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POPULAR ELECTRONICS

JULY 1963

35 CENTS

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RID AM RECEIVER OF TV SYNC-BUGS

NEW HULA-HOOP ANTENNA for Ham or CB Mobiles

A ZIFF DAVIS PUBLICATION

POPULAR ELECTRONICS

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VOLUME 19 JULY 1963 NUMBER 1

Special News Feature

Special Construction Feature

Electronic Construction Projects

Amateur, CB, and SWL

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Departments

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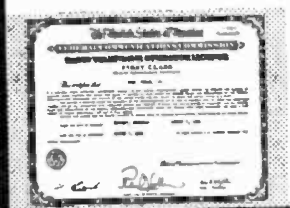

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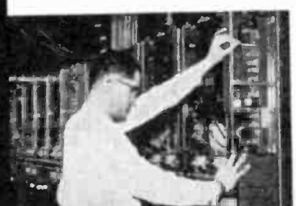

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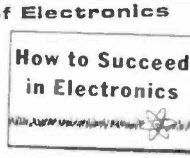

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LETTER TRAY

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

More Time on Tape

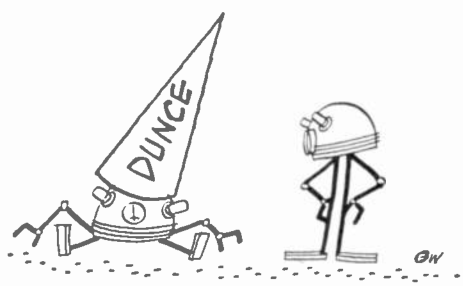
■ Congratulations to Fred Blechman for a clear, concise presentation of an increasingly popular subject ("A Buyer's Guide for Portable Tape Recorders," April, 1963). Your readers might also be interested in another Sarkes Tarzian, Inc. tape, advertised on page 15 in the same issue but not listed in the article—#1411-06. This is a 3¼" reel containing 600' of 0.5-mil Mylar tape, and provides more than twice as much recording time at the tape mentioned for Tarzian (two hours vs. 45 minutes at 1⅞ ips). It certainly helps prevent the frustration of running out of tape in the middle of a recording session.

WILLIAM C. BISHOP
Chicago, Ill.

Robots: Dumb Monsters?

■ I enjoyed reading "Our Heartless Friends the Robots" by D. S. Halacy, Jr. (May, 1963).

On page 100 in the second column, however, Mr. Halacy uses the Hebrew word "golem," a transliteration, as "early-day robots run amuck." The *Dictionary and Thesaurus of the Hebrew Language*, by Eliezer Ben-Yehuda, defines this word as "an ignorant person."



It would be interesting to know on what basis Mr. Halacy understands "golem" to mean "robot"; also where it is so used in the Old Testament.

PAUL L. CONANT, SR.
Richardson, Texas

An interesting point. Webster's *defines "golem" as "Adam in the shapeless state of his creation, a monster . . . In Jewish legends, an artificial man . . . hence, an automaton." One Biblical source referred to is* Psalms CXXXIX.16.

Automatically Automatic Automatons

■ Your article on robots (Halacy) in the May, 1963, issue was a real goody. Let's have more in

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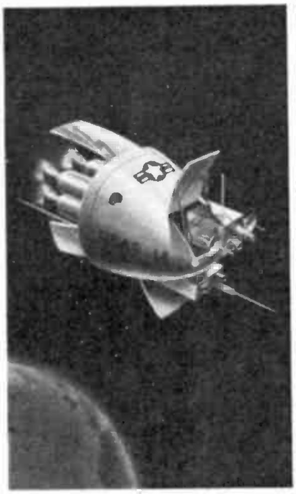

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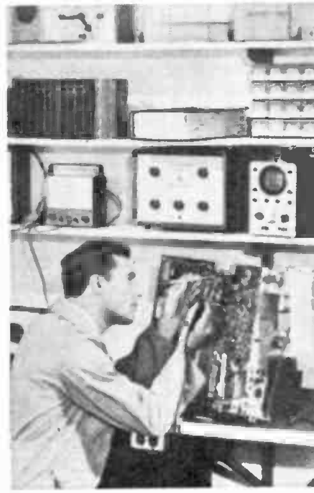

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Letter Tray

(*Continued from page* 6)

the same vein. One criticism, however, is that you forgot to mention that in order for a machine to be truly automatic, the automatic feedback must be automatically variable.

G. H. MORGAN
Vallejo, Calif.

As with human beings, for instance?

TV DX: South America

■ On Sunday, April 28, at about 3:15 P.M., I was trying to watch a baseball game on channel 3 from Savannah, 125 miles away. Some interference showed up about this time, and I turned my rotatable antenna a few degrees south to pinpoint the source. Lo and behold, a perfect test pattern showed up, a much better picture than that from Savannah.

The unusual thing about this was that the test pattern was from TGBOL-TV *in Guatemala.* It was as good as any picture I have ever seen. Will you please explain how this could happen?

CHAN HERRINGTON, WPE4GOY
Alma, Ga.

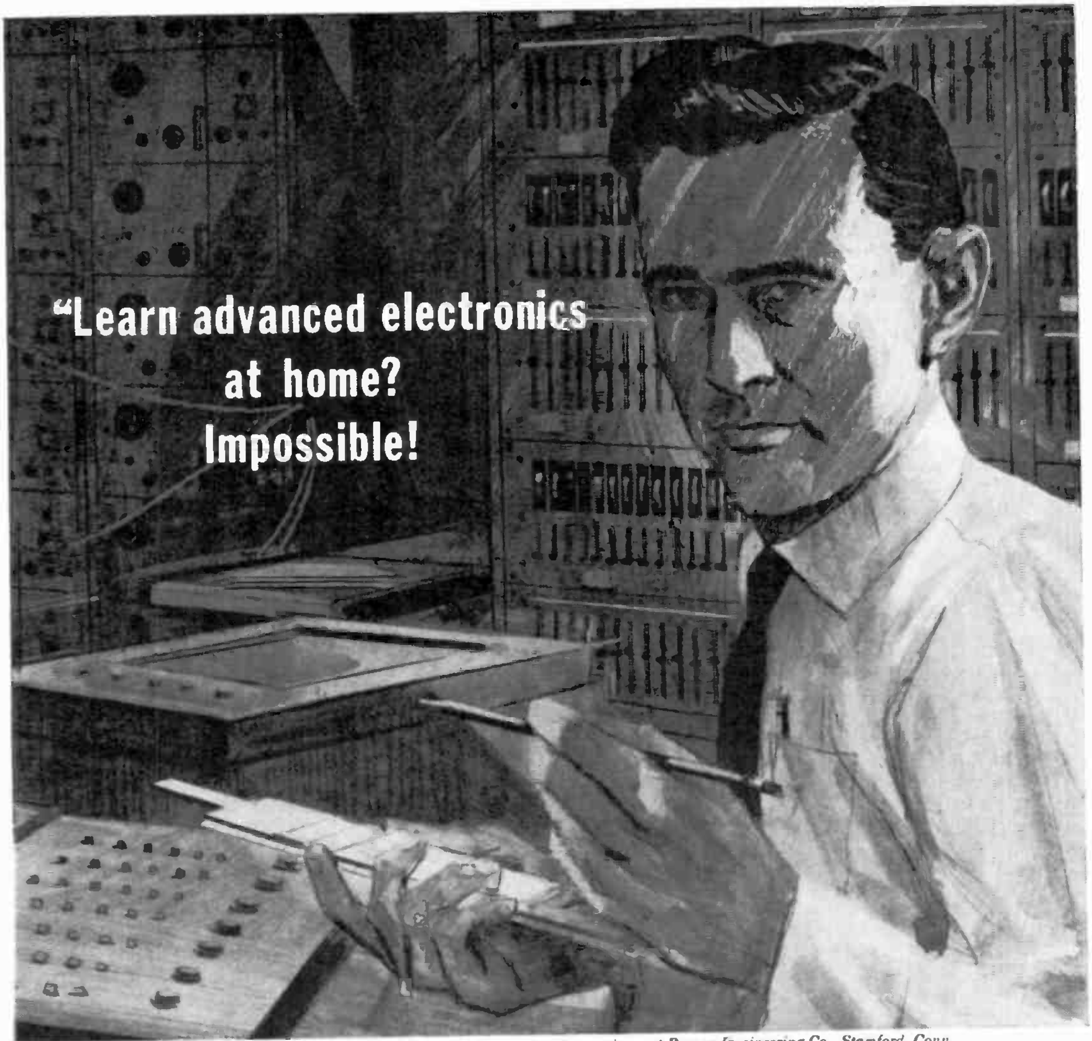
Congratulations on a rare bit of DX, Chan. Actually, cases of TV DX occurring in the spring and summer are not uncommon, but they're usually dismissed as local interference. What happens, for reasons unknown, is that scattered patches of relatively dense ionization appear at about the same height as the E *layer in the ionosphere. This phenomenon, called sporadic-*E *ionization, occurs in the early spring and lasts through August, reaching a peak during June and July. The patches of ionization reflect TV and other high frequency signals back to earth.*

No "Hobby Class" Say Hams, Others

■ I would like to express my disagreement with the proposal to establish a "hobby class" ameteur license (See "On the Citizen's Band," May, 1963, for news of this proposal).

Although industry benefits a great deal from the efforts of radio amateurs, amateur radio is not in existence specifically for this purpose . . . The requirements for an amateur license are not strict . . . any move to ease them would tend to lower standards. To place an amateur station on the air and operate it consistent with good engineering practices requires technical know-how . . . The establishment of a proposed "hobby class" license would be an invitation to those (who lack this knowledge) to buy packaged equipment and use it for play.

It must be assumed that . . . other amateur licensees would be barred from this allocation. This portion of 10 meters now finds much use for emergency nets such as Civil Defense, RACES, and AREC, not to mention international amateur comunications. May I suggest that the crowded conditions on the Citizens Band be alleviated by stiffer penalties for misuse and abuse, such as the complete removal of offenders . . . The proposal serves no national purpose other than to provide



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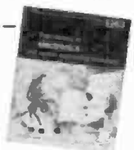

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Letter Tray

(*Continued from page 8*)

additional recreation to a few at the expense of many.

ALBERT T. WALTERS, JR., K4QIP/4
Eau Gallie, Fla.

■ . . . If they're going to have a "hobby class" license, why can't they put it on 2-3.25 mc., 4.5-6.75 mc., 8-13 mc., 15-20 mc., or even 31-49 mc.? They say that a simplified license will start a large group pursuing electronics . . . Like the Novice license, for instance?

CRAIG MCCLUSKEY, WPE6EFG
Los Angeles, Calif.

■ . . . It has a commercial aim behind it . . . In a month anyone can get their code speed up to 5 wpm . . . As the ARRL suggests, it would ruin 10 phone for all hams . . . please don't suggest that any such license be called an *amateur radio license!*

JOHN ZURIS
Chicago, Ill.

Versatile Receiver

■ I have obtained excellent results with the receiver ("One Receiver—All Bands," January, 1963), and even pulled-in some 40-meter DX that my brother's ham set didn't do as well on.

There did seem to be discrepancies between the schematic and pictorial in the article, however. For example, the pictorial shows the filament supply grounded, while the schematic doesn't. These little things make it hard if you're building your first project.

I plan to calibrate the receiver by getting it to oscillate and tuning in the squeal on a well-calibrated receiver. Also, what do you think of the idea of using the receiver as a signal generator by winding a coupling coil?

RICHARD SPAULDING
Cayuta, N. Y.

Thanks for the letter, Richard. Sorry you had difficulty in building this project. The schematic and pictorial were substantially correct, but we agree that some things might have been clearer. In answer to your question, you should be able to use the receiver as a signal generator by turning up the regeneration control just slightly past the point of oscillation, and simply coupling to the antenna coil winding through a small capacitor, say about 100 μμf. Reduce the coupling as much as possible, working with a minimum amount of signal. A tight coupling will tend to "pull" the compactron off frequency.

In Defense of CB

■ A letter in the May issue referred to CB'ers as common telephone users. This is wrong, as many CB'ers are hams, and many more hold first or second class commercial licenses. It is also possible to be interested in radio as a hobby and not be a ham.

I cannot deny the value of ham radio's many years of disaster work, research, and development, but the CB service, open for only a few years, has racked up a few achievements in this area also. The point is that we all have one common goal: better communications.

Looking in the front of my ARRL Handbook, I find the "Amateur Code of Ethics;" the amateur is gentlemanly, loyal, progressive, friendly, balanced, and patriotic. With this in mind, as a CB'er, SWL, hobbyist, and possibly one day a ham, I ask all hams to help us, don't knock us. We're only a few years old, and you have so many years of knowledge to share . . .

ROBERT JONES, 12W1009
Sacramento, Calif.

More WPE Clubs?

■ I find that the WPE Club idea is catching. Would you ask WPE8's interested in joining an SWL club to send me their names, addresses, WPE registrations, information on their equipment, and any comments they might have on starting a club? 73!

RAY WEBER, WPE8EZX
3839 Willys Pky.
Toledo 12, Ohio

■ I would like to get a WPE4 SWL club started here in Puerto Rico. Those interested should send me their names, addresses, WPE registrations, information on equipment, and any suggestions.

SERGIO PEREZ, WPE4GMF
Carmen Buzello St. 1104
Urb. Country Club
Rio Piedras, Puerto Rico

■ Could you publish my letter asking if any WPE6's are interested in joining an SWL club, and have them send me their names, addresses, equipment, and WPE registrations?

GUY MAZZA, WPE6EOO
2871 Almaden Rd.
San Jose 35, Calif.

Other readers who would like to form WPE clubs in their respective call areas (letters received at the last moment) are: Bruce Merritt, WPE6EQC, Rt. 1, 8872 Yosemite Blvd., Modesto, Calif., and John Wotysiak, WPE8FJT, 2204 Clifton Ave., Lansing 10, Mich.

Radio In a Bottle?

■ The acid test for the radio hobbyist is building a radio in a bottle. I have seen only a few attempts, all of which ended in failure.

DENNIS MULLENIX
Mattoon, Ill.

We'd like to see one, *Dennis, just one.*

Variable Voltage With 1625's

■ The power supply in the January, 1963 issue ("Variable Voltage . . . You Pick It") was just what I had been looking for. Instead of the more expensive KT-66, I used a 1625 transmitting tube, the 12-volt-filament version of the 807. The I.C.A.S. plate dissipation is 30 watts, and it costs just 20 or 25 cents at most surplus stores.

JAMES ZACHER, WA9DLT
Des Plaines, Ill.

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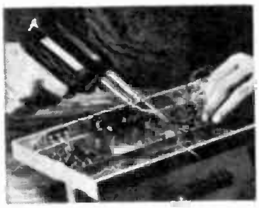

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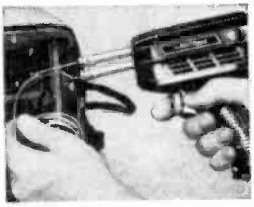

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Satellites On The Air

The following satellites, launched by the United States, were reported to have beacon and telemetry transmissions as of May 14, 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.

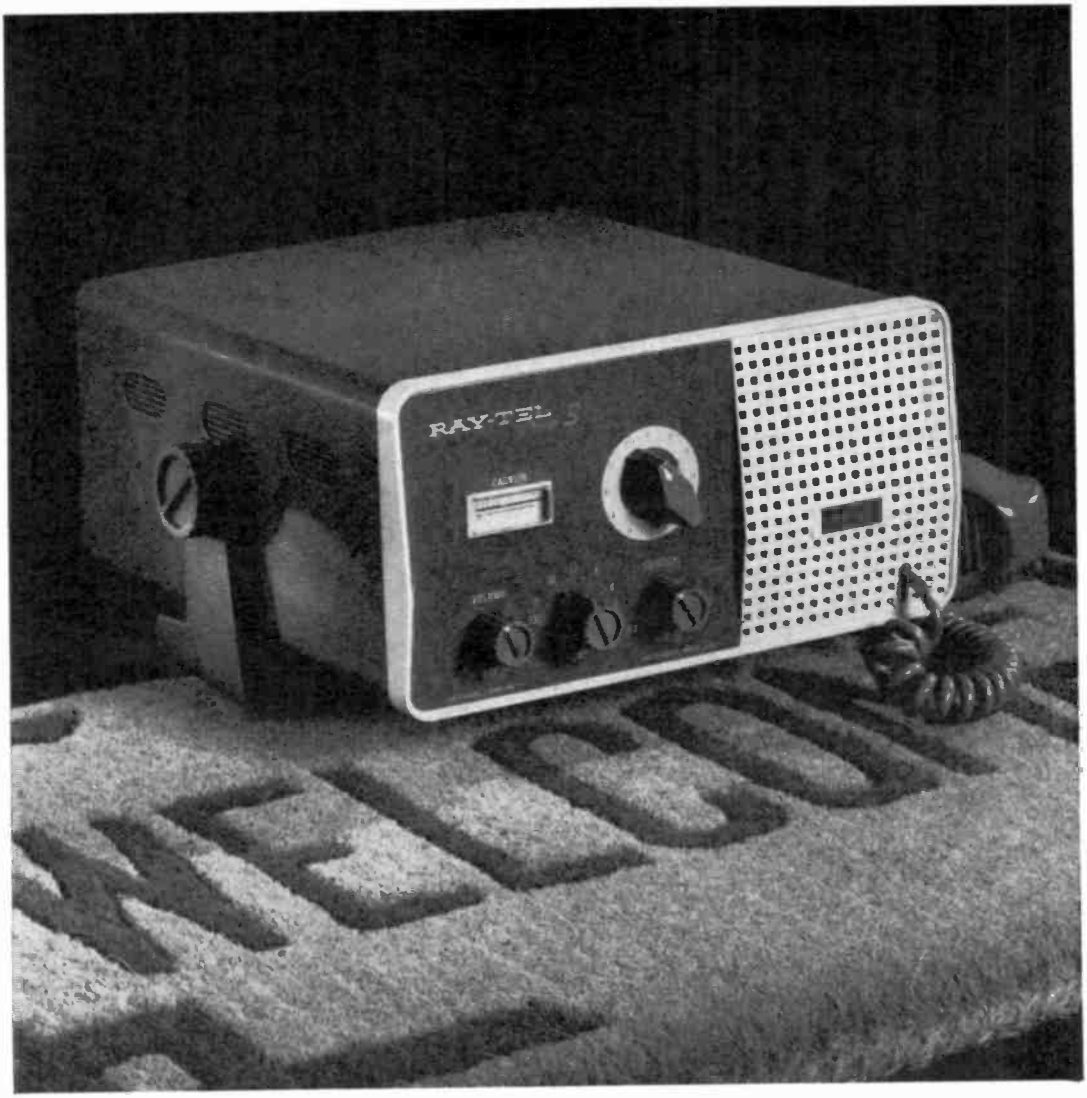
Transit 4A	54.000 mc.
Vanguard 1*	108.023 mc.
Telstar 2	136.000 mc.
Relay 1	136.140 mc.
Transit 4A	136.200 mc.
Explorer 16**	136.200 mc.
Tiros 4	136.230 mc.
Tiros 6	136.233 mc.
Tiros 5	136.234 mc.
Explorer 17**	136.317 mc.
Ariel	136.407 mc.
Explorer 14	136.440 mc.
Explorer 17	136.560 mc.
Alouette	136.593 mc.
Relay 1	136.620 mc.
OSO I	136.744 mc.
Anna 1B	136.815 mc.
Explorer 16	136.860 mc.
Injun 3**	136.860 mc.
Tiros 6	136.922 mc.
Tiros 5	136.923 mc.
Anna 1B	136.975 mc.
Alouette**	136.979 mc.
Transit 4A	150.000 mc.
Anna 1B	162.000 mc.

*Transmits only while satellite is in sunlight—no battery power

**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, 5, 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.



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Pop'tronics Bookshelf

PROFITABLE TELEVISION TROUBLESHOOTING, Second Edition

by Eugene A. Anthony

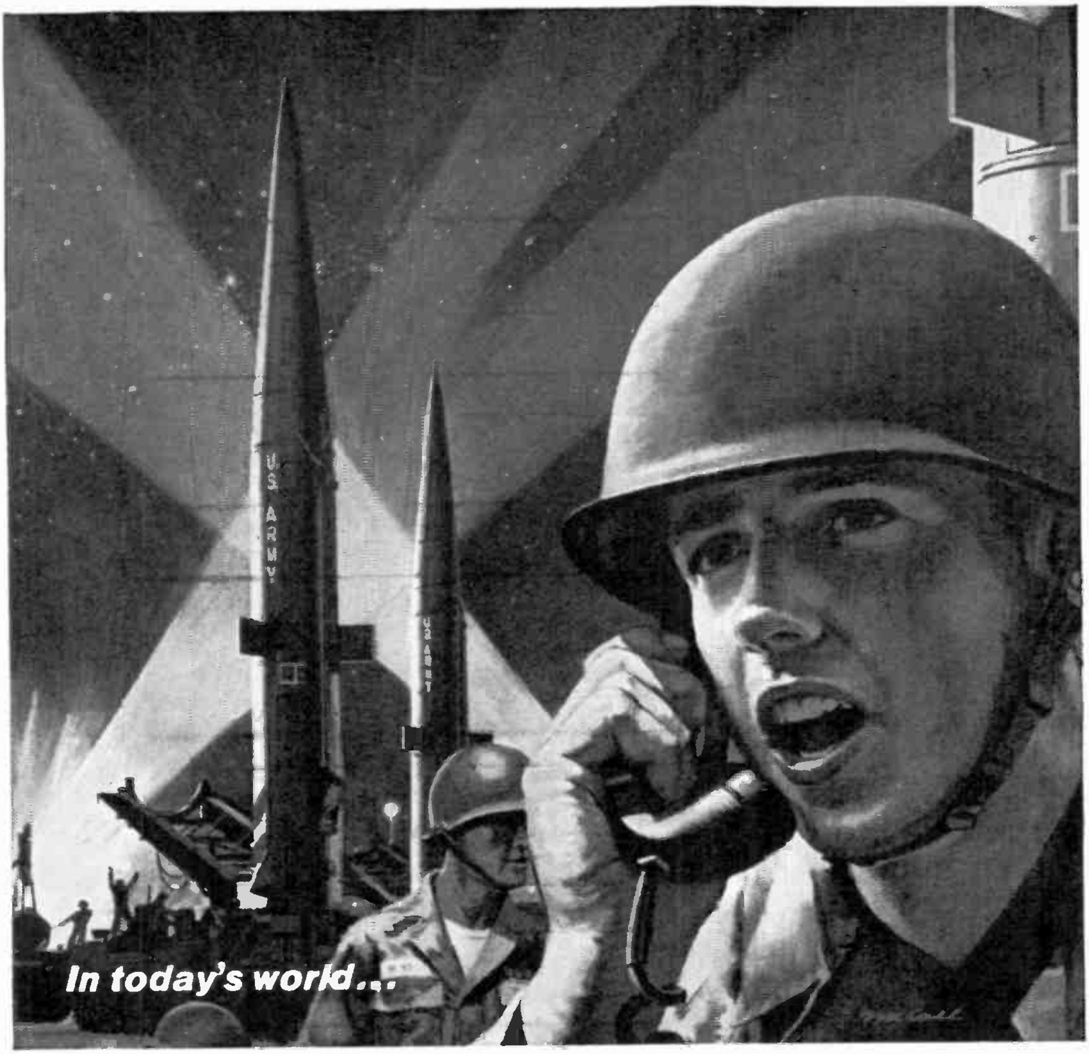
After the first edition of this book was published some six years ago, it gradually came to be regarded as the TV serviceman's "Bible." Between 1957 and 1963, literally hundreds of other books on TV repairs have been printed. However, as a thorough-going background reference work, few—if any—come close to this volume by Eugene Anthony. *Profitable TV Troubleshooting* is in a class by itself. The writing is clear and concise, the explanations are down to earth, and the flow of material is logically arranged chapter by chapter. The new edition includes many revisions which bring the whole book up to date. The chapters on color television have been almost completely rewritten, and a separate chapter has been added on remote controls. The step-by-step tables in chapter 12 will be helpful in solving 90% of the TV troubles a serviceman is likely to encounter.

Published by McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N.Y. Hard cover. 407 pages. $7.25.

CAREERS AND OPPORTUNITIES IN ELECTRONICS

by John M. Carroll

There is certainly a crying need for a well-thought-out, revealing book on the topic of careers in electronics. Unfortunately, this particular effort is more of a summary and condensed history of electronics than an informative guide of value, say, to a career-conscious high-school senior. True, it could excite a reader's interest in electronics and induce him to explore further in the field, but it doesn't tell him how to go about it. Your reviewer's impression is that the author has obviously been involved in elec-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In today's world...

tronics so long himself that he doesn't quite succeed in communicating the excitement that the field should hold for a newcomer; nor does the book live up to the promise of its title.

Published by E.P. Dutton & Co., Inc., 201 Park Ave. S., New York 3, N.Y. 190 pages. Hard cover. $3.95.

HAM ANTENNA CONSTRUCTION PROJECTS

by J. A. Stanley

Here is a book that lives up to its title with a vengeance. It's jam-packed with hundreds of practical ideas on antenna designs, mountings, radiation patterns, tuners, matching problems—anything you can think of that relates to antennas and antenna construction. Antennas are described that can fit anywhere and do just about anything. They are fabricated in special shapes for apartment dwellers, made out of TV conicals, rain gutters, aluminum tubing, or just about any piece of metal that comes to hand. If you are in that group of 19 out of 20 hams that doesn't have enough green stuff for a 5-element, 20-meter beam, this book is for you. About the only mystery attached to it is the author's ghost name—we're sure that many POP'tronics readers will realize that J. A. Stanley is really a very capable ham from Denver, Colorado.

Published by Howard W. Sams & Co., Inc., 4300 West 62nd St., Indianapolis, Ind. 160 pages. Soft cover. $2.95.

