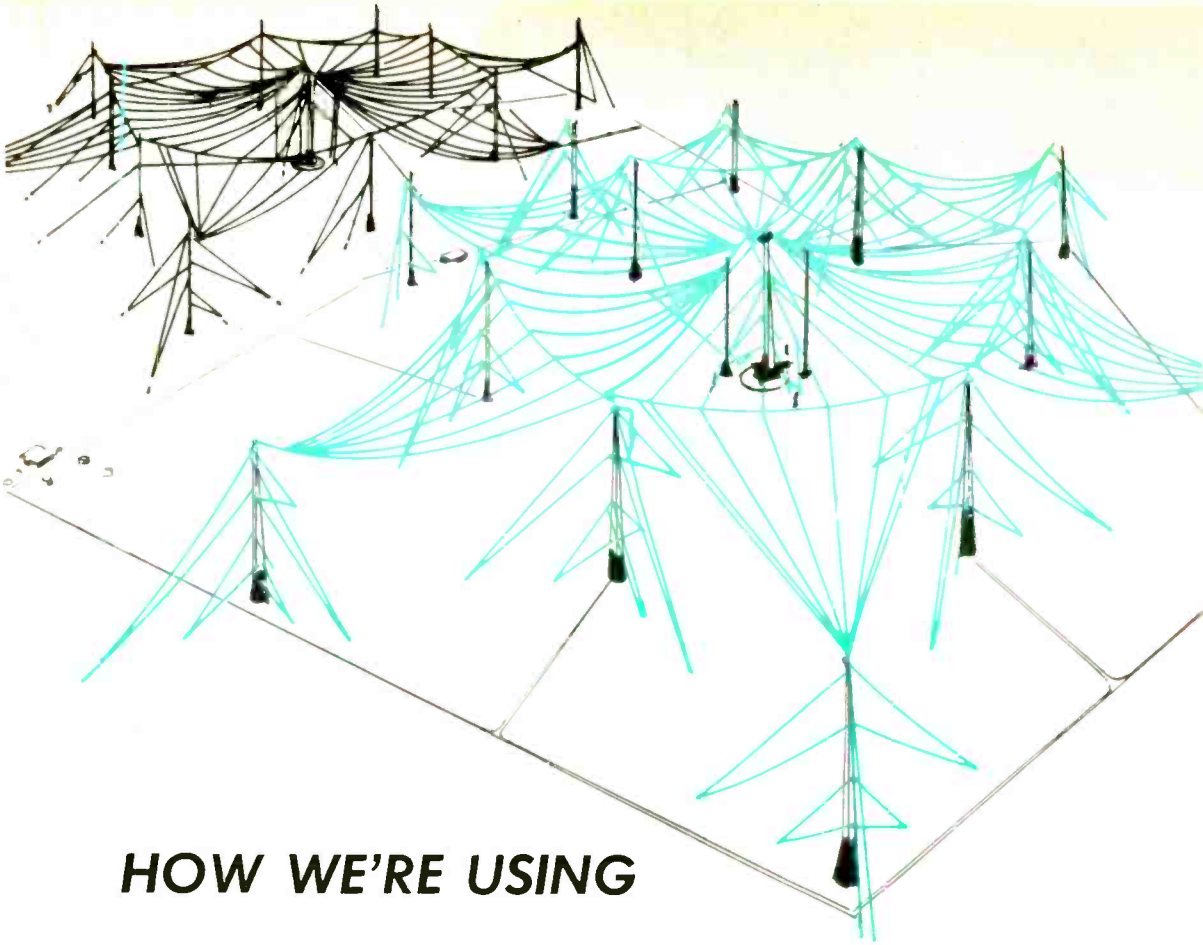
Enclosure with speaker board in position.



The Reflectoflex, or a pair of them, can be used in upright position, or on the side; the bottom of one unit can be butted against the bottom of another if two units are used with sides down. As previously noted, it is quite possible to use the walls or ceiling as reflecting surfaces instead of the enclosure lid. Simply position the enclosure or enclosures for best results.

The wire from the amplifier enters the cabinet through a hole in the bottom or rear panel if you choose to use the cabinet on its side. Metal "sliders" are fastened to the bottom; alternately, a simple rectangular base can be built from left-over plywood to lift the enclosure off the floor.

Finishing. The author used stain and several coats of varnish over hardwood veneer plywood to produce professional-looking cabinets. Even ordinary plywood can be quite pleasing to the eye, however, if care is taken in finishing it. In any case, your Reflectoflex enclosure can be counted on to provide a definite improvement in the realism of your living room "concert hall." -30-



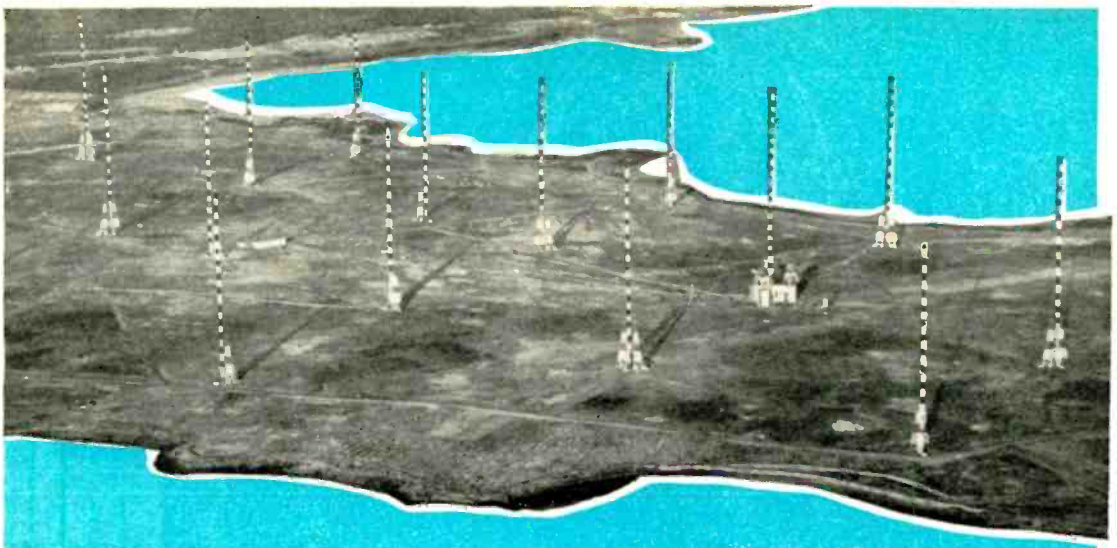
HOW WE'RE USING "ROCK-BOTTOM" RADIO

The long waves, used by Marconi, are back again—but with missions as up-to-date as missiles and satellites

By W. STEVE BACON, W2CJR, **and ED NANAS,** WA2HFF

SEATED AT A HUGE CONTROL CONSOLE, a Navy operator prepares to put NAA, the world's most powerful radio station, on the air. A routine operation? Hardly. Not when you consider that NAA has a power output of 2,000,000 watts, that its antenna coils alone are 40 feet high, that its huge, two-square-mile antenna system is supported by 26 towers over 800 feet high, and that its ground system of 11,000,000 feet of heavy copper wire covers an entire four-square-mile peninsula at Cutler, Maine.

Even more fantastic from the standpoint of those interested in electronics, however, are the "rock-bottom" radio frequencies on which NAA operates: *14 to 30 kilocycles*. Part of this range is well within the realm of audibility (when propagated as mechanical, rather than electromagnetic, vibrations), and the wavelengths involved are immense when compared to those in more familiar parts of the radio spectrum—at 14 kc.,



Antenna system at NAA, the Navy's Cutler, Maine, VLF radio station, covers two square miles, and consists of two arrays, each resembling a six-pointed star. The antenna system is actually a network of cables supported at an average height of 600 feet by 26 towers ranging in height from 800 to 1000 feet. In effect, the antenna is one plate of a huge capacitor—the elaborate ground system is the other plate—which couples NAA's tremendous output power to the atmosphere. Huge antenna and high power allow communication with submerged submarines.

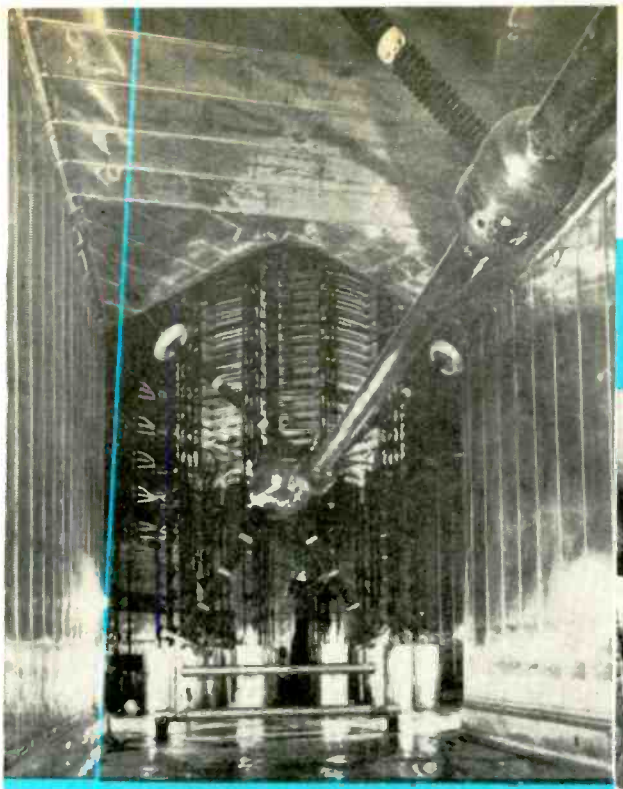
one wavelength is 21,429 meters, or over 13 miles long!

The Pioneers. "Rock-bottom" radio received a lot of attention when radio was still in swaddling clothes. Marconi used a relatively low frequency for his pioneering 1901 transatlantic transmissions, and experimenters quickly discovered that the longer the wavelength, the greater the range at which signals could be picked up—or so they thought.

In 1913, after considerable experimentation with what was regarded as a somewhat dubious method of communications, the U.S. Navy commissioned the original NAA at Arlington, Va.—the world's first high-power long-wave station. It used the most modern equipment of the time: a Fessenden 100-kw. synchronous rotary spark apparatus. Following in NAA's footsteps, more and more stations were erected to operate in the very low frequency (VLF) and low frequency (LF) portions of the radio spectrum, 3 to 30 kc. and 30 to 300 kc. respectively. They used wavelengths five to ten miles long, huge expensive antenna arrays, and high power to achieve coverage over a substantial portion of the globe.

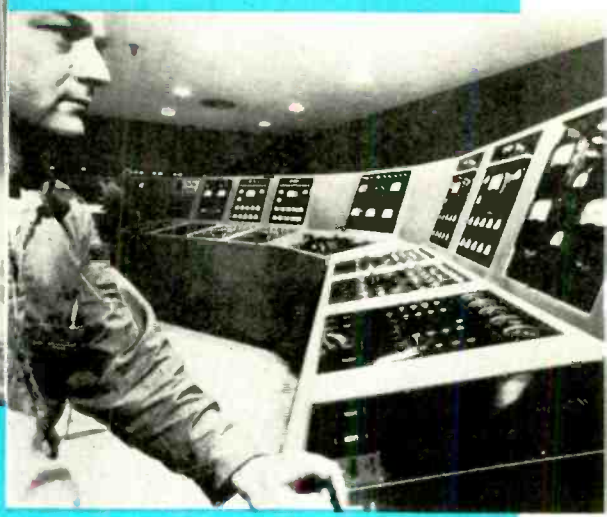
The low frequencies reigned supreme for governmental and commercial communications purposes until the early 1920's. It remained for the amateurs, who were handed what looked like a dirty deal but turned out to be Aladdin's Lamp in disguise—200 meters and below—to prove that VLF with its unwieldy antennas and high powers was out of date as a means of routine communication. If proof of the propagation potentials of the higher frequencies was needed, it was amply provided by the amateur stations, sometimes running just a watt or two of power, that regularly spanned the Atlantic using frequencies in the vicinity of 100 meters and below.

With the discovery of the advantages offered by the higher frequencies, VLF suffered a decline as radio came of age, and it was not until after World War II,



What is it? The long pipe in this metal-clad tunnel is a transmission line—size can be judged from the man standing near supporting insulator—and object in background is antenna (helix) coil.

Part of NAA's wide U-shaped control console. Included here are frequency generators, intermediate power amplifiers, and controls for the final amplifiers, power supplies, antenna tuning.



with the need for long-range navigational, communications, and tracking networks becoming acute, that attention again focused on this part of the radio spectrum.

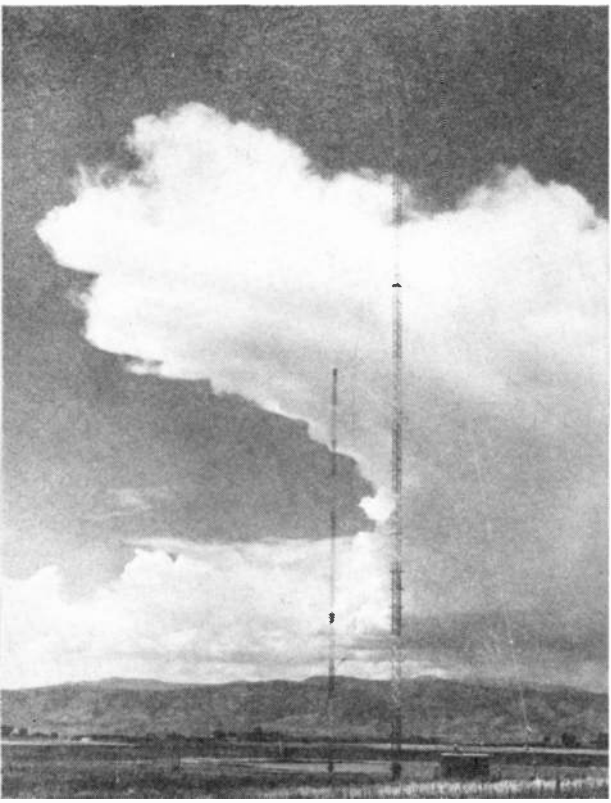
Advantages of VLF. What advantages does VLF offer to offset the disadvantages imposed by its high power and huge antenna requirements? First, and most important, is the fact that VLF radio waves propagate over great distances with little loss of strength. Strangely enough, the ionosphere (the ionized region of the atmosphere 40 to 60 miles high which reflects radio waves back to earth) and the earth act as a gigantic duct or wave guide that carries VLF waves around the world in a manner similar to the way an air-operated speaking tube carries the voice of a ship's captain from the bridge to the engine room.

One reason this happens is the fact that the dimensions of this 40- to 60-mile high, earth-ionosphere wave guide are compatible with the physical length of the VLF waves, which range from 6.2 to 62 miles long. Another reason is that while higher frequencies are absorbed to a greater or lesser degree by both the earth and the ionosphere, much less attenuation (or absorption) takes place at VLF. The ionosphere exhibits a high degree of reflectivity at VLF, and this reflectivity is relatively constant, whereas (as every ham and SWL knows) reflection, or skip, at higher frequencies is a sporadic, sometimes thing.

Unlike higher frequencies, VLF is little affected by daily, seasonal or atmospheric variations. In addition to its other properties, moreover, it can penetrate water to some extent. Due to this last property, it offers a means of communicating with submarines even when they are submerged.

Submarine Communications. The key to the effectiveness of the Polaris-firing nuclear submarine is communications, since the terrible retaliatory weapons it carries can be unleashed only by presidential order. Sea water hides the sub-

"ROCK-BOTTOM" RADIO



Two of four 400-foot towers supporting the antenna array for WWVB, new 60-kc. Bureau of Standards station near Ft. Collins, Colo. There are two arrays—one for WWVL on 20 kc.—covering 200 acres.

marine and protects it from electromagnetic detection systems, but this same "protective shield" also makes communications difficult or impossible. How can this problem be overcome? Even the propagation advantages of VLF are not enough—it takes power, a lot of power, and favorable receiving conditions.

In order to receive VLF signals, a submarine must be reasonably close to the surface—perhaps 20 or 30 feet below it due to the fact that the attenuation of VLF radio signals in water is on the order of 1.5 db per foot of depth. However, thanks to a new technique, a submarine can receive orders and messages and still remain at undetectable depths several hundred feet below the surface. It involves sending up an antenna attached to a float into the receiving layer of water near the surface.

In order to maintain instant contact with Navy ships all over the world—surface vessels as well as submarines—the Navy operates a number of high-power VLF installations like NAA at Cutler. One is "Big Jim," at Jim Creek near Seattle, Washington, which literally has its antennas strung between mountaintops, and boasts a 1.2-megawatt transmitter. Other stations are located in Japan, the Canal Zone, Hawaii, and Annapolis, Maryland; and another huge installation is planned for Australia. But the big baby of VLF is the new Cutler facility which—with its enormous power—covers the Atlantic to well below the equator, the Arctic, and down into the Mediterranean Sea from its site on the rocky Maine coast.

Space Age Mission. Not nearly as obvious but perhaps more important in terms of space age technology are other uses of VLF—the broadcasting of standard time and frequency signals. How, for example, can the clocks in stations tracking manned satellites be synchronized to the degree of accuracy required to bring a satellite down in a predetermined place, or (and this problem will be a real one in the near future) make possible the rendezvous of two manned satellites in outer space?

The answer might seem simple to those who have monitored the National Bureau of Standards' time and frequency signals broadcast on 2.5, 5, 10, 15, 20, and 25 mc.—the seconds are ticked off with great precision—but is it so simple? These high-frequency transmissions of WWV and WWVH (the latter is the high-frequency National Bureau of Standards station in Hawaii) bounce between the earth and ionosphere, but exactly *how* they are reflected from the ionosphere depends on atmospheric conditions.

Variations in these conditions change the amount of time required for the signal to reach the receiver, and, as a matter of fact, these variations occur continuously. The end result is that, since the time required for the signal to reach

(*Continued on page* 104)

High school and college level electronics for ten-year-olds? PALS, a pioneering educational activity in the San Francisco area, has found that many youngsters thrive on difficult material. In addition to classroom lectures, project-building facilities are provided (note superregenerative receivers in progress here). After students have completed formal course of study, they are free to specialize.

San Francisco's PALS Starts Them Young

By AL and REE CORONA

WITH SCIENCE and science fairs becoming increasingly important in the nation's schools, San Francisco's "PALS" (for Planned After-school Lab Sessions) is playing an important role in educating talented youngsters of the area from the primary grades to the high school level. With above-average marks and his principal's recommendation, a ten-year-old in the fifth grade, as well as older students, may begin "Electronics I" at Lux Lab—an educational opportunity not afforded most young people until their college days.

PALS was the brain child of San Francisco educators and the president of the Miranda Lux Foundation. The local school board and the Foundation, with help from the government under the National Defense Act, established Lux Lab at Polytechnic High School in 1956. Under the dynamic program, both boys and girls receive instruction in electronics from qualified experts. They are scheduled for a minimum of four hours a week, with one day thrown open to special project work.

"Electronics I" begins with a general introduction to the subject, plus the nature of electricity, sources of electricity, simple circuits, measuring of electric current, electricity and magnetism, alternating currents, and transformers. Six projects are offered in the first semester, and not until the first project is completed to the satisfaction of both student and instructor is the second begun.

One boy went rapidly through his first project, building a crystal receiver, and

then quickly polished off the next five assignments, which ranged from building a regenerative receiver to putting a full-blown amplifier together. He was ready for "Electronics II" before some of his fellow students had finished the second project.

"Why did you bother with 'Electronics I'?" an instructor asked him.

"Well," the boy frowned, "I just figured first things come first."

Actually, the policy at Lux Lab is much more flexible. Since some youngsters are more adept, quicker to grasp instructions, or possibly more talented, they are encouraged to progress at their own rate. No one is ever held up while his classmates reach his level.

"Advanced Electronics" cuts down the classroom lecture period. At this point, instruction is tailored to meet individual interests, and many science fair projects, inspired by magazines, books, and lab sessions, reach fruition thanks to PALS. For example, a girl who was interested in guppies combined her newly gained electronics knowledge with her biological work and attempted to determine how high-frequency sound affected guppy life.

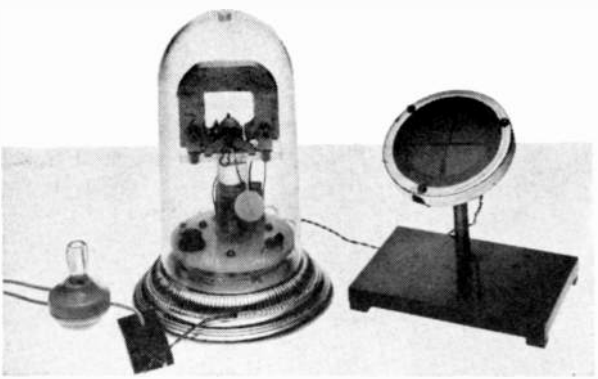
Many PALS students have their own labs at home where much of their allowance is swallowed up. A few youngsters are fixing TV sets for added income.

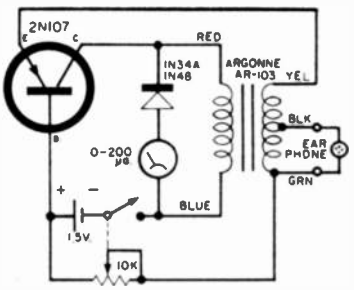
The lab facilities cannot accommodate all those who want to enroll in PALS, and each instructor is faced with the necessity of weeding out some applicants. Instructor Gil Rankin feels his procedure is fair. He gives an introductory talk on lab safety followed by a written quiz on its contents. Those with the highest grades remain.

PALS, presented as a no-nonsense, no-credit science plan, has been an outstanding success, and has attracted visitors from other school districts and from foreign countries. In addition to a tour of PALS' facilities, they are equally interested in watching ten-year-olds soaking up high school and college level material in electronics.

At present, the PALS program is almost unique in the United States. The San Francisco organization hopes this won't be the case for long. -30-

SOLAR "CLOCK"





The original Zarr circuit shown above is adapted as described in text to build Solar "Clock."

A glass jar and base and a pedestal for the selenium cells makes the Solar "Clock" an attractive display device.

A NOVEL DEVICE for demonstrating the conversion of light to electricity, the Solar "Clock" has a swinging pendulum which goes slower or faster depending on light intensity. (A crystal earphone can be used to hear an audible beat.) The circuit above was originally described by R. Zarr in "Perplexual Motion" (POPULAR ELECTRONICS, May, 1959, page 112). To make the "Clock," a microammeter movement from a Weston Master exposure meter was substituted for the 0-200 μa. movement in this circuit, and a paper pendulum glued to the end of the pointer. Four small selenium cells, used instead of the 1.5-volt battery, were made by cutting a single exposure meter cell into four equal parts and connecting them in series. A 400-ohm, ½-watt resistor replaces the 10,000-ohm control. —*J. Thos. Rhamstine*

Build a Telephone Beeper

The law says you must put an audible tone on the line when you record a phone call—here's an inexpensive gadget that does the trick for you

By FRED BLECHMAN, K6UGT

SINCE the introduction of inexpensive tape recorders and inductive pickups, the practice of recording telephone conversations has become widespread. In business or private life, it often saves the day for people who can't take shorthand, permitting them to transcribe the important facts of the conversation at their own pace later on. But there's a catch: An FCC Order issued May 20, 1948, directed that an audible tone signal must be sent over the line at least once every 15 seconds on calls that cross a state or national boundary when a conversation is being recorded. Not long thereafter, most telephone companies filed new tariff regulations with the Public Service Commissions of the various states, imposing the same requirement for calls within state boundaries. And when these regulations were approved, they acquired the force of law.