DIODE CIRCUITS HANDBOOK

by Rufus P. Turner

One of our favorite authors, Rufus Turner, has come up with a valuable addition to any experimenter's bookshelf. This *is* a handbook in every sense of the word—it contains nearly 100 circuits using germanium and silicon, tunnel and varactor, zener and varistor diodes. Name a circuit in which it's possible to employ a crystal diode and, in all probability, you'll find a description of it. According to the press release on the book, there are 23 receiver, 9 transmitter, 6 audio, 15 power supply, 28 instrumentation, 9 computer, 6 control, and 4 miscellaneous circuits. We didn't count them, but it certainly looks like they're there. *Diode Circuits Handbook* is a must for the electronics gadgeteer.

Published by Howard W. Sams & Co., Inc., 4300 West 62nd St., Indianapolis 6, Ind. 128 pages. Soft cover. $2.50.

Tips and Techniques

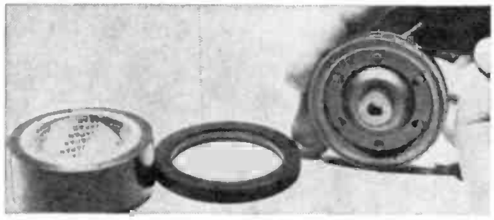
WORKING WITH STRANDED WIRE

Most experimenters know that stranded wire is called for where there's much flexing or bending to be expected. But getting all of the wires through small holes in tube socket or terminal strip wiring tags, or into the cup of military type connector pins can be a very frustrating job. Do it the easy way by first making the end effectively into a solid wire for the short length that must enter the hole. Cut the wire to length, carefully strip the ends, clean the strands if necessary, and tin the end portions, shaking off the excess solder before it solidifies. The tinned ends can now be bent and squeezed into just the right shape to enter a tight hole. Once in place, you'll find the freshly tinned wire much easier to solder, too.

—*Arthur L. Jennings*

STEPPING UP PHONO SPEED

Those children's phonographs are great until they start losing speed and 33-rpm records play at 29-30 rpm, or 45's at 40 rpm. The cause is usually due to wearing of the rubber rim on the idler wheel. You can make a temporary repair by building up the worn



surface with plastic tape, but the best way to handle this situation is to increase the diameter of the rubber from the *inside.* Just slip the rubber "tire" off the idler wheel and place a single layer of plastic tape along the bottom of the groove in the

(*Continued on page* 20)

Here's what they're saying about Sarkes Tarzian's free new booklet, "Lower the Cost of Fun with Tape Recording"...

"The vigor of this presentation proves that Tarzian is interested in getting this country (and tape recording) moving again...everyone should walk to their nearest tape store and request a copy...or walk to Bloomington"
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"'Invite Tape to Your Party' is the chapter that puts the bright light of public inspection on those 'friendly get-togethers' in suburbia"
...Chipman Report

"The chapter dealing with recording of short wave broadcasts blatantly lays bare more capitalistic tricks for spying on peaceful communications of our people's democracies"
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...Hall Street Journal

"I agree" *...Harry Goldwater*

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Tips

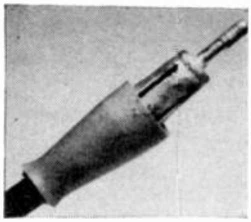
(*Continued from page* 18)

metal center. A single layer of tape may do the trick, but if not, experiment with additional layers until you reach the proper speed. Put a thin layer of cement over the tape (after the proper amount has been determined) so that the rubber tire and plastic base will not slip.

—*Homer L. Davidson*

PIN-PLUG PLASTIC INSULATORS

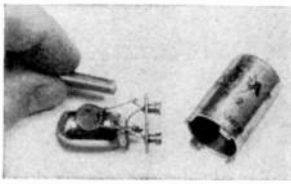
Sometimes it's necessary to have insulating covers on pin-plugs. There are plugs on the market with such insulators over the ground caps, but if you need one of these plugs in a hurry, you can whip one up right on the spot. Just take a rubber or flexible plastic insulator—the type used on test clips—and cut about ½" or ¾" off the narrow end. When you slip this short insulator over a plain pin-plug, you'll have an insulated one.



—*Charles Lang*

FLUORESCENT STARTER REPAIR

The starters in fluorescent light fixtures seldom outlive the fluorescent tubes. This is almost invariably due to the failure of the poor-grade capacitor used in the starter. When the starter goes, the tube blinks on and off, or doesn't light at all. To repair the starter, open its case by bending back the lugs holding the aluminum shell to the fiber base. Clip out the paper-foil capacitor and discard it. Substitute a 600-volt., 01-μf. ceramic disc capacitor for the original capacitor if the light uses a 15-20 watt fluorescent tube. For a light using a 30-40 watt tube, install a .005-μf., 600-volt ceramic disc capacitor. Then reassemble the starter, making sure that the capacitor leads do not short to the aluminum shell.



—*Bert Isbell, K5IBZ*

(*Continued on page* 22)

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

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

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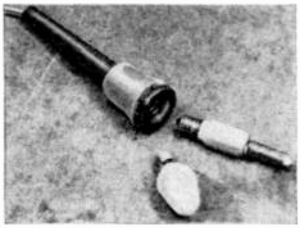
Tips

(Continued from page 20)

EXTRA "LAMP HANDEE"

Here's an old trick, but one so useful that it's worthwhile rehashing. It's easy to see into those dark chassis corners if you have a spare Ungar "Standard Line" soldering iron. This is the type of iron that comes equipped with several screw-on heating units of different wattages. The thread is the same as that for the base of a standard 7-watt decorative light bulb. For less eye strain, all you have to do is to screw one of these bulbs into the soldering iron, in place of a heating unit.



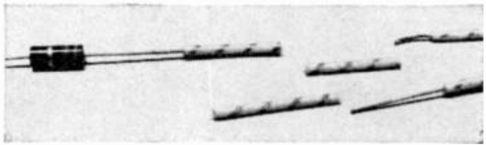
—*Steve Brant, K8VII*

WATER COLORS IDENTIFY TERMINALS

Ever remove a component—such as a resistor—from a piece of equipment, and then waste precious minutes trying to locate the terminals from which it was unsoldered when you went to replace it? You can avoid this stumbling block by identifying the terminals beforehand with children's water color paint. Put a dab of paint on the two terminals from which you remove the part, and you can't miss them when you're ready to resolder. —*John A. Comstock*

HOMEMADE SPAGHETTI

There's no need to be caught short when you want some spaghetti to insulate the leads of a component. If regular spaghetti isn't readily available, take some hookup



wire—the plastic insulated type is best—and strip off a length of insulation equal to the desired length of spaghetti. For large diameter spaghetti, use larger insulated wire—plastic mike cable insulation serves very well. —*Homer L. Davidson*

SWL/QSL BUREAU

THE SWL/QSL Bureau is a non-sponsored organization operating with the cooperation of the ARRL QSL Bureau and the Newark News Radio Club. Its purpose is to handle incoming overseas SWL and QSL cards destined for W, K, and VE SWL's. When cards arrive with a complete address, the SWL is notified by post card and requested to send a 9½ x 4¼ inch SASE (legal size, self-addressed, stamped envelope), with an extra stamp enclosed, to the Bureau so that cards may be forwarded to him. Many SWL and QSL cards arrive incompletely addressed, however, or addressed only to a WPE call-sign. Cards are held for the call-signs listed.

If your call-sign appears in this list, and you have not already filed your name, address, and WPE call-sign with the Bureau, send an SASE to: LeRoy Waite, WPE2AK, Manager, SWL/QSL Bureau, 39 Hannum St., Ballston Spa, N. Y. Upon receipt of the SASE, your card/cards will be forwarded to you.

WPE1DIA
WPE1DKI
WPE1EHJ
WPE1TV

WPE2AAK
WPE2ADW
WPE2AQO
WPE2AWP
WPE2BJV
WPE2BWW
WPE2BCP
WPE2CFP
WPE2CRL
WPE2CSD
WPE2CSE
WPE2CSL
WPE2CT
WPE2DDZ
WPE2DEY
WPE2DNL
WPE2DXA
WPE2EAA
WPE2EC
WPE2EGX
WPE2EMG
WPE2FEN
WPE2GJD
WPE2HIH
WPE2HKT
WPE2KK

WPE3AGB
WPE3BDV
WPE3CCM
WPE3CQF
WPE3DAA
WPE3MC
WPE3UY

WPE4CIA
WPECVN
WPE4EDP
WPE4EEJ
WPE4FBO
WPE4RX

WPE5ACB
WPE5AWK
WPE5AWV
WPE5CFE
WPE5RJ

WPE6AQT
WPE6BJW
WPE6CBQ
WPE6CRJ
WPE6CWY
WPE6DJW
WPE6OT
WPE6UD

WPE7AKB
WPE7AQB
WPE7AQZ

WPE8BAU
WPE8BCY
WPE8BGP
WPE8BXY
WPE8CBC
WPE8CBG
WPE8CCL
WPE8CMQ
WPE8DQF
WPE8EET
WPE8ETY
WPE8IED
WPE8PH

WPE9ATR
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THE HULA HOOP —A New Ham or CB Antenna

Superior mobile performance without that tree-limb-slapping quarter-wave whip

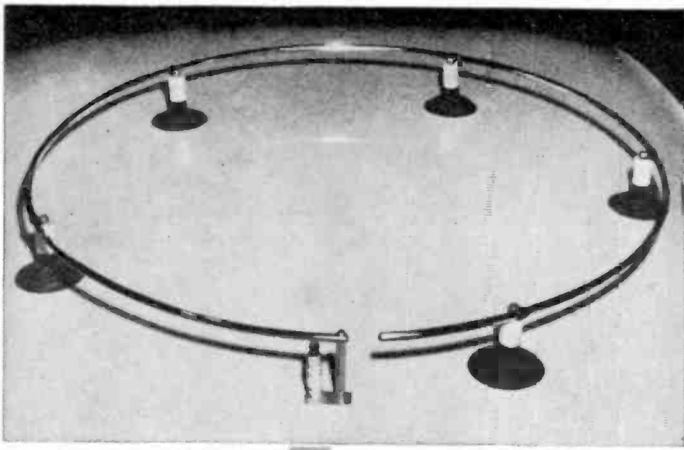
COVER STORY

By **ROY E. PAFENBERG, W4WKM,** KCG1046

The superstructure shown on the top of the station wagon on this month's cover is not a new-style luggage rack. It is a brand-new and highly efficient ham or CB antenna that you can install on your car—provided it's not a convertible. Properly known as the Directional Discontinuity Ring Radiator (DDRR) and commonly called the "Hula-Hoop," this antenna is a big performer in a small package. The Hula-Hoop is a recent invention* and

*"Hula-Hoop Antennas: A Coming Trend?", J. M. Boyer, *Electronics*, pp. 44-46, Jan. 11, 1963.

THE HULA HOOP



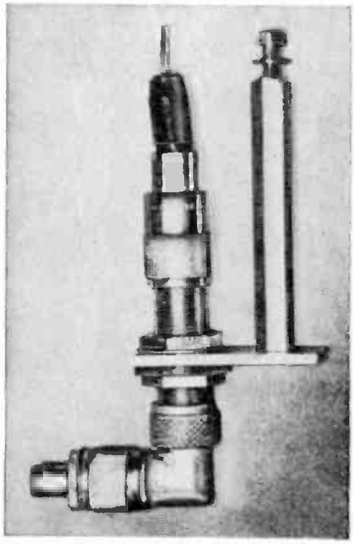
The Hula-Hoop can be held to the roof of your car with suction cups. For a tight installation, the cups and rooftop must be very clean. Apply a liberal coating of glycerin to the inside of the cups to make them waterproof and airtight.

is not as yet manufactured commercially. However, you can construct this antenna yourself, easily and economically, from readily available materials.

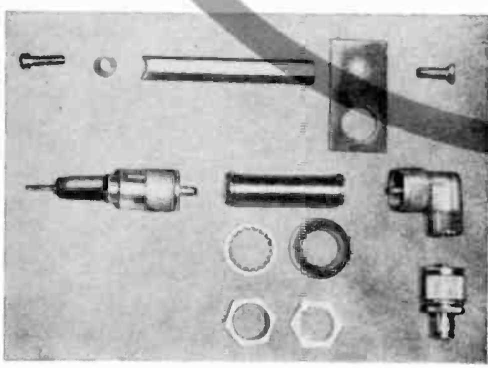
Exhibiting most of the desirable characteristics of the full quarter-wave vertical antenna, the Hula-Hoop packs all of this performance into a unit that projects only three inches above the roof of a car. The full quarter-wave vertical whip has set the performance standard for mobile antennas, and the usual loaded or shortened designs rarely perform as well. Unfortunately, the quarter-wave whip is an ungainly and not exactly handsome item of hardware. If all the bent, broken and lost CB antennas that have been mangled by overhead obstructions were placed end-to-end, they would easily reach from New York to Chicago!

The Hula-Hoop is a more efficient radiator than most quarter-wave whip installations. The whip is usually mounted on the rear bumper or fender so that the car body absorbs a healthy portion of the radiated signal. The whip, mounted in this fashion, also has pronounced directional effects. The Hula-Hoop, on the other hand, is mounted in the center of the car roof, which serves as a very effective ground plane. Since this location is unobstructed, little energy is absorbed by the car, and the radiation pattern is almost perfectly circular.

There are other advantages. At high road speeds, a whip antenna will vibrate



Completed rooftop r.f. feed-through is shown in the photo above. The connector is put together using the following Amphenol parts (left to right, below): 83-1SP, 83-22F, 83-1AP, 83-1SP with 83-185 adapter.



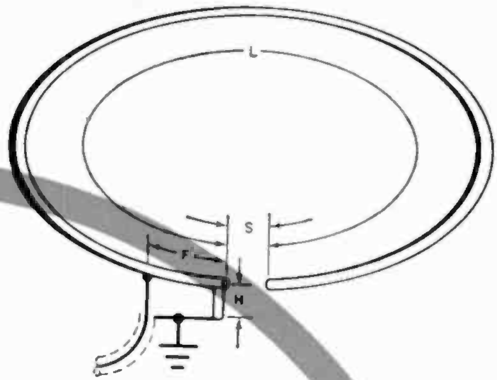
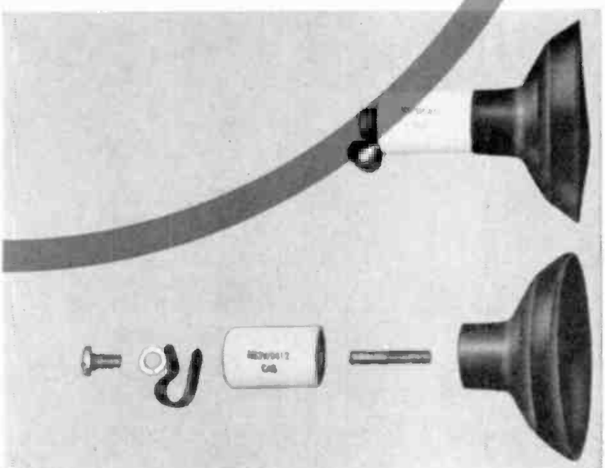


Fig. 1. Dimensions of Hula-Hoop antenna are keyed in drawing above and detailed in table below. Cut element "L" 1-1½" longer than specified and then tune up the antenna as described in text.

Band	Frequency (mc.)	"L"	"H"	"F"	"S"
CB Channel 1	26.965	104.8"	3"	See text	2"
CB Channel 9	27.065	104.4"	3"	See text	2"
CB Channel 23	27.255	103.7"	3"	See text	2"
10 Meters	28.000	100.9"	3"	See text	2"
10 Meters	29.000	97.4"	3"	See text	2"
10 Meters	29.700	95.1"	3"	See text	2"
6 Meters	50.000	55.8"	2"	See text	1"
6 Meters	52.000	53.7"	2"	See text	1"
6 Meters	54.000	51.7"	2"	See text	1"

Fig. 2. Insulator assemblies (5 required) are made of luggage rack suction-cups. Replace bolt supplied with cup with one 1½" long having ¼-20 threads. Insulator is available as a surplus item, or use Birnbach #731 for assembly.



or flutter in the wind. This flutter causes rapid variations in the strength of both transmitted and received signals. Since the Hula-Hoop is rigidly mounted to the top of the car, the antenna will not flutter at any speed. Another positive factor is that one end of the Hula-Hoop antenna element is grounded so that static charges are quietly bled off. This results in a pronounced reduction in receiver noise level when operating at high road speeds.

The Hula-Hoop has a relatively narrow bandwidth. This can be a blessing or a disadvantage depending on your mode of operation. If you normally operate on a single frequency or on a number of closely spaced frequencies, the Hula-Hoop will reduce receiver interference by rejecting signals from widely removed CB channels and other communications services. On the other hand, if you normally jump from one end of the band to the other, the Hula-Hoop will require retuning.

How It Works. The Hula-Hoop antenna consists of a quarter-wave length of conductor bent into a circle with the ends separated by a small gap. The hoop is supported by insulators above a ground plane (the car roof) at a height which is a small fraction of a wavelength. One end of the hoop is grounded by a grounding stub which doubles as an antenna element support post. The antenna is fed by an unbalanced, coaxial transmission line with the shield grounded to the ground plane and the center conductor connected to the antenna element a short distance from the grounding stub. This feed point is adjusted to obtain a proper impedance match between the transmission line and the antenna. Fig. 1 shows the basic design.

While it is impossible to present all of the theoretical considerations relating to the Hula-Hoop antenna, the following explains the basic idea. The ring conductor, or hoop, forms a single wire transmission line with the ground plane surface. Radio frequency energy traveling down this transmission line is radiated as both horizontally and vertically polarized waves. This radiation, at right angles to the conductor, occurs along the full length of the antenna element. The horizontally polarized wave is cancelled by the current flowing in the

ground plane. Vertically polarized radiation occurs because the curvature of the ring radiator introduces an infinite series of electrical discontinuities in the transmission line. This vertically polarized wave is not cancelled, and is radiated into space. It is this predominantly vertically-polarized radiation that makes the Hula-Hoop antenna ideal for CB use.

Construction. Building the Hula-Hoop antenna is not at all difficult. The photographs show construction and assembly details. Figure 1 gives the critical dimensions, and Figs. 2, 3, and 4 show the details of the simple metal parts required.

You will need five of the antenna insulator assemblies shown in Fig. 2. Drill or ream the clearance hole in the plastic cable clamp to pass a 1/4" - 20 screw. Mount the cable clamp to the top of the insulator but do not tighten the screw.

The antenna element is made from 3/8" copper tubing. When you buy the tubing, try to get a length from a roll that is not bent or kinked. Also, handle the tubing carefully to avoid extra work later on. Cut a length of tubing a couple of inches longer than the dimension shown in Fig. 1 for the frequency you desire to work. Dress the ends smooth and then carefully form the tubing into a perfect circle, leaving a gap of about an inch. Select a short length of metal rod or a stud cut from a 5/16" screw and force it into one end of the tubing. File this insert flush with the end of the tubing. Using a #10 drill, drill a hole 1/4" in from the end of the reinforced section of tubing and perpendicular to the plane of the hoop.

The grounding stub support post, shown in Fig. 3, is made from a length of 3/8" round or hexagonal, aluminum or brass rod. Carefully file one end of the rod to match the contour of the copper tubing.

Now fabricate the grounding stub mounting plate shown in Fig. 4. Secure the post-plate assembly to the antenna element, using a #10 - 32 machine screw, with lock washer, through the hole previously drilled in the antenna tubing. Now slide the cable clamps of the insulator assemblies on the antenna element with the insulators positioned to the inside of the hoop. Position the insulators evenly around the hoop and tighten the cable clamp screws. The photos show these assembly details and the antenna ready for installation.

Installation. Details of the installation will depend to a large degree on the construction of your car. Although the gap in the Hula-Hoop may face toward either the front or the back, the antenna should be centered on the roof for maximum efficiency. Ideal as this may be, it does not always result in a practical location for bringing the transmission line through the roof. On most station wagons and many sedans, the antenna feed point may be positioned near the dome light. Temporary removal of the light will give access to the desired portion of the roof with little or no removal of upholstery.

In any event examine the construction

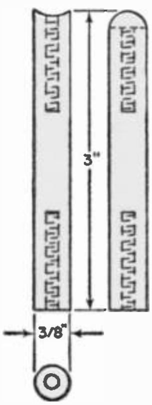


Fig. 3. Grounding stub post is made of brass or aluminum rod. Both ends are drilled and tapped to 1" to accept 10-32 screw.

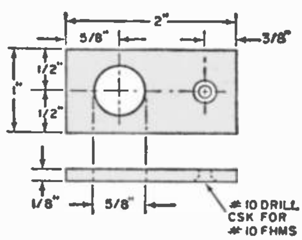


Fig. 4. Grounding stub mounting plate can be fabricated from either brass or aluminum.

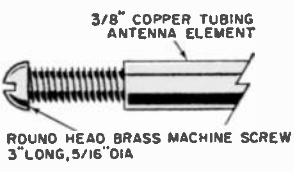
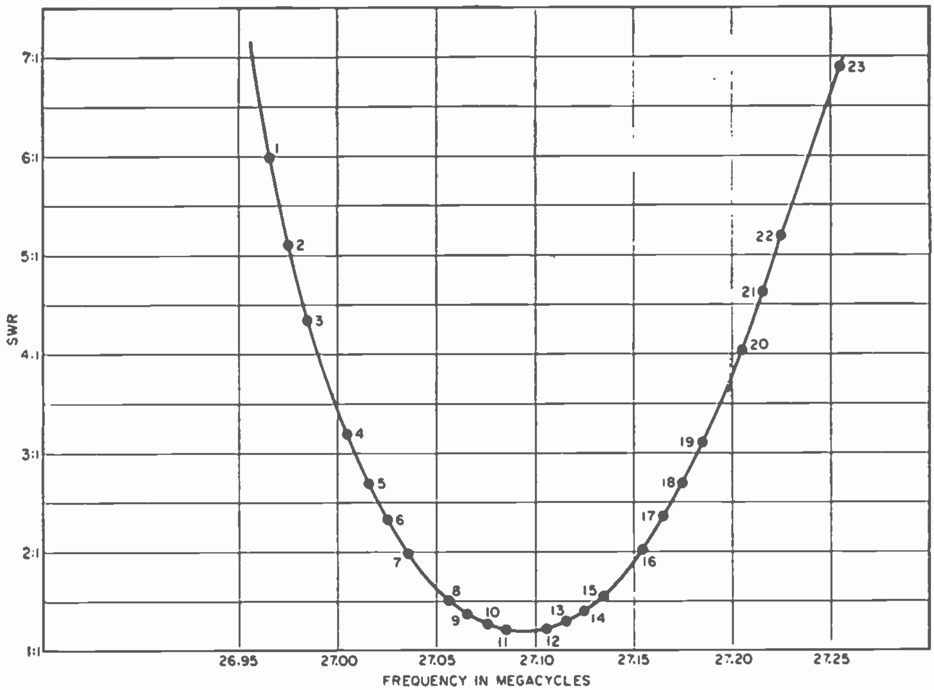


Fig. 5. Tuning adjustment screw is helpful in loading Hula-Hoop.



The sharp tuning characteristics of the Hula-Hoop are amply demonstrated in this VSWR graph covering the Citizens Radio band.

of your car. Remove the dome light and determine how the upholstery is secured to the roof. Since you will need to reach only one hand to the feed point, perhaps you can work your arm through to the desired location. If you are still in doubt, consult your car dealer or an automotive body shop to determine the best approach.

After the antenna feed point is located, carefully drill a ¼" hole in the roof of the car. Have a helper hold the bottom part of a ⅝" punch under this hole while you position the top part and insert the drive screw from the top of the roof. The transmission line feedthrough adapter should now be assembled.

Run one of the 83-22F mounting nuts flush against the 83-1AP adapter coupling nut. Smear a ⅝" fiber washer with automotive sealing compound and place it over the body of the adapter. From the inside of the car, feed the body of the 83-22F adapter through the hole in the roof and through the hole in the antenna stub mounting plate. To insure a leakproof installation, apply automotive sealing compound between the body of the adapter and the holes in the roof and the mounting plate. Slide a lock washer over the body of the adapter and run down the second mounting nut. Carefully align the antenna with the body of the car and securely tighten the mounting nut. Moisten the bottoms of the suction cups and fully collapse them by pushing down firmly on the insulator assemblies.

Temporarily connect the transmission line to the antenna by soldering a 6" length of #16 or larger, solid conductor, insulated copper wire to the center conductor of a PL-259 connector. Strip the insulation from approximately 4" of the free end of the wire and connect the PL-259 to the top of the 83-22F feedthrough adapter. Wrap this bare wire around the copper tubing antenna element at a point about 2" from the grounding stub.

Routing of the coaxial cable from the roof feedthrough adapter to the transceiver will depend strictly on the construction of your car. You can probably save a lot of work by following the routing of the dome light wiring. In some cars, this wiring is made fully accessible

THE HULA HOOP

by removing the center post trim strip. Use a length of solid copper wire as a combination probe and fish line to pull the cable under the upholstery to the desired location.

To finish the inside work, terminate the coaxial cable with a fitting to match the connector used on your transceiver, and replace the dome light assembly.

Adjustment. Although tuning the Hula-Hoop antenna is not difficult, there are a number of adjustment steps, and these must be accomplished in the indicated sequence. Also, the use of a SWR meter is almost mandatory for the initial adjustments. This should not be a major problem since a wide selection of inexpensive SWR meters are made by various manufacturers and are available in both kit and wired form. If you do not care to make such an investment at this time, you may be able to borrow an instrument from an obliging ham or CB'er.

Since transmitter tuning and antenna adjustments can interact, the best procedure is to adjust the transmitter for operation into a 50-ohm load and then leave it alone until the antenna tuning is completed. To initially tune the transmitter, simply hook two 100-ohm, 2-watt composition resistors in parallel and connect between the antenna terminal and chassis ground. Tune the transmitter into this dummy load in accordance with the manufacturer's instructions. Remove the resistors and connect a short length of coaxial cable between the transceiver antenna connector and the SWR meter input connector. Use RG-8/U or RG-58/U coaxial cable fitted with appropriate connectors for this purpose. Connect the Hula-Hoop transmission line to the output connector of the SWR meter.

Inspect the antenna to insure that the suction cups are fully collapsed and that the gap between the ends of the hoop is approximately that shown in Fig. 1. *Shifting of the ring radiator with respect to the car top during or following adjustment will detune the antenna.* Readjust the gap to that shown in Fig. 1 following any significant alteration in the length of the antenna element.

Switch the SWR meter to read forward power, apply power to the transceiver, switch to transmit and calibrate the SWR meter for a full-scale meter reading. Switch the SWR meter to read reflected power and transmit. Keep all test transmissions very short and identify your station during each transmission. The SWR reading should be quite high at this stage.

Move your hand close to the ungrounded end of the ring radiator and the SWR reading should increase. This increase indicates that the antenna is too long and that the hand capacity is resonating the antenna to a still lower frequency—the expected result, since we initially cut the copper tubing a bit too long.

The antenna radiator must now be cut to the proper length and there are two possible methods of doing so. You can alternately shorten the antenna in 1/8″ increments and conduct resonance tests, or you can install the tuning adjustment screw shown in Fig. 5. The latter course is highly recommended, since it simplifies initial tuning and permits easy adjustments to other channels.

Cut 2″ off the ungrounded end of the copper tubing antenna element, file the end square, and readjust the gap between the ends of the tubing. Recalibrate the SWR meter, switch to read reflected power, and again conduct the hand-capacity resonance test. As your hand approaches the antenna you should note a pronounced dip in the reflected power reading as the antenna passes through resonance, and an increase as you move your hand still closer to the antenna. If these effects do not occur, cut another inch from the end of the copper tubing, file the end square, readjust the gap and again conduct the test.

When the hand capacity test indicates resonance, temporarily thread a 2″ long, 5/16″ brass machine screw into the end of

(Continued on page 88)

BREAKTHROUGHS

Brief news flashes on important developments in the field of electronics

TWENTY-FOUR MEGAWATT KLYSTRONS, the most powerful amplifier tubes ever to go into production, by Sperry. Generating 360 pulses a second, 240 of the tubes will be arrayed along the two-mile-long atom smasher being built by Stanford University. The amplifiers will boost the energy of electrons 40,000 times as they zip through a 10,000-foot pipe.

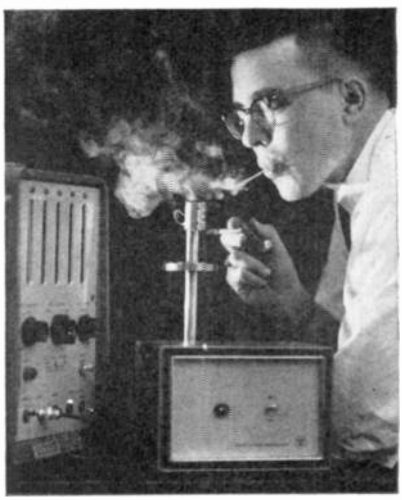
TRANSPARENT "GLASS" WIRES by Corning, .0025-inch fibers of glass coated with an electrically-conductive film of metal oxide and covered with transparent insulation. The wires are for use in electroluminescent coordinate display panels.

ELECTRONIC NURSE continually monitors heart and respiration rates, temperature and blood pressure, presents these factors at a central location, and records them on a chart. ITT is the manufacturer.

FUEL CELLS that produce electricity by combining air with inexpensive fuels such as propane, natural gas, and even gasoline are a new development from General Electric. Here, Dr. Leonard Niedrach (left) and Dr. Thomas Grubb demonstrate one of the cells which may one day revolutionize the production of electricity.

SOLID STATE ELEMENTS that combine the best properties of transistors and vacuum tubes are displayed here in a silicon wafer held with tweezers. There are hundreds of the devices, known as insulated-gate field-effect transistors, in 20 complete circuits within the wafer. The new elements may make possible circuits that are cheaper, simpler, and more reliable than anything to date.

MICROBALANCE by Westinghouse is so sensitive that it measures the tars and other residue from cigarette smoke blown at it by an engineer. The heart of device is a quartz crystal.



LOW NOISE UHF SILICON TRANSISTOR by RCA is said to extend the frequency of silicon devices to over 1,000 megacycles. So small that its working area would fit within the cross-section of a human hair, the device achieves VHF-UHF performance thus far possible only with a few germanium transistors and some special purpose vacuum tubes.

ELECTRONIC VIBRATION DETECTOR that is immune to airborne sound yet so sensitive that it can pick up minuscule vibrations. About the size of a pocket watch, the Honeywell device serves as a burglar alarm when taped to safes, showcases, etc.

HIGH-SPEED TUNNEL DIODE MEMORY by IBM which can modify computer instructions at a rate at least three times as fast as other types. Making use of the tunnel diode's ability to switch from one voltage state to another in a split-billionth of a second, the memory unit has a 200 nanosecond cycle and can process 45 million letters or numbers a second—equivalent to 90 full-length novels.

A Few Winning Words on Hi-Fi

From BOB TUPPER

I guess I started collecting records the day I first noticed the covers on some of the albums.

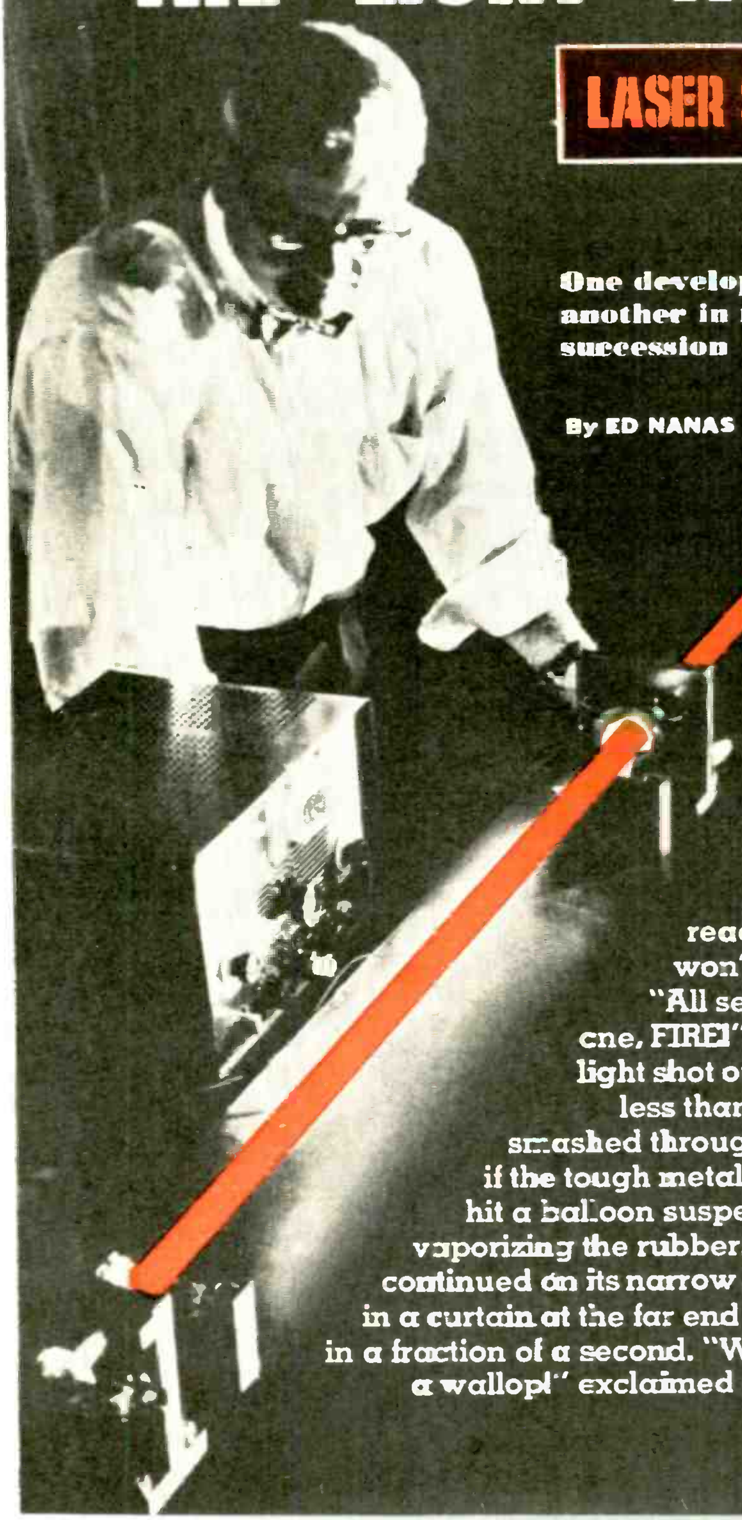
No thank you—I'm just listening around.

It's one of those Make-It-Yourself records from your mother.

Could it be a tube?

THE "LIGHT" FANTASTIC

LASER STATUS REPORT



One development follows another in rapid succession

By ED NANAS

THE MAN behind the telescope-like device was ready. "I'll count down so you won't miss the action," he said. "All set? Here we go—three, two, one, FIRE!" A pencil-thin beam of red light shot out from a six-inch ruby rod less than a half-inch in diameter. It smashed through a stainless steel plate as if the tough metal wasn't even there. Then it hit a balloon suspended some ten feet away, vaporizing the rubber. And still the beam of light continued on its narrow path, burning a small hole in a curtain at the far end of the room. It was all over in a fraction of a second. "Wow! That light sure packs a wallop!" exclaimed a teen-age radio amateur.

LASER STATUS REPORT

Page 33: A c.w. gas laser recently demonstrated by Sylvania. An r.f. field excites gas mixture to self-sustaining oscillation.

He was standing at the rear of the hall with his father, an electronics engineer. "I've never seen anything like it!"

Until three years ago, *nobody* had seen anything like it!

The boy and his father had just witnessed a demonstration of one of the most promising and fastest developing technological devices ever conceived by man—the laser. In only three whirlwind years, the laser—which gets its name from the initials of *L*ight *A*mplification by *S*timulated *E*mission of *R*adiation—has moved out of the theory stage, out of the laboratory curiosity category, and into a whole new, exciting world of applications.

The laser has the unique ability to generate and amplify light waves at specific wavelengths just as radio waves are generated and amplified at specific wavelengths. Light generated by a laser is known as *coherent* light because it is "pure," or predominantly of one frequency. Making the sun seem like a hand-held flashlight by comparison, the thin beams of coherent light, which have already vaporized steel and, in a recent experiment, illuminated the moon, can be used to:

- Transmit a billion simultaneous telephone conversations on a single thread of light one millimeter in diameter—without interference;
- Build laser radar systems, including portable range finders, having resolutions more than 1000 times better than conventional narrow-beam radars;
- Perform micro-surgery—delicate eye surgery has already been demonstrated—precise enough to allow cutting of a single human cell;
- Reach billions of miles into space with a beam powerful enough to guide a spaceship, communicate with life on planets in other solar systems;
- Construct ultra-precise clocks, guidance systems, and laboratory instruments;
- Devise practical underwater communications and ranging systems using recently developed techniques for generating green or blue coherent light;
- Build new battlefield weapons, including an anti-missile device and a form of "death ray";
- Greatly speed up the functioning of complex computers by using lasers in conjunction with fiber optic paths to transmit great masses of information within a computer or from one machine to another;
- Investigate the possibility of transmitting electric power through space;
- Speed up chemical processes thousands of times, such as those that take place during photosynthesis.

Fantastic? Not at all; and the list is by no means complete. The laser is indeed creating a revolution, and new discoveries relating to the generation and application of coherent light are being announced almost daily. Let's take a closer look at the phenomenon of laser light and the mechanisms used to generate it.

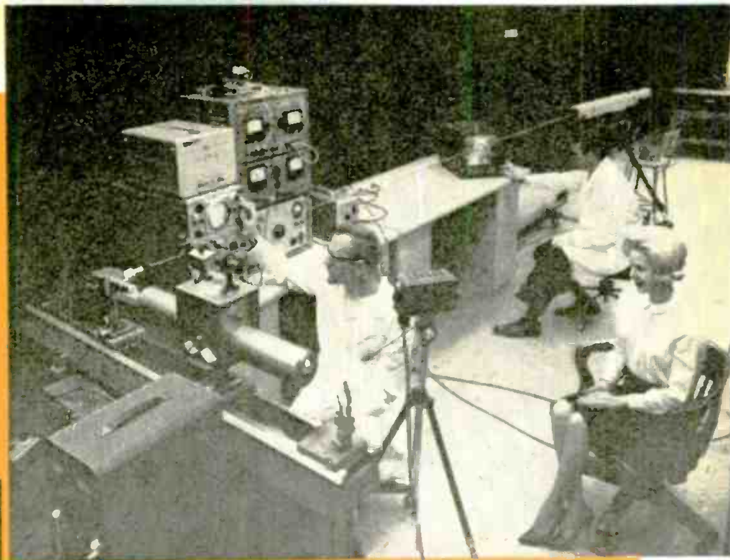
Coherent vs. Incoherent. Light waves coming from the sun or from incandescent or fluorescent lamps consist of a broad band of frequencies all mixed together. In addition, light from these sources can be considered as having been emitted from an infinite number of sources, all of which have random phases and polarizations with respect to one another. We call this kind of light *incoherent*.

A similar thing happens in the radio bands when lightning is discharged. A whole host of frequencies are generated, and they can be heard as noise or static on a radio receiver. As another example, incoherent water waves on the surface of a pond can be created by throwing in a handful of pebbles; coherent waves by dropping in a single large size rock.

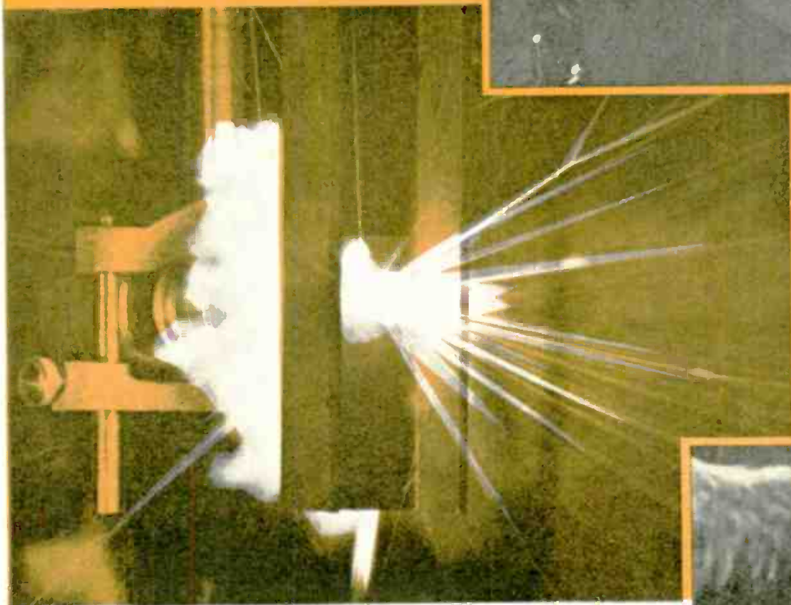
Both a radio transmitter and a laser generate coherent radiation that is predominantly of one specific frequency. The difference between the two is that the radiation produced by the laser is very much higher in frequency (and, therefore, much shorter in wavelength), so that it falls within the optical portion of the electromagnetic spectrum.

The electromagnetic spectrum ranges from extremely low frequencies where wavelengths (the distance between two

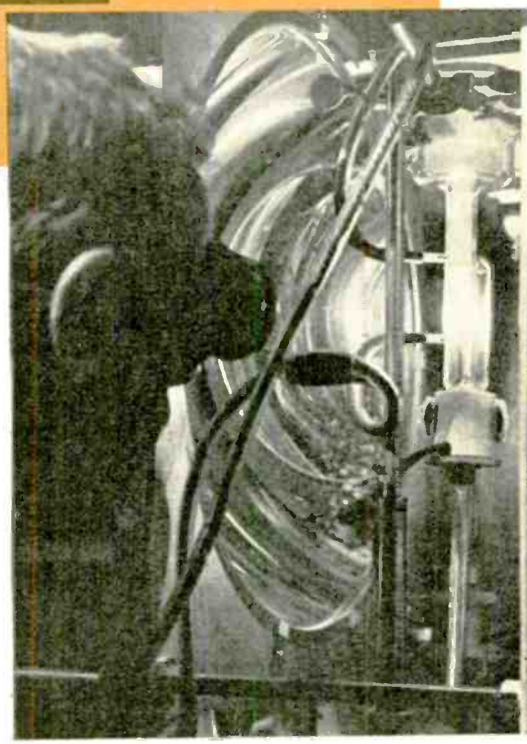
TV via laser is an accomplished fact. Image of the young lady is relayed (in this experiment) to an optical modulator which impresses it on a c.w. laser beam. The beam strikes a photocell in a telescope-like receiver (right, rear) and is converted to the TV signal seen on monitor.



Highest power laser to date, the 350-joule Raytheon model below may soon be dwarfed by powers as high as 3000 joules. Intense beam of light is shown blasting its way through a steel girder a quarter-inch thick.



Continuous wave (c.w.) lasers have reached powers of 3 watts and are expected to go higher in the near future. Many of these types use a dysprosium-doped calcium fluoride crystal as does the RCA model below. The whole apparatus is enclosed by two hemispherical mirrors which focus light on the crystal. The crystal itself is obscured by the light source next to it.



specific crests or two troughs in a given wave) can be measured in miles or meters, to frequencies far above the visible band where wavelengths are measured in microns (one-thousandth of a millimeter) and angstrom units (one ten-thousandth of a micron). In terms of cycles per second, light waves vibrate at an extremely rapid rate—10^{15} cps would be a rough figure.

At visible frequencies, radiation must be generated on an *atomic* level—as in a laser. This is made possible by the fact that the atoms of certain materials, when excited by large doses of energy, emit light at one frequency or group of frequencies. Thus, a *substance* (ruby, for example) made up of atoms which can be excited, and which will, at a certain point, emit coherent light, are used

Laser rifle is actually a compact rangefinder which fires a pulse of coherent light, collects the light reflected back from the target, and indicates exact distance to the target by computing the elapsed time for pulse's round trip. The device has measured up to seven miles.

Sunlight pumping of a solid-state laser is a new development which may soon make it possible to put sun-powered lasers aboard satellites for communications, tracking, and geodetic measurements. This device, designed by RCA, uses a 12" hemispherical mirror to focus sun on calcium fluoride crystal rod.

in lasers instead of the *electron tubes* used at lower frequencies.

The Amazing Laser. The properties exhibited by laser beams are much more startling than the foregoing explanation indicates. Like ordinary light, they can be focused and modulated, but there the similarity ends. A laser beam, because of its extremely short wavelength and because it is generated at the atomic level with all of the light energy in phase, is *a very narrow beam of extremely high energy*. This energy, concentrated at a single point, can burn through steel.

The fact that a laser beam can be modulated is expected to be of great importance in future applications. The reason is easy to understand. The transmission of a voice by radio requires a band of frequencies several thousands of cycles wide. The transmission of a television signal complete with sound takes up *six million cycles* of the available spectrum. By and large, the radio portion of the spectrum is now overcrowded, and the situation is expected to get progressively worse.

The use of optical frequencies for communications opens up great new vistas. In the visible white-light portion of the spectrum alone, the number of frequencies available is fantastic—250 million megacycles! This figure represents thousands of times more frequency space than in all the radio frequency bands combined. One or two laser beams, relayed as microwaves are now, could carry all of the communications traffic in America from coast to coast—telephone calls, television programs, computer data, and facsimile!

Optical Powerhouses. The first successful pulsed optical maser (laser) generated a peak power of about 10 kilowatts for very short intervals. The newer lasers have now climbed much higher—recently one was announced by the Korad Corporation with a peak of 500 megawatts (500,000,000 watts)—all concentrated in one narrow beam of 7-nanosecond duration. For the 500-megawatt pulse, it was calculated that the electric field in the focused electromagnetic beam was on the order of 10^7 volts per centimeter. The beam was observed

LASER STATUS REPORT

A "Colidar" (for Coherent Light Detecting and Ranging), produced by Hughes Aircraft Co., operates on the same principle as the laser "rifle" opposite. Research is underway on other laser ranging devices.

to cause ionization of the air in its focal path with a brilliant blue flash, and spectacular damage was done to materials placed at the focal point. Since these gigantic pulses of energy were for extremely short intervals, the total pulse energy was only about 5 joules.

In only one year, the output energies of pulsed lasers have spiraled up from 1 or 2 joules (one watt for one second) to 350 joules. A thousand joules is just around the corner and may be achieved by the time you read this. A glass laser with a pulsed output of somewhere between 2000 and 3000 joules is under development by American Optical Company, and may be announced as early as August, 1963. Theoretically, there is no limit. Ten-thousand-joule-outputs are predicted within the next year.

What do all these figures mean? Just *one* joule—about the same amount of energy you get from a flashlight bulb in several seconds of operation—is enough to vaporize a hole through a 1/32-inch-

THE BASIC LASER

The essential ingredients of a laser are:

A resonant cavity: Usually formed by two reflecting surfaces, such as precisely parallel mirrors, one slightly less opaque than the other;

An active medium: Positioned inside the cavity with its axis perpendicular to the reflecting surfaces. It may be a (1) gas—a noble gas such as helium, mixed with neon, and contained in a glass or a quartz tube; (2) crystal—a rod of high purity ruby, glass or a rare earth material such as calcium tungstate; (3) liquid—an organic liquid, such as benzene or pyradine; (4) semiconductor—the newest of the lasers, a gallium-arsenide diode.

Pumping power: Applied to the active medium to excite its atoms. It may consist of: (1) high-power lamps—used with crystal lasers; (2) concentrated sunlight—also used with crystal lasers; (3) electrical or radio frequency discharge—used with gas lasers; (4) direct electric current—10,000 to 20,000 amperes injected directly into the junction of a diode laser.

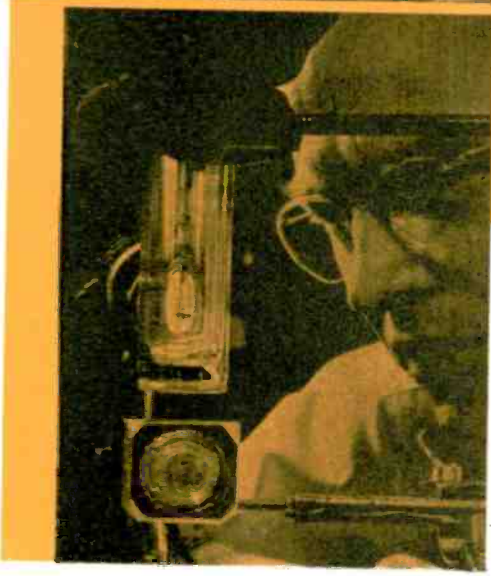
The basic principles of laser light generation are similar to those of the microwave maser. Atoms in the active medium can possess different amounts of energy. Ordinarily, an atom will occupy the lowest of several energy levels, and is said to be in the ground state. But when "pumping" power is applied, they get excited. That is, the atoms absorb some of the photons (particles or "quanta" of light) from the power source and jump to a higher energy level, like water being pumped into a tank atop a standpipe.

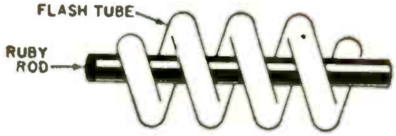
At this higher energy level, usually two steps above the ground state, the atoms begin to relax. They fall to an intermediate energy level, but still above the original lowest level. This intermediate level is called the metastable condition, because the atoms are more reluctant to leave it than they were to leave the higher level to which they were originally excited. In order to make their departure they must give up the light they absorbed. The important thing is that the light they give up in dropping back to the ground state is of a specific wavelength.

Sooner or later. (within a few microseconds), the first atoms begin to drop from the metastable level. They are put to work in the resonant cavity of the laser. Without the reflecting surfaces, the light they emit would be mere fluorescence, like that of a neon sign. But inside the resonant cavity of the laser, they are bounced back and forth. With each pass parallel to the axis of the active material, they stimulate other excited atoms in the metastable level to give off their absorbed light much more quickly than they would ordinarily. The stimulated light moves in the same direction as the light stimulates it. With each pass, the light gains more energy in an effect akin to a chain reaction.

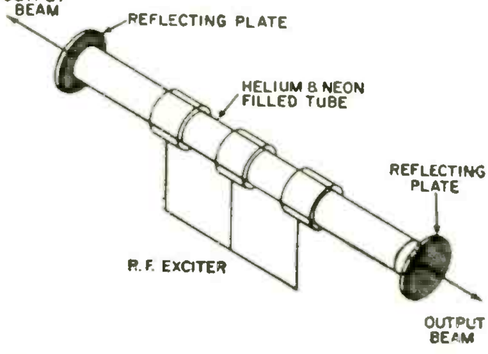
In only 200 microseconds or so, the released light waves, traveling in parallel and in phase back and forth between the reflecting ends of the laser—you might call it "feedback"—build up to an intensity great enough to escape through the one end of the laser which is only partially opaque. This output beam of light has almost all of its intensity in a very narrow cone. All its waves are in step; of the same phase and frequency. It is coherent light.

Brightest stars of recent research are semiconductor and liquid laser devices. At top, left, is a liquid "frequency converter" that can change the frequency or color of a laser beam. At left is one of the first gallium arsenide lasers produced by G.E. (others were made by I.B.M. and M.I.T.). It is suspended in liquid nitrogen to keep it cool when large excitation currents are passed through it. Above, I.B.M. scientists examine a brand-new semiconductor laser announced very recently: an indium phosphide type.