You can equip yourself to comply with this requirement by building the "Telephone Beeper." The outlay is modest (around $8.00), and the unit is small, self-contained, and requires no electrical connection to the telephone. This latter point is of some importance, since telephone companies are understandably touchy about having unauthorized devices connected to their equipment.

Many tone signal units in commercially available equipment are

Telephone Beeper

Induction pickup for recorder is attached to earpiece. Clip holds Telephone Beeper to mouthpiece as shown.

inductively coupled to the telephone earpiece. This usually results in a very loud BEEP on the recording, but a rather low-level tone at the other party's end. In fact, to make the tone audible at the distant end, it may be necessary to raise the beep to such a level that some incoming words are smothered on the recording.

In addition, it's easy to forget to turn off some units, since only the position of the power switch indicates the "on" or "off" condition of the tone signaler.

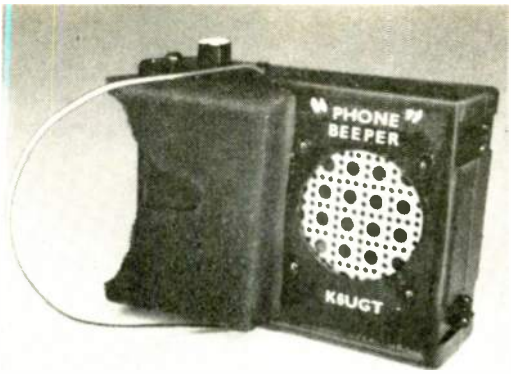
What the "Beeper" Does. The Telephone Beeper overcomes all of the above disadvantages neatly and simply. The tone signal itself is an audible "beep" emitted from a miniature loudspeaker positioned so that the sound enters the telephone transmitter (microphone) acoustically, along with the voice of the user. Thus, there's no need for any electrical coupling or connection to the phone.

The signal is also coupled to the recording pickup on the earpiece via the sidetone path provided between mouthpiece and earpiece within the telephone circuit itself. It is this sidetone circuit that allows you to hear your voice in the earpiece when you speak, and of course it carries the sound of the Beeper just as well. Because of this arrangement, the Beeper is recorded at about the same level as it is heard at the other end of the line.

As for forgetting to shut off the unit, its continued beeping after you've hung up the phone will be an unfailing reminder to you to do so.

The photograph on page 57 shows how the Beeper is mounted and used. The device contains an oscillator, speaker, and a timing circuit, along with two 9-volt transistor batteries for power. It is held in position adjacent to the mouthpiece by a retaining clip made of piano wire. It does not interfere with normal use of the telephone, and may be left permanently in place.

How It Works. The simple circuit that generates and times the beeps is shown in the schematic on the next page. Transistor *Q1* is a unijunction type, which is energized by the two 9-volt batteries in series. When switch *S1* is closed, capacitors *C1* and *C2* are charged through resistor *R1*. When the voltage at the emitter of *Q1* reaches a certain value, *C1* and *C2* discharge through resistors *R4* and *R5*, and the emitter-base 1 junction of *Q1*. The resulting positive voltage at the junction of *R4* and *R5* provides conductive bias for oscillator transistor *Q2*. Feedback for oscillation is obtained through the center-tapped primary of transformer *T1*, which also couples the oscillator output to the speaker. Variable

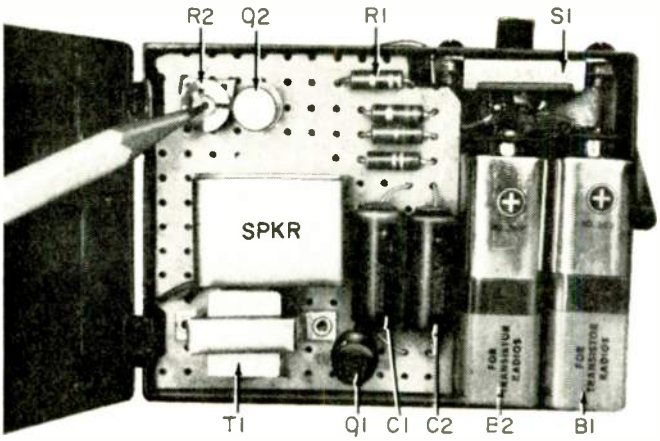


Contoured block of sponge material fits phone shape, secures Beeper in position.

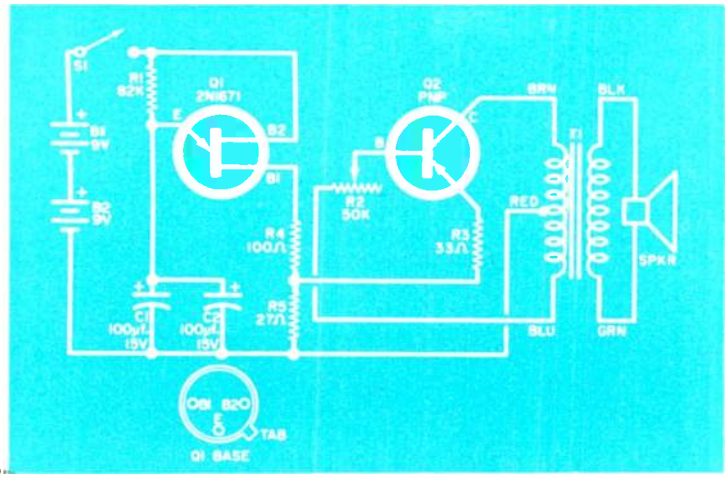
resistor *R2* controls the oscillation frequency.

This circuit is somewhat critical, so you must use the parts specified for transformer *T1* and transistor *Q1*. Transistor *Q2* may be just about any inexpensive *pnp* germanium transistor (CK722, 2N107, etc.) since adjustment of *R2* will compensate for any difference between specific transistors. Potentiometer *R2* is the smallest unit available.

(*Continued on page* 110)



Parts placement isn't critical. Author's layout shown here permits easy assembly.



Simplicity of basic circuit is clear in schematic. Only critical parts are T1, Q1.

PARTS LIST

B1, B2—9-volt transistor radio batteries
C1, C2—100-μf., 15-volt ultraminiature electrolytic capacitor
*Q1**—GE 2N1671 unijunction transistor
Q2—CK722 or 2N107 *pnp* germanium transistor
R1—82,000 ohms
R2—50,000 ohm subminiature potentiometer (Allied Radio, 10,000 ohm unit)
R3—33 ohms (all resistors 1/2 watt unless otherwise noted.)
R4—100 ohms
R5—27 ohms
S1—S.p.s.t. slide switch
*T1**—Output transformer (Lafayette TR-15 or Philmore SI-52)
T—Induction type pickup (Lafayette MS-60)
SPKR—3" diameter speaker (Lafayette SK-61)
Misc.—Case (author used plastic box 2" x 2 1/2" x 4 1/2"), perforated circuit board, perforated aluminum for grille, rit screw on clip, coax rubber, battery terminals, etc.

*Do not substitute for these parts

Hi-Fi Lab Check

EICO ST-97 FM Stereo Tuner

Manufactured by EICO Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City 1, N.Y.

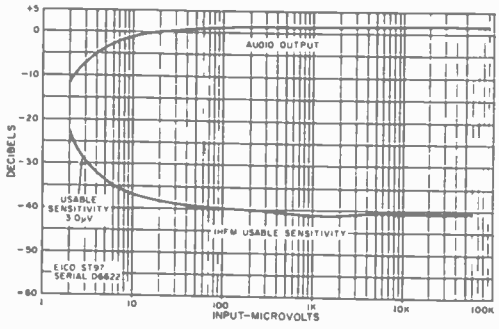
Prices: $99.95 (kit); $149.95 (wired)

RUNNING MATE of the ST-70 stereo amplifier reviewed in September, the EICO ST-97 arrives, as a kit, with pre-assembled front end and i.f. strip. The builder completes the point-to-point wiring between these two printed-circuit boards, makes up the multiplex demodulator board, and wires the power supply. Average assembly time should be about 14 hours.

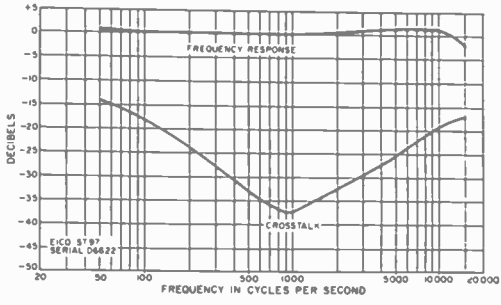
Under test, the ST-97 gave an excellent account of itself. Sensitivity, audio frequency response, multiplex separation and distortion are all equal to, or better than, the manufacturer's conservatively stated claims. Drift from a cold start is very small and is easily handled by the a.f.c. system (panel switch). If care is exercised in building the ST-97, i.f. alignment will probably not be required. A modest touch-up might improve sensitivity in some cases.

The right and left halves of the ST-97's slide rule dial provide frequency and multiplex logging scales, respectively. A traveling "magic-eye" tube behind the frequency scale dims to indicate correct tuning. A neon indicator lamp behind the multiplex scale lights when the signal tuned in is a multiplex transmission.

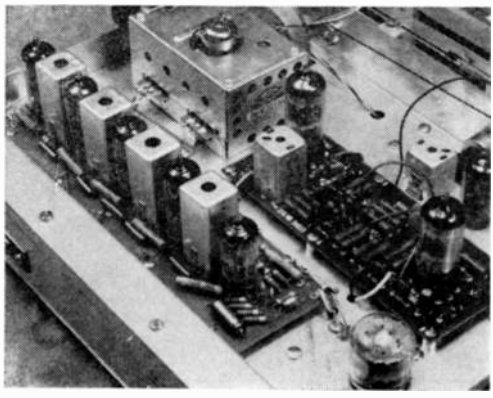
For dollar value, the kit builder gets his money's worth with the ST-97. Its performance is superb and, as with all EICO kits, there is a feeling of permanence. In other words . . . it's built. -30-



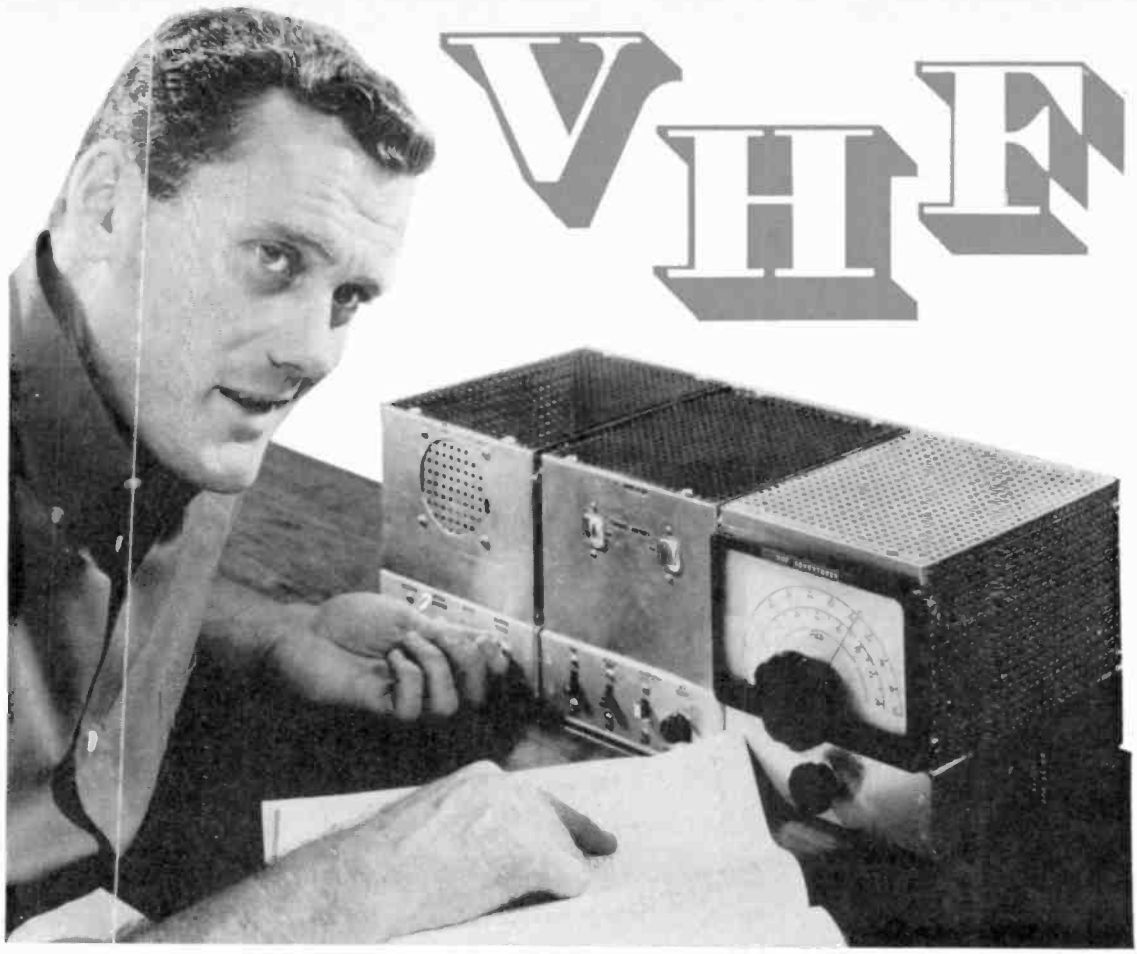
Maximum output is 0.9 volt at 100% modulation—a modest figure, but plenty for a stereo amplifier.



With separation control set for best mid-range figures, channel-to-channel separation is as above.



The i.f. strip (printed-circuit board to left), r.f. tuner (box to the rear) and multiplex board are the three major parts of the ST-97.



VHF adventurer

PART 3

By JAMES G. LEE, W6VAT

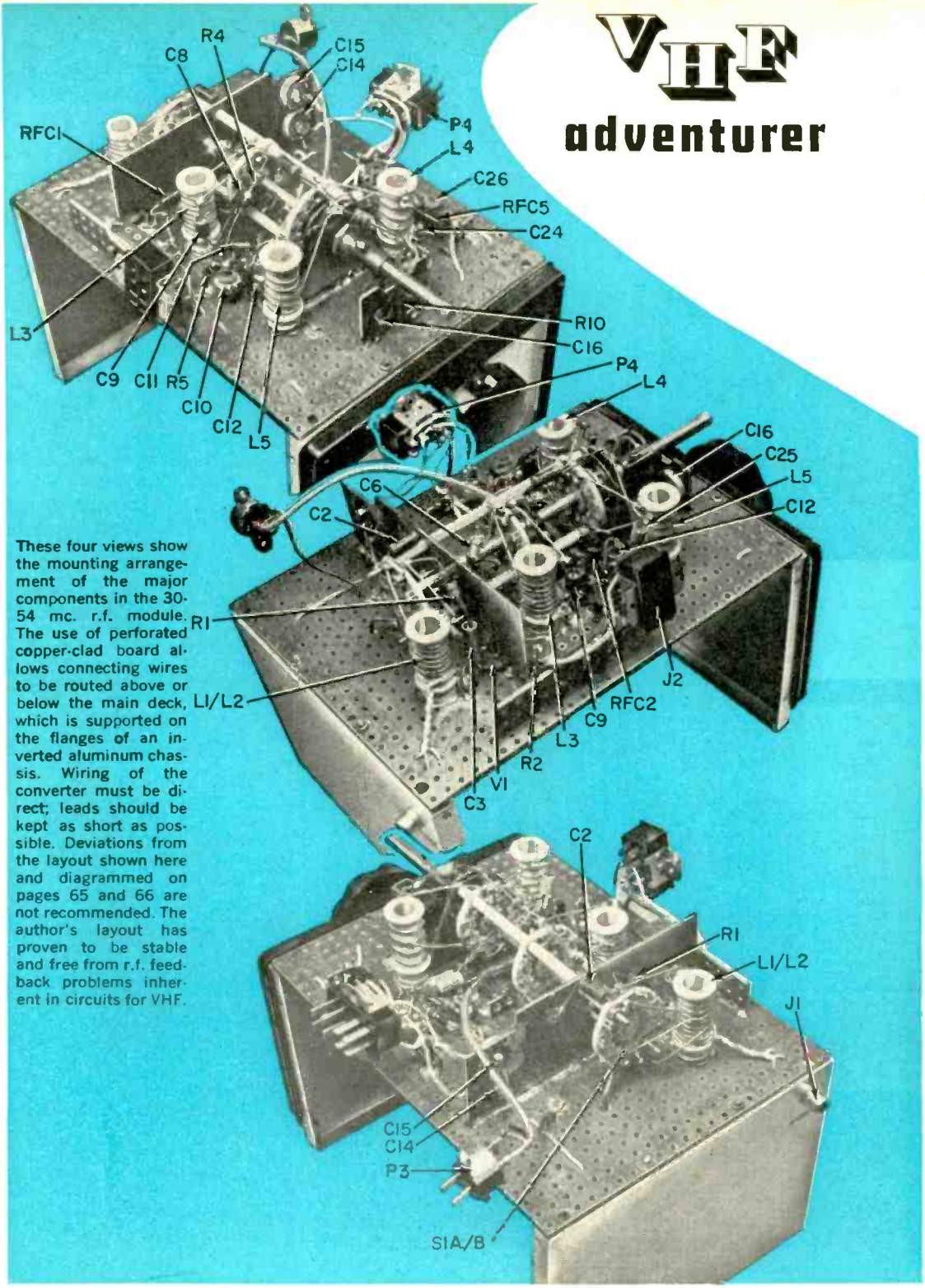
Add a "front end" and you're in business! This one tunes 30-54 megacycles

INTEREST in listening in on the very high frequencies is zooming to new heights. With hundreds of new stations coming on the air every week, the limited reception range in this part of the spectrum—usually 50-75 miles—matters not at all. When the lower part of the VHF spectrum opens up to skip DX, the crowding of stations will be comparable to the 40-meter ham band.

In the two preceding parts of this receiver story (October and November issues), the audio/power supply module and i.f. detector module were carefully outlined. In this third part of the present series, an r.f. module is detailed that covers 30-54 mc., starting where most short-wave receivers leave off. In 1964 we will describe more r.f. modules that will tune other segments of the VHF spectrum.

Because of the 20-megacycle tuning range in this r.f. module, bandswitching must be used, if tuning is not to be

VHF adventurer



These four views show the mounting arrangement of the major components in the 30-54 mc. r.f. module. The use of perforated copper-clad board allows connecting wires to be routed above or below the main deck, which is supported on the flanges of an inverted aluminum chassis. Wiring of the converter must be direct; leads should be kept as short as possible. Deviations from the layout shown here and diagrammed on pages 65 and 66 are not recommended. The author's layout has proven to be stable and free from r.f. feedback problems inherent in circuits for VHF.

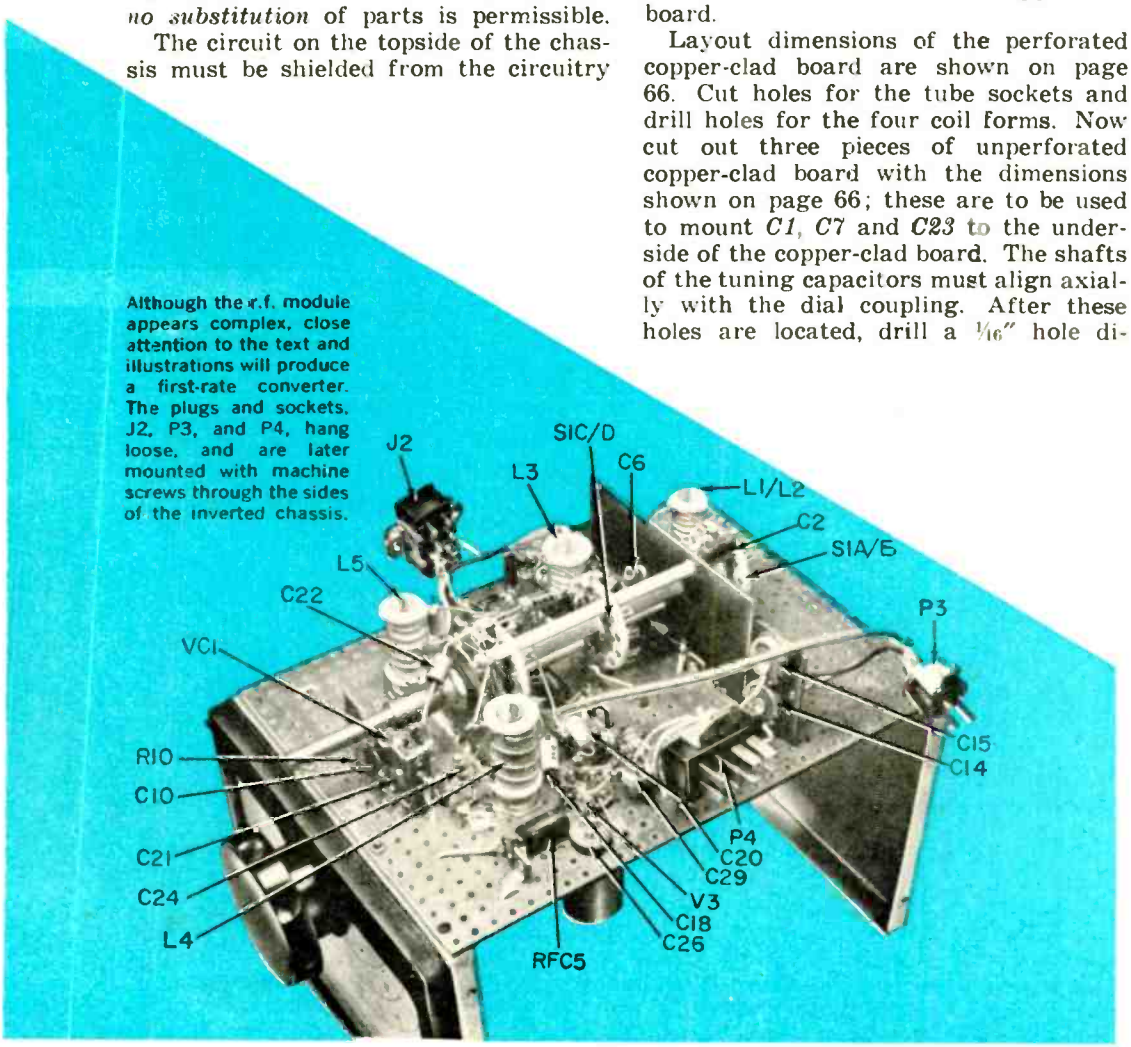
excessively crowded. One band tunes 29.5 to 40 mc., and the second band tunes 39 to 54 mc., covering the frequencies used by a wide variety of fixed-service VHF stations and the six-meter ham band. In keeping with the advanced design of this receiver, a tuned r.f. stage appears in the circuit before the mixer/oscillator stages. The tubes are a pair of 6FG5's and a single 6C4.

Construction. The r.f. modules are the most difficult parts of the VHF ADVENTURER to construct. Because we are working with very short wavelengths, all leads must be direct and as short as possible. Bypassing to eliminate stray r.f. is extremely important. Special capacitors and r.f. chokes are used throughout the circuit and in numerous instances *no substitution* of parts is permissible.