The drawing, the basic ruby laser, illustrates in a general way the setup used with most crystal types.

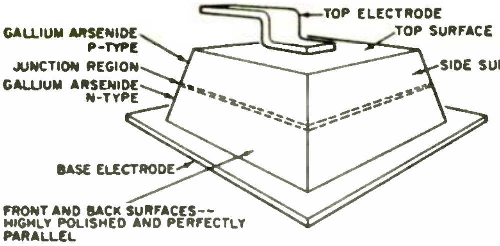


Basic configuration of a low-power c.w. gas laser. The reflecting plates reflect back a large percentage of energy; result is a small, continuous output.

thick sheet of steel if it is transmitted in a concentrated burst of about a millisecond.

A 10-joule ruby laser, which is fairly common today, operating at a wavelength of 0.7 micron, has a power density at the center of the beam of about 10^{16} watts per square meter. The power density at the surface of the sun is less than 10^{8} watts per square meter. Thus, this rather modest laser is capable of producing a power density 100-million times that of the surface of the sun!

Continuous-Wave Lasers. A little over a year ago, the first crystal laser was made to operate *continuously* (the high-power devices we have been discussing are *pulsed*) at Bell Laboratories with power outputs of a few milliwatts. Gas lasers and semiconductor lasers also



LASER STATUS REPORT

Gallium arsenide laser, greatly enlarged and shown in schematic form, looks like this. Coherent light is emitted perpendicular to the front and back surfaces and along the junction of device.

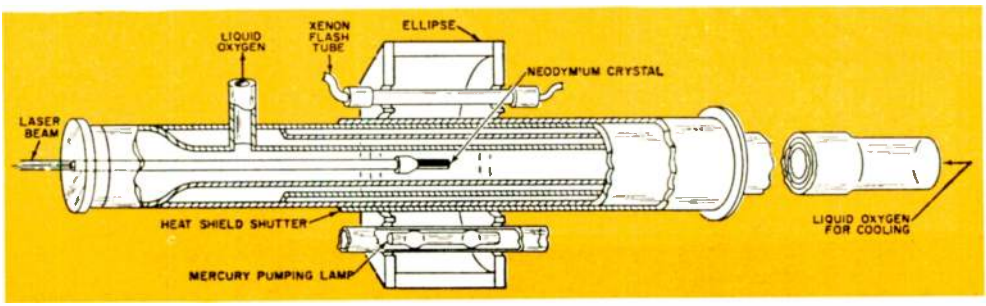
have been made to operate continuously with comparative power outputs. As POPULAR ELECTRONICS goes to press, however, a new 9-watt continuous-wave (c.w.) laser is about to be introduced for use in research related to welding and other machine tool uses.

A 45-watt c.w. laser may be another major development to be announced in 1963. Both this unit, which is being researched at M.I.T.'s Lincoln Laboratory, and the 9-watt c.w. laser use dysprosium-doped calcium fluoride crystals rather than gases or semiconductors.

Although c.w. lasers are somewhat puny in their power outputs compared to the pulsed type, they have immense advantages as carriers for communications purposes. At optical frequencies and with narrow beam angles concentrating all the radiated energy into a small cone, a television channel could be established between the earth and Saturn with only about 600 watts, while a voice channel to the most distant planet, Pluto, could be maintained with as little as five watts.

Dr. Donald S. Bayley, of General Precision, Inc., one of some 400 organizations conducting laser research, has said that an interstellar information channel carrying one binary bit per second could be set up with the star *Altair* (16.5 light-years away) with only 10 watts from a laser. Already, General Electric has designed a burst communications system using a rapid laser pulse of great power (rather than a continuous wave) to carry vast amounts of data.

Power Transmitters? In the vacuum of space, attenuation is slight, governed primarily by the degree of beam spread. Recently, Sperry Rand Corporation has been able to achieve the minimum theoretical beam spread of a point source of light—0.005°, or 10^{-4} radians—without the use of external lenses. Previously, the already narrow laser beams, on the order of 0.05°, were further focused down by what amounts to an inverted telescope.



Continuous wave crystal lasers use configurations somewhat like this Bell telephone design. The neodymium crystal is at one focus of a eliptical cavity, and the mercury lamp at the other to concentrate pumping light.

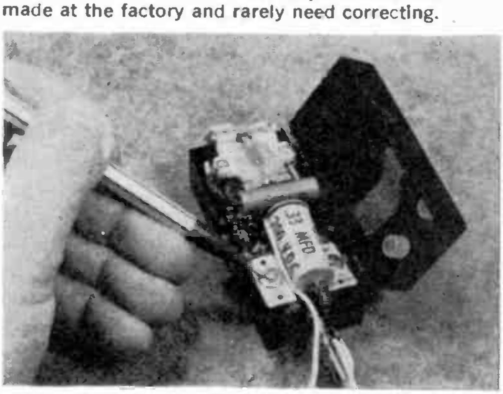
The ultra-small beam spread of concentrated optical-frequency energy indicates that it will be possible to transmit power over great distances with very little loss; power for spaceships, for instance. It is now possible to construct optical antennas, nothing more than a series of lenses, to transmit laser beams which would lose only 1/30th of one percent in a 20-mile hop—far less than present-day transmission lines. Thus, if

(Continued on page 76)

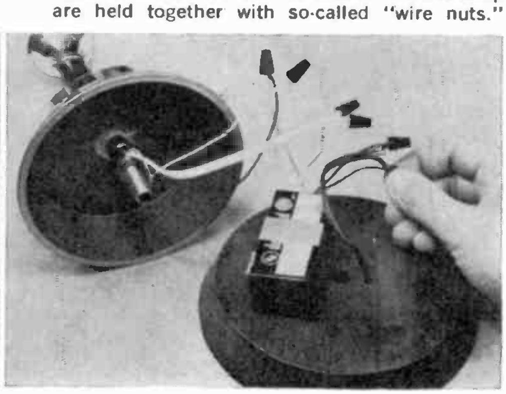
Dynaquad Touch Control

IF you're looking for an interesting household gadget using a modern-day semiconductor, you might investigate the Dynaquad Touch Control Lamp. Marketed by Tung-Sol Electric Inc. (545 N. Arlington Ave., East Orange, N.J.) as a do-it-yourself kit listing for $19.95 but available to electronics hobbyists at most jobbers for under $15.00, the lamp incorporates a body-capacity switching system built around a TS1595 *pnpn* transistor. The kit can be assembled in about 30 minutes. Hidden in the base of the lamp is a touch control switch using the special *pnpn* transistor in a neon bulb oscillator circuit. Body capacity—which acts when you touch the metal base of the lamp—triggers a relay which turns on the light. A second touch—at the ring on the center post of the lamp—releases the relay through a second oscillator circuit. Tung-Sol plans on making just the *pnpn* transistor, or the touch control switch, available to experimenters for alarm systems and computer projects.

The touch control switch consists of two neon oscillator circuits, a relay, and a pnpn transistor. The antenna trimmer adjustments are made at the factory and rarely need correcting.



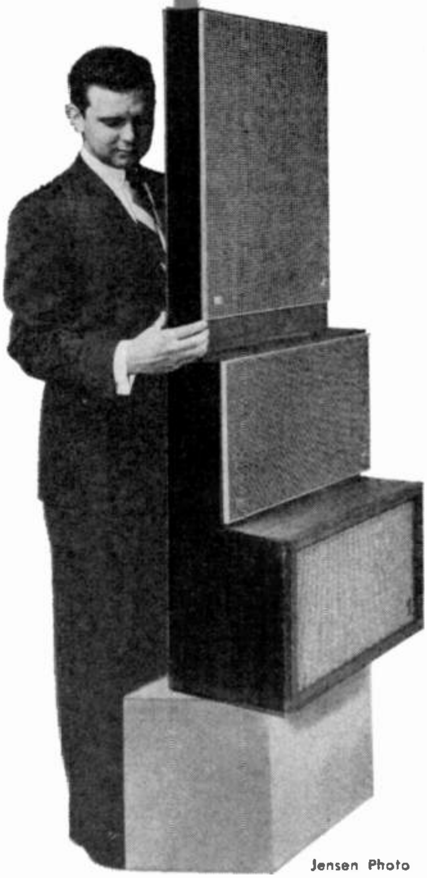
Wiring of the lamp is so simple that it can be assembled in 30 minutes. No soldering is required since all of the leads to and from the lamp are held together with so-called "wire nuts."



SLIM SILHOUETTE SPEAKER SYSTEMS

Originally conceived to appeal to the eye, they sound good, too

By HANS H. FANTEL



Jensen Photo

IF an audio fan tells you his speakers are flat, it's no longer a safe bet that he's talking about frequency response. Nowadays he might be referring to his speakers' *shape*.

The new look in loudspeakers—the flat panel—is undoubtedly handsome, but simply mentioning it is a sure way to start an argument. "Just put it down as a furniture fashion—nothing more," scoffs a veteran hi-fi'er who resolutely sticks to his bulky baffles.

"It's a design challenge with interesting possibilities," says Dick Shahinian, the audio engineer who developed the Paco L-4, one of the latest entries in the field.

Behind this conflict of opinions are the unresolved questions posed by any new development: How does it work? *Does* it work? And, should you buy one? The engineers involved in this development don't beat around the bush. They admit outright that good looks and space-saving compactness are the chief reasons for the slim-down. None would claim that the slim speakers are superior in principle to their chunky counterparts.

In sum, slim speakers are not a natural technical development. They were conceived as an innovation to spur sales. And the furniture stylists tossed the challenge to the engineers: "Make the thin ones as good as the fat ones!" The surprise is that it's being done—almost.

SLIM SILHOUETTE SPEAKER SYSTEMS

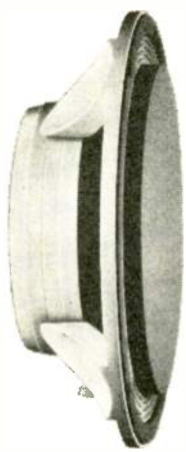
"We're fighting all the rules in the book," admits Shahinian. "Like any engineering challenge, it's a battle against the laws of nature. Normally, good bass reproduction requires an ample amount of air space in the baffle. When you slim down the box, you've got to make it up in other ways."

Each manufacturer, it seems, is finding his own ways of doing so.

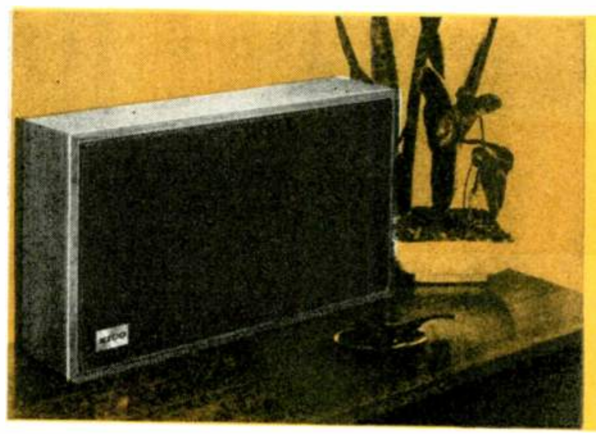
Multiple Woofers. To compensate for the small air space in the slim enclosure, some designers enlarge the active area from which the sound radiates. Paco, for instance, crams four small woofers into its slim box. Pumping air in unison, these multiple woofers create a broad wave front that transfers low-frequency energy more effectively to the listening room. Goodman's "Slimline" Series and Lafayette's "Decorette" and "Slenderette" systems follow the same principle. The idea is to set enough air in motion with the woofer cones alone so that bass projection becomes largely independent of the cabinet.

Going all the way with this line of logic, the Audax "Sonoteer" got rid of the cabinet entirely. This speaker is simply an open panel with four woofers and a tweeter, radiating sound both front and back, and seems to be in open defiance of the old principle that the back of a loudspeaker must always be enclosed to keep the back wave from canceling out the front wave at low frequencies.

When Saul J. White, the designer of the Sonoteer speaker system, was asked how he avoided bass cancellation in an open-back design, he had a ready answer: "You'd get bass cancellation all right if the speaker stood out in the open. But in a normal-size living room not all the bass gets away. You get enough bass bouncing back from the walls to make up for the cancellation loss. Multiple reflections in the room may cancel the bass in some spots, but they reinforce it in others—depending on whether they are in or out of phase in any particular part of the room."



One answer to the problem of putting speaker systems on reducing diets was the ceramic magnet. The one here, at the back of a Jensen 3-P woofer, is molded into a pancake to reduce depth. Note also flat-head piston cone.

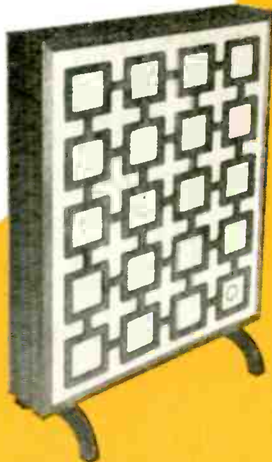


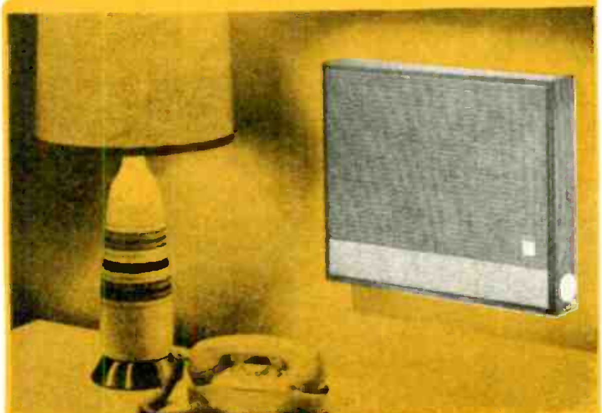
EICO's HFS-6, above, is a slim, compact system which crams a 10" woofer, an 8" midrange unit and a dome-radiator tweeter into this enclosure. Opposite, center is the HFS-10, a low-cost, compact two-speaker system by the same company.

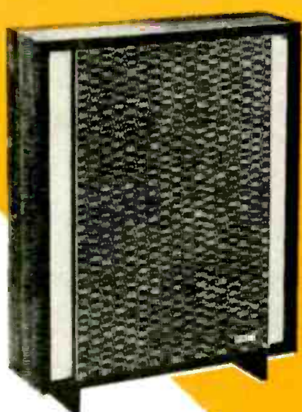
To elaborate on White's answer, you have to find the right spot in the room for a backless baffle because it relies on wall reflections for bass reinforcement. But once you have found it, the front-plus-back radiation provides a pleasant, spacious kind of sound. Of course, you can't push such speakers flat against a wall—the rear needs breathing space.

Ceramic Magnets. The Jensen people took another tack. Their efforts centered on making a fairly large woofer shallow enough to fit into a narrow enclosure.

Radiating both front and rear, the Audax Sonoteer has no back. Bass is augmented by the wall reflections.







Paco's L-4, a floor-standing slim-line design, gets good base boost from extra woofers—four 6" units.

To accomplish this, they took advantage of ceramic magnet materials which had been developed shortly before. These are suspensions of metal particles in a ceramic binder, and they permit magnets to be molded into flat shape and still concentrate plenty of magnetic flux around the voice coil.

Jensen engineers succeeded in making a powerful speaker magnet in the form of a flat pancake with a hole in the middle. Around this magnet they were able to produce a 10" deep-swinging woofer less than 3" in depth (Model 3P/W1). This woofer, also unconventional in its use of a cone with a flat piston head, is the core of Jensen's 3-P and TR-9 slim-line systems, which measure from 3⅝" to 5½" deep, reach down to 30 cps, and handle up to 25 watts of power.

Inverted Magnets. Still another way to reduce the depth of a woofer is to invert the magnet. Instead of sticking out in back, the magnet is turned around so that it projects into the hollow of the cone, taking up no additional space. Utah Electronics Corporation built its "Sorcerer" speaker system (5" deep) around an 8" woofer of this type.

One drawback of this design is that the magnet located "inside" the cone cannot be directly supported by the speaker frame but must be cantilevered from it. It is difficult to suspend heavy magnets in this manner, and the power-handling capacity of such speakers is limited. However, the Utah "Sorcerer" handles 12 watts which suffices for one channel of a medium-power stereo system.

Coneless Speakers. By far the most radical slim-down exercises were performed by audio designer Abraham Cohen of Advanced Acoustics, who cut out the cone altogether. Instead, he uses a thin wood panel as the vibrating element.

Flexibly suspended by its edge, the panel is activated by a voice coil and functions, in effect, as a depthless cone; its large area makes up for the shallow swing of the panel and enables it to move a sufficient amount of air. Like the backless Audax Sonoteer described above, the panel puts out sound both front and back, and hence works best at some distance from the nearest wall. The frequency output of the open panel

SPEAKER COMPARISON CHART

MODEL	SOURCE	DIMENSIONS (w x h x d)	SPEAKER COMPLEMENT	POWER RATING (watts)	FREQUENCY RESPONSE (cps)	IMPEDANCE (ohms)	DESIGN PRINCIPLE	FURNITURE FINISH	PRICE
ADVANCED ACOUSTICS WAFAIRE, BI-PHONIC COUPLER	A	$13\frac{1}{2}$ x $21\frac{3}{4}$ x $3\frac{1}{8}$	panel woofer, 2" tweeter	25	30—beyond audibility	8	coneless panel	walnut	$ 69.50 124.50 (pair)
ADVANCED ACOUSTICS MINI, BI-PHONIC COUPLER	A	$13\frac{3}{8}$ x $17\frac{1}{4}$ x 2	panel woofer, 2" tweeter	20		8	coneless panel	walnut or teak	42.50 79.50 (pair)
ARGOS PETITE PHF-IS	B	18 x 12 x $3\frac{3}{4}$	1 woofer, 1 tweeter	6	50-17,000	8	vented enclosure	walnut	24.95
ARGOS SPACE SAVER HFWB-8S	B		8" woofer, $3\frac{1}{2}$" tweeter			8	vented enclosure	walnut or birch	17.95
AUDAX SONOTEER CA-70	C	21 x 25 x 4	2 woofers, 2 mid range, 1 tweeter	45	40-18,000	8	open back	fruitwood, walnut, ebony	89.95 79.95 89.95
EICO HFS-6	D	$23\frac{1}{2}$ x $13\frac{1}{2}$ x $5\frac{3}{4}$	10" woofer, 8" mid range, dome-radiator tweeter	40	50-20,000	8	vented enclosure	walnut	62.50 (wired) 52.50 (kit)
ELECTRO-VOICE REGINA 200	E	$16\frac{3}{8}$ x $24\frac{1}{8}$ x $5\frac{5}{8}$	10" woofer, 5" tweeter	40	50-15,000	8	sealed enclosure	walnut	89.50
FISHER KS-1	F	18 x 24 x $5\frac{3}{4}$	10" woofer, 5" mid range, 3" tweeter	60	40-18,500	8	sealed enclosure	birch walnut	84.50 89.50
FISHER KS-1 (KIT)	F	18 x 24 x $5\frac{3}{4}$	10" woofer, 5" mid range, 3" tweeter	60	40-18,500	8	sealed enclosure	unfinished birch unfinished walnut	59.50 64.50
GOODMAN G-1	G	17 x 25 x $5\frac{1}{4}$	8" woofer, 6" mid range, $3\frac{1}{2}$" tweeter	20	40-17,000	16	vented enclosure	walnut	56.50
GOODMAN G-2	G	17 x 25 x $6\frac{1}{4}$	10" woofer, 6" mid range, $3\frac{1}{2}$" tweeter	20	40-17,000	16	vented enclosure	walnut	59.50
GOODMAN G-3	G	17 x 25 x $5\frac{1}{4}$	3 8" woofers, 6" mid range, $3\frac{1}{2}$" tweeter	45	40-17,000	16	vented enclosure	walnut	79.50
GOODMAN G-4	G	20 x 28 x $6\frac{1}{4}$	3 10" woofers, 6" mid range, $3\frac{1}{2}$" tweeter	60	40-17,000	16	vented enclosure	walnut	89.50
HEATH PROFILE AS-22 (KIT)	H	$19\frac{1}{2}$ x 25 x 5	10" woofer, 6" mid range, $3\frac{1}{2}$" tweeter		55-12,000 $\pm$5 db	8	inverted magnet	walnut, unfinished	54.95 49.95
JENSEN 3P/1	I	25 x $13\frac{7}{8}$ x $5\frac{1}{2}$	10" woofer, 8" mid range, 2 $3\frac{1}{2}$" tweeters, dome-radiator super tweeter	25	20—beyond audibility	8	vented enclosure	walnut	119.50 97.50 (kit)
JENSEN 3P/2	I	$21\frac{1}{4}$ x $28\frac{5}{8}$ x $3\frac{5}{8}$	10" woofer, 8" mid range, 2 $3\frac{1}{2}$" tweeters, dome-radiator super tweeter	25	20—beyond audibility	8	vented enclosure	walnut	139.50

JENSEN TR-9	I	22¾ x 13½ x 5⅝	10" woofer, 8" mid range, super-tweeter	25	30—beyond audibility	8	vented enclosure	walnut	89.50
JENSEN X-20	I	15⅜ x 12⅞ x 2⅝	1 woofer, 2 tweeters	6		4, 8 or 16	vented enclosure	walnut	39.95
KNIGHT KN-281	J	23¾ x 13½ x 6½	10" woofer, 2 3½" tweeters	30	35-15,000	8	vented enclosure	walnut unfinished gum	49.95 94.90 (pair) 44.95
KLH MODEL NINE	K	23½ x 70 x 2⅞	full-range electrostatic	75		16	electro-static	—	1140.00 (pair)
LAFAYETTE DECORETTE SK240WX	L	17 x 25 x 4¾	2 8" woofers, 1 8" mid range, 1 3½" cone tweeter, 1 horn tweeter	60	40-20,000	8	sealed enclosure	walnut	59.95
LAFAYETTE SLENDERETTE SK235WX	L	20 x 24 x 5	2 6" woofers, 1 8" mid range, 2 3½" tweeters	20	50-15,000	8	sealed enclosure	walnut	39.95
LANSING TRIMLINE C54	M	23¾ x 20 x 5⅛	8" full-range speaker, 8" passive cone	25		8	parasite cone	walnut	117.00
PACO L-4	N	20 x 26¾ x 6 3/16	3 6" woofers, 1 3½" tweeter	30	45-18,000	8	multiple woofers	walnut	99.95
UNIVERSITY MINI	O	18 x 13⅜ x 2	panel woofer, 1 tweeter	20	50-17,000	8	coneless panel	walnut	44.49
UNIVERSITY SYL-O-ETTE	O	23 x 29 x 4	8" woofer, 6½" midrange-tweeter	30	40-20,000	8		walnut	99.95
UTAH SORCERER SH-4W	P	20 x 12 x 5	8" woofer, 5" tweeter	12	45-17,000	8	inverted magnet	walnut unfinished birch	49.95 46.95
UTAH PT3	P	18 x 12 x 3	8" woofer, 3½" tweeter	10	-18,500	8	inverted magnet	walnut	33.25
V-M SILHOUETTE	Q	20½ x 26¾ x 4¾	10" woofer, 6" midrange, 3½" tweeter	25	30-16,000	8	vented enclosure	walnut	68.00
V-M MODEL 42	Q	15 x 20 x 4	6" woofer, 3½" tweeter	15	50-14,000	8	vented enclosure	walnut	49.95

A—Advanced Acoustics Co.
67 Factory Place
Cedar Grove, N.J.

B—Argos Products Co., Inc.
301 Main St.
Genoa, Ill.

C—Audax Div. Rek-O-Kut Co. Inc.
38-19 108th St.
Corona 68, N.Y.

D—EICO (Electronic Instrument Co.)
33-00 Northern Blvd.
Long Island City 1, N.Y.

E—Electro-Voice, Inc.
Buchanan, Mich.

F—Fisher Radio Corp.
21-21 44th Drive
Long Island City 1, N.Y.

G—Goodmans Loudspeakers
Rockbar Corp.
650 Halstead Ave.
Mamaroneck, N.Y.

H—Heath Company
Hilltop Rd.
Benton Harbor, Mich.

I—Jensen Manufacturing Co.
6601 S. Laramie Ave.
Chicago 38, Ill.

J—Allied Radio Corp.
100 N. Western Ave.
Chicago 80, Ill.

K—KLH Research & Development Corp.
30 Cross St.
Cambridge 39, Mass.

L—Lafayette Radio Electronics
111 Jericho Turnpike
Syosset, L.I., N.Y.

M—James B. Lansing Sound, Inc.
3249 Casitas Ave.
Los Angeles 39, Calif.

N—Pacotronics, Inc.
70-31 84th St.
Glendale, L.I., N.Y.

O—University Loudspeakers, Inc.
80 S. Kensington Ave.
White Plains, N.Y.

P—Utah Electronics Co.
1124 East Franklin St.
Huntington, Ind.

Q—V-M Corporation
Benton Harbor, Mich.

covers bass and midrange; the top end is provided by a 2″ cone tweeter. Sold under the name of "Bi-Phonic Coupler," this design is available in various sizes, the largest ("Wafaire") going down to 30 cps. The same idea is followed in University Loudspeakers' "Mini" model which has been shaved down to a mere 2″ in over-all thickness.

Undisputed king of the coneless speakers is KLH's Model Nine, a large panel less than 3″ thick. Being a full-range, all-electrostatic speaker (in fact, the only American speaker of this type), its slimness is not the result of compromise but is inherent in its electrostatic principle. This puts the KLH Nine in a class by itself, not really comparable to the rest of the slim speaker tribe. So is the price tag: $1140 for a matched stereo pair.

Ports and Parasites. Most thin speakers rely on some variant of the familiar bass-reflex principle to scoop more lows out of the shallow box. In many designs, the bass port (the hole through which the lows are let out) has an internal duct attached to it. This provides acoustic loading and keeps the opening of the port from being too close to the woofer cone. The Jensen, Knight, Paco, Argos, Heath, Goodmans, and EICO models are all slim speakers with such duct-loaded ports.

J. B. Lansing uses a different method of port loading in its C54 "Trimline"—a driverless 8″ speaker cone is tacked across the bass opening. This "parasite cone" or "passive cone" shakes with the air pressure waves built up by the bass in the box (generated by a regular 8″ speaker), and thus transmits the low frequencies into the room.

Exceptions to the rule of vented enclosures are the Electro-Voice Regina 200, the Fisher KS-1, and the Lafayette "Decorette" and "Slenderette." These systems employ hermetically sealed enclosures, presumably to avoid the resonance problems sometimes encountered in vented baffles. The loss of bass reinforcement through the port is made up in those designs by woofers with long voice-coil travel and very compliant cone suspensions capable of pumping more air with each stroke.

Family Resemblance. With designers going off in so many directions, it is hard to evaluate slim speakers as a group. But a certain family resemblance is evident despite the differences. Except in the open-back designs, there is a possibility that the rear panels may vibrate excessively because of their large area and the high back-pressure building up in the narrow enclosures. Such vibration may lead to distortion in loud passages. One way to test a speaker of this kind is by banging the rear panel with your fist. If you hear a hollow bong, it indicates that the panel has a tendency to vibrate. A toneless thud tells you that the panel is tightly braced, as it should be, and that the speaker won't honk if a strong bass note comes along.

As a rule, the bass you get from slim speakers is not as fat and sassy as the bottom notes from standard enclosures. The specifications may rightly claim response down to, say, 30 or 40 cps. What the specs usually don't tell you is just how much response drops off from the "flat" level in those lower reaches. Only rarely is the deviation from flat response given with a ± db rating for the extreme frequencies. Of course, you can fill in some lows with bass boost from your amplifier, and in most cases you wind up with pleasantly balanced sound. Don't expect orchestral thunder or low organ notes to shake the walls, but most kinds of music come across convincingly.

Slim speakers sound best in moderate-size rooms (less than 20′ long) where their bass output is not too greatly dissipated and extreme lows are not practical, anyway. (Even with the best of speakers, it takes a large room to let those bottom notes of the pipe organ roll out properly.) As a group, slim speakers are quite efficient. They put out plenty of sound at low wattage, and amplifiers rated between 10 and 25 watts per channel drive them easily. In fact, a blast from a powerhouse amplifier in the 50-watts-per-channel class would probably shatter most of the slim speakers.

Medium-power amplifiers are thus natural companions to the slim speakers, and smallish rooms their natural habitat. And it is in just such rooms that the space-saving feature really counts. If you can't find a place to put them, you can easily hang the backless speakers from the ceiling. And the others you can hang on the wall—like a picture. –30–

NONSENSE BOX

The most useless thing ever published, but your children will think it's great

By ALAN L. DANZIS

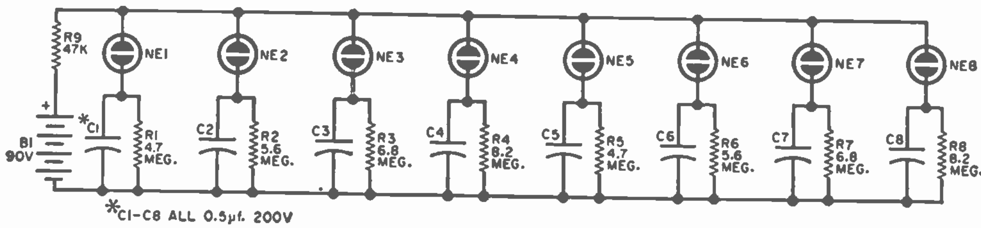
YOU MIGHT tell your kids it's a scintillation counter detecting cosmic messages from outer space. Or, you casually can mention to friends the fact that it's a miniaturized digital computer reading out answers in binary computations. Chances are they'll believe every word you say; only you will know that this box is actually "nonsense."

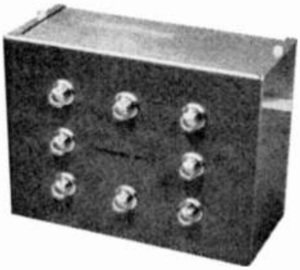
The "Nonsense Box" consists of eight neon lamp flashing circuits flashing at various independent time rates, and all powered by a single 90-volt battery. The current drain imposed by this circuit is around 65 microamperes and the battery should last well over a year. Of course, this is one of the *advantages* (?) of the Nonsense Box—there is no switch to turn it off.

How It Works. Each flashing circuit consists of a neon glow lamp, a 0.5 μf. 200-volt capacitor and a resistor of one of four specified values from 4.7 to 8.2 megohms. Take a look at the first flashing circuit (*NE1, C1,* and *R1*). Since there is no current flowing in the circuit, there is no voltage drop across *R1,* or the resistor *R9* in series with the battery. This permits *NE1* to fire (conduct) setting up a voltage drop across *R1* and charging *C1*. As the charge across *C1* rises, the voltage across the neon bulb drops, and *NE1* is extinguished. Now *C1* slowly discharges through *R1* (the old *R/C* time constant effect) until sufficient voltage builds up across the neon bulb to fire it and cause the whole process to repeat itself.

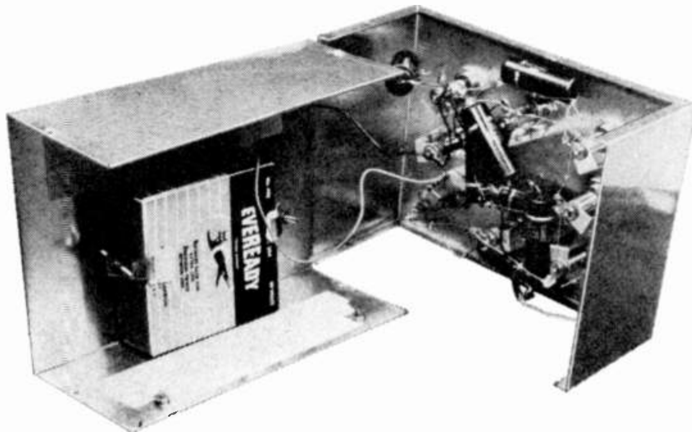
Even though the flashing circuits are doubled up (*C1/R1* and *C5/R5* have the same values), small capacitor and resistor mismatches insure that no two flashing circuits have the same time constant. Resistor *R9* helps insure the random nature of the firing pattern.

Construction. The Nonsense Box can





The neon lamps can be arranged in any pattern desired—circle, square, etc.



The interior wiring of the Nonsense Box can be as haphazard as you want. Be sure to clamp the battery in place to prevent it being shaken loose.

PARTS LIST

- *B1—90-volt "B" battery (Burgess type V60 or Eveready type 479)*
- *C1-C8—0.5 µf., 200-volt paper capacitors (eight required)*
- *NE1-NE8—NE-51 type neon bulb (eight required)*
- *R1, R5—4.7 megohms*
- *R2, R6—5.6 megohms*
- *R3, R7—6.8 megohms*
- *R4, R8—8.2 megohms*
- *R9—47,000 ohms*

(All resistors ½-watt)

- *8—Neon lamp socket (Dialco type 810-B with clear plastic lens)*
- *Misc.—Mounting box, battery retaining clamp, wire, solder, etc.*

be made of either metal or wood. It should have sufficient space inside to comfortably hold the neon bulb sockets and permit the battery to be mounted rigidly in place. The latter measure is especially necessary since many people will try to shake the Nonsense Box to make it turn off.

Care should be exercised in laying out the holes for mounting the neon lamps. The spacing is not critical, but uniformity is desirable. The lamps could be arranged to make a person's initial, or in the square fashion shown in the photos.

Wiring is noncritical—even the battery polarity may be reversed. It is suggested that one terminal of each of the eight lamp sockets be wired together. Solder one end of *R9* to this common connection and leave the other end temporarily free. Now solder one end of resistors *R1-R8* and capacitors *C1-C8* to each of the unused lamp socket terminals according to the wiring schematic. Bring all 16 free leads from these capacitors and resistors to a common bus bar and solder. The two leads from the battery connect to the free end of *R9* and the common bus bar.

The Nonsense Box should start flashing immediately—and only you will know that it's all "nonsense." —30—

Double-Duty EICO 772

Combination CB and amateur installation? A few simple changes put this transceiver on both 10 and 11 meters

MANY CB'ers, introduced to the fascinating world of two-way radio via the 11-meter band, are qualifying for ham tickets. And why not? How else can you rag-chew on the air to your heart's content, contact rare DX stations in such exotic locales as Sarawak and Sumatra, or maybe just talk to the hams in your home town?

On the other hand, many already-licensed hams are finding a CB ticket a handy thing to have. With it, you can operate a low-cost, two-way utility radio system—and the units that make up your system can be operated by a friend, business associate, or your wife.

The inescapable conclusion is that it would often be desirable to have a *dual-purpose* rig that could be used for both hamming and CB, especially in the case of mobile installations where space for equipment is strictly limited. You can, of course, convert CB equipment to the 10-meter ham band (see POPULAR ELECTRONICS, June, 1961, page 64). A still better idea, however, is to add a 10-meter crystal-controlled amateur channel to your CB rig *and keep the unmodified CB channels for CB use.* The modifications are usually easy to make; and, when completed, you have a double-duty rig that switches quickly back and forth between 10 and 11 meters.

The changes outlined here refer to the EICO 772 CB transceiver, but the basic ideas are ap-

By ROBERT CLARK-DUFF
W2OMM/KBG-2857

This is the author's version of a "Double-Duty" EICO Model 772. The nameplate shows his original CB call—2A4148. New control functions are indicated in the photo on the facing page.

plicable to most CB rigs having both "tunable" and "fixed-tune" receiver functions. From the operator's seat, the 772 is actually two sets in one, sharing a lot of common parts. The author decided to convert the "tunable-receive" half of the set to 10-meter operation and use the "fixed-tune" half for CB operation.

Putting the 772 on 10. All that is involved in converting the receiver to ham-band operation is resetting the slug of the tunable oscillator coil. With this one simple adjustment, it is possible to make the unit cover any 500 kc. portion (approximately) of the 10-meter band. At first glance, the fact that coverage is limited to 500 kc. might seem like a disadvantage (the 10-meter band extends from 28 to 29.7 mc.—1700 kc.), but actually most activity on 10 meters tends to be concentrated approximately in the center of the band. In view of this fact, 500-kc. coverage is quite adequate.

The only necessary requirement for putting the transmitter section on 10 meters is a third overtone crystal cut for the frequency desired, plus a bit of tuning up.

Although the 772 can be put on 10 meters practically "as is," a number of mechanical modifications were made in the author's unit for more operating flexibility. These included the addition of a ten-position rotary selector switch to make available up to ten CB receive channels on fixed tune, an external socket for CB transmit crystals—making it possible to change them by hand, and a vernier dial for the tunable 10-meter receiver.

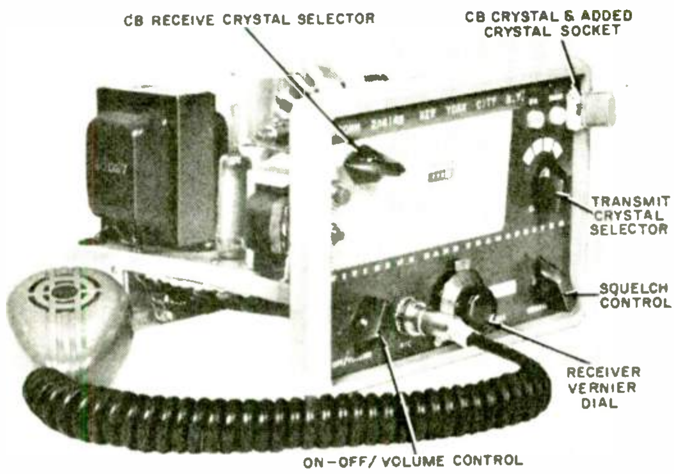
Three of the four original transmit crystal sockets were used for 10-meter crystals. Since this left room for only one CB channel, another socket was connected in parallel to the fourth and installed on the front panel.

The end result is a 10-meter amateur receiver and a 10-meter transmitter which operates at 5 watts input with a selection of three transmit crystals. In addition, the rig can still put out a legitimate signal on any CB channel, plus receive on ten preselected crystal-controlled channels. And all this comes in one transceiver measuring 6" x 8½" x 9"!

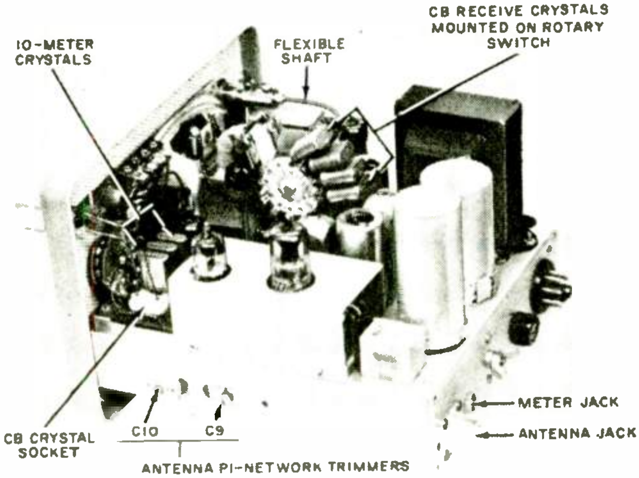
Modifications. Although it is not necessary to make all of the modifications described, they are well worthwhile, and do not involve extensive wiring changes. The ten-position rotary selector switch is "sandwiched in" by mounting a bracket in approximately the center of the chassis and then mounting the switch on it.

This control is made accessible by mounting a bushing and shaft in a new hole drilled at the upper left of the front panel, and connecting it to the switch assembly with a flexible shaft and two couplers.

The new CB receive crystals are mounted directly on the switch. The only circuit change necessary with this arrangement is to remove the original receive crystal and insert two leads in the socket. One lead goes to a common ground (one leg of each crystal mounted on the switch is grounded), and the other lead goes to the common terminal



Front panel additions for greater flexibility include a CB receive crystal selector, a CB transmit crystal socket, and a vernier dial.



The CB receive crystals and switch are mounted on bracket at center of chassis. Trimmers C9 and C10 are peaked to change bands.

of the new switch to complete circuit.

The socket for CB transmit crystals is mounted on the front panel at the upper right as shown in the photographs. Simply extend two leads from the fourth crystal socket and connect them to the new socket. And the last modification is to mount the vernier dial on the front panel to "bandspread" the tunable 10-meter receiver.

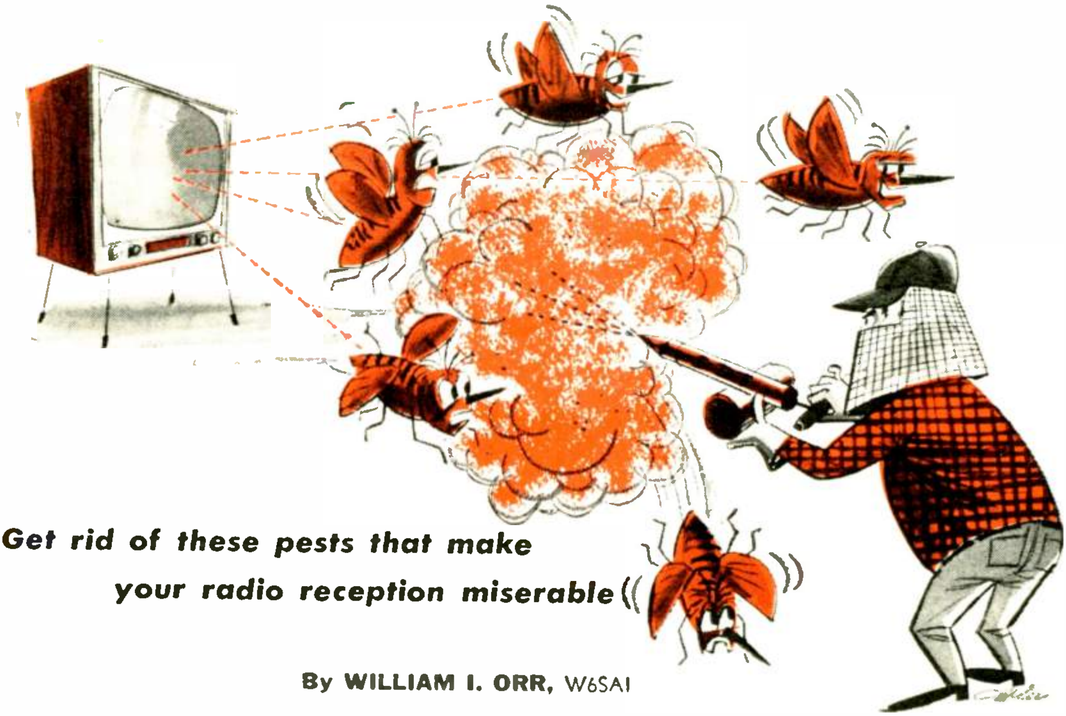
With the modifications complete, the 772 is ready for tuning up. All that's needed for this operation are 10-meter transmit crystals and a signal generator or other accurate r.f. source for aligning the receiver.

Adjustments. To put the tunable receiver in the 10-meter band, set the r.f. alignment source for 28.5 mc. With the plates of the tuning capacitor (*C21*) fully meshed, adjust the tunable oscillator coil (*L6*) until the signal is heard. It will be found necessary to bring *L6*'s slug, which is adjusted from the top of the chassis with a hex alignment tool, upward.

To put the transmitter section on 10 meters, insert a third overtone crystal in one of the three inside crystal sockets. Connect a dummy load to the antenna jack (a #47 pilot light), and, while pressing the transmit switch, adjust the antenna pi-network trimmers for maximum output as indicated by bulb brilliance. Adjust *C9* and *C10* in that order, and

(*Continued on page 80*)

Exterminate TV



Get rid of these pests that make your radio reception miserable

By WILLIAM I. ORR, W6SAI

ARE YOU plagued by TV "sync-bugs?" Many amateurs and SWL's hear this persistent nuisance, which is threatening to make a shambles of the radio spectrum, as rough, unstable signals found at close points across the dials of their short-wave receivers.

Sync-bugs creep across the bands with a slow, measured tread, uncanny in their instinct for squatting directly atop the signal you're trying to listen to. The broadcast listener hears them in the form of "birdies" and "whistles" across the dial that turn Toscanini and Fabian into a cacophony of howls and catcalls.

Where do these "insects" come from? The truth of the matter is that they are generated by a nearby TV set (which is probably operating quite normally). The 15 kc. horizontal oscillator, which possesses about as much stability as a hundred-foot antenna mast made of "two-by-four's," generates powerful pulses of energy rich in harmonics which can be radiated for hundreds of yards. You can identify the sync-bugs by the fact that they appear every 15 kc. across the dial; check to see if it's your TV set you're hearing by turning it on and off.

TV Set Radiation. Sync-bugs can reach your receiver in three different ways: they can be radiated by the TV lead-in and antenna system, they can travel down the power cord and into the a.c. line to be "piped" to your receiver, or they can be radiated directly by the wiring of the TV set. Since you can't eliminate the *source* of the radiation (without, that is, eliminating your TV viewing), the answer is to prevent the interference from being radiated beyond the immediate vicinity of the set.

The first step is to effectively trap the sync-bugs that are radiated by the antenna system of the television receiver. This can be accomplished by shunting the radiations to ground (the chassis) while permitting the TV signals to pass down the antenna to the set without appreciable attenuation. A simple linear trap made of a length of 300-ohm TV "ribbon" lead-in affixed to the antenna terminals will do the job.

To make the trap, cut a length of

Sync-Bug Interference!

300-ohm line 25″ long. Strip 1½″ of insulation from each end and tin the leads; twist the wires at one end together. Trim both leads of a .01 μf., 1000-volt ceramic capacitor to ½″ and connect one of them to the shorted end of the 300-ohm line as in Fig. 1.

Connect the other capacitor lead to ground by fastening it under a self-tapping screw on the TV chassis, or by soldering it to any convenient grounding point. Connect the opposite end of the trap across the TV antenna terminals. The trap can be conveniently draped about the rear of the cabinet, taking care that it doesn't touch tubes or other parts.

Wiring and Power Line Problems. The next step is to prevent unwanted sync-bugs from reaching your receiver via the a.c. cord of the TV set and the house wiring. To block this exit from the set, two .01 μf., 1000-volt ceramic capacitors are placed across the a.c. line to ground at the point where the line leaves the TV chassis. With most TV sets, the power connection is made through a simple interlock mounted at the rear. It may be possible to solder the capacitor leads to the back of the plug pins (see Fig. 2), or a bit of insulation can be removed from the power wires and the leads soldered to them. Tape the wires securely. Solder or bolt the other two capacitor leads to the chassis.

Radiation is especially apt to take place from the wires running from the chassis to the socket of the picture tube, since these wires carry the 15 kc. signal generated by the horizontal oscillator. The cure for this problem is a simple shield made from heavy aluminum foil, such as "Reynolds Wrap." Form the wires into a bundle, and wrap them with a covering of electrical tape. Trim the foil to size and carefully wrap it over the tape. Smooth the foil and form the rough edges back on themselves until the wires are substantially shielded. *Do not shield the high voltage lead going to the bulb of the picture tube.* Finally, wrap several turns of wire around the foil, twist it tight, and connect the other end to the chassis.

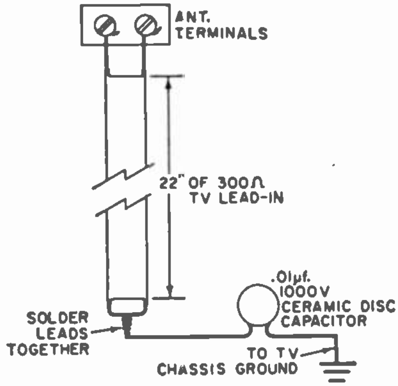


Fig. 1. Simple trap for eliminating sync-bugs from antenna system consists of 22″ of TV lead-in and a .01 μf. bypass capacitor.

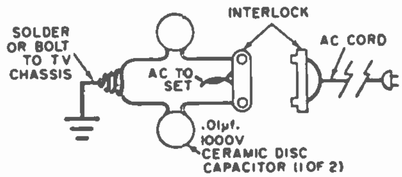


Fig. 2. Radiation into power line can be cured by bypassing to ground (the chassis) both sides of the a.c. line with capacitors.

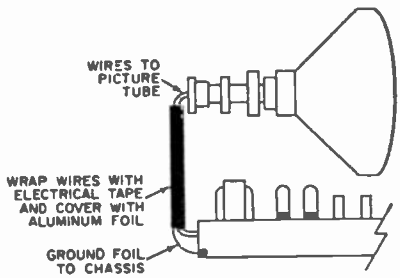


Fig. 3. To stop the set's wiring from radiating, shield the wires running from the chassis to the picture tube socket; see text.

The results of all this? In the author's case, the sync-bugs almost vanished, going from S9 to S3 in strength on 80 meters. On an a.c.-d.c. receiver, the sync-bugs had almost obliterated a local station; after "exterminating" them, they were unnoticeable. –30–

HERE'S a new kind of "breadboard" that enables you to assemble and disassemble experimental hookups in a jiffy. Although it uses a metal chassis, it virtually eliminates the machine work needed for individual circuit assembly. In addition, it reduces "wear and tear" on parts, permitting the same components to be used time and again.

The secret here is that a variety of components, mounted on various "plug buttons," can be snapped in or out of a chassis hole in a second. And this feature is also responsible for the unusual name—"Snap-In Breadboard"—which is exactly what this is. "Plug buttons," circular pieces of metal with flanges, are ordinarily used to fill unwanted chassis holes. Here, they allow components to be snapped "in" or "out" at will.

A standard 7″ x 13″ x 2″ aluminum chassis was used by the author, although either smaller or larger bases can be employed to suit specific needs. The size low the chassis plane), or at the bottom. This arrangement also permits two or three chassis to be "stacked" vertically for assembly of more complex circuits.

Finally, appropriate terminal strips are premounted across the center of the chassis and lengths of #12 tinned busbar soldered in position, the latter to serve as connection strips for filament, B+, bias, ground, and other common wiring.

Once the chassis is completed, assemble a basic stock of "snap-in" components, and you're off to the races. The initial stock can include tube sockets of various sizes, "L" brackets, selenium rectifiers, variable capacitors, terminal strips, stand-off insulators, variable resistors, switches, and similar components. Individual parts are mounted on appropriate plug buttons, with machine screws, nuts, and lock washers—or, where feasible, simply by soldering them in position.