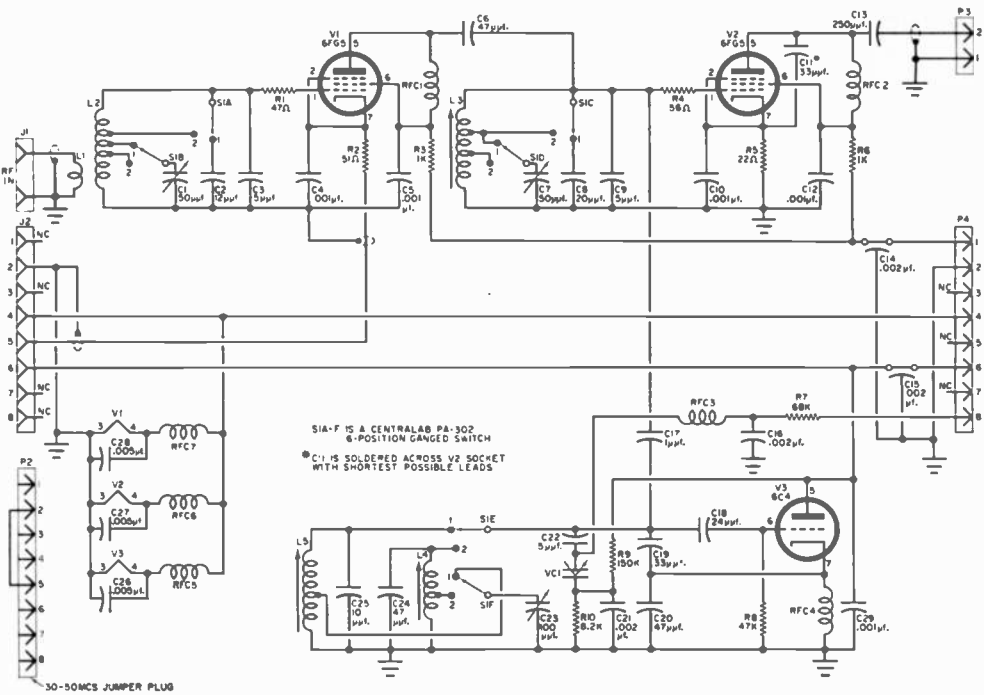
The circuit on the topside of the chassis must be shielded from the circuitry on the underside. The author found it very practical to use perforated copper-clad board as the chassis deck. The perforations permit easy lead dress and the copper cladding is excellent for grounding and shielding at these frequencies. When the circuit is complete on the board, the aluminum chassis is inverted, and the copper-clad board is bolted or screwed to the lips of what would ordinarily be the bottom of the aluminum chassis.

Begin the mechanical construction by mounting the tuning dial. An Eddystone #598 has a very smooth vernier action and the size matches the front panel. Mount the dial flush with the bottom edge of the panel, and bolt the two panels (front and rear) to the copper-clad board.

Layout dimensions of the perforated copper-clad board are shown on page 66. Cut holes for the tube sockets and drill holes for the four coil forms. Now cut out three pieces of unperforated copper-clad board with the dimensions shown on page 66; these are to be used to mount *C1*, *C7* and *C23* to the underside of the copper-clad board. The shafts of the tuning capacitors must align axially with the dial coupling. After these holes are located, drill a 1/16" hole di-



Although the r.f. module appears complex, close attention to the text and illustrations will produce a first-rate converter. The plugs and sockets, J2, P3, and P4, hang loose, and are later mounted with machine screws through the sides of the inverted chassis.



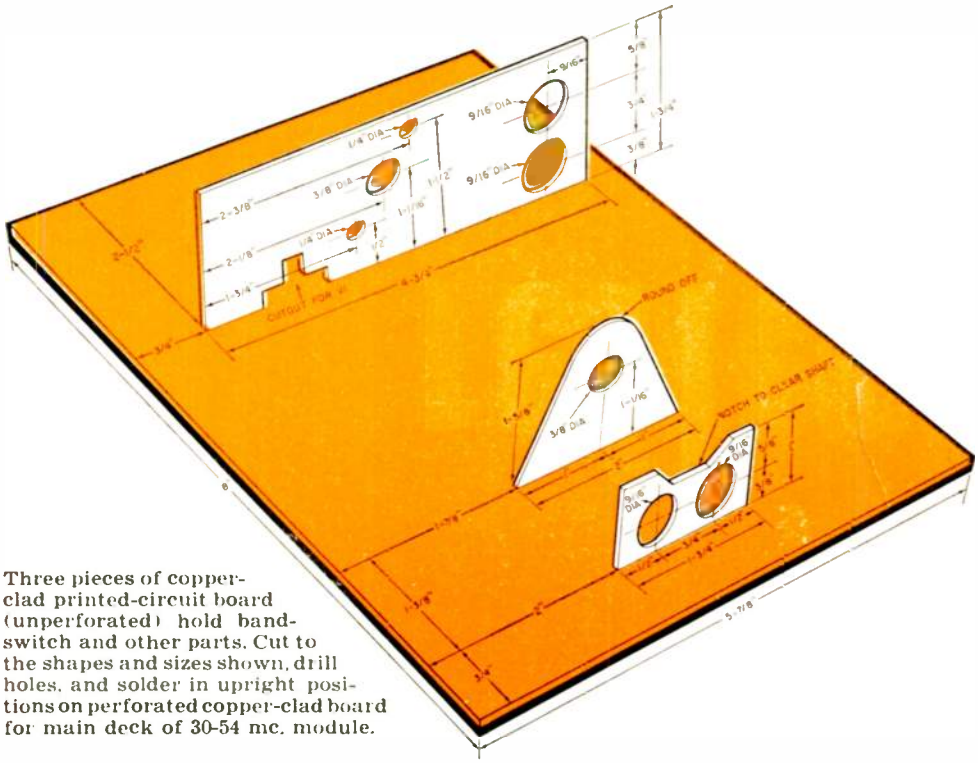
Module schematic shows r.f., oscillator, mixer details. Switch arrangement gives 30-54 mc. coverage.

PARTS LIST

C1, C7—50-μμf., 600-volt variable capacitor (National UM-50 or equivalent)
C2—12-μμf., 600-volt ceramic tubular capacitor
C3, C9, C22—5-μμf., 600-volt ceramic tubular capacitor
C4, C5, C10, C12, C29—0.001-μf., 600-volt silver mica button capacitor (Erie 370-FA-102K or equivalent)
C6, C20, C24—47-μμf., 600-volt ceramic tubular capacitor
C8—20-μμf., 600-volt ceramic tubular capacitor
C11, C19—33-μμf., 600-volt ceramic tubular capacitor
C13—250-μμf., 600-volt ceramic tubular capacitor
C14, C15, C16, C21—0.002-μf., 600-volt silver mica button capacitor for chassis mounting (Erie 370-CB-202K or equivalent)
C17—1.0-μμf., 600-volt ceramic tubular capacitor
C18—24-μμf., 600-volt ceramic tubular capacitor
C23—100-μμf., 600-volt variable capacitor (National UM-100 or equivalent)
C25—10-μμf., 600-volt ceramic tubular
C26, C27, C28—0.005-μf., 600-volt ceramic disc capacitor
J1—Phono jack, RCA-type (may be SO-239 type if desired)
J2—Chassis-mounted jack (Cinch-Jones S-308-AB or equivalent)
L1, L2, L3, L4, L5—See coil table
P2, P4—Chassis-mounted plug (Cinch-Jones P-308-AB or equivalent)
P3—Chassis-mounted plug (Cinch-Jones P-302-AB or equivalent)
R1—47 ohms
R2—51 ohms
R3, R6—1000 ohms } *All resistors ½ watt unless otherwise stated*
R4—56 ohms
R5—22 ohms
R7—68,000 ohms
R8—47,000 ohms
R9—150,000 ohms
R10—8200 ohms
RFC1, RFC2—10-μh. r.f. choke
RFC3—15-μh. r.f. choke
RFC4—50-μh. r.f. choke (National R-33 or equivalent—must be capable of carrying 200 ma.)

rectly below and in line with each rotor lug.

Mount each tuning capacitor with the hardware supplied by the manufacturer to the unclad side of one of the boards described in the last paragraph. Solder a ½" length of #16 tinned busbar from the rotor contact terminal of each capacitor to the copper side of the board on which it is mounted. Loosely join the capacitor shafts to each other and the dial shaft, using Millen Type 39003 solid coupling. The spacing of each board, starting from the front panel, is 1¾" to the oscillator capacitor (*C23*), 4³⁄₁₆" to the mixer capacitor (*C7*) and



Three pieces of copper-clad printed-circuit board (unperforated) hold band-switch and other parts. Cut to the shapes and sizes shown, drill holes, and solder in upright positions on perforated copper-clad board for main deck of 30-54 mc. module.

RFC5, RFC6, RFC7—Ferrite bead r.f. choke (National R45-253—no substitute)
S1a-f—2-position, 6-pole ceramic rotary switch (Centralab PA-302 Index with three non-shorting PA-3 ceramic sections—no substitute)
V1, V2—6EG5 tube
V3—6C4 tube
VC1—Voltage-variable silicon capacitor (Pacific Semiconductor V15E—no substitute; may be obtained from Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill., for $3.05, plus postage)
1—Tuning dial (Eddystone #598, available from British Radio Electronics, Ltd., 1742 Wisconsin Ave., N.W., Washington 7, D.C., for $8.00, postpaid)
1—California Chassis Co. Type A-120 chassis; if not available locally, write to 5445 E. Century Blvd., Lynwood, Calif. (or use Bud AC-406 or Premier ACH-404 which are 1" larger in depth and width, and adjust cutouts accordingly)
Misc.—Perforated copper-clad board—see text, tube sockets, busbar, screws, nuts, decals, knobs, solder, hookup wire, etc.

COIL TABLE

All coils are wound on Miller 43A000CBI ½"-diameter x 1"-long ceramic slug-tuned forms

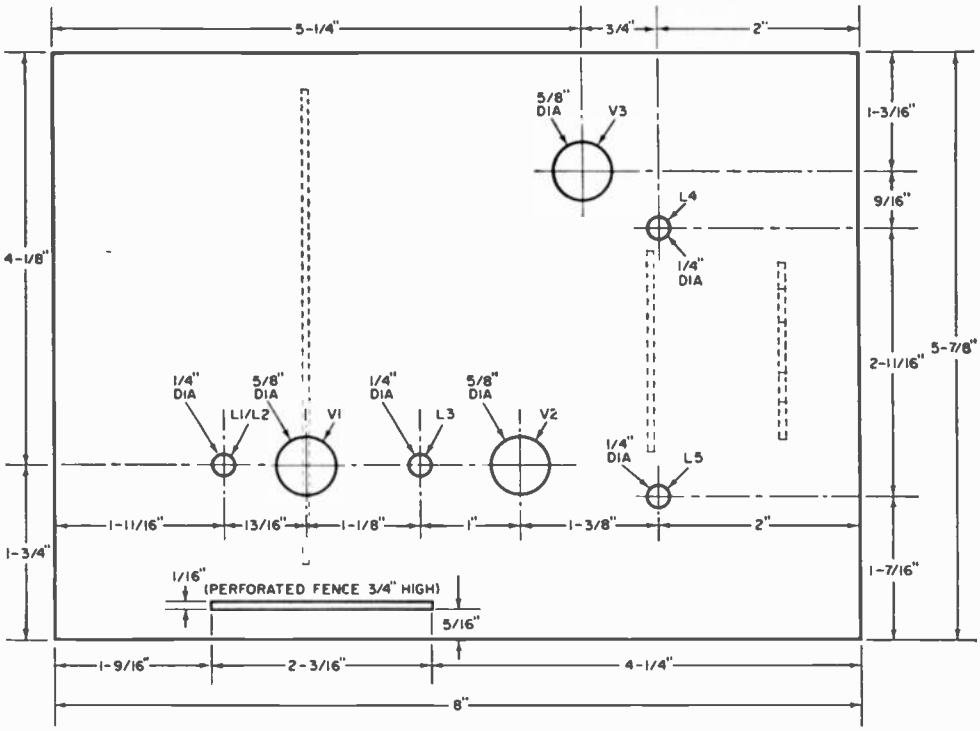
L1—2 turns of hookup wire wound between bottom two turns on L2
L2—9 turns of #16 tinned busbar with low band tap down 3½ turns from the top; the high band has the top 2½ turns shorted with bandspread tap 5½ turns down from the top
L3—8 turns of #16 tinned busbar with the low band tap 1½ turns down from the top; the high band has the top 1½ turns shorted and the bandspread tap is at 4⅝ turns from the top
L4—4 turns of #16 tinned busbar with the bandspread tap 1½ turns from top; this coil tunes the high band oscillator range
L5—6 turns of #16 tinned busbar with the bandspread tap 2¾ turns from top; this coil tunes the low-band oscillator range

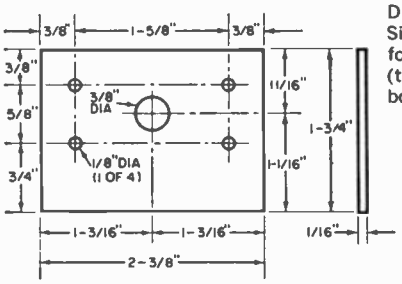
Note: The positions numbered 1 and 2 on bandswitch S1a-f on the schematic are the low band and the high band respectively

6-5/16" to the r.f. stage capacitor (*C1*).

Once the capacitors are positioned properly, tighten the coupler setscrews, making sure that the capacitors are fully meshed and the dial set at "0". The capacitor mounting boards are attached to the main perforated board with crank-handle-shaped pieces of #12 tinned busbar. Solder a busbar to the mounting boards through a perforation so that the opposite end of the bar can be soldered to the main copper-clad board.

The bandswitch is supported by two pieces of unperforated copper-clad board. The one nearest the front of the chassis is trapezoid-shaped; the rear support





Drilling layout for underside of main deck is shown above. Since it's perforated, extra care is needed in making holes for tube sockets. Make mounting boards for tuning capacitors (three required) as at left, using unperforated copper-clad board; these capacitors are mounted with busbar (see text).

board is a rectangle. Dimensions for the boards and necessary holes are shown on page 65. The copper-clad side of the larger board faces to the rear and the small mounting board towards the front.

A notch is cut into the bottom edge of the rear board so that there is a snug fit over the keyway to pin 3 of *V1*, to provide shielding between the input and output sections of this tube. Tin the base of a single ¼" fuse clip and slip it over the bandswitch shaft between the shield and the rear section. It will be soldered in place later.

Once the tube sockets are all mounted, the rear bandswitch shield is positioned across the socket of *V1*. Hold this board with pliers so that it forms an accurate right-angle with the main copper-clad board, and solder the copper cladding surfaces together where they meet. Make a smooth "fillet" using plenty of solder, so that the board is held rigidly. Make sure that the bandswitch shaft will be directly below the tuning knob. Now fillet-solder the front bracket into place.

Initial Wiring. Wind the coils as shown in the Coil Table. Remove and discard the slug from the r.f. coil (*L1/L2*). Mount the coil forms in the positions shown on page 63. Fillet-solder the perforated "fence" as shown above and attach a 3-lug miniature terminal strip and *C4* and *C5* to the "fence."

Wire in the grounds to all the filaments. Pin 3 of *V1* is grounded directly to the shield bracket and soldered. Push the fuse clip on the bandswitch shaft up against the rear shield and solder it to the copper-clad surface. It must make contact with the switch shaft at all times. Wire in and solder filament by-

(*Continued on page* 94)

Beef up the sound of your phone bell and put it where you can hear it when you're out at the barbecue pit or in the garage

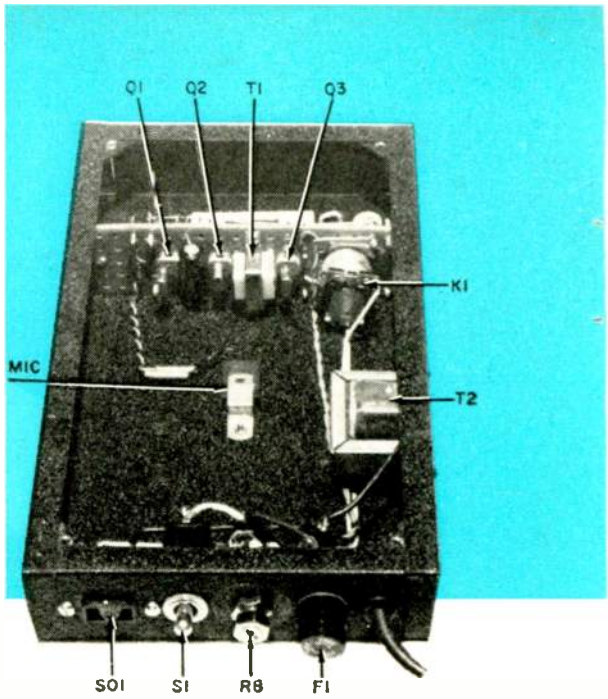
"LOUD-HAILER" for the TELEPHONE

By DONALD L. WILCOX

DID YOU ever miss an important telephone call because you were working outdoors or in the garage, or lounging on the patio or porch, where you couldn't hear the bell? Most of us have had this frustrating experience at least once or twice. One way to avoid it is to have the phone company install a loud outside bell. This is fine, *if* you need the outside bell all year round, and *if* it won't disturb the neighbors, and *if* you're always in an area where the bell can be heard readily.

But that's a lot of "if's," which for many families just don't add up to placement of an order with the phone company. Nevertheless, when the lady of our house was heard to remark to a friend, "We heard *Radio Australia* last

"LOUD-HAILER" for the TELEPHONE



You can duplicate the author's layout by following the parts placement shown here. Holes in chassis allow bell sound to reach bracket-mounted microphone.

night on the short-wave set, but we can't hear the phone ring out at the barbecue pit," it was clear that something had to be done. It was, and the alternative solution to the remote telephone signal problem described here is the result.

It involves no monthly service charge at any time—let alone for those months when you don't need the bell, doesn't require any connection to telephone company equipment, permits you to put the bell where you need it, and allows you to relocate it at any time without inconvenience. Furthermore, you can build the "Loud-Hailer" in a couple of evenings, at a nominal cost of about $18.00, even using all new parts, and you can probably halve that by raiding the trusty junk box.

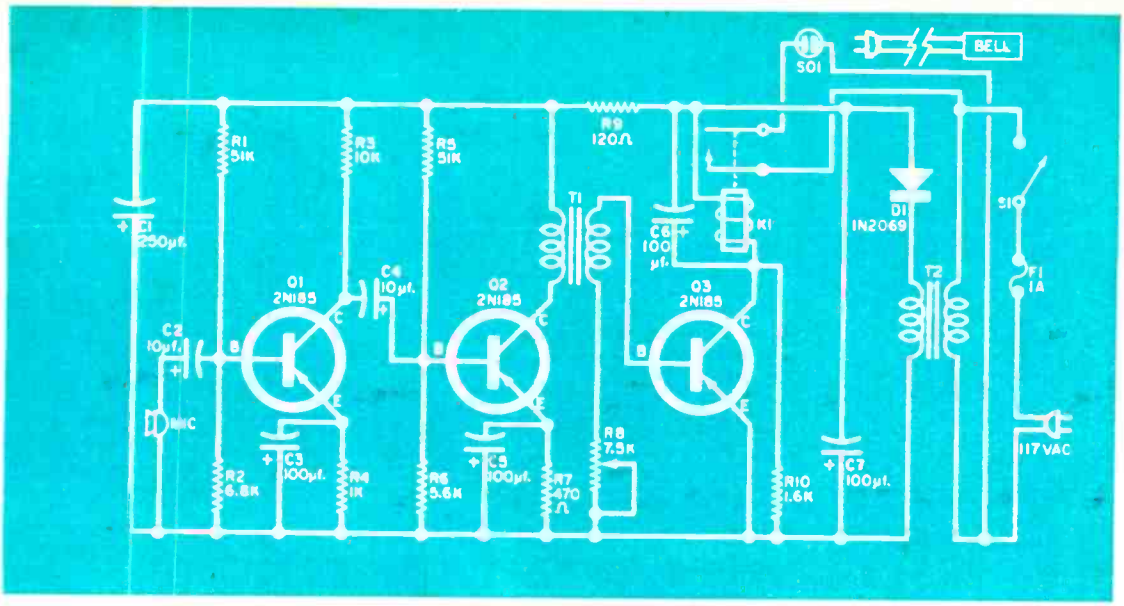
How It Works. The Loud-Hailer is a simple device, made up essentially of a microphone, audio amplifier, and a relay, energized by a small power supply that plugs into the house a.c. line. With the unit in operation, the sound of the telephone bell is picked up by a microphone, the output from which is amplified to a level capable of closing a relay. The remote bell is energized by a.c. from the line, applied through contacts of the relay. The remote bell can be mounted outside the house at any suitable point, or moved about from garden to garage to pool, wherever its extension cord will reach.

A look at the schematic diagram will clarify details of the circuit function. The first two transistors, *Q1* and *Q2*, operate as Class A amplifiers, boosting the microwatt output of the microphone to a level great enough to drive transistor *Q3*, which operates as a Class B power detector.

With no sound at the microphone, *Q3* is practically cut off, since there is no base current; and the emitter-to-collector current is therefore no more than a few microamperes leakage. When the phone bell rings, the amplified microphone signal drives the base of *Q3* negative once each cycle, causing the *Q3* collector current to flow in a series of d.c. pulses. This output, smoothed by capacitor *C6*, energizes relay *K1*, applying a.c. power to the remote bell.

Construction. Since the circuit is extremely non-critical, parts placement and other mechanical details can be varied to suit the constructor's preference. In the author's unit, most of the circuit parts are mounted on a strip of vector board, as shown in the photograph. The controls are grouped at one end of the metal box. The microphone is mounted in the middle of the box, facing a group of drilled holes which permit easy entry for the sound of the phone bell. Wiring is simple and straightforward, and requires only the normal caution about use of a heat sink when soldering transistor leads.

Operation. In use, the Loud-Hailer is placed under the phone with the controls at the rear, so the cords to the a.c. line and the remote bell can be dressed out of the way. This brings the microphone of the Loud-Hailer directly under the bell of the usual desk-type telephone



Schematic diagram shows basic simplicity of the Loud-Hailer circuit.

PARTS LIST

C1—250-μf., 12-volt electrolytic capacitor
C2, C4—10-μf., 6-volt electrolytic capacitor
C3, C5—100-μf., 6-volt electrolytic capacitor
C6, C7—100-μf., 15-volt electrolytic capacitor
D1—1N2069 silicon diode
K1—S.p.s.t. relay, 6-volt, 335-ohm coil (Potter & Brumfield RS5D or equivalent)
Q1, Q2, Q3—2N185 germanium transistor
R1, R5—51,000 ohms
R2—6800 ohms
R3—10,000 ohms
R4—1000 ohms
R6—5600 ohms
R7—470 ohms
R8—7500-ohm potentiometer, with shaft lock
R9—120 ohms
R10—1600 ohms
All resistors ½-watt carbon unless otherwise specified
S1—S.p.s.t. toggle switch
SO1—A.c. convenience outlet socket
T1—Transistor driver transformer, 10,000-ohm primary, 2000-ohm secondary (Lafayette TR-96 or equivalent)
T2—Filament transformer, 6.3-volt secondary (Lafayette TR-11 or equivalent)
1—Alarm-type bell, 115-volt a.c. (Lafayette EL-85 or equivalent)
1—5½" x 9½" x 1½" pan-type chassis
1—600-ohm dynamic microphone (Lafayette PA-74 or equivalent)
Misc.—Vector board, fuse holder, transistor sockets, solder, wire, hardware, etc.

TYPICAL D.C. VOLTAGES

	Q1	Q2	Q3
Ve	—0.90	—0.75	0
Vb	—1.00	—0.85	0
Vc	—1.30	—10.00	—9.6

All voltages are measured to ⊥ side of C7 with high-impedance voltmeter, no input signal to microphone.

where sound pickup will be strongest.

The extension cord leading to the remote bell is plugged into a.c. outlet *SO1*, and gain control potentiometer *R8* is adjusted so that an incoming ring causes reliable ringing of the remote bell. This setting can be tested by asking one of your neighbors to dial your number. When correct operation has been obtained, locate the remote bell where you'll be sure to hear it when it rings.

If you want to use the Loud-Hailer only occasionally, and in different locations, such as the garden, attic, garage, or barbecue pit, you may want to keep the extension cord free, to be rerouted as necessary. However, if you intend to use the Loud-Hailer for just one or two remote locations, you may prefer to install permanent remote lines and outlets. Either way, you'll stop missing those important calls. —30—

On the Citizens Band

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

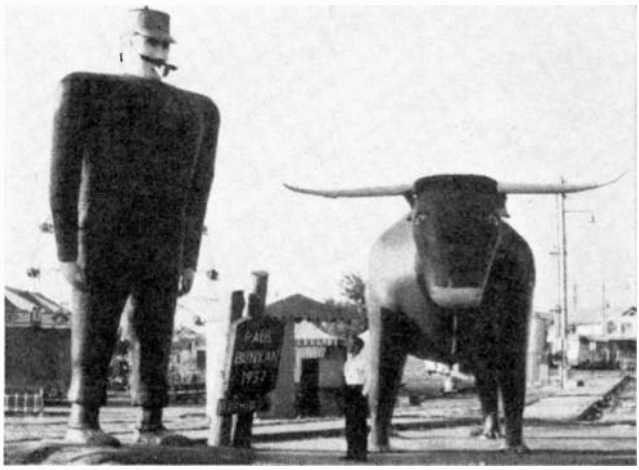
TALL PAUL BUNYAN and friend (Babe the blue ox) played host to the largest single event of its type in history last July. The attraction was the Wally Byam Caravan Club's Sixth International Rally, an affair for trailer owners, which was held at Bemidji, Minn. We were honored to receive an invitation to the week-long gathering and it gave us a chance to chat with people from all walks of life and practically every state in the Union, many of them ardent CB'ers. Also, it alerted us to some of the most useful applications of Citizens Band communications we've seen to date.

TRAILERING CB'ERS HOLD RALLY

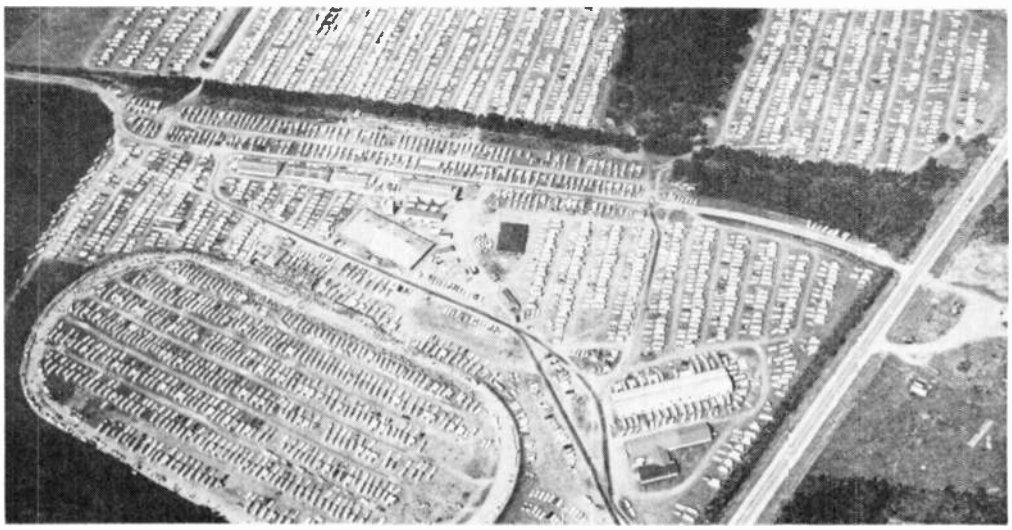
Most of our readers will remember the story on the world-traveling Wally Byam Caravanners in the April edition of the OTCB column. We told of the club's decision back in 1960 to incorporate CB gear in their journeys across the country (and now, across oceans when special permission is granted).

Over 2000 Airstream travel trailers were parked on Bemidji's Beltrami County Fairgrounds the week preceding the rally, covering over 180 acres. Trailers were towed into place by vehicles that brought some 6000 rally participants to the grounds. The temporary mobile city appeared to fall into place—completely organized—almost as though the annual get-together were a weekly affair. The mammoth "city on wheels" had roads (clearly marked), and its own police force and information center at each entrance—in fact, all the conveniences of a populated city of *50,000!*

CB on the Fairgrounds. The WBCC International Rally was thoroughly covered by three different kinds of communication links. Telephone facilities were installed on the grounds for those who might care to place long-distance calls anywhere in the world, or for those who might need to be notified in case of emergencies at home or their place of business. Amateur radio facilities were manned by licensed hams among the Caravanners, with gear mounted and operating in their trailers; they were ready for emergencies and on hand for the relaying or receiving of information of value to WBCC members. Citizens Band operation was mostly personal and conducted on



Those CB'ers who attended the Wally Byam Caravan Club's week-long Sixth International Rally at the Beltrami County Fairgrounds, Bemidji, Minn., were welcomed to the scene by giant Paul Bunyan and his like-sized ox.



Over 2000 trailers and the 2000-plus vehicles that brought them there—many of them CB-equipped—were parked at the 180-acre Beltrami Fairgrounds. About 6000 Caravanners took part in the rally.

an orderly basis; the band was monitored constantly for emergencies, personal messages, and trailer-to-trailer communications between friends, officials, committee members, and trailer maintenance headquarters.

The Caravanners began using the Citizens Band as a means of keeping traveling units in constant contact. It enabled groups to have the comforting knowledge that help was as near as their CB equipment, gave the "lead" trailer a chance to inform all other CB'ers in the caravan of traffic and road conditions ahead, and let the trailer "bringing-up-the-rear" know that he hadn't been left too far behind. CB radio also made it possible for Caravanners to receive help from stations based in whatever area they chanced to be.

At the fairgrounds, there were innumerable hand-held CB transceivers being used by young and old alike. They kept trailer units in contact with any part of the family on foot somewhere in the 180-acre rally area. Most of the mobile units we peeked in on had been so mounted in the hauling vehicle that they could be easily removed and placed in the trailer. Other installations incorporated two permanently mounted units so that a driver could keep in contact with his campsite when running errands. After driving down row upon row of trailers for 30 minutes counting mobile whips, we gave up—before we lost our 20-20 vision—and estimated that approximately 1500 trailers were mobile-whip equipped!

Some of the more important calls handled during the rally involved Caravanners approaching Bemidji who asked directions to the rally site. A member making his approach after dark—with a flat tire—called for assistance, and received it in short order. The only accident we became aware of happened on the grounds when a gentleman was hit by a car. We were honored to have relayed the plea for help to a WBCC doctor who, in turn, was at the injured man's side in less than five minutes.

For those in need of technical information or assistance in mounting or operating their equipment, Globe Electronics service engineer Sam Ricker was on hand, as was WBCC-member Earl Johnston. Earl headed the Emergency Radio Committee, organized the amateur operators on the grounds, and headed a huge CB gathering under the big-top to discuss future use of CB among the Caravanners.

Trailer-Traveling Traylor. Sally Sue Traylor, a talented 18-year-old CB'ing YL from Lufkin, Texas, made off with top honors during highlights of the Sixth International Rally that were held for the younger set. Sally broke rally contest records by having the honored titles of "Miss Top Talent of 1963" and "Miss National Teen Queen" bestowed upon her. It was the first time in rally history that both awards had been captured by the same contestant.

Highly active in high school dramatics, world affairs, Red Cross, volunteer work, and electronics (believe it or not), Sally's talent-grooming began at age three, from which she danced her way to piano recitals

International Rally Queen Sally Sue Traylor made good use of CB at the fairgrounds. Thousands of transceivers kept the trailer units in contact with individuals on foot or in the hauling vehicles.

at age five. And, she placed first with a superior rating in a national competition of the Federation of Music Clubs by playing her own composition at the ripe old age of 12! All of these efforts backed her version of "Acrobatic Modern Jazz"—her spotlighted performance for thousands of Caravanners—and crowned her "Miss Top Talent." As for the "National Teen Queen" title, we feel that the accompanying photos explain quite well why Sally was crowned!

That about sums up the up-to-the-moment biography of an energetic CB'ing YL, with the exception of one unofficial title she unknowingly was awarded by one of the CB'ers in attendance at her double crowning. While we can't pinpoint the source, one CB'er was heard declaring that Sally should also be crowned "The Young Lady Who CB'ers Would Like Most To Be On Frequency With!"

Fourth of July highlights topped the Caravanners' activities for the week. Preceding the traditional Independence Day parade, Minnesota Senator Hubert Humphrey welcomed the Wally Byam Caravanners to the state and praised them as "American ambassadors to the world." As this column is being read, over 100 Caravanning trailers are well on their way to a 14-month tour around the world—all equipped with Citizens Band radio!

Miss National Teen Queen and Caravan executive officers had a chance to chat with Minnesota Senator Hubert Humphrey during the WBCC activities. Sen. Humphrey was made an honorary Caravanner.

CB Jamboree News. Many clubs have been submitting excellent reports on CB jams that were held across the country starting early last spring. The Beaumont CB Radio Club, Texas, held its first annual get-together in May and drew some 200 CB'ers. The event was considered a smash hit for a first try; they expect bigger and better things to happen next year at the Second Annual Jamboree.

More than 800 CB'ers from Pennsylvania, New York, New Jersey, Maryland, and Delaware attended the Second Annual Shippes Grove Jamboree near Reading, Pa., in September. Our informant stated that the same good food was on hand that was enjoyed by all last year. There was live entertainment as well as many exhibits, including communications gear, QSL cards, supplies and radios. The only problem encountered was that of getting three and four duplications in the "big swap" for QSL cards. It appears that many CB'ing parents also equipped their YT's (young tots?) with QSL cards so they could join the fun.

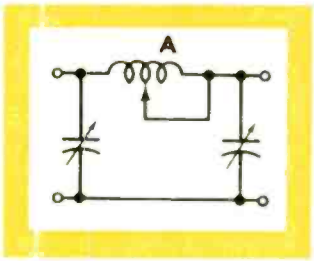
With CB'ers from Illinois, Minnesota, Iowa, Nebraska and Missouri in attendance, the Des Moines Mobile Emergency Team held their successful Hawkeye CB Jamboree on September 7 and 8. Entertainment, prizes, excellent exhibits and chow were on hand. Attendance neared the 400 mark.

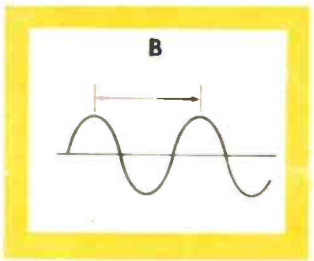
Canadian News. Word from Canada indicates that the Chateauguay General Radio Club recently handled its first major emergency. Ten CBRC mobile units aided

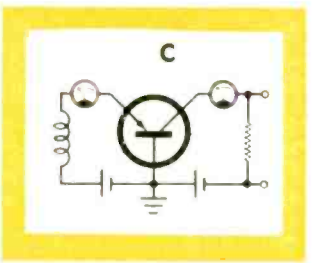
(*Continued on page* 110)

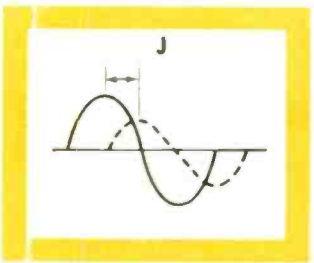
GREEK ALPHABET QUIZ

By ROBERT P. BALIN

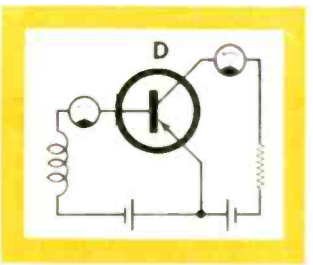


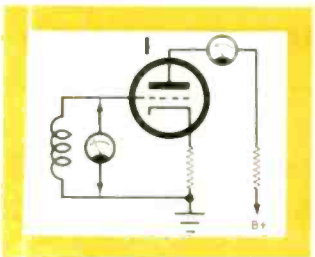


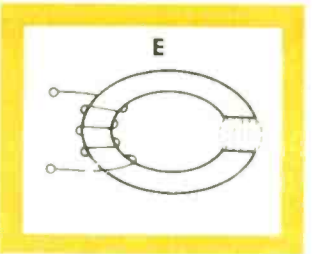


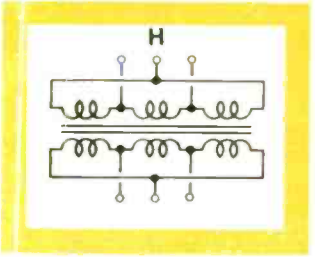


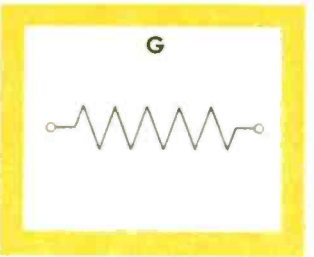
Engineers and scientists use Greek letters as symbols for many properties, quantities, or relationships that are important in electrical and electronic circuits. Study the ten examples illustrated here and test your knowledge by matching the drawings with the Greek letter most commonly used as a symbol for the quantity or relationship illustrated. Eight correct answers is a good score.

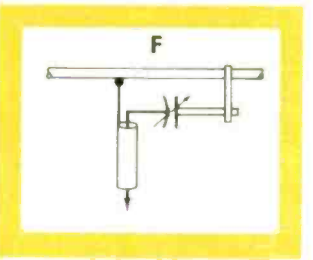












(*Answers on page* 107)

1 Alpha α____ 2 Beta β____ 3 Gamma γ___ 4 Delta Δ___ 5 Theta θ____

6 Lambda λ___ 7 Mu μ____ 8 Pi π____ 9 Phi Φ____ 10 Omega Ω___

Transistor Topics

By **LOU GARNER,** Semiconductor Editor

WITH the Holiday Season here once again, chances are you're faced with the annual problem of selecting gifts for your technically minded friends and fellow hobbyists. If you have an unlimited budget, the problem is a simple one—a new oscilloscope, communications receiver, transmitter, audio amplifier, or a piece of test gear should do nicely. On the other hand, if you have budget problems, a good deal of head-scratching may be in order.

One solution to the problem of selecting budget-priced gifts is General Electric's new "Experimenter Line" of electronic components. Some 16 different types of individually blister-packaged components are offered at prices ranging from 55 cents to $6.30 each. Except for a simple reed switch (Item No. X-7, at $1.00), all the components are transistors or related semiconductor control devices.

Among the items available are four different types of silicon-controlled rectifiers (SCR's) with ratings up to 20 amperes, a light-activated power switch, a photoconductive cell, two types of unijunction transistors, a zener diode, and six different types of *pnp* and *npn* transistors. Both high-frequency and general-purpose transistor types are included in the line.

Each component package contains a complete schematic diagram for one or more special construction projects. The circuits featured include such units as an HO speed control, a slave photoflash, burglar alarm, tachometer, metronome, and several different types of light flashers, CPO's, audio amplifiers and radio receivers. A typical schematic diagram is given in Fig. 1.

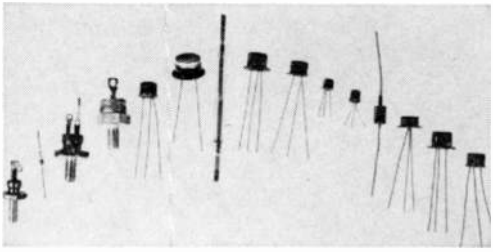
In addition to the basic electronic component and schematic diagram sheet, hardware items are included in each package where necessary. For example, a magnet and coil form come with the X-7 reed switch.

Introduction of this new series of products by GE is a veritable milestone for the hobbyist, since, to our knowledge, it is the first time a *major* manufacturer has offered a complete line of components tailored to experimenters' specific requirements. True, a number of large firms have offered one, two, or even a half-dozen "experimenter" items in the past, but never such an extensive group of components.

The "Experimenter Line" is available from GE's Distributor Sales Division, Owensboro, Ky., or from local authorized distributors.

Readers' Circuits. While most P.E. readers prefer to assemble and test simple circuits, an increasing number of hobbyists are ready to tackle more advanced projects. This month we hope to satisfy *both* groups by featuring one circuit submitted by a professional design engineer, as well as one of the ever-popular two-transistor broadcast-band receiver designs.

Reader Robert Kuhnemund (Yarmouth Rd., White Plains, N. Y.), who submitted *the receiver circuit* illustrated in Fig. 2, writes that he has "built almost every Reader's Cir-



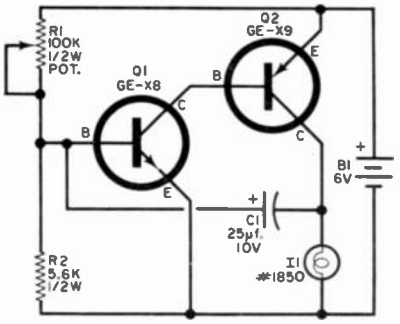


Fig. 1. This circuit diagram is typical of those which are included with each semiconductor device in General Electric's new "Experimenter Line" shown above. Note that all parts values are given.

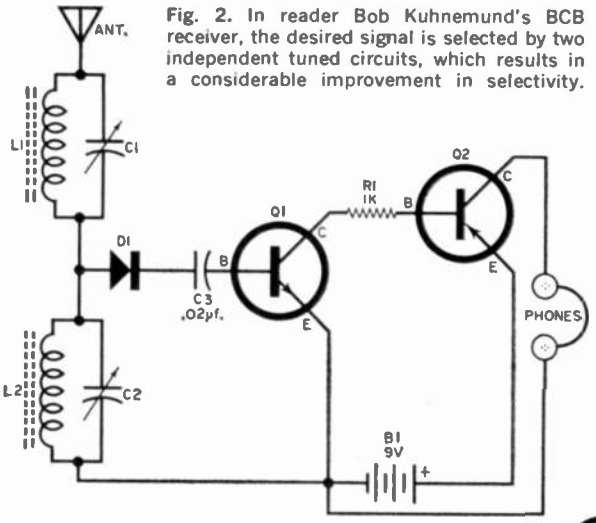
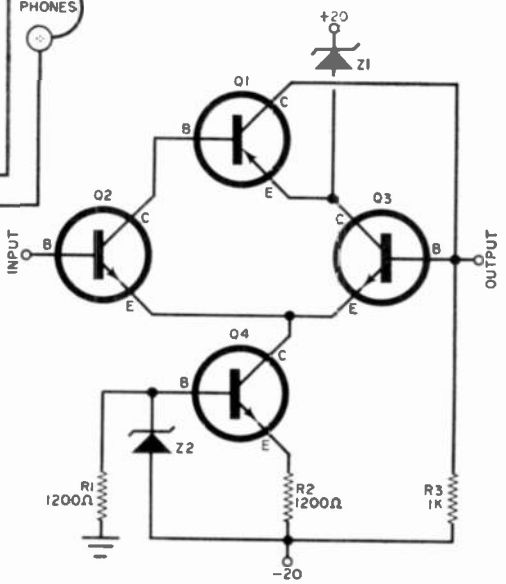
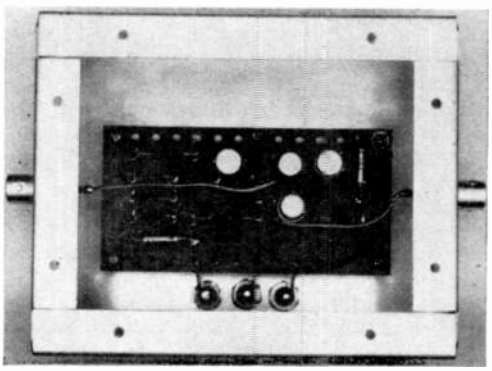


Fig. 2. In reader Bob Kuhnemund's BCB receiver, the desired signal is selected by two independent tuned circuits, which results in a considerable improvement in selectivity.

Fig. 3. Isolation amplifier circuit submitted by Jeff Harman has unity gain and a 5-mc. bandwidth. Input impedance: over 1 megohm when driving a 100-ohm load. Mounting within metal chassis as shown will minimize trouble from pickup of stray signals that often plague wideband devices.





cuit you have printed." He also says that he developed the circuit shown after considerable experimentation.

Bob used *npn* (*Q1*) and *pnp* (*Q2*) transistors in a complementary configuration as a two-stage audio amplifier. In operation, the desired station's signal is selected by *two* independent tuned circuits (*L1-C1* and *L2-C2*), the first of which acts as a *wave trap* in series with the antenna lead. Net result: a considerable improvement in over-all selectivity. The selected station signal is detected by diode *D1* and coupled through *C3* to the two-stage amplifier which, in turn, drives the headphones. Interstage resistor *R1* establishes *Q2*'s base bias.

Readily available components are used in the receiver. Antenna coils *L1* and *L2* are standard broadcast-band ferrite loopsticks. Tuning capacitors *C1* and *C2* are independent 365-$\mu\mu$f. units, while *C3* is a small ceramic or paper capacitor. Resistor *R1* is rated at a half-watt. As far as the semiconductor components are concerned, *D1* is a 1N34 diode, while *Q1* and *Q2* are types 2N170 and 2N107, respectively. The headphones are familiar 1000-to-2000 ohm units. Finally, operating power is supplied by a 9-volt transistor battery (*B1*), such as a Burgess 2N6; if you wish, however, the power supply can be made up of six penlight cells connected in series.

Neither layout nor lead dress should cause problems in duplicating Bob's receiver. For maximum selectivity, *L1* and *L2* should be mounted at right angles with respect to each other and with sufficient physical separation to minimize coupling. The circuit itself can be assembled on a small chassis or wired "breadboard" fashion, as preferred.

Bob's receiver should give acceptable performance on local stations when used with a moderately long external antenna. Some experimentation may be needed to perfect an operational technique, for the two tuned circuits (*L1-C1* and *L2-C2*) are adjusted independently. As a general rule, however, *C2* is tuned to select the desired station while *C1* is adjusted to reject any strong undesired interfering signals.