SNAP-IN

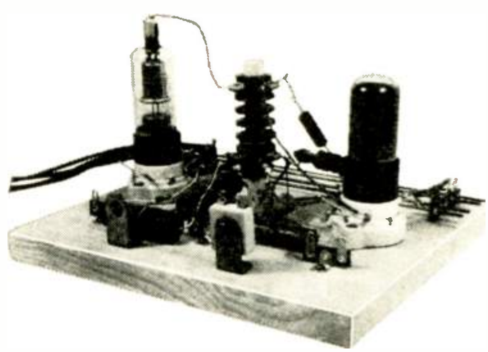
The time-honored breadboard is back again—in an updated, improved version

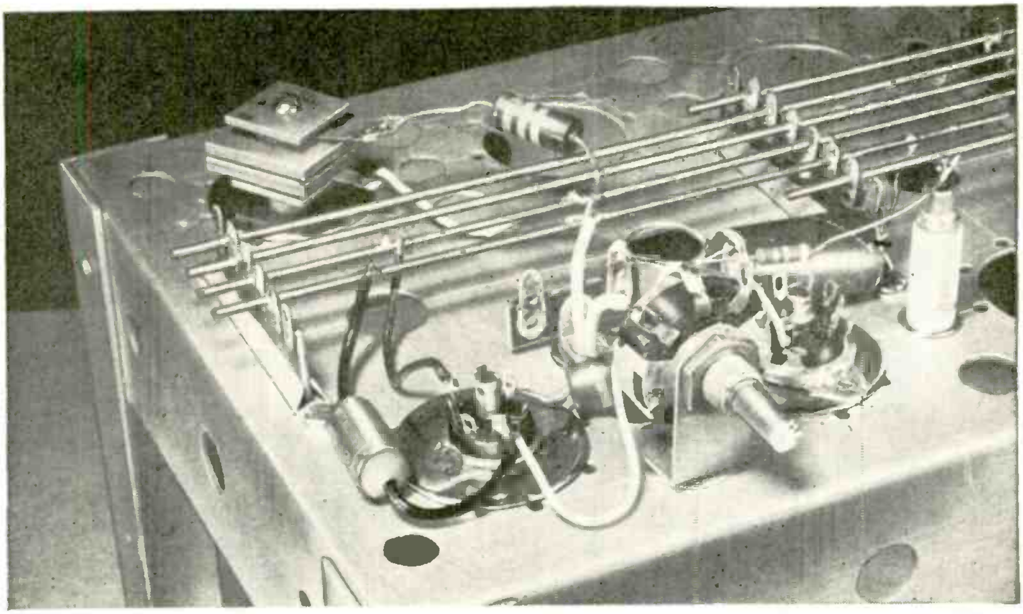
shown is suitable for assembling not only single-stage circuits and simple networks but complete receivers and multi-stage amplifiers. For larger and more complex circuits, a number of basic chassis may be bolted together horizontally or "stacked" vertically.

Holes are drilled and punched in a symmetrical pattern. Only four hole sizes are used—⅛″, ⅜″, ½″, and 1¼″—the smallest for machine screws; the ⅜″ and ½″ holes for potentiometers, switches, and similar controls; and the 1¼″ holes for tube sockets.

Extruded aluminum angle is used for the four legs. These are drilled so the chassis may be mounted either at the top (as shown), in the middle (providing "leg" extensions both above and be-

The classic breadboard of days gone by looked a little like this. Commercial receivers of yesteryear also used this convenient wiring technique.

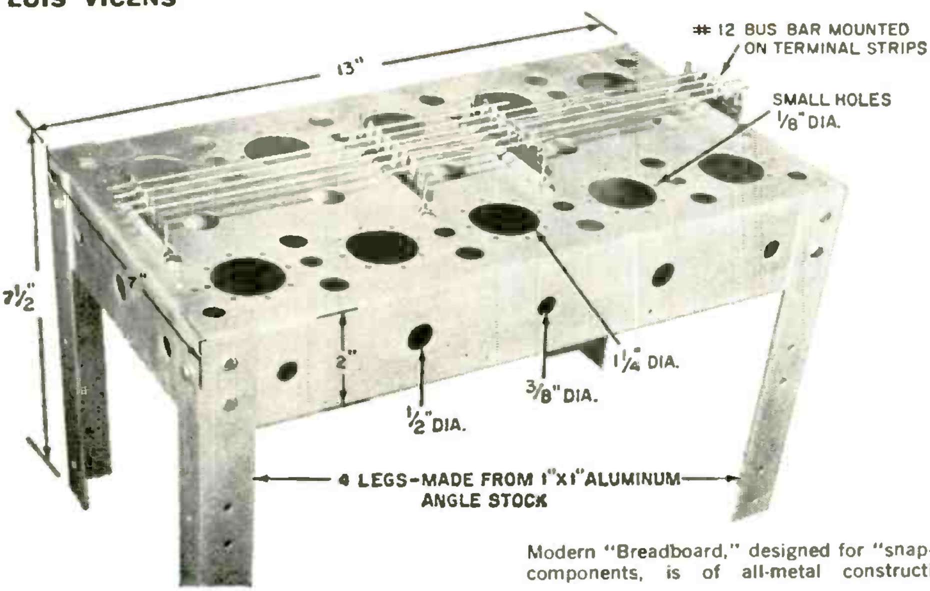




Thanks to "snap-in" feature, experimental circuits can be assembled and disassembled in a jiffy. Wiring is point-to-point; resistors, capacitors, and similar components are supported by their own leads.

BREADBOARD

By LUIS VICENS



Modern "Breadboard," designed for "snap-in" components, is of all-metal construction.

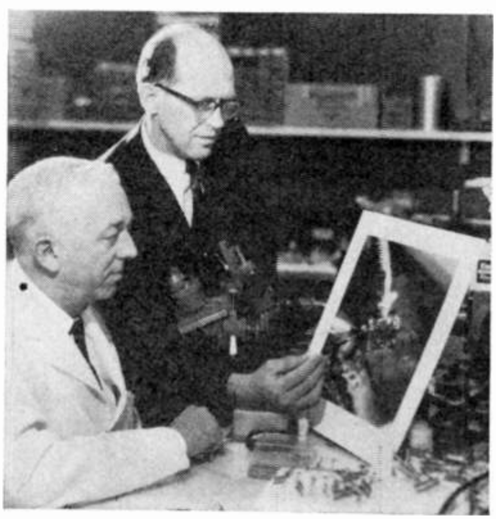
Transistor Topics

By **LOU GARNER**, Semiconductor Editor

IN PAST COLUMNS, we've discussed many new types of semiconductor devices. Some of these—the Spacistor, for example—haven't, as yet, reached the production stage. Others, such as the field-effect transistor, have only recently become available to hobbyists and experimenters. Still others . . . the tunnel diode and SCR are prime examples . . . have become "staples" on the shelves of many home laboratories and workshops. The time-lag between the announcement of a new device and its general availability at competitive prices may be from as little as a few months to as much as several years, depending on the production problems encountered and upon general industrial demand for the device.

The newest semiconductor device that has come to our attention is the *optical transistor*. Developed by scientist Richard F. Rutz of IBM's Thomas J. Watson Research Center (Yorktown, N. Y.), it can be operated at very high frequencies and is relatively easy to fabricate. Although dubbed a "transistor" and performing similar functions, the new device operates on a completely different principle. The basic unit is manufactured of gallium arsenide and, like a conventional transistor, consists of alternate layers of *p* and *n* type material, as illustrated in Fig. 1. In operation, however, the recombination of holes and electrons at the base-emitter junction causes the emission of light energy. This light passes across the base region and creates electron-hole combinations when it is absorbed at the base-collector junction. Thus, energy is transferred from the emitter to collector by light waves rather than by the movement of electrons and holes. An external signal applied to the base-emitter junction varies the number of electrons and holes available and thus the amount of light emitted, permitting the device to be used as an amplifier.

Since light travels at much higher



Researchers at IBM's Thomas J. Watson Research Center study a greatly enlarged picture of the newly developed light-operated gallium arsenide transistor.

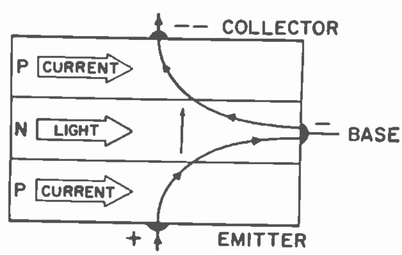


Fig. 1. Speed of light travel across base region from emitter junction to collector junction is cause of gallium arsenide transistor's faster response.

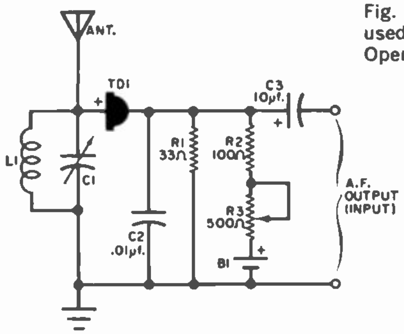


Fig. 2. Richard Mattos' tunnel diode circuit can be used for FM reception or as a wireless microphone. Operating mode is determined by circuit adjustment.

speeds than conventional current carriers (holes and electrons), the optical transistor can be used at extremely high frequencies without the need for the hard-to-make ultra-thin base regions required by standard high-frequency transistors. Laboratory models of the new device have been operated as oscillators at frequencies of one megacycle, but, theoretically, it should be possible to build units capable of handling signals in the kilomegacycle range.

As this is written, the optical transistor is still an experimental device. In future months, however, when production units become available, this new device should be ideal for home-built VHF and UHF gear, including transceivers, mobile transmitters, FM receivers, UHF-TV converters, and similar projects.

Readers' Circuits. The tunnel diode is one of the most versatile of semiconductor devices. As an example of its versatility, the basic circuit illustrated in Fig. 2, submitted by reader Richard J. Matos (603 Edgewater Drive, Pensacola, Fla.), may be used without modification either as a simple *FM broadcast-band receiver* or as an *FM wireless microphone,* depending on bias adjustment.

Referring to the schematic diagram, the tunnel diode, *TD1*, is used either as a regenerative detector or oscillator, with its frequency of operation determined by tuned circuit *L1-C1*. Operating power is furnished by battery *B1,* with the critical bias needed for detector or oscillator action determined by voltage-divider *R1-R2-R3*. Capacitor *C2* serves as an r.f. bypass, while *C3* is used as a d.c. blocking and a.c. coupling capacitor.

Standard components are used. The diode is a Philco T 1925 general-purpose unit or equivalent type. Coil *L1* is made up of five turns of #16 or #18 wire on a ¼" dia. by ½" form. Capacitor *C1* is a 3-25 µµf. trimmer capacitor, *C2* a 0.01 µf. mica, or ceramic unit, and *C3* a 10 µf., 3 to 10 volt electrolytic. Resistors *R1* and *R2* are ½-watt units, while *R3* is a small potentiometer. The power supply, *B1,* is a standard 1.5-volt zinc-carbon or mercury cell.

Assembling the tunnel diode circuit is a straight-forward procedure. Either etched wiring, conventional chassis, or breadboard wiring techniques may be used. Neither layout nor lead dress is overly critical, but good VHF wiring practice should be observed, with signal-carrying leads kept as short and direct as is practicable.

According to Dick, there are two critical factors: antenna length and adjustment of *R3*. He suggests the use of a quarter-wave vertical antenna and reports good results with the 20" whip used in his model. Potentiometer *R3* must be readjusted for optimum performance each time the operating frequency is changed.

The circuit may be used as an FM receiver by connecting a high-gain audio amplifier and suitable output device (such as earphones or a loudspeaker) to the audio terminals. If the circuit is to be used as a wireless microphone, the amplifier is replaced by an audio signal source . . . such as a dynamic earphone used as a microphone. In either mode of operation, *R3* must be adjusted for best performance.

Suitable for use at either CB or 10-meter ham band frequencies, the *super-regenerative receiver circuit* shown in Fig. 3 was submitted by Norman Dick, WN2EHB (241 East 169th St., Bronx 56, N. Y.). Norm reports that he has received 5-watt CB stations at distances of up to three miles and has picked up out-of-state 10-meter stations quite regularly. He indicates, however, that while the circuit is very sensitive, it is not overly selective.

Turning to the schematic diagram, we find that Norm has used a *pnp* transistor in the common-base configuration as a simple oscillator/detector. The circuit's

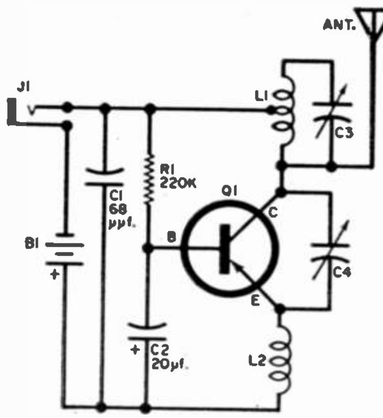


Fig. 3. Norman Dick's receiver circuit is a super-regenerative type covering CB and ten meter band frequencies. Sensitivity at low cost is its main appeal.

This month we are inaugurating "Transitips," a new feature which, as with "Readers' Circuits," we plan to make a regular section of the column. In it we'll pass on practical information on circuit design and modification, test techniques, and application tips which should help you to obtain maximum performance from your home-assembled experimental circuits, and to trouble-shoot balky projects. The material offered will be based on the practical experiences of your Semiconductor Editor, upon contributions by readers, and upon suggestions offered by semiconductor manufacturers. This month we'll discuss some of the problems encountered in assembling wireless microphones.

operating frequency is determined by tuned circuit *L1-C3,* while *C4* provides the necessary collector-emitter feedback. Coil *L2* serves as the emitter load. Operating power is obtained from a 9-volt battery, *B1,* with base bias supplied through *R1,* bypassed by *C2.*

Norm's circuit may be duplicated easily from readily available components. Transistor *Q1* is a Lafayette SP271 or Sylvania 2N247; *L2* is a 73-μh. TV peaking coil, while *L1* consists of 24 turns of #22 wire, center-tapped, on a ¼"-diameter form (air core); *C1* is a 68-μμf. silver mica capacitor, *C2* a 20-μf., 12-volt electrolytic, *C3* a 180-μμf. trimmer, and *C4* a 2.5-13μμf. trimmer. Resistor *R1* is a ½-watt unit; *J1* is a standard open-circuit 'phone jack (3000-ohm impedance magnetic 'phones are used); while *B1* may be any 9-volt transistor battery (typically, types 2N6 or 2U6). A 38" whip antenna is employed.

Point-to-point wiring, a circuit board, or any standard construction technique can be employed when assembling the receiver, provided a reasonably "clean" layout is used, with signal leads kept short and direct. Norm assembled his original model in a plastic box measuring 3" by 2" by 1".

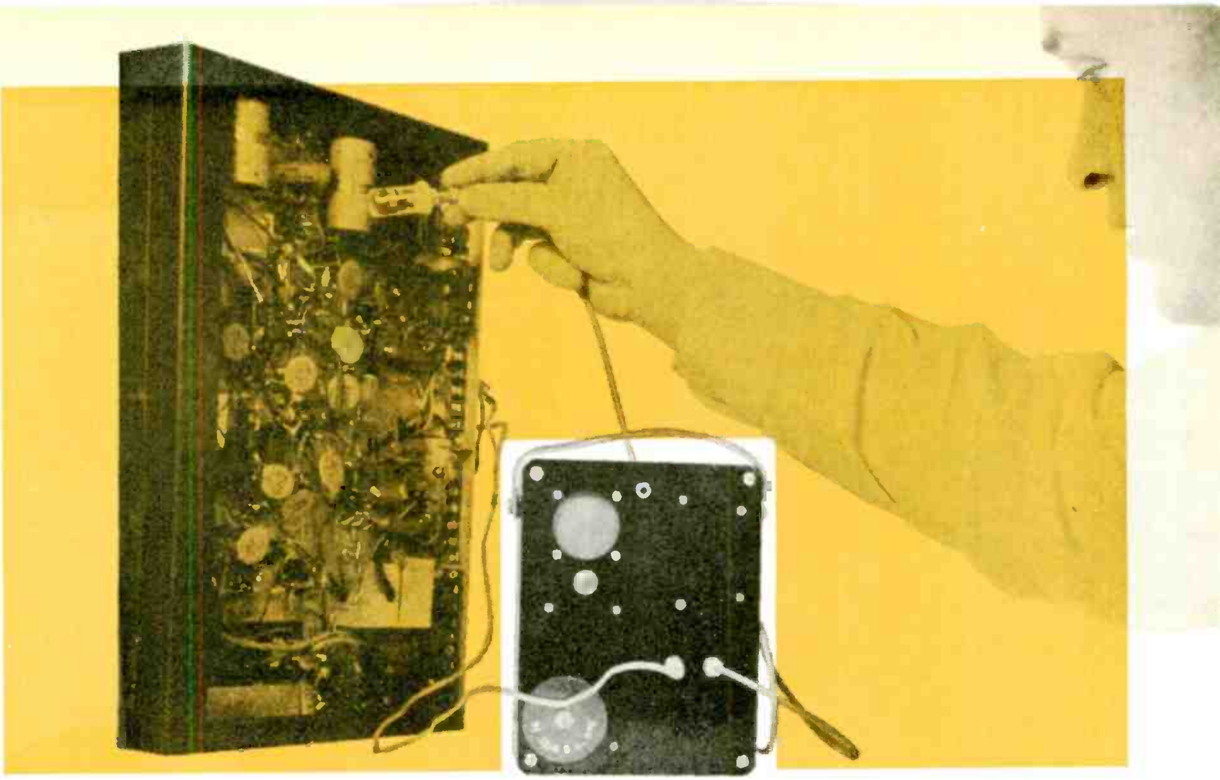
In operation, receiver tuning is determined by adjustment of *C3,* while feedback capacitor *C4* serves as a *sensitivity* control. For best performance, *C4* should be adjusted until a clean "hiss" is obtained when not tuned to a station. Replace *C4* with a larger (or smaller) capacitor value if necessary for good operation. Bear in mind when operating the unit that any superregenerative receiver can cause serious interference in other nearby receivers operating in the same band.

Transitips. In terms of general popularity, the AM wireless microphone or "home broadcaster" probably ranks second only to the simple broadcast-band receiver as a hobbyist project. Despite its popularity, however, this type of project seems to be one of the most troublesome for the average experimenter, and many hobbyists have tried literally dozens of circuits before they've found a satisfactory design.

The wireless microphone is basically nothing more than a modulated oscillator, and, therefore, any standard r.f. oscillator circuit *should be* capable of satisfactory performance as a wireless microphone *provided* reasonable modulation can be obtained. One typical circuit . . . a tickler feedback oscillator . . . is illustrated in Fig. 4.

Referring to the schematic diagram, a *pnp* transistor, *Q1,* is used in the common-emitter configuration. An *npn* unit may be used in the same circuit if the battery (*B1*) polarity is reversed. The circuit's operating frequency is determined by tuned circuit *L1-C1,* while the feedback needed to start and sustain oscillation is furnished by *L2,* coupled to

(*Continued on page* 81)



THE SIGNAL STETHOSCOPE

It's a combination radio, signal tracer, hum finder, tuner, amplifier—and the cost is low

By LYMAN E. GREENLEE

ONE OF THE most useful pieces of equipment on any service technician's bench is a good signal tracer, and this one more than fills the bill. With it you can easily trace or inject a signal through most stages of any amplifier or AM receiver. You'll also find the "Signal Stethoscope" excellent for checking such things as phono cartridges or speakers, tracking down hum, and even locating concealed a.c. wiring. But that's not all. When you don't need the unit for service work, you can use it for play! A twist of the switch turns the Signal Stethoscope into a sensitive portable radio, or an AM tuner for a p.a. system. What's more, as the following paragraphs reveal, building this seemingly-complicated instrument is a snap.

About the Circuit. This unit is designed around two preassembled circuit boards which are available at very reasonable cost. One of these is a three-transistor AM tuner, the other a four-transistor audio amplifier (see the Parts List). The wiring, shown in the schematic on page 61, is simple. The tuner output (red wire) is connected to the amplifier input (green wire) through closed-circuit jacks *J1* and *J2* and volume control *R1*. Amplifier output (gray wire) is fed to the speaker through closed-circuit jack *J3*.

Battery *B1*'s positive terminal is wired to the ground leads (gray and black, respectively) of the tuner and amplifier. Switch *S1*, connected between the negative terminal of *B1* and the negative leads of the tuner and amplifier (blue and orange, respectively) controls the power.

A plug inserted into *J1* will break the connection between tuner and amplifier, receiving the output of the tuner. The connection will also be broken by a plug inserted into *J2*, and this plug will feed a signal to the input of the amplifier. Similarly, a plug inserted into *J3* will break the amplifier-speaker connection and receive the output of the amplifier. With no plugs inserted and *S1* in position 2, the unit works as a radio.

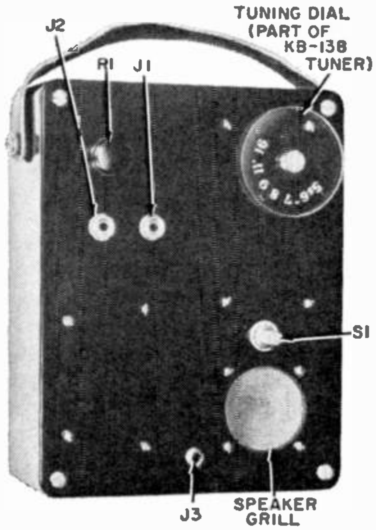
Two special probes, both of which plug into the amplifier input, were constructed for signal tracing and detecting hum. In the signal tracing probe, *D1* acts as a detector and demodulates r.f. signals. The hum-detecting probe contains *L1*, a winding and core from a discarded i.f. transformer. When this probe is plugged into *J2*, any hum picked up by *L1* will be fed to the amplifier input.

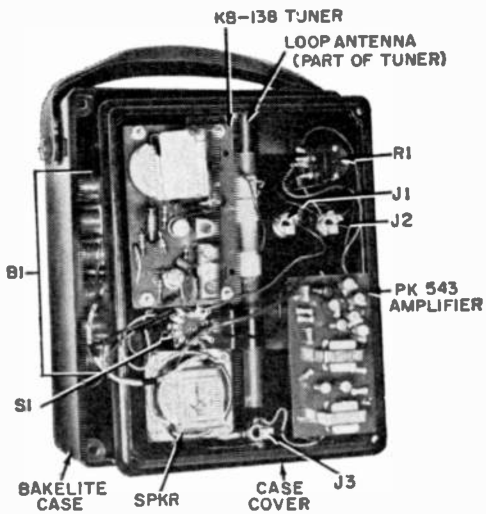
Construction Hints. The Signal Stethoscope is built into a 6¾" x 5¼" x 2¼" Bakelite case. All of the components, except the six penlight cells composing *B1*, are mounted on the case cover. The cells (installed in two holders) are fastened inside the case proper.

Since the two major components of the Signal Stethoscope, the KB-138 AM tuner and the PK-543 transistorized amplifier, are preassembled, construction is rela-

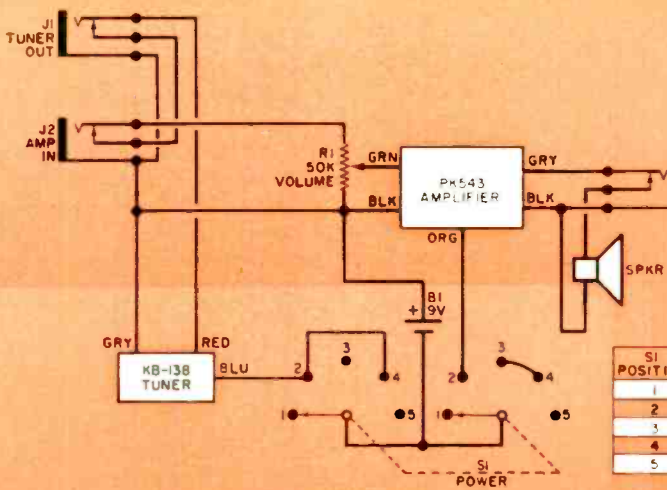
PARTS LIST

B1—Six penlight cells in series
C1—250 μμf. miniature mica or ceramic capacitor (Aerovox type 1468LS or 1469)
C2—500 μμf. miniature mica or ceramic capacitor (Aerovox type 1468LS or 1469)
D1—1N34A germanium diode or equivalent
J1, J2, J3—Miniature closed-circuit phone jack (Switchcraft 42A or equivalent)
L1—Winding and core from discarded i.f. transformer (see text)
R1—50,000-ohm miniature audio taper potentiometer (Lafayette VC-31; switch not used)
R2—10,000 ohms, ¼-watt
R3—27,000 ohms, ¼-watt
S1—2-pole, 5-position miniature rotory switch (Lafayette SW-78 or equivalent)
SPKR—1½" PM speaker with 8- to 10-ohm voice coil (Lafayette SK-61 or equivalent)
1—Transistorized AM tuner (Olson KB-138)
1—Transistorized amplfiier (Lafayette PK-543)
1—6¾" x 5¼" x 2¼" Bakelite case (Lafayette MS-218 with MS-219 cover or equivalent)
2—3-cell battery holders (Keystone 171 or equivalent)
3—Miniature phone plugs (Switchcraft 740 or equivalent)
1—Miniature panel connector, male (Switchcraft 5501 MP or equivalent)
1—Miniature cable connector, female (Switchcraft 5501F or equivalent)
Misc.—Ball-point pen, pill vial, hardware, shielded cable, alligator clips, knobs, etc.



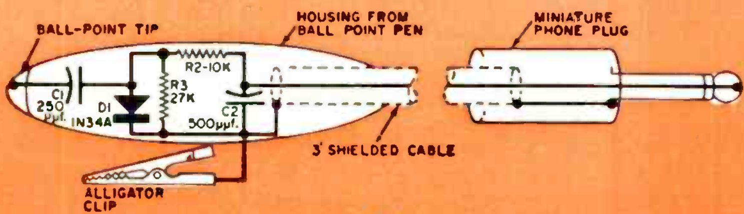


Parts layout is noncritical; the components fit nicely into a Bakelite case of convenient bench size.

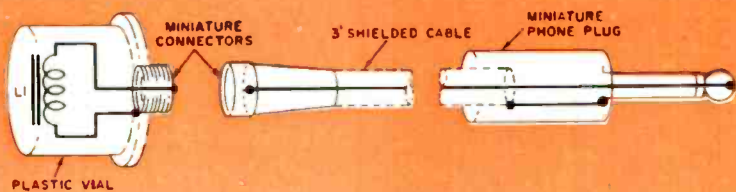


S1 POSITION	FUNCTION
1	TUNER & AMP OFF
2	TUNER & AMP ON
3	AMP ON, TUNER OFF
4	TUNER ON, AMP OFF
5	TUNER & AMP OFF

Wiring the Signal Stethoscope is simply a matter of connecting preassembled units as indicated here.



The signal-tracing probe (left) requires a bit of ingenuity. Miniature components are installed in a ball-point pen housing.