Suitable for more advanced workers, *the isolation amplifier circuit* illustrated in Fig. 3 was submitted by Jeff Harman (3297 Iowa St., Costa Mesa, Calif.), a design engineer

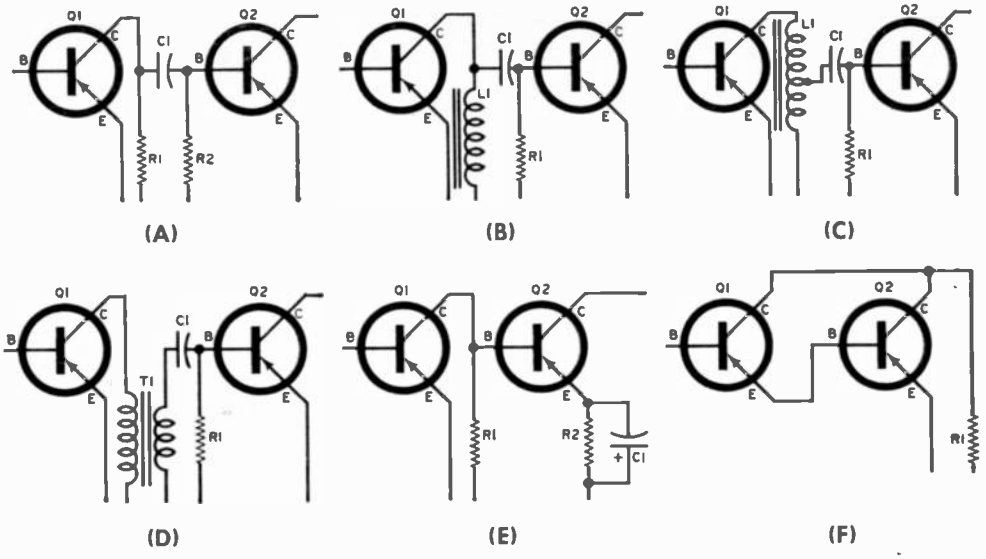


Fig. 4. Transistor amplifier coupling techniques: (A) RC coupling; (B) impedance coupling; (C) tapped impedance coupling; (D) transformer coupling; (E) direct coupling; (F) Darlington stage.

with the ISC Division of Collins Radio Company.

Before we discuss Jeff's circuit in detail, a word of explanation about "isolation amplifiers" may be in order. The sole purpose of this instrument is to isolate a load from the signal source. Thus, such an amplifier neither amplifies nor attenuates the signal . . . in other words, it has *unity voltage gain*. In general, the isolation amplifier has high input and low output impedances, introduces little or no distortion, has relatively wide bandwidth, and is designed for maximum stability. Such amplifiers are often used at the inputs of oscilloscopes, recorders, computers, medical instruments, industrial controls, measuring devices and similar equipment.

According to Jeff, his amplifier has unity gain and a bandwidth of 5 mc. He measured an input impedance of over 1 megohm when driving a 100-ohm load.

Transistors *Q2* and *Q3* are used as a differential amplifier, while *Q1* serves as a common-emitter amplifier, with 100% negative feedback taken from *Q1*'s collector and applied to *Q3*'s base. Transistor *Q4* serves simply as a regulated current source. Zener diodes *Z1* and *Z2* regulate the amplifier and insure stable operation.

Except for the semiconductor components, relatively few parts are needed. Resistors *R1*, *R2* and *R3* are all half-watt units. Zener diodes *Z1* and *Z2* are rated at 7.5 volts. Transistor *Q1* is a *pnp* 2N1132, while *Q2*, *Q3* and *Q4* are all 2N2270 *npn* units.

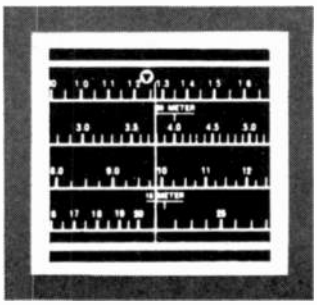
A duplicate of Jeff's amplifier can be assembled using any one of several construction techniques—etched-circuit boards, a conventional chassis, etc. Regardless of the method chosen, good wiring practice should be observed, with top-quality components used throughout. Jeff's original model (see photo) was assembled on a perforated board and later mounted in a small metal chassis.

Transitips. Whenever a piece of equipment requires more gain than can be obtained from a single amplifier stage, common practice is to use two or more stages in cascade. With this arrangement, the output signal of each stage becomes the input signal for the next succeeding stage, and the circuit's over-all gain is the *product* of the gains of the individual stages (or the *sum* of the db gains of each stage). For example, if three stages having, say, voltage gains of 5, 10 and 8, respectively, are cascaded, the circuit's over-all gain is 5 x 10 x 8, or 400.

Any of several methods can be used for interconnecting—or coupling—cascaded amplifier stages. The most popular techniques are illustrated in Fig. 4. Each of these methods has certain advantages and limitations, depending on the type of signal handled (d.c., a.f. or r.f.), bandwidth required, and similar factors.

Resistance-capacity, or *RC*, coupling, as shown in Fig. 4(A), is used extensively in audio amplifiers. In operation, the amplified signal appearing across *Q1*'s collector load resistor, *R1*, is coupled through *C1* to *Q2*'s base-emitter circuit. Resistor *R2* is *Q2*'s base

(Continued on page 96)



Across the Ham Bands

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

OPERATING ANOTHER HAM'S STATION

THE OTHER DAY two hams—one "mobile," the second "fixed"—were working each other. Let's say that they were using the call letters "W9EGQ" and "W9EGQ/mobile." A third ham broke in and told them that what they were doing was completely illegal. According to the intruder, an amateur must use his own assigned call letters when operating a licensed station other than his own. The only difference in operating another ham's station, according to the volunteer authority, is that you sign your call as a "portable," even if the station is in your own district. When this chap righteously stood by, several other hams chimed in to congratulate him on keeping illegal operations out of the ham bands.

There's just one flaw in the above advice: it's wholly and emphatically WRONG! When you operate *any licensed amateur station* (the only kind you *can* operate legally), you *must* use the call letters assigned to that station. In the eyes of the FCC, using any other call-sign is a serious violation of the amateur regulations.

Even if a ham has a station in his home, another one in his automobile, a portable station in a temporary location, and still another one in his private aeroplane, the legal call-sign of each would be the same (modified by the "portable" or "mobile" designation, if necessary). Furthermore, any or all of the units could be on the air simultaneously, as long as each one was being operated by a properly licensed operator. Of course, in such cases, each operator would have to have his own operator's license in his possession, and operate the station in compliance with all applicable FCC regulations—keeping an accurate log, and so

Novice Station of the Month

Glen Peterson, WN6BOD, of San Diego, Calif., uses a Heathkit DX-40 transmitter and an old Hallicrafters SX-25 receiver with some of the coils missing. However, those missing coils haven't prevented him from working 27 states in only a few months of weekend operation. Besides being a ham, Glen is president of Explorer Post 288, Boy Scouts of America, which, oddly enough, specializes in amateur radio! For submitting this photo in our Novice Station of the Month contest, Glen will receive a free one-year subscription. All future entries for the contest should be sent to Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana, 46401.

on. In addition, either the original station license or a photocopy of it would have to be posted in a prominent place in the station.

It is worth noting that while the rule discussed above applies to all transmitters covered by a station license, it is possible for one individual amateur to take out more than one amateur *station* license. For example, someone who maintains a home in New York and another in Florida might want to do so. In such a case, the call of the New York station still is the only call that may legally be signed when operating the New York station, and the Florida call must be signed when operating the Florida station. However, since FCC regulations now require only one notification per year when operating away from the home QTH, few hams bother to obtain more than one station license.

Finally, it is doubtful if any ham uses his call letters incorrectly on purpose, but it's amazing how many do so through ignorance or carelessness. Why risk being a "silent key" through a license suspension when a little care and common sense will keep you in the clear?

TECHNICAL TIP

Operators of the National VFO-62 variable-frequency oscillator who need a bit more output to excite hard-to-drive 2- and 6-meter transmitters should be interested in the following modification from Victor E. Penny, W1MTS.

First, add a tuned circuit to the output circuit of the VFO-62, as suggested in the National Company's field service note #23. Connect a 3-30 $\mu\mu$f. trimmer across a 4-μh. r.f. choke (such as the National R-60) or equivalent coil. Next, connect the paralleled combination across the solder terminals of a standard phone plug, and connect one end of a 2′ length of coax to the phone plug also. Be sure to wire the coax shield braid to the sleeve of the plug, and the coax center conductor to the plug tip connection. Terminate the other end of the coax in a plug that mates with your transmitter's crystal socket.

Insert the phone plug into the phone jack (not the cathode follower jack) on the back of the VFO-62, and insert the other plug into the transmitter crystal socket. Then adjust the 3-30 $\mu\mu$f. capacitor for maximum output in the center of the desired band—8.666 mc. for 6 meters, 8.111 mc. for 2 meters.

If you want Rhode Island on 80 meters, look for Warren Crookes, KN1YVN, between 4:30 and 6:00 a.m. He operates out of Foster, R.I., with a Johnson Ranger transmitter, National NC-270 receiver, and doublet antenna—they've netted him 32 states.

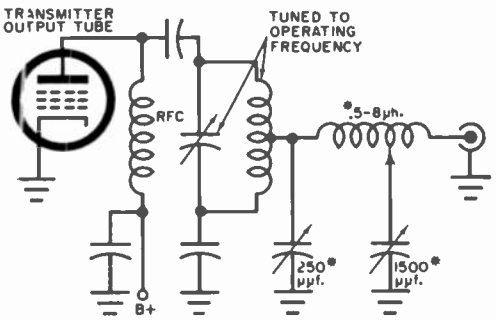
Adding the tuned circuit will in itself increase the VFO-62's output appreciably. But carrying out the rest of W1MTS's modification will increase the output much more. Immediately behind the phone jack under the VFO-62 chassis, an insulated 2-terminal tie strip is mounted. Replace it with a 3-terminal strip or mount an additional single-terminal strip near it.

Referring to the VFO-62 circuit diagram, disconnect the screen r.f. choke *L4* (which comes from pin #8 of the tube socket) and the plate load resistor *R3* from the original tie point. Replace resistor *R3* with a 3300-ohm, ½-watt unit; then connect both the resistor and choke

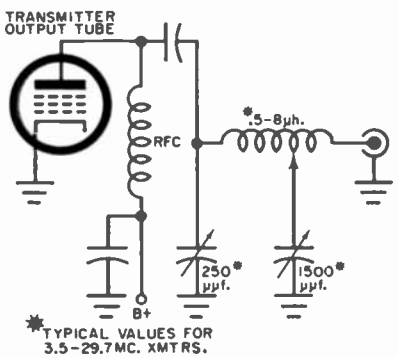
So far Elaine Berkowitz, WN9ESY, Milwaukee, Wis., has worked 30 states, 24 confirmed. She runs 75 watts to a Knight-Kit T-50 transmitter to excite a Hy-Gain 14-AVS vertical antenna, and receives on a Mosley CM-1. Elaine's son, Mike, is also a ham.

to the added third terminal. Bypass the terminal to the chassis through a 0.01-μf. ceramic capacitor, and solder a short length of wire between the terminal and the junction of resistors *R5* and *R6* and the filter capacitor. Solder the connections, and the job is done.

This change removes the pentode section of the 6BH8 tube from the OB2 voltage regulator; the critical B+ voltages on the oscillator section are still regulated, however. Incidentally, while you *can* take the first step in the modification without taking the second, *don't* reverse the procedure.



The diagram above shows how the classic pi-network circuit was first used in amateur transmitters in conjunction with a parallel-tuned tank circuit as an antenna-matching network. The modern, simplified arrangement below employs a pi-network combination plate tank circuit and antenna-matching network.



CLASSIC HAM CIRCUITS

Have you ever tried to visualize what modern band-switching amateur transmitters would be like if the universally used *pi*-network tank circuit had never been developed? Without it, they certainly would be bulkier, more complicated, and more expensive. In addition, they would probably be slightly more difficult to tune; and—other things being equal—their emitted signals would contain just a bit more undesired harmonic energy.

Pi-Network Tank Circuit. Probably the first use of the *pi*-network in amateur transmitters was described in the article "A Universal Antenna Coupling System for Modern Transmitters," by Arthur A. Collins, W9CXX, in *QST*, February, 1934, page 15. Art claimed that the new circuit (see diagram at left) would feed power into virtually any antenna, with increased transmitter efficiency and decreased harmonic output.

For some months after the publication of the article, almost every ham seemed to be building a "Collins Coupler," and they were loading up all sorts of unlikely metallic articles like bedsprings and window screens as antennas. But after its novelty wore off, the Collins Coupler was soon forgotten by the average ham.

Some time later, Frank C. Jones, W6AJF, described a low-power, portable transmitter which used a *pi*-network combination output tank circuit and antenna-matching network in the *Jones Amateur Radio Handbook*, the predecessor of the *Radio Handbook*. W6AJF's circuit (diagram at left) was identical to that used in many transmitters today.

In spite of its claimed advantages, however, the *pi*-net tank circuit did not gain much popularity up to the start of World War II. But during the war practically every ham was involved in defense electronics work, or was in the Armed Services, and many were directly concerned with mobile and portable communications transmitters. Such equipment was more useful if it could feed r.f. energy into almost any random length of wire in an emergency. It also had to be light and compact, without sacrificing efficiency and reliability.

As a result of their wartime experience, these hams came home convinced that an amateur transmitter, even the "full-gallon" size, did not have to be a rack-and-panel monster, forever condemned to inhabit the attic or basement. The idea of the compact, table-top-cabinet transmitter caught on strongly, stim-

(*Continued on page* 104)

Short-Wave Broadcast Predictions

DECEMBER 1963

BY STANLEY LEINWOLL, Radio Propagation Editor

YOU MAY NOT KNOW that up-to-the-minute information about radio propagation conditions can be obtained from WWV for trans-Atlantic paths, and WWVH for trans-Pacific paths twice every hour. Station WWV broadcasts reports at 19½ and 49½ minutes past each hour on 2.5, 5.0, 10, 15, 20, and 25 mc., WWVH at 9 and 39 minutes past each hour on 5, 10, and 15 mc. They both transmit a letter-number combination in slow Morse code. The letter, which indicates conditions at the time of the broadcast, is either N, U, or W, for normal, unsettled, or disturbed. The number represents a forecast of conditions expected during the coming six hours, as follows: (1) useless, (2) very poor, (3) poor, (4) poor to fair, (5) fair, (6) fair to good, (7) good, (8) very good, and (9) excellent.

TIME (EST)

Between Eastern USA and:	00	02	04	06	08	10	12	14	16	18	20	22	24
Western Europe	6	6	6	9	15	17	17	11	9	7	6	6	
Eastern Europe	6	6	6	7	15	15	9	7	6	6	6	6	
South & Central America	11	9	9	15	17	17	17	17	17	15	11	11	
Near East	6	6	6	6	17	17	11	9	9	7	7	6	
North Africa	6	6	6	9	17	21	17	11	9	7	7	7	
South & Central Africa	9	9	9	11	21	21	21	21	17	11	9	9	
Australia & New Zealand	9	9	9	9	9	11	*	17	21	17	11	9	

TIME (CST)

Between Central USA and:	00	02	04	06	08	10	12	14	16	18	20	22	24
Western Europe	6	6	6	7	15	17	11	7	6	6	6	6	
Eastern Europe	6	6	6	6	11	11	7	6	6	6	6	6	
South & Central America	9	9	9	11	17	17	17	17	17	11	9	9	
North Africa	6	6	6	7	15	17	15	9	7	7	7	6	
South & Central Africa	7	7	7	9	15	21	21	21	17	11	9	7	
Far East	6	6	6	6	6	7	9	7	15	17	11	7	
Australia & New Zealand	9	9	9	9	11	11	*	21	21	21	11	9	

TIME (PST)

Between Western USA and:	00	02	04	06	08	10	12	14	16	18	20	22	24
Western Europe	6	6	6	9	15	9	7	6	6	6	6	6	
Eastern Europe	6	6	6	7	9	6	6	6	6	6	6	6	
South & Central America	9	9	7	17	17	17	17	17	15	11	9	9	
Africa	7	7	7	15	17	21	21	21	15	11	9	9	
Far East	7	7	6	7	9	9	9	21	21	11	7	7	
South Asia	6	6	6	6	9	9	9	9	9	11	7	6	
Australia & New Zealand	9	9	9	7	11	17	21	21	21	17	11	9	

To determine the frequencies and times for best short-wave reception in the United States, select the table for the area you are located in, read down the left-hand column to the region you want to hear, then follow the line to the right until you are under the figures indicating your approximate local time. The boxed numbers will tell you the frequency band (in megacycles) to listen to during any 2-hour interval. Asterisk (*) indicates that signals will probably not be heard.

Monthly Short-Wave Report

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

WELCOME TO THE SWL NEWCOMER

THE MONTH of December is traditionally the beginning of the "busy" season for your Short-Wave Editor. Many radio receivers, large and small, costly and inexpensive, are given each year as Christmas presents. And the recipients of these gifts write in to us, from the last days of December until well into the following spring, requesting information on everything imaginable related to short-wave listening. So it might be a good idea, at this particular time, to discuss briefly just what we do here in the Short-Wave Department, and how you, especially those of you who are new short-wave listeners, can take part in our activities.

What We Do. Just as the American Radio Relay League's monthly journal, *QST,* is designed for the amateur radio fraternity, so is POPULAR ELECTRONICS designed for SWL's, as well as experimenters, Citizens Band operators, amateur radio enthusiasts, and those interested in the audio and hi-fi fields. This is the world's largest-selling magazine having a column devoted entirely to the short-wave listener.

Your Short-Wave Editor's main purpose is to provide you with a monthly column on the doings in the short-wave broadcast bands, with an occasional ramble into the local broadcast band, the utility channels, or other frequencies that may be of interest. The Current Station Reports section is based on what YOU, the listener, are hearing each month. An item here and there might be obtained as a result of our own

DX Awards Presented

The following DX'ers have qualified for awards this month (100, 75, 50, and 25 countries verified). Congratulations, and welcome to the Awards List!

One Hundred Countries

George R. Buchanan (WPEØVB), Webster Groves, Mo.
Frank Peters (WPE9EZI), Chicago, Ill.

Seventy-Five Countries

Chuck Edwards (WPE4BNK), Fort Lauderdale, Fla.
Hector Davila Borrero (KP4PE1G), Bayamon, Puerto Rico

Fifty Countries

James F. Lennon (WPE2DMD), Camden, N. J.
Leo Baca (WPE5CLR), East Bernard, Texas
William P. Stevens (WPE3OZ), Jeannette, Pa.
Dean Hanson (WPE6MF), Honolulu, Hawaii
Arthur S. Mullins (WPE9FUW), Oak Park, Ill.

Twenty-Five Countries

Fred Essenwein (WPE2DVS), Mineola, N. Y.
Paul R. Hunter (WPEØSJ), Greensburg, Kansas
Richard Hallowell (WPE9EJT), Pekin, Ill.
Ralph Mahoney (WPE3DEX), Philadelphia, Pa.
Michael J. Plihcik (WPE2JDF), Woodside, N. Y.
John Edward Misiak (TF2PE1C), F.P.O., New York, N. Y.
Henry Clifton (WPE2FXW), New York, N. Y.
Leroy E. Shurtz (WPEØCGD), Derby, Kansas
Ken Richardson (WPE4FXZ), Arlington, Va.
T. T. Lutwiniak (WPE2HTT), Kearny, N. J.
Frank T. Hames (WPE3CDM), Takoma, Park, Md.
Paul Becher (WPE9EXW), Wyatt, Ind.
Edward L. Bowerman (WPE6BCW), Rogers, Ark.
Rob Sanden (WPEØCYH), Ogden, Iowa
Robert Wechsler (WPE2IGE), Brooklyn, N. Y.
Albert J. Quader, Jr. (WPE8CTZ), Cleveland, Ohio
Pedro G. Vasquez (WPE5RB), Antigo, Wisc.
Robert T. Nordstrom (WPE3FAU), Washington, D. C.
Robert Andrews (WPE3EWC), Gaithersburg, Md.
Jerry Heien (WPE9BOD), Berkeley, Ill.
Ovide M. Brudo (WPE1EEX), Ware, Mass.
Richard Yukubousky (WPE2IHM), Highland Park, N. J.
Robert W. Floyd (WPE6ELM), San Diego, Calif.
Joseph Martin Agrella (WPE4FNS), Fort Lauderdale, Fla.
Roger Pentrak (WPE8FEG), Huntington Woods, Mich.
R. D. Fisher (WPE8OG), Beach City, Ohio
Rulon G. Guymon (WPE7BPK), Orem, Utah
James L. Dionne (WPE1LB), Westwood, Mass.
Charles Wohlers (WPE2IRQ), Orchard Park, N. Y.
John L. McQueen (WPE8GZH), Birmingham, Mich.
Dennis Freeman (WPE6CRN) Mt. Shasta, Calif.
Mike Wolowich (VE3PE1TW), Fort William, Ont., Canada

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)*
Australia	Melbourne	17,840, 15,220	2030, 2130, 2330
		9580	0745
Bulgaria	Sofia	6070 (and/or 9700)	1900, 2000, 2300
Canada	Montreal	15,190, 11,720, 9625	1800 (Caribbean)
East Congo	Leopoldville	11,755	1630, 2100, 2230
West Congo	Brazzaville	11,725	2015
Czechoslovakia	Prague	11,990, 9795, 9550, 7345, 5930	2030, 2330
Denmark	Copenhagen	9520	2100, 2230
Finland	Helsinki	15,185	1530 (Mon., Fri.)
West Germany	Cologne	15,405, 11,795	1010
		9640, 6160	2035
		11,795, 9735, 6145	0000
Hungary	Budapest	11,910, 9833, 7220	1900
		9833, 7220	2230
Italy	Rome	9575, 5960	1930, 2205
Lebanon	Beirut	11,890	1630
Netherlands	Hilversum	15,220, 11,950	1030 (Tues., Fri.)
		17,810, 15,220	1415 (Tues., Fri.)
		15,445, 9715	1630 (exc. Sun.)
		9590, 5985	2030 (exc. Sun.)
Portugal	Lisbon	6185, 6025 (and/or 9740)	2105, 2305
Spain	Madrid	9360, 6130	2215, 2315, 0015
Sweden	Stockholm	17,840	0900
		11,805	2045, 2215
U.S.S.R.	Moscow	9730, 9650, 9620, 9610, 7320, 7310, 7240, 7200, 7150 (may not all be in use at any one time)	1730, 1900, 2000 2100, 2300, 0040
Vatican City	Vatican City	9645, 7250	1950

personal listening, and some items might come through directly from the stations involved, but for the most part the reader is the source of the information.

Anyone who gets a new receiver as a Christmas present more than likely won't be able to tell the difference between a megacycle and a motorcycle, but he will dive into his new hobby with all of the enthusiasm that he can muster. And before long, he'll have a good working idea of what it's all about; how and when to find various stations on his dial; how to identify many of the more easily heard foreign stations; and how the English-language newscasts from the overseas stations can be a fascinating way for him to keep up to date on current events.

Fred Rockman, VE7PE1E, of North Burnaby, British Columbia, does his DX'ing with a Hallicrafters SX-99. Fred is a member of the Canadian DX Club.

Any newcomer to SWL'ing will find it much easier to get started if he has a copy of the *Communications Handbook* which is published by POPULAR ELECTRONICS and is available in the U.S. for $1.00 ($1.25 in Canada and elsewhere). This book spells out the "basics" of short-wave listening (as well as those of amateur radio, CB, and the Business Radio Service).

What You Can Do. Drop us a report now and then listing the stations you have been hearing. But make it a current report—don't wait until May to tell us what you heard in January. Include the frequency on which you heard a particular station, its call-sign

or name, the exact times that you heard it, and a brief resume of what transpired during that time segment, such as English-language news, nonstop music, news commentary, or whatever it might be. Be sure to indicate the language used. And you might also mention whether the station was easily heard or if there was interference, and what kind.

In other words, include anything in your report that might be of interest to other SWL's, and that would help them to log that station, too. If you should be fortunate enough to hear a station that is on the

(*Continued on page* 100)

Norman Kleinberg, WPE2KGY, of Brooklyn, N. Y., has a record of 34 countries logged, 24 verified. His Hammarlund HQ-145X receiver pulls them in.

SHORT-WAVE MONITOR CERTIFICATE APPLICATION

ALL radio listeners interested in furthering the hobby of SWL'ing—regardless of whether you DX on the BCB, VHF, TV, SW, or FM bands—are eligible to apply for a POPULAR ELECTRONICS "Certificate of Registration." You must have verified (have QSL cards from) a minimum of five radio stations, of which one was outside the borders of the United States. There is no age limit, or special equipment qualification; the only requirement is that the applicant have a sincere interest in radio communications.

A new certificate processing procedure has just been introduced. All certificates are filled in and lettered before mailing. All certificates are now mailed flat and unfolded. If you want to register and receive your WPE identification sign, fill in the new application blank below before January 15, 1964. Mail with 25 cents in coin to: Monitor, POPULAR ELECTRONICS, One Park Avenue, New York 16, N. Y., 10016. Canadians should use their own currency. All other applicants not in the U. S. A. should use five International Postal Reply Coupons. Allow 2-4 weeks for processing.

(Please Print) (Do not fill out)

Name . . . . . .

Street, City and Zone . . . . . .

State and Zip . . . . . .

Receivers in use Make . . . . . Model . . . . . .

Make . . . . . Model . . . . . .

Age Occupation . . . . . .

Ham / CB call - letter assignment(s) . . . . . .

I listen mostly to SW Broadcast Hams CB BCB VHF VLF . . . . . .

I use the following antennas . . . . . .

I have QSL cards and countries verified. Check if subscriber to P.E. . . . . .

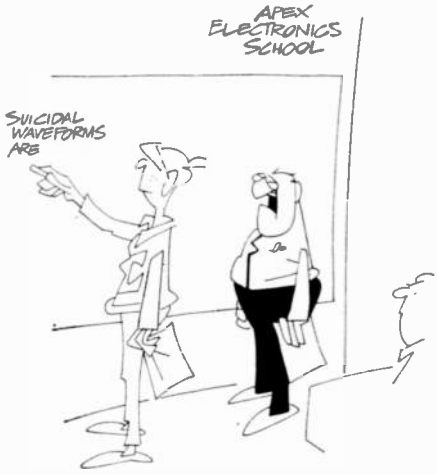
Signature . . . . . Date . . . . . .

(Good only until January 15, 1964)

Hobnobbing with Harbaugh

"Electronics fraternity."

School Days—School Days



"SINUSOIDAL!"

"Sir . . ."

"It's always nice to see one of our students make good."

A Carl and Jerry Adventure in Electronics

By
JOHN T. FRYE
W9EGV

JOKING AND JEOPARDY

THE MID-DECEMBER day found Carl and Jerry standing on the shore of a large, frozen, wind-swept lake watching some men fishing through the ice. Home from Parvoo University for the weekend, the boys were returning from Christmas shopping in a neighboring city when they spied the motley collection of fishing houses, tents, windbreaks, and rugged characters with no protection at all from the biting wind scattered over the frozen surface of the lake several hundred yards from shore.

"Catching anything?" Jerry hollered to a surly-looking, unshaven man crouched over a couple of poles.

The only answer was an unfriendly grimace and a mumbled phrase that sounded like "beat it."

"Burrr!" Carl exclaimed, dancing a jig to warm his cold feet, "let's get back to the car. I haven't seen a fish caught yet, and I can't bear to watch those poor clods standing there in this cold without even a nibble."

"Yeah," Jerry reflected. "I was thinking the same thing. Do you suppose it would be in keeping with the holiday spirit if we sort of pepped things up for them?"

"Hey there! What scheme is crawling through that evil mind of yours? I don't like that glint in your eye."

"I was thinking about that miniature remote-controlled submarine we built last summer. Now if we pitch a tent to give us a place to work in the middle of that bunch of fishermen, and then turn the submarine loose down under the ice . . ."

There was no need for Jerry to finish. A slow grin spread over Carl's face as he thought of the possibilities. Two years of college weren't enough to eradicate an inborn love of mischief. "Come on! What are we waiting for?" he asked as he headed for the car.

It didn't take them long to reach their laboratory in the basement of Jerry's house and dig the miniature submarine

and its associated parts out from beneath the workbench. The thing didn't look much like a submarine. It looked more like what it was: a two-foot-long piece of six-inch irrigation pipe with hemispheric caps fitted tightly over the ends. A propeller shaft came through a watertight bushing in the center of one of the caps, and a rudder projected downward from the hull just in front of the shaft. On either side at the rear of the cigar-shaped object were two movable vanes to control the up and down motion of the craft.

The propeller was protected from fouling by a cage composed of two U-shaped rods with their ends welded to the sides of the hull and crossing each other at right angles behind the end of the propeller shaft. A heavy nylon cord was fastened to the spot where these U-shaped pieces were welded together and was intended to be used for retrieving the submarine if the control system failed or the ship became snagged on the bottom. The boys were taking no chance of losing the elaborate control gear installed inside the crude hull.

"Think everything's still O.K.?" Carl asked as he helped Jerry spread the submarine and its parts out on the workbench.

Nodding, Jerry removed a gasket-sealed hatch from the top of the submarine so that fresh batteries could be installed to drive the main motor and power the control unit. The controlling was done by ultrasonic sound conducted through the water from a transducer stuck into the water at the control point to another transducer fastened outside the hull of the submarine.

The high-frequency signal was amplified by transistors inside the hull and then rectified and made to work a sensitive relay. This relay, in turn, operated a stepper relay that selected one of five functions: right rudder, left rudder, surface, dive, and stop motor. Four other positions permitted combined operation of rudder and diving planes. Actual working of the rudder and vanes was performed by two small reversible PM motors.

When power was applied to one of these motors, action of a series solenoid pressed the motor shaft against a rubber friction wheel, and a cord around the revolving shaft of this wheel moved the rudder or vanes the way a dial cord moves a pointer. When power was removed from a motor, its shaft disengaged the friction wheel and spring-loading returned the deflected surface to a neutral position.

"You press the relay while I check things out," Jerry ordered, and Carl gently depressed the contacts to make the stepper relay go into action. Jerry watched closely as the motors activated the various controls.

A delay circuit kept power from being applied to a motor until the stepper relay paused an appreciable length of time in one position. This prevented unwanted controls from "jiggling" as the stepper relay moved past their positions. The submarine contained enough ballast so it barely floated when dead in the water, and it made only powered dives. The control "console"—made out of a cheese box—had a duplicate stepper relay that moved in time with pulses sent to the sub so that a pointer on the console always indicated what function was being called for by the relay in the submarine.

SATISFIED that everything was working as perfectly as it had the previous summer, Carl and Jerry hurriedly dressed in their cold-weather gear, stuck a small tent, fishing gear, and ice-chopping tools into the trunk of the car, and took off for the lake.

As the boys were carrying their stuff across the ice, they decided the weather hadn't warmed up and the fish weren't biting any better. They selected a vacant spot near the center of the group of fishermen.

"All right if we set up here?" Carl inquired politely of the surly character whom they had spoken to previously.

"Suit yourself," the man grunted. "The lake's free. If you want to, you two can go out there on the thin ice like that other fool is doing." He nodded to where a small man was vigorously chopping a hole in the ice some fifty yards north of the other fishermen.

Carl and Jerry quickly spudded two holes close to the one-foot-in-diameter limit through the ice and set up their small tent over them. The submarine, which had been kept carefully concealed

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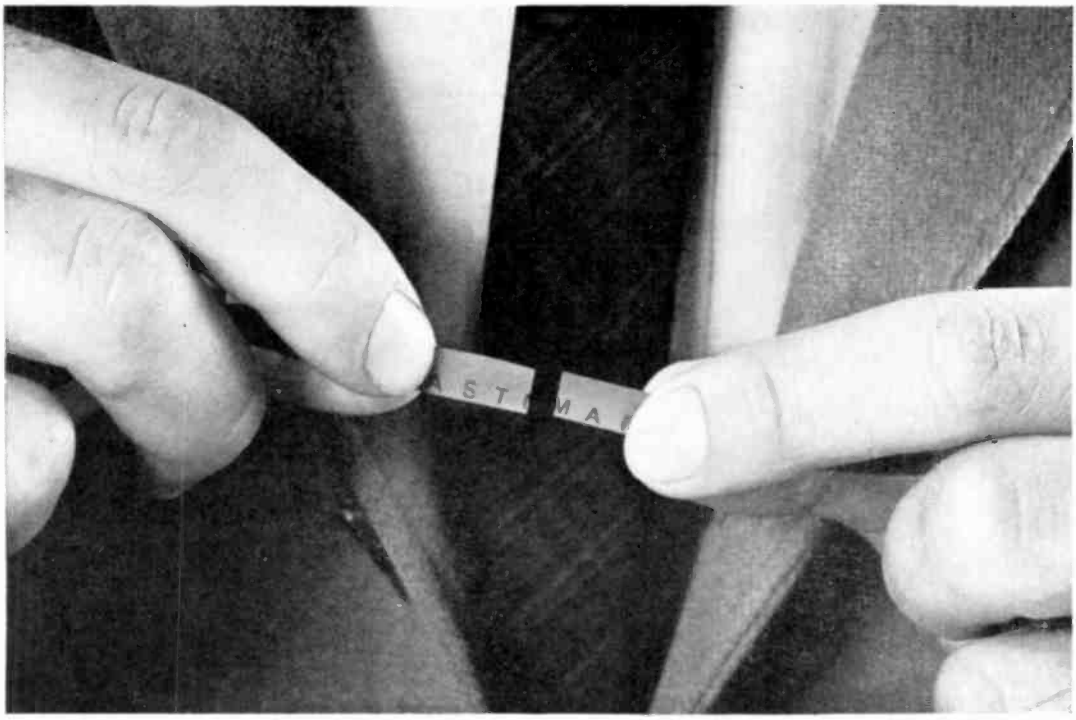

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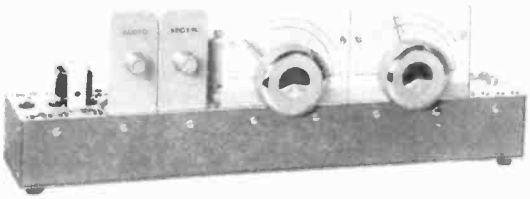

RECEIVER KITS

This new line of International receiver kits cover a wide range of amateur, citizens band and special frequencies. Designed for AM, CW, or SSB reception, this basic receiver using a superheterodyne circuit* with regenerative second detector may be expanded to a more elaborate receiver by the addition of other Add-On-Circuits. Sensitivity usable to below 10 microvolts for voice and 1 microvolt for code. Nuvistor rf amplifier, mixer, oscillator, I.F. transformer, detector/1st audio, and power audio amplifier. Tube lineup: 6DS4 nuvistor, 6BE6, 6U8, 6AQ5. Shipping weight: 15 lbs.

Receiver kit includes 4" speaker and power supply.

Kit	Frequency	Price
AOR-40	Special	$69.00
AOR-41	150 kc — 450 kc	62.50
AOR-42	2 mc — 6 mc	62.50
AOR-43	6 mc — 18 mc	62.50
AOR-44	80 meter/40 meter	62.50
AOR-45	15 meter/10 meter	62.50
AOR-46	6 meter	66.50
AOR-47	2 meter	66.50
AOR-48	Citizens 27 mc	62.50

*AOR-41 uses a tuned rf circuit with 6BA6

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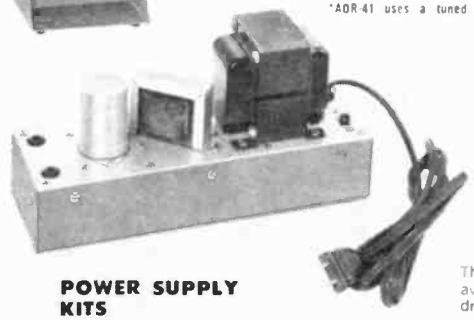
AOT-50 transmitter kit less power supply and key, but with one 40 meter novice band crystal. Shipping weight: 5 lbs. **$35.00**



POWER SUPPLY KITS

AOP-100 350 volts, 150 ma intermittent or 100 ma continuous service, 6.3 volts @ 5 amps. Shipping weight: 8 lbs. **$18.50**

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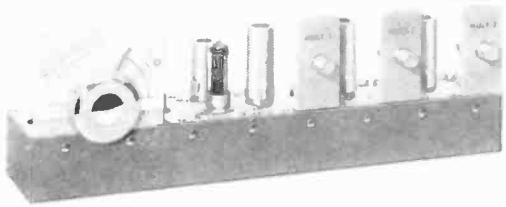

VFO KITS

The International AOF series of variable frequency oscillator kits is available in three versions. For example, the AOF-91 kit is a complete driver unit to be used with 6 meter and 2 meter transmitters. Approximately .5 watt of power is available on both bands. Tube lineup: 6BH6 oscillator, OB-2 voltage regulator, 12BY7 buffer-amplifier/multiplier. Shipping weight: 5 lbs.

Kit	Frequency	Price
AOF-89	VFO 8 mc — 9 mc and buffer	$22.00
AOF-90	VFO 8 mc — 9 mc plus buffer multiplier and 6 meter output	29.00
AOF-91	VFO 8 mc — 9 mc plus buffer multiplier, 6 meter/2 meter output	36.00

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in a piece of canvas, was slid through a hole into the icy water. Power was switched on, and a brilliant little lamp on the bottom of the hull glowed to indicate that all was ready. A windlass carrying a hundred and fifty yards of nylon cord was anchored beside the hole. Carl fastened the control transducer to the front of a crude periscope made of a piece of downspout and a couple of war-surplus prisms so that the signal was always projected in the same direction the periscope was "looking."

"Let's get our happy, unshaven friend first," Jerry suggested. "You watch him through the opening in the tent flap. We'll send the sub in a big loop around his fishing hole. I'll leave lots of slack in the line, and it'll float up against the ice. Ready?"

"Up—I mean down—periscope!" Carl answered as he thrust the bottom of his crude observing instrument into the water.

Jerry keyed the transistorized ultrasonic oscillator and power amplifier inside the control console, and the stepping relay moved off the "stop motor" position. The propeller began to spin, and the submarine moved away swiftly. A layer of snow on top of the ice made it opaque, but Carl, peering through the periscope, could easily follow the bright light on the sub through the crystal-clear water.

"Bear right a bit," he said; "now steady as she goes . . . we're about ready to come about . . . hard aport . . . that's fine . . . now straighten her up and hold that course . . . hard aport again . . . O.K. . . . a little right rudder . . . here she comes . . . avast!"

"O.K. Captain Bligh," Jerry muttered,

moving the control to "stop motor" position with taps of his key, "here comes your fish." The little submarine glided past the hole in front of him, and he reached down and grabbed the trailing line with his left hand and began turning the windlass with his right.

Carl, peering through the slit in the front of the tent, saw both rods of the bearded fisherman suddenly jerk down in unison as the encircling nylon cord pulled his lines taut. The man grabbed up both rods in a mad scramble and managed to thumb one of the reels. The tip of its rod bent down inexorably toward the ice and then snapped upward as the line broke. Precisely the same thing happened to the other rod when his thumb stopped the screaming of its click-warning. His howls of excitement brought the other fishermen out of their huts and tents.

"It must be a school of muskies!" the man shouted, brandishing the broken lines. "They never even slowed down when I tried to set the hooks!"

"BOY, he really came alive!" Carl chuckled. "I wasn't sure for a minute there which of you was going to win the tug of war. You were really bracing your feet and yanking on that cord. Our friend will be talking about those twenty-pound muskies for the next week!"

The boys set to work untangling the nylon line and getting the little sub ready for another mission when suddenly they were silenced by a shrill cry for help. "He's fallen through!" someone shouted, and they looked out of the tent to see the little man who had gone fishing out on the thin ice floundering wildly in the center of a jagged hole.

Leaving their lines untended, the fishermen watched helplessly as the man tried again and again to lift himself out of the frigid water, the thin ice crumbling away in front of him. Several men started running toward him, but they had gone only a few yards when the ice began to crack ominously beneath their feet.

"We'll never reach him over this rotten ice, and he can't last long in that cold water," one man said to Jerry. "See, he's getting weaker already. Once he slips beneath the ice, he's done for."

"Come help us!" Jerry said, grabbing the man by the elbow. "If we can't reach him over the ice, maybe we can reach him under it!"

Directed by Jerry, the three of them raced back to the tent and quickly tore it down. Then they began chipping away at the ice between the two holes to enlarge the opening.

"We're going to try to send this remote-controlled gadget under the ice to the man out there," Jerry explained to the fishermen standing around in a circle. "If we can do it, maybe we can pull him here under the ice. I know it sounds crazy, but it looks like our only chance. Are you ready, Carl?"

Carl nodded, and the little submarine took off toward the man in the water who was now resting, exhausted, with his elbows propped on top of the ice. Carl strained his eyes to keep sight of the diminishing little light, and now and then quietly called for correcting signals to be tapped out by Jerry so that the submarine kept going straight for the hole in the ice. They kept paying out line from the windlass so there was minimum drag on the little ship.

"It ought to be about there," Jerry said. "A third of the line is off the reel. Tell him to look for it."

Before they could call to him, the man in the water suddenly reached down and came up with the line. He had felt the submarine brush past him.

"Make several half-hitches of that line around your wrist," Jerry called. "Tie it so it won't come off even if you black out. We're going to pull you to us under the ice. Take several deep breaths and then hold the last one and nod your head. Then relax and leave the rest to us. Do you understand?"

"I understand," the man's voice came weakly across the ice.

"Four or five of you grab this cord and be ready to take off across the ice with it when I give the word," Jerry instructed. "Start slowly, and then go as fast as you can. Remember he's not going to be breathing while you're pulling. But be ready to stop when I call. We don't want to fracture his skull against the sides of this hole. Okay! He's nodding his head! Take off!"

The volunteers started pulling on the cord, and the head of the man in the water disappeared from sight. The line

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slid rapidly out of the hole, but it seemed endless to the anxious eyes watching it. Finally, Jerry spotted a grease stain on the rope that he knew was only about thirty feet from the end. He let out a shout, and the men pulling the cord slid to a halt. At this instant the figure of the little man popped up through the hole in the ice, and a dozen hands lifted him, coughing and spluttering but very much alive, out of the water.

THEY rushed the shivering man to a waiting car, and the driver took off at once for the hospital. Back on the ice, Jerry quickly set about collecting the equipment.

"What's the rush?" Carl whispered. "I'm enjoying this hero bit. We're real big with these guys."

"Yeah?" Jerry drawled out of the side of his mouth. "You just wait until they simmer down and start wondering why we had the sub out here, and then start connecting it with those muskie bites. Our bearded buddy isn't going to take kindly to our making a fool of him. Take a good look at those shoulders of his. The guy is built like *Mr. Clean*! Can't you just picture him feeding us our tin fish, batteries and all? I'm going while the going is good."

"Wait for me!" Carl shouted as he started after him. -30-

Re "Operation PICKUP"

While popular, much-talked-about projects are every Editor's goal, the immense volume of mail on POPULAR ELECTRONICS' "Operation PICKUP" ignition system (see the June and October issues) has temporarily paralyzed our answering facilities. While every effort will be made to answer routine questions (allow about four weeks), highly specialized inquiries cannot be handled due to the heavy research load they place on our technical staff.

In the meantime, two important developments concerning the PICKUP system have cropped up: The J. W. Miller ferrite choke type number 9350-38 is now recommended in preference to all other types previously specified. No series resistor is necessary if this choke is used. Although it is not cataloged, your parts dealer should be able to order it for you. Secondly, it should be noted that the positive ground system using a Westinghouse transistor also requires a special hardware mounting kit. This is 35 cents extra, and has part number 140A602G04.

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Frequency range (megacycles): 3.5 to 4.0, 7.0 to 7.5, 14.0 to 14.5, 21.0 to 21.5, 28.0 to 28.5, 28.5 to 29.0, 29.0 to 29.5, 29.5 to 30. **Intermediate frequency:** 3.395 megacycles. **Frequency stability:** 100 cps after warmup. **Visual dial accuracy:** Within 200 cps on all bands. **Electrical dial accuracy:** Within 400 cps on all bands. **Backlash:** No more than 50 cps. **Sensitivity:** Less than 1 microvolt for 15 db signal plus noise-to-noise ratio for SSB operation. **Modes of operation:** Switch selected: LSB, USB, CW, AM. **Selectivity: SSB:** 2.1 kc at 6 db down, 5.0 kc at 60 db down (crystal filter supplied). **AM:** 3.75 kc at 6 db down, 10 kc at 60 db down (crystal filter available as accessory). **CW:** 400 cps at 6 db down, 2.5 kc at 60 db down (crystal filter available as accessory). **Spurious response:** Image and IF rejection better than 50 db. Internal spurious signals below equivalent antenna input of 1 microvolt. **Audio response: SSB:** 350 to 2450 cps nominal at 6 db. **AM:** 200 to 3500 cps nominal at 6 db. **CW:** 800 to 1200 cps nominal at 6 db. **Antenna input impedance:** 50 ohms nominal. **Muting:** Open external ground at Mute socket. **Crystal calibrator:** 100 kc crystal, ±.005%. **Front panel controls:** Main tuning dial; function switch; mode switch; AGC switch; band switch; AF gain control; RF gain control; preselector; phone jack. **Rear apron connections:** Accessory power plug; HF antenna; VHF #1 antenna; VHF #2 antenna; mute; spare; anti-trip; 500 ohm; 8 ohm speaker; line cord socket; heterodyne oscillator output; LMO output; BFO output; VHF converter switch. **Tube complement:** (1) 6BZ6 RF amplifier; (1) 6AU6 Heterodyne mixer; (1) 6AB4 Heterodyne oscillator; (1) 6AU6 LM osc.; (1) 6AU6 LMO mixer; (2) 6BA6 IF amplifier; (1) 6AU6 Crystal calibrator; (1) 6HF8 1st audio, audio output; (1) 6AS11 Product detector, BFO, BFO amplifier. **Power supply:** Transformer operated with silicon diode rectifiers. **Power requirements:** 120 volts AC, 50/60 cps, 50 watts. **Dimensions:** 14⅞" W x 6⅝" H x 13¾" D.

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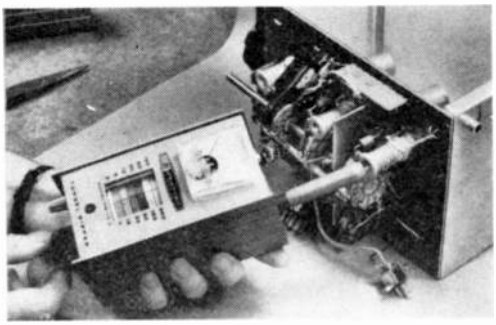
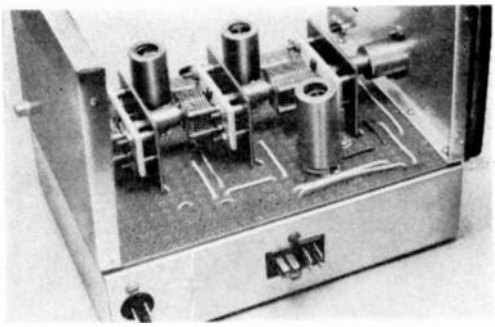
(Continued from page 66)





Initial tuning of coil slugs should be done with tubes in place, power off. Use VHF grid-dipper (a Heathkit "Tunnel Dipper" is shown in photo at left) to find correct slug positions. View above shows chassis top and side that plugs into i.f. module. Route connecting wires through holes in copper-clad board, keeping them taut and providing r.f. shielding.

pass capacitors *C26*, *C27*, and *C28*, as well as *RFC5*, *RFC6*, and *RFC7*. Run the filament leads down through nearby holes to the unclad board side, across the board, and back through holes near the power plug (*P4*).