The hum probe (right) is part of a discarded i.f. transformer and a miniature connector installed in a plastic pill vial.

tively easy. The loopstick antenna with the tuner comes disconnected; this is mounted and wired in after the tuner is in place. Discard the tuner battery holder and snip off the battery leads and connector supplied with the amplifier.

The amplifier's two orange leads are meant to be connected to a volume control-mounted, on-off switch. Since a different arrangement is used, cut off the orange lead running to one of the (now disconnected) battery leads and leave the other one intact. Five amplifier leads remain: one green, one gray, one orange, and two black. The black leads are both grounds; it's convenient to use one for the speaker circuit and the other for the input and power circuits (see the schematic). The tuner has three leads (gray, red, and blue) which are connected as shown in the diagram above.

Mechanical Assembly. Parts layout is not at all critical; you should have no trouble fitting everything in the case specified. Both the tuner and amplifier boards are mounted with 4-40 screws and nuts. Fiber or rubber washers are slipped over the screws to provide clearance between the circuit boards and the panel of the Bakelite case.

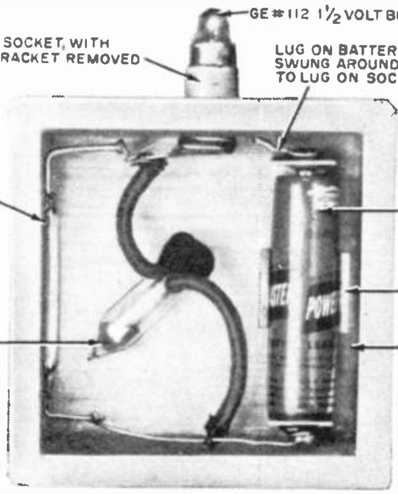
A grille for the speaker can be made by simply drilling a series of holes in the front panel. The author cut one large hole and covered it with a section cut from a wire mesh gasoline filtering element (available at most auto supply houses). Drill holes for the three jacks, *R1*, and *S1*, and mount them. Position the loopstick antenna near the radio;

(*Continued on page* 78)

WHAT'S a "What's What Light?" As far as your friends are concerned, it can be anything; a mechanical fortune teller, a lie detector, a mystery light, or just a handy switchless flashlight—only *you* know the secret of its operation, and, "what's what."

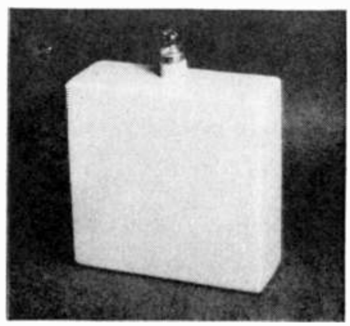
There are no protruding switches, no holes in the case. How does it work? Simple. Just turn it on its side and the light shines brightly. "Ah-ha," someone says, "a mercury switch." Let him think he has discovered the secret, and then turn the box *upright*. Bring your hand close to the box—without touching it—and light the bulb a second time!

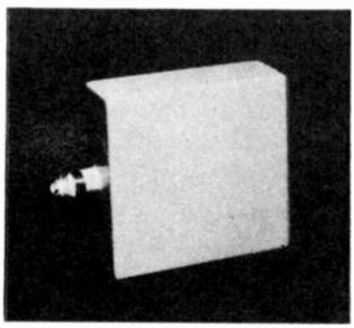
In the first case, the actuating device is, of course, a small mercury switch (Burstein-Applebee Cat. No. 17A994 or equivalent). In the second example, the switch is of the magnetic proximity type—a glass-enclosed reed switch which closes when a small magnet, hidden in the palm of your hand, is brought near the side of the box. Reed switches complete with magnets are available from several suppliers (Radio Shack Cat. No. 27K95L486 is one) for under $2.00.



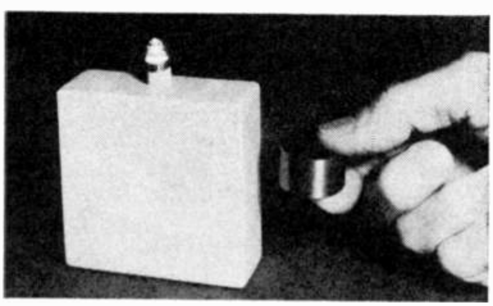
What's What Light

By ART TRAUFFER





The secret? Let friends try to guess, then prove them wrong. When box is placed on its side, the light shines as shown at right. When box is upright, the light remains off unless a small magnet is brought near side of box (photo below).



The light shown here was built in a 3" x 3" x 1⅜" wooden box made of ¼" stock, but almost any housing can be used. Gouge a groove in the side of the box for the reed switch and position the mercury switch as shown. The two switches are wired in parallel, and in series with battery and bulb. Fasten the box together with small brads, sand and finish, and you'll have your own "What's What Light." —30—

Extracurricular Education

a Carl and Jerry Adventure

By
JOHN T. FRYE
W9EGV

ON A WARM, moonlit July evening, Carl and Jerry were enjoying a couple of cold root beers at a drive-in when a rakish white convertible with the top down pulled up alongside. The two young men sitting on the red upholstery of the front seat hailed them with boisterous friendliness.

"Look, Phil," said the driver to his companion; "it's the Wireless Boys. Hiya, Carl; hiya, Jerry. How are the prides of Old Parvoo?"

"Humbly grateful to be recognized by the driver of a dreamboat like that," Carl retorted, recognizing Phil Briggs and Dave Hayden, friends home from an Eastern college for the summer. "You must have saved a lot of trading stamps for that set of wheels, Dave."

"Nope, my uncle gave it to me for making the dean's list," Dave answered. "Come on. Get in and live a little. All I need is a chance to show it off."

Carl and Jerry needed no second invitation. They pulled their car around behind the root beer stand and piled into the back seat of the convertible.

"Hey, Dave, what's that bright little white light I noticed in the middle of your grille?" Jerry wanted to know as they rolled out into the street.

"That's a 'running light,'" Dave explained. "Lots of drivers are putting them on as a safety feature since they were written up in the *Indianapolis Star*. It's just a twenty-one candlepower white light like the truck marker lights. You mount it in the middle of the grille and as near on a line with the headlights as possible, and wire it into the ignition switch so that it comes on whenever you start the car. It really shows the other guy that you're moving or getting ready to."

The boys covered the town in the next hour. First they circled all the drive-in eating places. Next they followed a carload of girls in another convertible, exchanging flirtatious quips with them until a train at a crossing separated the cars. Finally Dave demonstrated how his car could screech the tires while rounding a corner at high speed and how the tires could make two long black marks on the pavement when the accelerator was suddenly floored.

Carl and Jerry, who had great respect and even affection for anything mechanical, winced at this abuse but said nothing. After all, it was Dave's car, and if he wanted to drive it like a member of the teen-age Silly Set, that was his misfortune.

Then Dave drove out of town onto the

highway and really stuck his foot into the fan.

"Ease off, Dave!" Jerry shouted when the speedometer was touching 95 miles per hour. "You've convinced us your car can really roll. Carl and I have to get home."

"Aw, Dave, let's take them out on that old abandoned river road and show them how this car can take the bumps," Phil suggested.

"Yeah, fellows, this won't take long," Dave said as he pulled off the highway onto a mile-long lane that ran to a stretch of road along the river. The road had been abandoned ever since the new highway had gone through a few years before, and, without maintenance, the pavement had cracked, had been heaved up by the frost, and had developed huge chuckholes. Fishermen parked their cars on it occasionally; otherwise it was not used.

"Fasten your seat belts, men," Dave said when they reached the broken pavement. "I won't need mine because I have the wheel to hang on to. Now watch how this sweet little buggy keeps an almost even keel while I make like the mad driver in the TV commercial."

Carl and Jerry barely had time to fasten their belts as the car leaped ahead along the rough roadway. It swayed crazily from side to side as Dave tried to miss the deepest of the holes.

Gaining speed, the heavy car shot over the crest of a sharp rise and for a sickening moment was actually air-borne and spinning at the same time. It came down with a tremendous thud and started rolling over. Carl and Jerry just had time to duck down and wrap their arms around their knees when the car rolled off the road and down over a steep bank toward the river. End-over-end, side-over-side it went, and finally came to rest upside down amid a shower of glass from the broken windshield.

THERE was a deathly silence after the deafening noise. Carl found himself hanging upside down by his seat belt. Cautiously he loosened the buckle and eased himself down on a flinty-hard surface. "Jerry . . . Jerry," he called into the darkness, "are you all right?"

"I will be if you get your big feet out of my face," Jerry answered, slipping out of his belt and crouching on the ground beside Carl.

"How about you, Dave and Phil?" Carl said. "You guys okay?"

"Does having a broken leg disqualify me?" Dave's voice, with a note of hysteria evident in it, came faintly from somewhere outside the car.

"Forget the wise-cracking and tell us what kind of shape you're in," Carl demanded.

"So who's wise-cracking? I was thrown out when the car rolled over, and my right leg's broken just below the knee. You better shut off the ignition and cut the light switches. We don't want a fire."

It was hard to orient one's self in pitch darkness beneath an upside-down car, but Carl finally managed to crawl forward underneath the bucket seat on the driver's side and turn off the switches. As he started to back out, his hand brushed a limp body hanging head down in a seat belt. A cold chill ran up his spine, but he forced himself to feel Phil's lifeless-looking wrist. The pulse was weak, but it was beating.

Working carefully in the cramped quarters, Carl loosened Phil's seat belt and eased him down onto the hard limestone that bordered the road along the river. As his hand touched the unconscious youth's head, he felt something warm and sticky that he was sure was blood.

"Phil's hurt and unconscious," he reported between grunts while he delivered lusty kicks against the closed doors of the inverted car. "Dave, why can't I get these doors open? How is the car resting?"

"It's wedged in the bottom of a kind of pocket in the limestone," Dave answered. "The slanting sides are holding the doors shut. The hood's torn off, and the whole front end is sticking out over the edge of a ledge. I'm lying under the front looking up at the motor. If the car had gone over the ledge, I'd have been squashed. Why aren't you and Jerry mashed?"

"There's more room under here than you'd think," Jerry said as he explored their prison with his hand. "We're resting right on top of a hollow in the limestone, and I'm sitting up without my head touching the floor, but the only opening I can find is a little space about two inches high and a foot long between the middle of the cowl and the ground."

"See if you can find a penlight in the glove compartment," Dave suggested.

When Carl opened the glove compartment, the light inside came on and illuminated the interior of the car. It showed Phil's pale fale and closed eyes and a deep cut on his forehead from which blood was oozing. The penlight was passed out through the narrow slit to Dave down below.

"Suppose you could hobble to get help?" Carl asked Dave. "Phil needs a doctor pretty badly from the looks of him."

"I'll try," Dave's voice answered. They heard him moving around, and then there was the sound of a body falling heavily to the ground. Only after they called to him a number of times did he finally answer weakly: "Sorry, you guys, I passed out. It's no go with this leg. I just conk out when I try to move on it."

"Just lie still," Jerry told him. "We'll think of something. Maybe we can attract attention with the horn." But when he pushed the horn button there was no sound except the clicking of the relay.

"That's no good; the horn is smashed," Dave said, his voice quavering. "So are the headlights. No one would see or hear them anyway. I know they'd never see this little flashlight. You guys can't get out. I'm out, but I can't go anywhere. It may be days before we're found. Phil is hurt . . ."

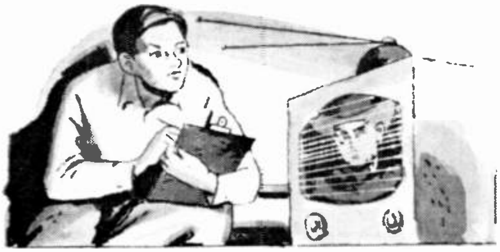
"Let's not waste time punching the panic button," Jerry said crisply. "I've got an idea, but it'll take a few feet of wire. Do you see any we can get?"

"The running light has about ten feet," Dave replied. "You can cut it loose from the switch inside and I can cut it loose out here."

Jerry whipped out his pocket knife and cut the wire loose from the switch. Three feet was cut off and the insulation stripped from both ends. One end of this short piece was shoved out to Dave.

"Strip insulation from the low-voltage lead going from the ignition coil to the distributor and wrap the end of this wire around the bare spot," he directed. "Then pull the high-tension lead out of the coil and stick the bared end of the long piece of wire into the socket. Scrape the insulation off this wire at a place close to the coil and fasten this bared spot so that it's about an eighth of an inch from the motor block or the metal car frame. Fasten it so it'll hold and throw the loose end of the wire on top of some bushes so it doesn't touch the ground. Can you do everything?"

"I *will* do it!" Dave promised. "I got us into this mess, and I can certainly help get us out."



SOS . . . *trapped under wrecked car on river road*

"Mind telling me what you've got in mind?" Carl asked Jerry as they heard Dave fumbling around the front of the car.

"I'm going to try to make a spark transmitter with the ignition coil," Jerry answered. "The battery current from the ignition switch goes through the primary of the coil back to ground through the points inside the distributor. When I rub the end of this short wire against the metal body of the car, the contact will be in parallel with the points and the voltage-boosting capacitor across them. The current surge through the primary will induce a high voltage in the secondary that will arc across the spark-gap Dave is fixing up. The rest of the wire will act as an antenna to radiate the r.f. energy in the arc."

"Why not use the high-tension lead to make your spark gap?"

"It's probably the resistance type designed to reduce ignition interference to radio and TV and would keep us from getting out."

"How are you going to key it?"

Jerry was busy cutting a series of close-spaced notches through the paint

(*Continued on page* 89)

Short-Wave Broadcast Predictions

JULY 1963

By STANLEY LEINWOLL
Radio Propagation Editor

FROM May through August, and particularly during June and July, there is a considerable increase in the number of sporadic-E clouds formed in the ionosphere —even more so in low-sunspot years like this one. Sporadic-E clouds are regions of extremely high ionization density which can reflect frequencies much higher than the ionosphere's normal F-layers are capable of returning to earth. Last summer record numbers of E-skip interference cases were reported on the lower television channels, and this type of interference is expected to be just as bad this summer. Because of the ionospheric activity, short-skip openings from *Voice of America* transmitters beamed overseas on 15 and 17 mc. should occur frequently during daylight hours up to about 1000 miles from the major transmitting sites in New Jersey, North Carolina, Ohio, and California.

TIME (EST)

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

TIME (CST)

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

TIME (PST)

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

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

VOA GREENVILLE—ON THE AIR

THE WORLD'S largest and most powerful long-range radio facility is on the air. Operated by the U. S. Information Agency from the vicinity of Greenville, North Carolina, it is broadcasting America's story to the world. The power output—4.8 *million* watts—is equivalent to that of 96 of America's 50,000-watt medium-wave commercial stations!

The Greenville site covers nearly 6200 acres, broken into three separate areas: one for receiving, and the other two for transmitting facilities. The two transmitting sites each occupy some 2800 acres. To maintain full operations at Greenville requires the services of 100 people who work in shifts around the clock.

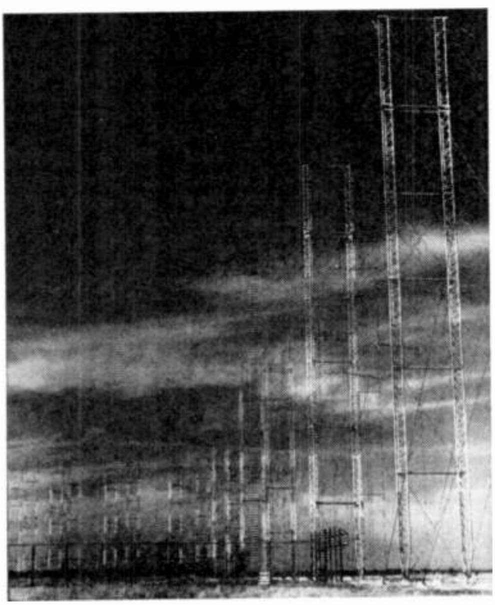
Thanks to Greenville, some 21 years after the *Voice of America* was born the U. S. can broadcast with a "loud and clear" voice to Latin America, Europe, and Africa. In addition, the new receiving-transmitting complex provides *VOA* stations in Europe, the Mediterranean, and Africa with more reliable and higher quality programs for relay to their respective target areas.

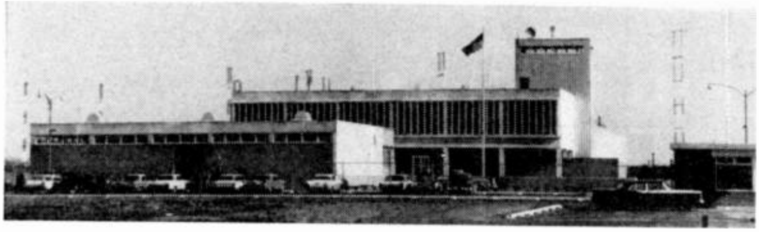
Over-All Picture. There are numerous ways to communicate with foreign countries, some of which are newspapers, pamphlets and magazines, motion pictures and photographs, telephones and teletype machines, exhibits, and personal verbal contacts. However, radio broadcasting is a unique means of communication in that radio waves cannot be stopped at national boundaries.

Even the 2000-odd jamming transmitters that are used by Communist-bloc countries fail to effectively block the *VOA* or defeat its basic purpose—to spread the truth to all corners of the earth. Such a tremendous job of jamming, if attempted by the U. S., would cost in the area of $150,000,000 yearly. Compare this with the $22,000,000 which is the annual operating cost of the entire *VOA* network, of which some $2,500,000 is budgeted for operation of the Greenville station. A considerable portion of that annual cost will be offset by the retirement of obsolete *VOA* stations at Wayne, N. J., and Brentwood and Schenectady, N. Y.

The Greenville station boasts six transmitters rated at a half-million watts

Directional antennas at transmitter site at Greenville. Utilizing specially designed equipment, programs are fed through various antennas from one transmitter.





This is one of the two transmitter buildings at Greenville. A separate building houses the receiving facility. VOA in Greenville has 22 transmitters and 96 directional antennas.

each, six quarter-million-watt units, six 50-kilowatt transmitters, and four little 5000-watt'ers. Broadcasts are beamed through 96 directional antennas. But the new equipment at Greenville by no means makes up the entire picture of the *VOA*'s current expansion in broadcasting.

Existing *VOA* stations in Dixon and Delano, Calif., and in Bethany, Ohio, are being modernized. New antennas have been constructed for the U. S. Information Agency's station in Free Berlin to enable that station to increase its effective power by five times for night broadcasts to blanket East Germany. Six transmitters leased by the *VOA* from the British Broadcasting Corporation in Wooferton, England, are being increased in power to 250,000 watts each. A major relay station is being built near Monrovia, Liberia, the site of a currently operating mobile station. The U. S. Coast Guard Cutter *Courier,* anchored off Rhodes in the Mediterranean, will have its transmitters replaced by more efficient land-based stations.

Other mobile units are now in operation in Marathon Key, Florida, and beamed strongly toward Cuba—tune for them on 1180 kc. in the medium-wave band. Three other medium-wave outlets (rated at *one million watts* each!) are located in Munich, Germany; the Philippines; and Okinawa.

Programming. The *VOA* was born on February 24, 1942, to "tell the truth" to the world, and has never deterred from

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, 15,315, 9580	2030, 2130, 2230, 0745
Bulgaria	Sofia	6070	1900, 2000, 2300
East Congo	Leopoldville	11,755	1630, 2100, 2230
West Congo	Brazzaville	11,725	2015
Czechoslovakia	Prague	11,990, 9795, 9550, 7345, 5930	2000, 2330
Denmark	Copenhagen	9520	2100, 2230
West Germany	Cologne	15,405, 11,795	1010
		9640, 6160	2035
		11,795, 9735, 6145	0000
Hungary	Budapest	11,890, 9833, 7220	1900
		9833, 7220, 5960	2230
Italy	Rome	11,905, 9575	1930, 2205
Netherlands	Hilversum	9715, 11,710	1625 (exc. Sun.)
		6035, 9630	2030 (exc. Sun.)
Portugal	Lisbon	6185, 6025 (or 9740)	2105, 2305
Spain	Madrid	9360, 6130	2215, 2315, 0015
Sweden	Stockholm	17,840, 7270	0900, 2045, 2215
Switzerland	Berne	11,865, 9535, 6165	2030, 2330
U.S.S.R.	Moscow	(announced) 9650, 9570, 7320, 7250, 7150, 7130, (also monitored) 7230, 7200, 7110, 7070, 7030	1700, 1900, 2000, 2100, 2300, 0000 0040
Vatican City	Vatican City	9645, 7250	1950

DX Awards Presented

Awards have been issued for 25 countries verified to the following DX'ers, in the order in which they appear. Congratulations to all of you!

David Zuehlke (WPE9FPL), West Bend, Wisc.
C. McKinstry (WPE6CXS), San Bernardino, Calif.
Irwin Belofsky (WPE2BYZ), Brooklyn, N. Y.
Robert E. Jewell (WPE9EX), Crown Point, Ind.
Henry Mendenhall (WPE3BQX), Glenolden, Pa.
Thomas Bell (VE4PE4Q), Winnipeg, Man.
Bill Harrison (WPE4FSJ), Nashville, Tenn.
Amedeo Calviello (WPE2FAE), Brooklyn, N. Y.
C. T. Langlais (WPEØCRH), Grand Junction, Colo.
Charles Matterer (WPE6DGA), San Leandro, Calif.
Charles Morrissey (WPE2IIT), Bellerose, N. Y.
Robert Davis (WPE5AUR), San Antonio, Texas
Michael Schieman (WPE4DNI), Decatur, Ga.
John Otey (WPE5DV), Tulsa, Okla.
R. Force (WPE2AWH), Berkeley Heights, N. J.
Russell Anderson (WPE8DFW), Muskegon, Mich.
Serge Nuemann, II (WPE6AKA), Culver City, Calif.
Marshall Hopper (WPE2EYT), Syracuse, N. Y.
Dave Siddall (WPE1EBN), Hyannis, Mass.
James Albrinck (WPE8AZJ), Reading, Ohio
John Berg (WPE7BGF), Seattle, Wash.
Jim Phelps (WPEØCGE), Davenport, Iowa
Jerry McMahan (WPEØSS), Cedar Rapids, Iowa
Andrew Kasparson (WPE1DFW), Auburn, Mass.
Gary Frankeberger (WPE9DBO), Normal, Ill.
Richard Mills (WPE2HOZ), New York, N. Y.
Arthur S. Mullins (WPE9FUW), Oak Park, Ill.
Jack Elias (WPE3CKI), Philadelphia, Pa.
Paul Lange (WPE8FGN), Flint, Mich.
Joseph Liberatore (VE7PE4R), Victoria, B. C.
James Coston (WPE5CEP), Corpus Christi, Texas
Gerry Klinck (WPE2FAH), Buffalo, N. Y.
Emil Lenchak (WPE3AIR), Hazleton, Pa.
Philip Cutler (WPE9EFL), Barrington, Ill.
John Harvey (WPE2EG), Lewiston, N. Y.
Bernard Bastura (WPE1EID), Middletown, Conn.
Otto Barz (WPE2HVW), Flushing, N. Y.
Pete Mondron (WPE8CES), Mt. Vernon, Ohio
Glen Fornwalt (WPE3COM), Lancaster, Pa.
W. Chapman (WPE1DRZ), Middletown, Conn.
William Fields, Jr. (WPE4EPP), Macon, Ga.
Donald Reinholz (WPE8CRH), Detroit, Mich.
Ronald Walsh (VE3PE1BQ), Kingston, Ont.
Bruce Orcutt (WPE4ENZ), Brandon, Fla.

that policy. It has been estimated that the daily number of listeners is in the tens of millions and at times may run well into the hundreds of millions, especially during periods of world crises. In 1962, the *VOA* received over 200,000 letters from foreign listeners.

The U.S.I.A. has arranged *VOA* programming so that it will be heard in homes around the world at peak audience listening times, usually in mornings and/or evenings. In addition to the regular broadcasts, some 260 stations in 15 Latin American countries rebroadcast *VOA* programs by direct pickup or by taping them for future use. The high power of the new Greenville station will give such pickups better clarity.

Newscasts from the *VOA* are given in 35 languages, although as many as 60 languages may be used in the preparation of taped programs for rebroadcast over thousands of medium-wave local stations. The total broadcasting time, at the end of 1962, was 740 hours weekly.

The *VOA*'s broadcasting time is topped only by Red China (787 hours) and Moscow (1205 hours). Communist-controlled stations, as a whole, broadcast approximately 3800 hours of weekly international programs, but this figure is misleading since it also includes all of their own national and satellite countries' transmitters as well as clandestine radio transmitters that mask their identities with various pseudonyms.

The Greenville Station. The city of Greenville, which has a population of about 23,000, is 265 miles south of Washington, D. C., in the fertile coastal plain

(*Continued on page* 84)

The Master Control Panel at the receiving station of the USIA's new broadcast complex at Greenville.

On the Citizens Band

with **MATT P. SPINELLO,** 18W4689, CB Editor

LEGALLY and quite conveniently (and probably to the surprise of many readers), hobby-type two-way radio has been permissible between 26.965 and 27.275 mc. ever since the birth of CB in 1938. The legal scope of this type of operation includes such goings-on as working "skip" stations, unlimited length of transmissions, ham-type communications (CQ's included), and the use of c.w.—all allowed by the FCC and without a license!

CB PACKAGE FOR THE HOBBYIST

We're referring to 100-milliwatt handie-talkie type equipment, of course. For what used to be obvious reasons, 100-mw. units have rarely been utilized for anything other than short-distance communications, mostly line-of-sight operation. Under the Federal Communication Commission's rulings contained in Part 15, this equipment lent itself to a number of applications right from the start, but was never as practical as higher-powered 5-watt CB equipment—at least not until recently.

While it doesn't seem likely that 100-milliwatt gear will replace the 5-watt units, the fact remains that interest in the lower-powered equipment has been increasing, and much of this interest might easily lead towards the procurement of amateur radio licenses—as farfetched as that may seem!