Mount the bandswitch and make connections (short and direct) to the coil forms (see photo pictorials) using #18 busbar. Solder in the *V1* and *V2* cathode and screen circuits, plus *C20* and *RFC4* in the *V3* stage. Terminal strips—when shown—are simply held in place by soldering the foot to the copper cladding.

There is a notched copper-clad board in front of the bandswitch forward support bracket. This is the a.f.c. board and holds *C16*, *C21*, *C22*, *R7*, *R9*, *R10*, *RFC3*, and *VC1*. These components should be soldered into place before this board is fillet-soldered to the main perforated chassis. If the constructor chooses, this board can be put aside (and the parts with it) for the time being.

Wire in the remaining screen and power leads. Run leads through perforations and route them toward plug *P4*. Note that the mixer plate output lead is run across the chassis as a shielded lead. A length of insulated tubing covers this lead and coupling capacitor *C13*.

Preliminary Testing. Connect all three modules together, but leave tubes *V1*, *V2*, and *V3* out of their sockets. When your wiring has been checked out, and all obvious shorts, solder splashes, etc., removed, turn on the power. Voltages should remain the same with or without the r.f. module plugged in. If everything appears to be O.K., turn off the power, plug in the tubes, and you're ready for r.f. alignment.

A grid-dip oscillator is necessary for the preliminary tune-up. The r.f. coil (*L1/L2*) and mixer coils (*L3* or *L4*) tune identical ranges depending on the bandswitch setting. Oscillator coil *L3* or *L4* is tuned 4.5 mc. lower in frequency than the mixer coil. As with practically every superheterodyne, perfect alignment of all coils occurs at only three spots on the dial—near the ends of the tuning range and just about in the middle. However, all the coils are broadband and tracking is no great problem.

Tracking. Not too much space can be devoted here to the procedure of alignment and tracking. The author assumes that this project is being attempted by experimenters and hobbyists having some experience with such circuits.

Your first step should be alignment of the oscillator on the lowest tuning range. In this circuit, the oscillator runs 4.5 mc. *below* the incoming signal frequency. Therefore, to cover 28.5 to 40 mc., the oscillator must tune from 24 to 35.5 mc. With tubes in place but no power on, set the tuning capacitor gang (*C1*, *C7*, and *C23*) to the fully meshed position (dial pointer at left end of scale), set the grid dip meter to 24 mc., and inductively couple the dipper coil to coil *L5* of the module.

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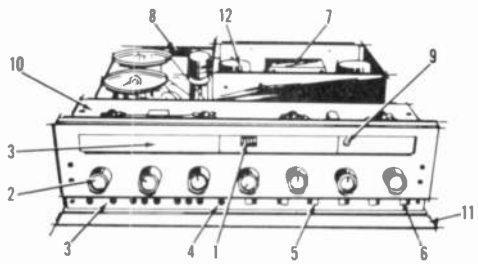

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Now adjust the tuning slug of *L5* to maximum dip of the meter, reducing coupling as necessary to minimize any pulling of the grid dipper frequency. Make a temporary pencil marking at this point on the dial, and turn the dial to bring the pointer to the right-hand end of the scale. Check the frequency of the *L5* tuned circuit with the grid dipper. If it is approximately 35.5 mc., go on to adjustment of the r.f. and mixer tuning. If it is high, replace *C25* with a slightly larger capacitance value, and repeat the procedure just given. If the frequency is low, change *C25* to a slightly smaller value, and repeat.

Using a similar procedure, align the low-band r.f. and mixer tuned circuits to tune from 28.5 to 40 mc. This brings the tuned circuits near enough to final alignment to permit the final touch-up to be made with the tubes in and power on. Alignment with the tubes "hot" will differ somewhat from that made with the grid dipper, but the final alignment will be much easier if the initial adjustments are made as given above.

The same procedure should be followed for the high band, except, of course, to set the grid dip meter to the required higher frequencies. All alignment work at these frequencies requires some cut-and-try, and may even require that you move the coil taps slightly if your layout differs greatly from the author's.

Final Assembly. All of the above tracking and alignment has been performed with the r.f. module outside of the aluminum chassis. With that work completed, it's time to mount the perforated chassis. To do this, some cutting and trimming of the aluminum chassis lips is called for. The best tool for this job is an Adel nibbler, but tin snips and a file will serve.

Drill a ⅜" hole in the front of the chassis for the extension shaft of the bandswitch. The author found it most convenient to solder nuts to the flanges of *J2, P3,* and *P4*. Holes are drilled in the sides of the chassis and bolts used to catch the nuts and rigidly hold the sockets and jack in place.

Tuning In. The antenna is an important part of any VHF installation. A simple dipole or coax-fed whip can be used; data on optimum length can be found in ham publications. In any case, your antenna should be *vertically* polarized for commercial VHF reception.

If you live in a city, you'll undoubtedly hear "paging" stations as well as mobile and base utility units. The paging stations operate continuously on 35.58 and 43.58 mc., and simply repeat numerals over and over. TV interference from sets with 40 mc. i.f.'s may be a problem; using an antenna cut for about 35 mc. will help.

Good DX—let us hear about it. -30-

Transistor Topics

(*Continued from page* 76)

bias resistor. The coupling capacitor, *C1*, serves a secondary role by blocking the application of *Q1*'s collector bias to *Q2*'s base electrode.

The chief advantages of *RC* coupling are simplicity and low cost. The disadvantages are: (1) low efficiency due to the mismatch between *Q1*'s output and *Q2*'s input impedances (the former is high, the latter moderate); and (2) limited bandwidth and relatively poor low-frequency response due to *C1*'s increasing reactance at low frequencies.

In general, the critical component is the coupling capacitor, *C1*. In audio circuits, its value may range from 0.01 μf. to 0.5 μf. where voice signals are of interest, or from 2 μf. to 50 μf. where music frequencies are handled. Ceramic or paper capacitors can be used for values up to 0.5 μf., while electrolytics are employed for higher values. In all cases, however, *C1*'s internal leakage must be low enough to prevent a serious effect on *Q2*'s base bias.

If the first stage load resistor is replaced by a coil or choke, the basic impedance-coupled circuit shown in Fig. 4(B) results. Here, *L1* serves as *Q1*'s collector load, *C1* is the interstage coupling capacitor, and *R1* is *Q2*'s base bias resistor. Since the reactance of *L1* decreases as the signal frequency is lowered, this arrangement has poorer low frequency response than the *RC* circuit. As a result, impedance-coupled circuits are used primarily where a limited bandwidth is needed . . . typically, in tuned audio amplifiers and (with suitable coils) in i.f. and r.f. stages. Except for the effect of *Q1*'s load, the over-all operation of the impedance-coupled circuit is essentially the same as the *RC* circuit and it has similar advantages and disadvantages.

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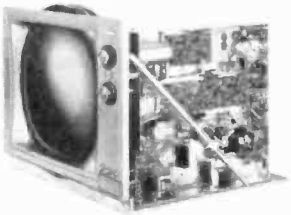

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Both of the coupling techniques discussed above suffer from a common disadvantage: low efficiency due to the impedance mismatch between stages. This can be overcome to some extent in the impedance-coupled circuit by tapping the collector load (*L1*) at a suitable point, as illustrated in Fig. 4(C). The tapped coil then becomes, in one sense, a type of *autotransformer*.

Where maximum circuit efficiency and gain is needed or where power is handled, transformer coupling is used. A typical circuit is illustrated in Fig. 4(D). Here, a step-down transformer, *T1*, matches *Q1*'s high output impedance to *Q2*'s low input impedance. Capacitor *C1*'s function, in this case, is to prevent a short of *Q2*'s base bias (furnished through *R1*) by *T1*'s secondary winding. The circuit's over-all frequency response depends on the transformer's characteristics and on *C1*'s value.

A point overlooked by many hobbyists is that an *exact match* is not necessary for acceptable circuit performance. For example, if a construction project specifies an interstage transformer with, say, a 10,000-ohm primary and a 1000-ohm secondary, chances are that acceptable results will be obtained with units having the same primary impedance and either an 800- or 1200-ohm secondary.

The coupling methods discussed thus far are suitable only for a.c. stages, i.e., those handling a.f., i.f. or r.f. signals, depending on the choice of loads and other circuit components. In some cases, the circuits may be tuned to a specific frequency (by a small capacitor across *T1*'s primary or across *L1*, for example). Where d.c. signals are to be amplified, *direct-coupling* is required. Typical circuits are shown in Figs. 4(E) and 4(F).

In Fig. 4(E), *Q1*'s collector is connected directly to *Q2*'s base. Resistor *R1* serves both as *Q1*'s collector load and *Q2*'s base bias resistor. Transistor *Q2*'s emitter resistor, *R2*, bypassed by *C1*, is included to limit *Q2*'s base bias current to an optimum value; resistor *R2* accomplishes this job by establishing a "reverse" emitter bias (due to the emitter current flow through *R2*) which offsets the moderately high base voltage applied through *R1*. In practical circuits, a relatively large capacitor is used for *C1* . . . typically, a 50-μf. to 1000-μf. electrolytic.

The direct-coupled circuit configuration illustrated in Fig. 4(F) is commonly known as a Darlington amplifier. Here, *Q1*'s emitter is connected directly to *Q2*'s base, while both collectors are connected in parallel. Resistor *R1* serves as the output load for both transistors. Since there are only three "external" electrode connections—emitter, base, and collector (dual)—the circuit arrangement behaves, in effect, like a "super" transistor, with an over-all gain approximating the product of the gains (*betas*) of *Q1* and *Q2*.

In addition to the popular coupling methods covered here, there are a number of techniques used in specialized applications. In some cases, for example, diodes may be used as coupling elements. The complementary direct-coupled circuit was discussed in an earlier column (September, 1963). Finally, a combination of techniques may be used in some multi-stage arrangements.

Product News. Texas Instruments, Inc. (13500 North Central Expressway, Dallas, Texas) has announced the availability of a number of new types of transistors, including four high-frequency germanium units and a series of silicon planar power transistors. The germanium transistors, Types 2N2996 to 2N2999, have upper frequency limits from 1 gc. (gigacycle, or kilomegacycle) to 1.6 gc.; prices range from $3.24 for the 2N2996 to $150.00 for the 2N2999. The new silicon units, Types 2N2987 to 2N2990, are capable of dissipating up to 15 watts and have cutoff frequencies of up to 30 mc.

Motorola Semiconductor Products, Inc. (5005 East McDowell Rd., Phoenix 8, Arizona) is now producing a series of *pnp* silicon Star transistors to complement its previously announced line of *npn* units. The new transistors, Types 2N2904 to 2N2907, are designed for medium-current, high-speed switching and driver applications and are priced even lower than previous *pnp* silicon units designed for similar applications.

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—*Lou*

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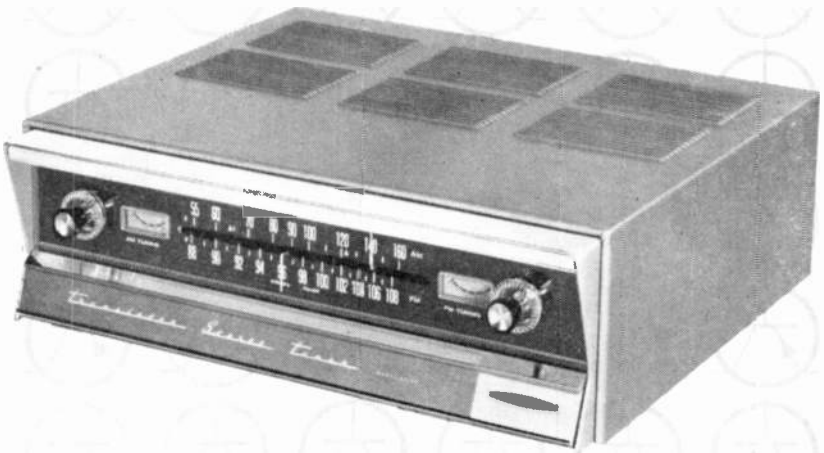

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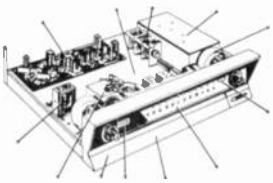

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Short-Wave Report

(*Continued from page 83*)

air for the first time, let us know about it at once—don't keep it a secret.

If you think that your report might not be worth anyone else's while, send it in anyhow, and let us judge whether we can use the material or not. Don't be disappointed if your report fails to "make it." Veteran reporters will tell you that their reports are often turned down, for many reasons—the main one being that our column is just so long and we can't include all of the reports received in any one month.

We suggest that you keep the following points in mind when making your reports. Try to include listings of: (1) new and rarely heard stations; (2) frequency and/or schedule changes; (3) English-language newscasts; and (4) any other-than-normal transmissions.

This, then, is a brief description of what we do here and what you can do to share in the activities. To you, the newcomer in the hobby, we extend a warm welcome and invite you to take an active part in a most fascinating pastime—short-wave listening!

Current Station Reports

The following is a résumé of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Eastern Standard and the 24-hour system is used. Reports should be sent to P.O. Box 254, Haddonfield, N.J., 08033, in time to reach your Short-Wave Editor by the eighth of each month; be sure to include your WPE Monitor Registration and the make and model number of your receiver.

Argentina—Buenos Aires has sent a form letter and brochure stating that they will verify reports for 6090 and 11,780 kc. with a special new QSL card in the future. The 6090-kc. outlet has recently shown increased strength but with reduced quality. English is beamed to N.A. daily at 2230.

Australia—Station VL2UV, Kensington, Sydney, has been logged on the West Coast on 1750 kc. with announcements for campus use and local activities. Verification was received by aerogram in one month. Time heard: around 2334. (We have no other information on this station but presume that it is a private school station—*Ed.*)

Bolivia—A comparatively new station is CP76, *R. Luis de Fuentes*, Tarija, on 6215 kc. Originally operating on 6140 kc., it is now variable and may drop as low as 6211 kc. It was logged at 2245 in Spanish with dance music. Do not confuse this station with *R. Santa Cruz* on 6210 kc. nor with *R. Colquiri* on 6217 kc.

Potosi seems to be the new location for *R. 9 de Abril*, 5910 kc. This was logged at 2150 in Spanish, overriding the Russian on the same channel. News was given at 2232.

British Honduras—*R. Belize* has been heard well on 830 kc. but the 3300-kc. outlet has not been heard. Try for the medium-wave channel from 2000 to 2305 s/off. There is a *VOA* newscast at 2200 and most of the general programming is in English.

Central African Republic—*R. Bangui*, 5035 kc., has been tuned until 1715 on Saturdays when it operates on an extended schedule. Xmsns are in French and all reports must be written in French.

Chile—Station CE965, *R. Yungay*, Santiago, 9658 kc. (listed for 9650 kc.) is noted at 0613-0630 with music and ads, and from 1738 with classical music and anmts in Spanish.

Congo (East)—Leopoldville broadcasts its Foreign Service on 11,755 kc. to North and South America at 2000. English is given to 2015, then Portuguese. A verification arrived after nine months.

Congo (West)—Brazzaville, 15,190 kc., has Eng. at 1400-1500 with news (1430), a French-Eng. lesson, and old U.S. pop tunes. French continues from 1500, and Eng. is again noted at 1615-1700. The 7105-kc. outlet is heard with Eng. news at 0015-0030. French is given on 9520 kc. during the 1615 to 1647 s/off period, with news at 1630.

Cuba—Station CMCA, Havana, 730 kc., carries Eng. from 1930 to 2100 or later, and they welcome reports. Short-wave outlets with Eng. are 15,155 kc. (1520-1640) and 11,960 kc. (2200-0100). These schedules may change with little advance notice.

Dominican Republic—*R. Santo Domingo Television*, 9505 kc., is scheduled from 1800 to 0600, with Eng. at 2200-2300. News is given at 2200-2220. They verify accurate reports by airmail; an IRC is required. Reports should go to Av. Dr. Tejada Florentine 8, Santo Domingo, Republica Dominicana.

Ecuador—Station HCAP4, *R. La Voz del Valle*, Machachi, 4841 kc., has a lot of pop music, commercials, and ID's on the hour and half hour, and is best heard at 2250 and later. This station is listed for 4830 kc. Do not confuse it with *R. Valera*, Venezuela, on 4840 kc.

Egypt—Cairo has Eng. to W. Africa at 1130-1215 on 17,690 kc.; to Europe at 1630-1730 (news at 1645) on 9495 and 11,915 kc.; and to Europe, the Middle East, and Central Africa at 0130-0200 on 11,930 and 7075 kc. There is no Eng. xmsn to N.A. at present.

Ethopia—Station ETLF, *Radio Voice of the Gospel*, Addis Ababa, has Eng. scheduled as follows: on 6050 kc. at 0930-1000 and on 4905 kc. at 1130-1200 to Ethiopia; on 7120 kc. at 1000-1030 to nearby areas ("nearby" means near to Ethiopia—*Ed.*); on 9705 kc. at 1045-1110 to E. Africa; on 15,270 kc. at 1330-1400 to W. Africa; at 1400-1430 on 15,270 kc. to W. Africa and on 9705 kc. to S. Africa; and on 15,410 kc. at 0900-0930 to S. India.

Fiji Islands—Suva has been noted from 2350 to 0030 s/off in Eng. on 9715 kc. The ID gave the call as VRH10. The outlet on 3286 kc.

was noted in Fiji language from 0450 to 0530 s/off.

Formosa—Taipei was tuned on 11,860 kc. at 0555 in Eng. s/off. Japanese began at 0600 in dual to 6095, 7130, and 15,225 kc.

Gambia—A letter from the station states that they are still on 4820 kc. and not likely to move. Power is 1500 watts. The schedule is 1250 to 1500, weekdays only.

Guinea—Conakry has moved from 3375 kc. to 3385 kc. to avoid teletype QRM. The 9675-kc. channel was noted at 1630-1700 in French.

Haiti—*R. Nacional du Haiti*, probably a new station, was tuned on 5920 kc. from 2000 to 2005 s/off with Latin American music and French comments. Actual s/off time is believed to be later.

Honduras—Station HROE, *R. Ocote Peque, La Voz De La Frontera*, 10,078 kc., is noted nightly with s/off at 1900 (Sundays at 1915) and Latin American programming. The tune "American Patrol" is heard often, possibly indicating that it is the station theme.

India—Delhi has Eng. at 1445-1545 on 9870 kc., dual to 7235 and 9520 kc. to United Kingdom, and on 9690 and 11,835 kc. to W. Africa.

Japan—*R. Japan* recently sent out questionnaires to all listeners who have reported regularly. All of those who returned the form were sent a record of Japanese folk music, a 1964 calendar, and a timetable for the 1964 Tokyo Olympic Games. New channels noted include: 3910 kc., in Eng., with a ball game at 0535; 9685 kc. in Japanese to E. Asia at 0715 and dual to 7195 and 11,940 kc.; 15,170 kc. at 1830 to N.A. East Coast; and 15,425 kc. at 0230-0330 to Europe with Eng. from 0300. This latter xmsn is scheduled at 0115-0345 in Russian, German, French, Italian, Eng., and Swedish, on 15,135 and 11,705 kc.

Mexico—Station XEUDS, 6140 kc., is operated by the University of Sonora on a strictly non-commercial basis. Programs consist mostly of classical music and are cultural and literary in nature. The power is 1000 watts. Judging from reports, this station is being widely heard in the western half of the U.S.A., but not much in eastern areas. Reports should go to Universidad de Sonora, Hermosillo, Sonora, Mexico, and return postage is not required.

Monaco—*Trans World Radio*, Monte Carlo, has "Back to the Bible" in Eng. at 0130-0230 on 7250 kc., a slight move up from 7245 kc.

Netherlands—*R. Nederland* has replaced 15,445 kc. with 15,220 kc. during the special xmsn of news to the U.S.A. on Tuesdays and Fridays at 1030 and 1415.

New Zealand—The latest schedule from Wellington reads as follows (Eng. unless otherwise indicated): to the Pacific Islands at 1200-1445 and 1500-0045 on 6080, 9540, and

SHORT-WAVE ABBREVIATIONS

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

15,280 kc., and at 0100-0345 on 6080 and 11,780 kc.; to Australia at 1500-1730 on 11,780 kc. and 1745-0045 on 15,110 kc., also at 0400-0645 on 6080 and 9540 kc.; to Antarctica (Sundays only) at 0315-0345 on 9540 kc.; to Samoa in Samoan on Tuesdays at 0200-0215 and to the Cook Islands and Niue in Rarotongan at 0245-0300 on Wednesdays and at 0300-0315 on Saturdays, both on 6080 and 11,780 kc.

Oman—According to a letter received from *Ibri Radio*, the station does not operate on a regular schedule and is part of a network of stations in Oman used by Petroleum Development, Ltd. This station is on 5710 kc. and does *NOT* verify.

Peru—Station OAX7F, *R. Nacional*, Puno, 9570 kc., is being noted at 2315 daily in Spanish. *R. Atlantida*, Iquitos, 9625 kc., is good around 2258 with music and ID's. *R. Loreto*, Iquitos, has been found on 4456 kc. at 1830 and later with Peruvian music, commercials, and ID's.

Singapore—*R. Singapore* is testing on 9590 kc. from before 0915 to 1130 s/off, all Eng., with varied programs of news, sports, pop music and documentary features.

Solomon Islands—A station has been testing on 3995 kc. with 500 watts but further details are lacking. The regular station operates on 5960 kc. at 0230-0610 (0355-0615 on Saturdays, 0355-0600 on Sundays).

South Africa—Recently reported xmsns: 6095 kc. at 0000, too weak to read; 4945 kc. at 2240-2330 with the Commercial Service; and 9720 kc. at 0045-0100 with African weather report and music and from 0930 to 1045 fadeout with serial stories, music, and commercials.

Spanish Guinea—*R. Ecuatorial*, Bata, Rio Muni, 4925 kc., is noted on Saturdays to as late as 1830 in Eng., French, and Spanish, with musical programs.

Syria—Damascus has been found on Cairo's listed channel of 15,115 kc. from 1115 to 1125 with news and until 1200 with music.

Tanganyika—Dar-es-Salaam, 5050 kc., has been logged at 2214 s/on in Kiswahili. Careful tuning is a must if you want to log this one!

Thailand—A new program schedule, just received, lists these xmsns: to N.A. at 2315-0015; for the Thai Forces in Korea, Vietnam, and Cambodia at 0430-0520, and in the General Service at 0525-0657. The listed frequencies are 11,910, 7305, and 6160 kc. They are anxious for reports; return postage is not required. Reports should go to *R. Thailand*, The Overseas Broadcasting Division, Public Relations Department, Bangkok, Thailand.

U.S.S.R.—Supplementing the information given last month, *R. Yerevan* verified promptly by registered mail and sent schedule brochures. They broadcast on Saturdays and Sundays at 1430-1530 in Armenian for listeners in the Americas; there may be a few moments of Eng. just prior to s/off. Spring-summer frequencies are 9725, 9610, 9540, and 7185 kc. For autumn and winter, they use 7270, 7185, 6155, and 5965 kc. The verification was for unlisted 11,850 kc.

On Wednesdays and Sundays, *R. Yerevan* has a similar broadcast for European countries at 0400-0430 (for the autumn and winter) on 15,385, 11,970, 11,925, 11,790, 7320, and 6010 kc. It also broadcasts to Near and Middle Eastern areas for Armenian listeners at 1030-1125 and 1430-1605 on 7270 kc. A program in Arabic for the same area is scheduled on 7270 kc. at 0900-0940 and 1400-1430.

Vatican City—*Vatican Radio* has been noted on 11,930 kc. at 2204 with English. This is evidently a new xmsn as our schedule does not show it.

Clandestine—*R. Espana Independiente* is heard nightly around 1800 on 10,110 kc. with talks and music, all-Spanish. The exact location is unknown but they did give two addresses—one in care of "L'Humanite," Paris, France, and the other in Czechoslovakia. The latter is probably the true location. Has anyone obtained a verification or any other information directly from the station? —30—

SHORT-WAVE CONTRIBUTORS

Dave Siddall *(WPE1EBX)*, Hyannis, Mass.
Peter Connolly *(WPE1FGL)*, Groton, Mass.
Irwin Be of ky *(WPE2BYZ)*, Brooklyn, N. Y.
Laurence Elkin *(WPE2CGM)*, Bronx, N. Y.
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Ken Culbert *(WPE2GOX)*, Cold Spring, N. Y.
Robert Wechsler *(WPE2IGE)*, Brooklyn, N. Y.
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Mike Flomp *(WPE2IXM)*, Valley Stream, N. Y.
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Joseph Prugar *(WPE2JGP)*, Rome, N. Y.
Dave Woody *(WPE2JHR)*, Woodbridge, Conn.
Jeffrey Angelo *(WPE2KIK)*, Roselle Park, N. J.
Sam Clopper *(WPE3DQO)*, Catonsville, Md.
Dennis Katchin *(WPE3EKQ)*, King of Prussia, Pa.
Ronald Stahl *(WPE3FHK)*, Steelton, Pa.
Grady Ferguson *(WPE4BC)*, Charlotte, N. C.
John Brunst *(WPE4BQ)*, Neptune Beach, Fla.
Joseph Agrella *(WPE4FNS)*, Fort Lauderdale, Fla.
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Jody Coles *(WPE5CSW)*, Houston, Texas
Arnold Lachner *(WPE5DED)*, Alamogordo, N. M.
Henry Borders *(WPE5DMN)*, Longview, Texas
Stewart MacKenzie, Jr. *(WPE6AA)*, Huntington Beach, Calif.
Charles Matterer *(WPE6DGA)*, San Leandro, Calif.
Richard Polson *(WPE6DTQ)*, Fresno, Calif.
John Ball *(WPE6DVT)*, Arcadia, Calif.
Bob Johnson *(WPE6DVH)*, Arcadia, Calif.
David Smith *(WPE6EIO)*, Los Angeles, Calif.
Pete Henricks *(WPE6EZG)*, Watsonville, Calif.
Phil Ritter *(WPE6FCT)*, Oroville, Calif.
John Laverman *(WPE7BKR)*, Seattle, Wash.
Tim Shaw *(WPE8BUV)*, Bay Village, Ohio
Ray Wasky *(WPE8FCK)*, Cleveland, Ohio
Robert French *(WPE8FGH)*, Bellaire, Ohio
Dan Schonberg *(WPE8FWH)*, Shaker Heights, Ohio
John Pirnat *(WPE8FWO)*, Euclid, Ohio
Norris Alford *(WPE8FYF)*, Winfield, W. Va.
Steve Gecewicz *(WPE8HAJ)*, Ravenswood, W. Va.
Jim Evans, Jr. *(WPE9DJM)*, Highland, Ind.
Lauris Young *(WPE9ERX)*, Elgin, Ill.
Bill Rohde *(WPE9ESO)*, Menomonie, Wisc.
John Beaver, Sr. *(WPEØAE)*, Pueblo, Colo.
Michael Rathbun *(WPEØDBX)*, Grand Junction, Colo.
Jack Perolo *(PY2PE1C)*, Sao Paulo, Brazil
Gregg Calkin *(VE1PE3L)*, Monte Carlo, Monaco
Ken Taylor *(VE3PE1SP)*, Belleville, Ont., Canada
Bert Pestor *(VE3PE9L)*, Sudbury, Ont., Canada
Bernard Brown, Derby, England
Robert Mills, San Diego, Calif.
Rodger Phillips, Eagle, Mich.
Joe Piechuta, Meriden, Conn.
Jim Wedewer, Dyersville, Iowa
Bill Wilson, Folcroft, Pa.
Radio New Zealand, Wellington, New Zealand
Sweden Calling DX'ers, Stockholm, Sweden

Satellites On The Air

The following satellites, launched by the United States, were reported to have beacon and telemetry transmissions as of October 16, 1963. The satellites are listed by their code names, according to frequency; because some transmit on more than one frequency, they appear more than once.

Transit 4A	54.000 mc.
Vanguard 1*	108.017 mc.
Telstar 2	136.050 mc.
Alouette**	136.077 mc.
Relay 1	136.140 mc.
Explorer 16**	136.200 mc.
Transit 4A	136.200 mc.
Tiros 5	136.233 mc.
Tiros 6	136.233 mc.
Tiros 7	136.235 mc.
Explorer 17**	136.316 mc.
Ariel	136.406 mc.
1963 14C (US)	136.415 mc.
Explorer 14	136.440 mc.
Syncom II	136.470 mc.
Alouette**	136.594 mc.
Relay 1**	136.620 mc.
OSO 1	136.744 mc.
Syncom II	136.770 mc.
Anna 1B	136.815 mc.
Explorer 16	136.860 mc.
Injun 3**	136.868 mc.
Solar Radiation	136.890 mc.
1963 30B (US)	136.891 mc.
1963 14B (US)	136.892 mc.
Tiros 6	136.921 mc.
Tiros 7	136.922 mc.
Tiros 5	136.923 mc.
Anna 1B	136.975 mc.
Alouette	136.978 mc.
Syncom II	136.980 mc.

*Transmits only while satellite is in sunlight
**Transmits only upon command from ground stations— not during every pass

Satellites of the Soviet Union have telemetry and tracking transmissions in the 19.990-20.010 mc. band. Whenever a Cosmos series satellite is launched, check Radio Moscow for an announcement of tracking frequencies. Most Cosmos series satellites re-enter the atmosphere in 60-90 days. Cosmos 2 and 8 are in orbit at press time, but do not seem to be transmitting.

If you're interested in eavesdropping on satellites, and missed our June 1962 article on the NASA-136 converter, we recommend that you look it up. Easy to construct, this sensitive converter can intercept the satellites operating in the 136-137 mc. band.

"Rock-Bottom" Radio

(*Continued from page* 54)

the receiver is unknown, it is impossible to determine the *exact* standard time (for extremely critical purposes) by monitoring it! Further, when propagation conditions are changing rapidly, slight changes in the *frequency* of standard high-frequency signals can be observed at the receiver due to Doppler shift.

The problem can be largely solved by broadcasting time and frequency signals on VLF channels—such a service has just been initiated on both 20 and 60 kc. by the National Bureau of Standards—since VLF radio waves propagate in a stable manner, and the time required for them to reach the receiver (regardless of its location) can be easily calculated.

The importance of these and other VLF stations, the Loran "C" stations, for example, to navigation cannot be underestimated. Radio navigation depends on the ability of shipboard receivers to measure the length of time required for signals from two different stations to reach the ship. It is then possible to determine the ship's distance from each of the stations and, by a process of triangulation, the exact location of the ship. So accurately can this be done with VLF signals that a navigator can determine his position to within 200 feet or better!

Although the ham, SWL, or commercial broadcaster need never worry about the accuracy of WWV—it's accurate to one part in ten million—the new VLF stations will be accurate to one part in ten *billion*. These stations, WWVB and WWVL at Fort Collins, Colorado, were dedicated on August 1, 1963 after a number of years of experimental, low-power operation. Station WWVB, operating on 60 kc., started broadcasting on July 4 with a new 5-kw. transmitter, and the power will shortly be increased to 7 kw. and ultimately to 50 kw.

Even more spectacular plans are in the works for WWVL. Currently broadcasting on 20 kc. on an experimental basis with a power of 1 kw., WWVL is destined to become a 50-kw. *global* radio station offering ultra-precise time and frequency measurements to all.

Once thought to be the only valuable part of the radio spectrum by engineers and scientists, then discarded in favor of the higher frequencies, "rock-bottom" radio has come the full circle. Those monstrous antennas and huge high-power transmitters are back—this time with a space-age mission. -30-

Across the Ham Bands

(*Continued from page* 79)

ulated by the early appearance in surplus of the Collins-designed AN/ART-13 and similar transmitters. And the *pi*-network speedily took over as *the* final tank circuit, for no other configuration known could be made so compact for the amount of power handled, and still provide front-panel band-switching, har-

monic suppression, reasonable efficiency, and the ability to drive a considerable range of load impedances.

De-Bugging the Pi-Network. Unfortunately, the performance of many transmitters did little to bolster the reputation of the *pi*-network. While many users had no trouble, others battled high harmonic output, and replaced numerous final tank components. Some technical Sherlocking soon pinned down the trouble. A lot of transmitter designers, both amateur and professional, had gone overboard in claiming that the *pi*-net was able to drive any and all impedances, and people expected far too much of it. Theory was one thing, but in practical equipment results were far better when the standard *pi*-network was not required to feed loads greater than 100 ohms or so.

Oddly enough, the Collins Radio Company, whose president, Art Collins, first brought the *pi*-network to the attention of radio amateurs as a "wide-range" coupler, was among the first to recognize the practical limitations of the circuit. Consequently, all post-WW-II Collins amateur transmitters have been designed to work into nominal 50- to 75-ohm loads and are not guaranteed to give satisfactory results with appreciably different load impedances.

Some manufacturers were a little slow to restrict the range of load impedances their transmitters would match. However, most of today's amateur transmitters are designed to work into 50- to 75-ohm loads (with the exception of some low-power beginners' transmitters). All of those we have had the opportunity of testing—which has been most of them—work well when fed into their rated load impedance.

Thus, after a sometimes painful "growing-up" period, the *pi*-network transmitter output tank circuit finally redeemed its early promise.

News and Views

Richard Spille, WN5FWA, 2136 N. 37th St. Baton Rouge, La., spent the first four months of his Novice career waiting for a transmitter. When it arrived—a Knight-Kit T-60—he worked 25 states in two months on 40 meters. A Knight-Kit Span Master receiver and a vertical antenna round out Dick's equipment. . . . **Stephen A. Maas,** 104 Treaty Rd., Drexel Hill, Pa., forgot to include his call letters, but he has just received

his General Class ticket. Steve strongly advises inexperienced Novices to start out with simple equipment. He didn't, and had a lot of trouble his first three months as a Novice. As a General, he uses a Knight-Kit T-150 transmitter and a Hallicrafters SX-140 receiver. . . . **Keith Conroy, WN2GJH,** RFD #3, Oswego, N.Y., 13126, uses an EICO 723 transmitter to feed 60 watts worth of electrons into an end-fed antenna. He receives on a Hallicrafters S-108. His record: 17 states and 61 QSL cards.

Dick LaPlante, WB2FEI, 163 Danbury Dr., Buffalo 25, N.Y., got his start as SWL Monitor WPE2JTJ. As a Novice, he made 335 contacts in 30 states (including Alaska) using an EICO 720 transmitter, a folded dipole antenna, and a Heathkit AR-3 receiver. When Dick's General ticket arrived, he added an EICO 730 modulator to his gear for phone contracts, although he still spends most of his air time on c.w. . . . **Sam Brown, WN4IUM,** Hiway 79 North, Guthrie Rd., Clarksville, Tenn, kept the ionosphere hot during his Novice career. With an EICO 723 transmitter, a Gotham V-80 vertical antenna, and a National NC-190 receiver, he worked 47 states (all confirmed), Peru, Ecuador, Hawaii, Mexico, Canal Zone, Canada, and Puerto Rico. Sam has a 20-wpm ARRL code-proficiency certificate on his shack wall and a General Class ticket on the way from the FCC.

"To make the handicapped's long day a little shorter through the media of amateur radio" is the motto of the Metropolitan Ragchewers Club, 5336 St. Clair Ave., Detroit, Mich. Its members offer to help any handicapped person in the Detroit area get started in the hobby. Contact Ralph Peterson, W8PUS, at the above address, or Vincent Fisher, K8PIA, 14796 Glenfield, Detroit, for further information.

Steve Buckstein, KN7YKV, 2854 N.E. 55 Ave., Portland 13, Ore., taught himself the code in less than an hour, using the method shown in our March, 1963, column. His Heathkit DX-60 transmitter sits on 40 meters most of time, where it feeds a folded dipole antenna 25' high; a well-used Hallicrafters S-20R, aided by a Q-multiplier, does the receiving; and the Code Monitor described in April, 1963, P.E., rounds out Steve's equipment.

Paul Folmsbee, WA4BRS, Laurinburg, N.C., sticks to 75-meter phone and 80-meter c.w. with his Heathkit DX-40 transmitter and BC-342 receiver. He also uses a war-surplus ART-13 2000-watt transmitter.

Fifteen states, including Alaska and Hawaii, and a couple of Canadians show up in the "worked" column of his log. . . . **Ike Kerschner, W3AZR,** calls attention to the "QRP Amateur Radio Club," which now has close to 900 members in all states and over 40 countries. Any amateur who consistently uses a transmitter power of less than 100 watts is eligible for membership. Certificates are awarded for working 25 other members on the low-frequency ham bands or 10 members above 50 mc., QRP WAC (Worked All Continents), etc. You can get additional info from James R. Perry, K4WVX, 2691B 56 St. North, St. Petersburg 10, Fla., if you include a stamped and self-addressed reply envelope with your query.

Phil Pierce, WN4MZU, WPE4ERF, 1738 Blue Licks Rd., Lexington, Ky., has worked 21 states with his AMECO AT-1 15-watt transmitter, a National NC-60 receiver, and a 40-meter "inverted-V" antenna. . . . Although **John Freiman, WN8FPL,** 331 Grand Ave., Akron 2, Ohio, can work 80, 40, and 15 meters with his 80-meter vertical antenna and 40-meter dipole, he likes 40 meters best. He huffs and puffs with a Heathkit DX-60 transmitter and a Hallicrafters SX-110 receiver. John has worked 35 states and Canada, and has the companion VFO for his transmitter all ready to go as soon as his General Class ticket arrives.

Speaking of tickets arriving, remember, if you are planning to try for a new or renewed ham ticket above the Novice class soon, do it before the end of the year and save paying a $4.00 license fee. (The fee doesn't apply to Novice licenses.)

Until next month, keep your news and pictures coming to: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana 46401. 73,

Herb, W9EGQ

Alphabet Quiz Answers

(*Quiz on page 73*)

1 - C ALPHA is the symbol for current gain of a transistor (the ratio of collector to emitter current) in a common-base amplifier circuit.

2 - D BETA represents the current gain of a transistor (ratio of collector to base current) in a common-emitter amplifier circuit.

3 - F The GAMMA matching network is one of the most popular methods of feeding the driven element of a beam antenna.

4 - H The DELTA connection of three-phase power transformer windings is used where minimum third harmonic of the line frequency is important, but it provides no neutral connection.

5 - J THETA is commonly used to indicate the angular phase difference between two a.c. signals, or between a.c. current and voltage in a reactive circuit.

6 - B LAMBDA is used to represent the wavelength of a periodic wave as measured between identical points on two consecutive waves.

7 - I MU is the symbol for the amplification factor of a vacuum tube. This is the ratio of a small change in plate voltage to the change in grid voltage that will produce the same change in plate current.

8 - A A PI-network is often used as the tank circuit in radio transmitters. It facilitates matching the transmitter output to the line or antenna impedance.

9 - E PHI is commonly used to represent the total magnetic flux in a magnetic circuit.

10 - G OMEGA is used primarily as the symbol for resistance, but is also used occasionally to represent the ohmic value of a reactive impedance.

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Telephone Beeper

(*Continued from page* 59)

Any standard potentiometer will do if the box you use has room for it. (If the adjustment of *R2* is too touchy, use alternate 10,000-ohm unit specified.)

The time interval between beeps is controlled mainly by the relative values of capacitors *C1* and *C2*, and resistor *R1*. Increase the resistance of *R1* if the interval is too short, decrease *R1*'s resistance if the interval is too long. If "chirp" is evident, readjust *R2*.

The speaker specified in the Parts List will fit in the plastic box used by the author. If a larger enclosure is used, any 3.2-ohm speaker will be satisfactory.

Construction. The construction of the Beeper may be varied to suit the builder, and wiring placement is not at all critical. The author used a perforated board, with components on top and point-to-point wiring and jumpers underneath. A cutout in the board accommodates the speaker frame and the transformer, which was cemented to the side of the plastic box. A single screw and spacer support the circuit board in the box. Small holes may be drilled in the box in the area of the speaker, or (as in the author's unit) a piece of perforated aluminum can serve as a grille to cover a cutout opening. The speaker itself is supported by four screws.

A simple retainer clip fashioned from 1/16"-diameter piano or coat-hanger wire is formed to fit around the mouthpiece of the particular telephone you intend to use (since the size of the mouthpiece is different for different-style handsets). A piece of foam rubber or plastic may be shaped with a razor blade to form a cradle for the mouthpiece, as well as to provide a "spring" force holding the phone snugly against the wire clip, which fits into the mouthpiece groove. The ends of the wire clip fit into small holes in the side of the box.

Switch *S1* is mounted with two screws, and wired to two battery connectors (which may be salvaged from discarded 9-volt batteries) in series. The batteries can be wedged into position by the circuit board, or held in the box with a bracket or cement. Spray-painting the box after assembly will improve the appearance, and title decals will add the finishing touch.

Operation. When the Beeper is in use, the first beep will be heard about 30 seconds after the switch is turned on. Thereafter the beeps will be heard at approximately 15-second intervals. To test the Beeper, temporarily connect a 10,000-ohm resistor across *R1*; this should increase the beep rate. Current drain is only about 2½ ma., so the batteries should last over 200 hours with normal intermittent phone use.

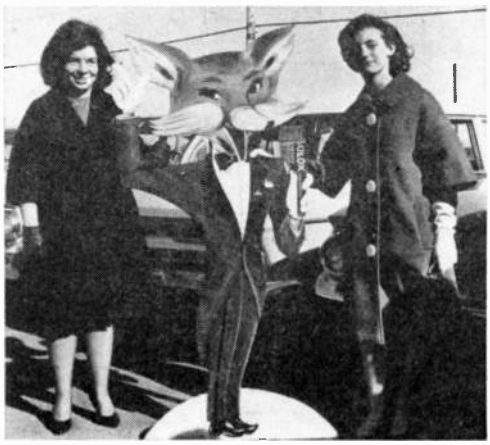
If you regularly record telephone conversations of technical discussions, business transactions, long-distance family calls or for any other purpose, the Telephone Beeper will be a useful accessory to remind the party at the other end that he is being recorded, and may also prevent you from being charged with unlawful recording. The investment is small, the inconvenience slight, the result worthwhile. -30-

On the Citizens Band

(*Continued from page* 72)

the local police, Civil Defense crews, and other local authorities during the flooding of Chateauguay last spring. The association was commended for a job well done.

As proof that YL's in Canada are just as CB-active as any of their southern cousins, meet Maxine Trehub, XM52-501, and



Louise Juster, XM52-1021. Maxine uses a Ray-Tel, fed into a vertical coaxial antenna, while Louise runs a Cadre into a two-element beam. The photo was taken after presentation of an award from the CGRC to radio announcer Al Saunders for his part in the Chateauguay flood control action. The chap standing between Maxine and Louise is radio station CFOX's mascot, Charlie Fox. There's no relation between Charlie Fox and Fox-Charlie-Charlie who resides in this country!

The CGRC president, "Moe" Edwards, XM52-255, says that membership now stands at 40, and that the club is "slowly-but-surely getting organized." Incidentally, president "Moe" is better known among the northern realms as "The Canadian Rebel." Why, Moe?

Club Chatter. The Cenla CB Radio Club of Alexandria, La., is the most recent association to be added to our club roster. The club constitution was signed on June 12, 1963, registered with the Chamber of Commerce of Alexandria. General meetings are held the second Wednesday of every month. Present club officers include: president, Robert Brewer, KEA0115; vice president, Jim Smith, KEB2291; secretary, Chas. Pospisil, KEA2231; treasurer, Jack Taylor, 8W1725. Information about joining this group may be had by writing the CCBRC at 1156 Rapides Ave., Alexandria, La., 71303.

The Cascade County CB Radio Club was organized in Great Falls, Mont., last June. They started with seven members, then jumped to 35 in less than three months. President Ed Steffens says that the increasing requests for membership applications indicate that membership may be tripled by the early months of 1964. Main objectives of the club are to assist in search and rescue when and wherever it can be of service. Members are on-call with civil defense authorities, the Sheriff's department, and the highway patrol. Their local monitoring channel is P.E.'s proposed National Calling Channel: "9."

If we haven't heard from you for a while and if we haven't mentioned your club activities lately, now is the time to fill us in on your correct club mailing address, officers, constitution and bylaws, membership roster and activities. Also, if your smiling face hasn't appeared across these pages, why not dust off the Brownie and show us what you and your club members have been up to? Our readers would very much like to see who's at the other end of those microphones.

I'll CB'ing you. —*Matt, KHC2060*

ELECTRONICS MARKET PLACE

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TRANSISTOR ignition described June and October Popular Electronics, "Operation Pickup." Complete kit quality components quickly assembled. No drilling. Complete instructions. Guaranteed. $14.95 Postpaid. Electromart, 1616 S. 81st St., Milwaukee, Wis.

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OHM'S law never forgotten with copyrighted tool. $2.00 Postpaid. Beck Radio. 6323 South Dale Mabry, Tampa, Florida 33611.

15 DISTANCE One-tube plans—25¢; One-tube Handbook—50¢. Includes Transistor experiments, catalog. Laboratories, 1131-L Valota, Redwood City, California.

CB transmitters $6.00. Other bargains, send 10¢ for list. Vanguard, 190-48 99th Ave., Hollis 23, N. Y.

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110VAC 60 cy from car generator. Powers lights, refrigerator, transmitter, receiver, etc. Simple, easy to convert. Plans, $2.00. Tedco, Box 12098, Houston 17, Texas.

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SELL CB Equipment. As distributors handling all major brands of CB equipment, we can now offer dealerships to aggressive people who can sell full or part time. Write for information and costs on the brands you prefer to handle. Knox Electronic, 65 N. Cherry, Galesburg, Illinois.

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1964 QSL Catalogue. New designs. 10¢. Longbrook, Box 393-C, Quakertown, New Jersey.

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MOBILE transistorized power supply. 12-14 vdc input. Output, 275vdc at 100 Ma. A compact, reliable source of high voltage direct current for mobile and portable applications. Features high quality components throughout. Factory wired and tested. Delivered complete with detailed instruction sheet. Guaranteed. Price, $16.44 postpaid. Technical Equipment Products Co., 106 Lynn Street, Tullahoma, Tennessee.

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DIAGRAMS: Radio, Television, HiFi Stereo; $1.00. State make, model. Schematic Collector, 618 4th St., Newark 7, New Jersey.

SPEAKERS—All types rebuilt—one day service. Westex, 5230 14th, Lubbock, Texas.

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MISCELLANEOUS

INVESTIGATORS, free brochure, latest subminiature electronic listening devices. Ace Electronics, 11500—K NW 7th Ave., Miami 50, Fla.

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POPULAR ELECTRONICS
December 1963
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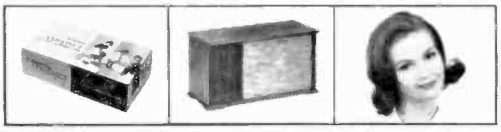

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