We're constantly on the lookout for methods and measures that might be instituted to take the pressure off the Citizens Band, yet still allow the self-appointed hobbyist a place to "hobby," and the serious-minded rule-abiding CB'er a place to communicate without interference. Without a doubt there is a need for such a separation, and at this stage of the game each type of operator is deserving of his own distinctive "corner to communicate"!

In the May issue of POPULAR ELECTRONICS, we mentioned International Crystal Manufacturing Company's petition to the FCC that a hobby class license be established in the 29.405-29.595 mc. region, carrying a maximum power input limitation of 10 watts. While this pot brews, International Crystal has taken a step in another direction by creating a 100-mw. "Part 15 package" that legally permits the hobbyist to practice ham-style communications without getting in anybody's hair, and with much more range than might be expected.

Obviously a big question here would be how anyone could possibly derive as much "communicativity" from one-tenth of a watt as with 5 watts. It stands to reason that a handie-talkie at ground level is not going to put a New Jersey "Jaunter" directly in touch with a Connecticut Clambake. But if conditions were right, the New Jersey talkie might "skip" all the way to Illinois, and quite legally!

Better still, if the New Jersey talkie were

The roof-mounted portion of International Crystal's 100-mw. Model 1500 includes transmitter, antenna, and receiver preamplifier. No license is needed for either phone or c.w. operation on the 11-meter band.

perched *atop a roof,* the operator might be surprised to find that he could chatter almost as far with a hand-held unit as with his 5-watt rig. Granted, 5 watts on the roof would give greater range, but considering the huge ball of coax that has to be unwound from the output of the 5-watt rig to the rooftop, the operator is lucky as he has 1 watt left fighting its way out of the antenna. Furthermore, if an efficiently selective receiver is made part of the 100-mw. Lilliputian system, a whale of a lot of communicating can result.

International Crystal's Model 1500 "Executive" transceiver, which permits phone and c.w. operation on 11 meters without a license, may well be the outcome of this line of thought. Since the transmitter and antenna are *combined for rooftop mounting,* maximum power goes into the antenna. In the house, a second unit contains a supersensitive receiver/exciter. A receiving preamp at the antenna boosts weak signals for better reception.

To round out this Part 15 package, the Model 1500 comes complete with eight sets of crystals plus a special socket on top of the unit for adding a chosen ninth channel. A key for c.w. operation is also included, providing the potential ham with an opportunity to put the code to actual on-the-air use.

Perhaps this type of equipment will ease the CB pains of yesterday and today by allowing the future communications expert the chance to get his foot in the door without kicking anyone in the process. Most important, he won't be hobbying illegally and can still enjoy a type of two-way communications to his heart's content.

The flea-power output of the 1500 is surprisingly effective: there are no transmission line losses. The part of the unit that goes on the roof can be mounted on a chimney, or on a tri-mount and mast.

Your CB Editor, shown here with the control part of the 1500, installed the unit in his back yard temporarily, and worked a moving handie-talkie for several blocks before a 5-watter QRM'ed him out.

Tech Tips. With summer weather luring the out-of-doors man to every conceivable type of sporting pleasure, it's a sure bet that several thousand CB units will be installed in all types of boating and camping equipment during the next few months. The Champion Spark Plug Company has published a useful list called "10 Tips for Good Marine Reception." If you're a boating enthusiast, take heed. They're definitely worth considering!

(1) Use a marine-type approved antenna—not an automotive type—and one that has proper electrical characteristics for the frequency on which it is to operate.

(2) Install the antenna on the opposite side of your remote control engine panel and as far forward in the bow as possible.

(3) Use a shielded lead-in wire. Ground the metal braid to the radio cabinet.

(4) Fiberglass and wooden boats will require at least a 12 sq. ft. under-hull ground plate or a commercially available radio ground plate for best results.

(5) Plate should have only one (#10) grounding wire connected to the negative battery post.

(6) All pieces of electronic and electrical equipment should terminate their grounds at the negative side of the battery, not directly to the plate.

(7) Interference from small electric motors (windshield wipers, bait wells, bilge pumps, etc.) can be eliminated by installing

Through a CB setup with "Mom," young Joey Guy has a guide as he crosses busy intersections on his way to school each day. See "Walkie-Talk" below.

a generator capacitor from the hot input lead to ground. The capacitor should be installed as near the offending device as possible.

(8) Metal boats do not require a ground plate, provided the electrical system is grounded to the hull. If possible, route all wiring under the metal rails of the boat.

(9) Check all boat wiring—be certain no wires run through a leaky bilge.

(10) Do not handle radio equipment, especially transmitting equipment, when standing in bilge water or when wearing water-soaked shoes. It is best to disconnect the hot lead or remove the line fuse when working on electrical equipment.

Tips 5 and 6 protect your boat and engine from electrolysis. Tips 9 and 10 protect *you* from electric paralysis!

Walkie-Talk. Last winter we mentioned that a couple of midwestern youngsters would be in instant contact with their homes while trekking through heavy snow and cold and crossing busy intersections. In the accompanying photo, Joseph Guy is shown proudly displaying his "direct-line-to-Mom." We understand the picture was taken on a 22-below-zero day just before Joey was camouflaged with heavy scarf, Russian-type headgear and mittens.

Standing by at the base station 5-watt CB unit, Joey's Mom audibly guided him across busy intersections by reminding him to look both ways before crossing and having him call back as soon as he had reached the other side. The CB system also enabled her to prod him along his path, lest he become an ice cube, until he finally reassured her that he had entered the heated school building.

The only problems encountered with the operation were in getting Joey to remember to turn the unit off (thank Heaven for rechargeable batteries), and the time spent answering phone calls each morning from mothers wanting to know if their children had arrived at school safely; children that were last seen following a little guy who was "holding something in his hand with a long wire sticking out of one end!"

CB Jamboree's. On July 14, The Wabash Valley Citizens Radio League will hold its annual Citizens Band Jamboree at Turkey Run State Park, located north of Terre Haute, Indiana. Last year's event drew some 2500 CB enthusiasts. This year the WVCRL offers a bundle of prizes along with huge displays from many manufacturers.

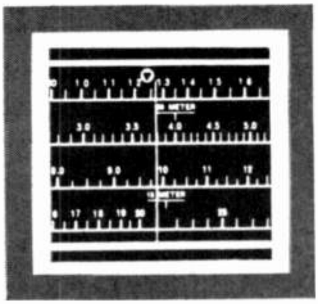
The Southern Tier CB Radio Club of Binghamton, N.Y., will hold its first Jamboree on Saturday, August 3, at Ross Park. A well-rounded program and prizes are promised. For more information, contact Robert T. Reagan, 86 South Washington St., Binghamton, N.Y.

Basil F. Petty informs us of the South Western Ohio Citizens Band Association's sponsorship of its First Annual Nationwide CB Jamboree to be held Sunday, August 25, 1963, at Lebanon Fairground, Lebanon, Ohio. The club has announced an *exclusive* premier showing of the newest concept in CB equipment. There will be $500 in prizes, food, entertainment, exhibits and displays. Proceeds of the event will be turned over to a national charity. For more information, Basil may be contacted at P.O. Box 231, Mason, Ohio.

Two other coming events are: The Cereal City C-B Radio Club Jamboree, Kellogg Airport Hangar #4, Battle Creek, Mich. to be held on July 27; and the 1963 Round-Up of the Maumee Valley C-B Radio Association, Inc., Hessen Cassel Hall, Fort Wayne, Ind., on September 22.

Club News. The Chateauguay General Radio Club of Canada finds itself with a membership of 20 after only two weeks of existence. While this is basically a suburban organization, Moe Edwards states that a few member stations are located in Montreal. The club monitors all channels, but keeps channel 20 available for pertinent club activities. They have already drawn up their rules and operating procedure and are presently working towards a network of communications to provide constant service for those in need. The CGRC will also publish its own news bulletin shortly. Interested

(*Continued on page* 90)



Across the Ham Bands

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

MAKE YOUR SIGNAL REPORTS MORE ACCURATE

HOW CLOSELY does your communications receiver S-meter agree with the standard amateur R-S-T signal reporting system? On 80 meters, for example, does the S-meter pointer hover well up on the meter scale even when no signal is tuned in, and do fairly strong signals pin the meter? But on 10 and 15 meters, are all meter readings much lower? If so, you have a typical S-meter.

Most S-meters are subject to large errors, as communication receiver operating manuals usually state. Fortunately, however, these errors can be practically eliminated—without modifying the receiver or S-meter in the slightest. Here's how to do it:

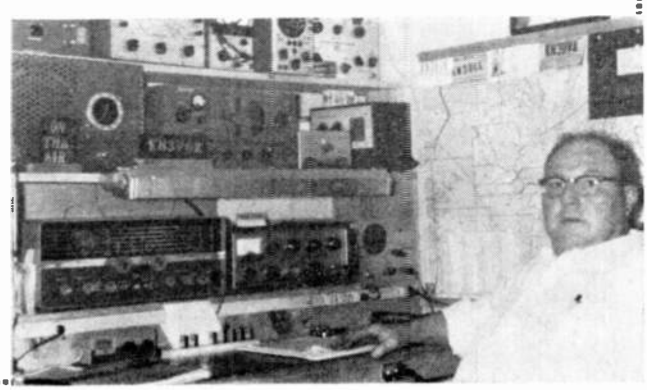
Adjust the receiver in the normal manner at a time when static and other external noises are low, tune it to a spot where no signals are being received at the moment, and write down the S-meter reading. This will be your true SØ point, no matter what the actual meter reading is. Next, locate a signal you can just barely hear, and note the new S-meter reading. This will be your new S1 point.

To establish your true S9, refer to your logbook and copy the S-meter readings of the strongest 10% of the signals you have logged over a period of random listening until you have compiled a list of about 20 reports. (Exclude the extra-strong signals of your immediate ham neighbors from the list.) Convert "db-over-9" reports into equivalent S-units by dividing the number over 9 by six; then add the answers to 9; 30 db over 9, for example, would be equivalent to S14. (Convert any fraction to the nearest whole number.)

Next, add the reports together and divide the sum by the number of reports you used, to get the average value. If the answer is greater than 9, subtract 9, and divide the remainder by 6. This puts the answer back into the conventional

Novice Station of the Month

This month's free subscription goes to John B. Becker, KN3VGR for his well equipped, efficiently organized station layout. Notice that transmitter and receiver are raised off the desk enough to put the controls and dial at a comfortable operating height; a "must" if fatigue is to be kept to a minimum during those long hours chasing elusive DX. John's big real complaint is that someone didn't steer him into amateur radio forty years ago. The General exam is his next objective.



Ron Ferris, KN1ZSY, of 18 Whittemore St., Concord, Mass., son of notable DXer W1HZ, bagged 41 states and seven DX QSO's in his first 10 weeks on the air.

db-over-9 form. This final answer will determine the new S9 point on your S-meter.

Finally, divide the number of divisions on your S-meter scale between your new S1 and S9 points by 7 to locate your new S2 through S8 points. Then put all this information into neat chart form, preparing a separte chart for each ham band of interest to you.

Your S-meter will now be accurately calibrated for your location and antenna system. As a result, your signal strength reports will be true evaluations of the strengths of the signals you hear, whether they are weak or strong.

Incidentally, if the meter turns out to be excessively "scotch" on some bands, resulting in weak signals not registering on the S-meter, use the signal-strength table to evaluate the strength of readable signals too weak to register on the meter.

FCC Notes. Mobile logging rules have been simplified. Effective March 21, 1963, the Federal Communications Commission modified section 12.136(a) of its amateur rules to provide that, during a period of continuous mobile operation, the mobile operator need only log call-signs of stations worked (and CQ's) at his first opportunity, such as a stop for service or refreshment, *provided that* he also logs the date and the starting and ending times of each period of continuous mobile operation.

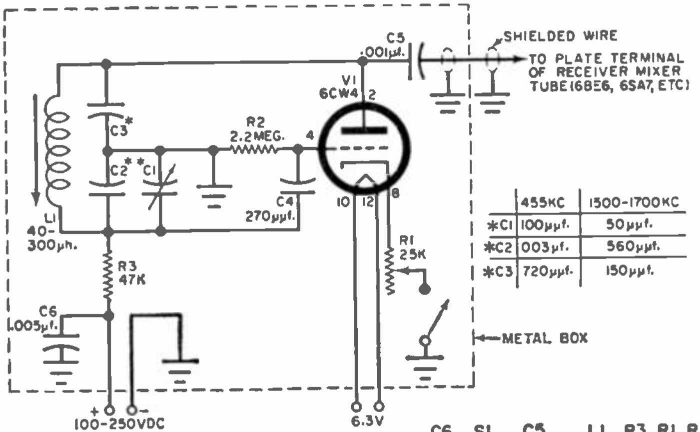
Also, the FCC has finally revoked the license of a K8 and issued orders to show cause why the licenses of a W1 and a WA4 should not be revoked. The reason for the action in each case was the *failure to reply* to official notice of violation of FCC regulations. In other words, these misguided hams probably moved and neglected to have their licenses modified for their new addresses. As a result, they never received their mail from the FCC.

Delores Y. Hovendick, K1VGH, 164 Lois St., Manchester, N.H., shares this rig with husband Jim, K1TLT. Having nothing else to do (except raise four children, bowl in two leagues, teach Sunday School, and sing in the choir), De worked most states as a novice before pausing to acquire her General ticket.

If you move, be sure to have your license modified for your new address immediately—even if you don't plan on getting on the air from the new location right away. Some one else might "borrow" your call letters, or your call could be miscopied by a monitoring station; in either event, *you* would be in trouble if you didn't reply to the notice, even though you were innocent of the violation.

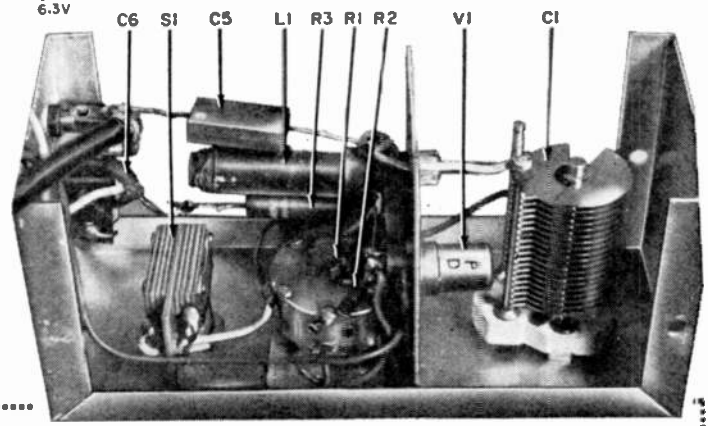
NUVISTOR Q-MULTIPLIER

Regular readers of our "News and Views" section have undoubtedly noticed that many equipment descriptions include something like "I use a 'you-name-it' receiver, *plus* a Q-multiplier for additional selectivity." A Q-multiplier is a regenerative circuit connected to the i.f. amplifier of a superheterodyne receiver to modify its selectivity characteristics. The simple Q-multiplier described here, which utilizes a nuvistor, will increase the ability of an inexpensive communications receiver to separate signals up to 10 times or more.



	455KC	1500-1700KC
*C1	100μμf.	50μμf.
*C2	.003μf.	560μμf.
*C3	720μμf.	150μμf.

As with other Q-multipliers, the nuvistor version makes use of controlled regeneration to boost selectivity.



Construction in the type of box shown permits parts layout for good electronic function and easy assembly.

PARTS LIST

**C1—100-μμf. (50-μμf.) midget variable capacitor*
**C2—0.003-μf. (560-μμf.) mica or silver mica capacitor*
**C3—720-μμf. (150-μμf.) mica or silver mica capacitor*
C4—270-μμf. mica or paper capacitor
C5—0.001-μf. mica or paper capacitor
C6—0.005-μf. mica or paper capacitor
L1—40-300 μh. slug-tuned coil (Miller #2002 ferrite rod loop antenna or equivalent)
R1—25,000-ohm potentiometer, linear taper
R2—2.2-megohm, ½-watt resistor
R3—47,000-ohm, ½-watt resistor
P1—Single-contact "phono" plug or equivalent
S1—S.p.s.t. switch
V1—6CW4 nuvistor
1—2¼" x 2¼" x 5" aluminum box (Bud #2104A or equivalent)
Misc.—Insulated tie points, shielded wire (RG-59U or equivalent), etc.

**First values are given for 455-kc. i.f. amplifiers; values in parenthesis are for i.f.'s in the 1600-kc. range.*

Construction notes. The frequency range of the Q-multiplier must match the receiver intermediate frequency; therefore, part values are included in the parts list for units to operate in both the 455-kc. and 1600-kc. i.f. ranges. The unit is built in a 5" x 2¼" x 2¼" aluminum, utility box; the small size of the nuvistor permits uncrowded construction. Although parts placement is not critical, the general arrangement shown in the photograph is recommended.

Refer to your receiver instruction manual in connection with the following step. The 6.3 volts at 0.135 amperes and 100—250 volts, d.c., at a few milliamperes required to power the Q-multiplier can be obtained from the receiver's accessory socket (if it has one), or from a convenient spot in the receiver, such as the heater and screen terminals of the output tube socket. The power may also be obtained from a small external power supply. In fact, with an a.c./d.c. type of receiver, an external supply is required; a Q-multiplier may not give completely satisfactory results on c.w., however, when used with inexpensive a.c./d.c. receivers.

(*Continued on page* 91)

The "Light" Fantastic

(*Continued from page* 39)

you had a laser putting out one million watts, a hundred miles away you would receive 997,500 watts: still quite a bit of power.

Laser Radar. One of the immediately attainable applications of the laser is in a radar-like system for measuring distance and velocity, and for tracking. Several such systems already have been built or are in the works, including those of Hughes, RCA, General Electric, and Sperry. For example, the RCA tracking system, using a two-inch corner reflector, is expected to achieve a range accuracy of six feet over 70 miles. The Sperry system, using the Doppler effect, can measure the frequency shift of vehicles traveling at 18,000 miles per hour, or as slowly as 0.2-inch per hour!

Such systems on the moon or in a satellite hold tremendous promise for guiding spacecraft and rendezvousing in space. By 1965, laser radars are expected to provide high-resolution maps of the moon and Mars, yielding new information about their surfaces that will make landing a man a fairly safe procedure. A laser ranging and telescope system will go into operation this year at Cloudcroft, N. M., to track satellites such as the new Discoverer series; in that area of the country, the weather is generally clear and lasers can be beamed into space from the ground.

Even the heavy-wheel gyroscope may be on its way out as a result of laser technology. Sperry Gyroscope—the organization which invented the gyro—has come up with a closed-circuit ring of lasers which can be used as an automatic device for guiding ships, planes, missiles and space vehicles.

New Laser Types. One of the most important developments in the rapidly changing field of laser technology came late last year when three organizations, I.B.M., General Electric, and M.I.T., announced almost simultaneously the development of a semiconductor laser.

The advantages of this type of laser—a gallium arsenide (GaAs) diode—are impressive when compared to crystal and gas lasers. Semiconductor lasers approach efficiencies of 100 percent as compared to a few percent for other types; they are excited directly by electric current while other lasers require bulky optical pumping apparatus; because they are excited by an electric current, they can be easily modulated by simply varying the excitation current.

Gallium arsenide diodes (research models are already available as relatively low-cost, off-the-shelf items) consist of a layer of *p*-type gallium arsenide and a layer of *n*-type gallium arsenide. When electrons in an intense electric current, about 20,000 amperes per square centimeter, are applied to the device, it emits coherent or incoherent light, depending upon the diode type, from the junction between the two layers of gallium arsenide.

Current research is concerned with improving the efficiency of semiconductor lasers, modulating them, and, in a new twist, using them as "pumps" to improve greatly the efficiency of other types of lasers.

Developed in a number of forms are lasers which use rare earth *chelates*—molecules which completely enclose each atom of a rare earth element such as europium. Chelates, combined with plastic, a liquid or other medium, can be pumped to produce laser action.

One of the most important new laser techniques is a method for generating light of different frequencies or colors from a single laser beam. By beaming coherent light through a liquid such as nitrogen, light of other frequencies is obtained. Laser frequencies can also be altered by heterodyning two beams by mixing them within a crystal. These developments make it possible to convert intense laser beams to any frequency; green, blue, or from far infrared to near ultraviolet regions.

Also within the year we have seen lasers operating at room temperatures rather than having to be immersed in expensive cryogenic environments to keep them cool. Lasers pumped by the sun, by cathode-ray fluorescence, and by exploding wires, as well as by directly applied electric current, have come into being in the past twelve months. Raytheon and M.I.T. have bounced a laser beam off the moon. Whereas early last year you had to build your own laser if you wanted one—an expensive and delicate process even for the most advanced electronics engineer—you can now buy a wide variety of laser types.

The Modulation Problem. While predictions on the future usefulness of laser beams in communications are highly optimistic, much work remains to be done on developing practical methods of modulation. Communications—including television signals—have already been transmitted by laser in laboratory setups, but thus far, only a small fraction of the fantastically large available bandwidth in a laser beam has been utilized.

The various approaches to modulation can be divided into two groups: internal modulation applied while the coherent light is being generated, and external modulation applied to the light beam after it leaves the laser. As we noted earlier, the gallium arsenide laser is relatively easy to modulate using an internal technique. The excitation current can be simply varied to produce modulation.

Another method of internal modulation, used with other types of lasers, involves changing the *Q* of the laser cavity with an electro-optical shutter between the laser material and a reflecting end plate of the cavity. This introduces a variable loss which causes large changes in the level of operating power akin to amplitude modulation.

A third approach is Stark-effect modulation, achieved by sending a strong transverse electric field into the laser material. This field causes line-splitting and frequency modulation of the output. A similar technique, using a magnetic field, has also been used. It is called Zeeman-effect modulation.

External modulation of the laser output can be accomplished using the Pockels effect, in which the beam is passed through a piezoelectric crystal which can be "strained" by an electrical field. Other external modulation approaches include the Kerr effect (plane-polarization), varying the pumping power, and mechanical means, such as the use of shutters, graings, lenses, reflectors and ultrasonics.

For demodulation, the radiation must be converted to electrical energy in most cases. New phototubes, photomultiplier detectors, and photodiodes have been developed for this purpose within the last six months. With coherent radiation, the same techniques will work with light beams that will work with microwaves, so it boils down to a difference in detail, not principle. Superheterodyne techniques can be used to convert the light into lower frequency signals, such as microwaves; microwave detection equipment can then be employed. "Heterodyning" is accomplished by "beating" one laser beam with another. The result is a frequency equal to the difference between the two falling in the microwave region.

Lasers, Present and Future. As indicated earlier, it isn't only the communications people who are taking a close look at the laser. At Columbia-Presbyterian Medical Center in New York, ophthalmologists already have used a ruby laser beam to coagulate a human eye retina to prevent it from becoming detached. Such an operation can be completed in less than 0.001 second, eliminating the possibility of damage due to eye motion during the exposure.

The machining and welding potential of the laser has already been demonstrated in certain applications. At G.E., the surfaces of industrial diamonds have been vaporized the instant the high-energy light beam strikes them. Production lines are now being set up to use the laser beam in cutting "components" to size for use in microcircuits, and to weld leads to semiconductors.

"It has a built-in memory."

The laser also holds the potential of becoming the ultimate anti-missile weapon. One proposal is to use high-power beams of several lasers focused on the enemy missile with sufficient energy to vaporize it. This would be a "clean" weapon compared to anti-missile rockets with nuclear warheads and their attendant radioactive fall-out.

A new laser scheme which theoretically could generate a billion joules or more is under development now. It involves the separation and sorting of hydrogen spins, the physics of which are too complex to go into in this article. Such a powerful laser could transmit its beam through the atmosphere and earth cloud cover and still deliver enough power at the impact point to vaporize a missile.

Power requirements could be sharply reduced, however, by orbiting an anti-missile laser above the atmosphere. Laser light could also be used as a spotlight from space for photography at long distances.

The laser is less than three years old, yet we have already come a long way. The experts say that this is one field in which we are well ahead of the Russians. To understand the laser is to understand an important facet of the future of communications, medicine, machining for industry, and the practical equivalent of the legendary death ray.

Whatever use the laser is put to, its impact on mankind will be great—comparable, perhaps, to the discovery of atomic energy. When and how will the impact be felt? Only time will tell. —30—

COMING NEXT MONTH

What is the state of the art when it comes to CB gear? Time has rolled around to take another look at transceivers, antennas, mikes, test equipment, and miscellaneous accessories. Our Third Annual CB Buyer's Guide will contain complete specifications of all equipment currently marketed for the CB'er.

- **THE TUBE FAMILY TREE, PART III** In the final installment of this series, we take up the history of the vacuum tube where we left it in the June issue. The discussion centers around the unusual special purpose tubes used in research, radar, and industrial applications.

- August will be a BIG ISSUE month for POPULAR ELECTRONICS. Presently scheduled are a variety of construction projects and features of interest to hams, SWL's, and experimenters, plus all regular departments.

The Signal Stethoscope

(*Continued from page* 61)

pieces of plastic tape can be used to hold it in place. After you mount the battery holders for *B1* inside the case, you're ready to start wiring.

Keep all leads reasonably short. Remember to hook up the loopstick, and to observe the proper battery polarity when connecting *B1*. You may find it necessary to align the KB-138 tuner when the wiring is completed. The instructions that come with this unit tell you how to do so, both with and without instruments. If you should notice any feedback or motorboating after the tuner has been aligned, experiment with the dress of the interconnecting wires to clear it up.

If you live in a metropolitan area, you may find that the output of the tuner on local stations overdrives the input of the amplifier. If this is a problem, add a 47,000-ohm, ½-watt resistor in series between the tip connection of *J2*, and the "hot" ungrounded end of potentiometer *R1*.

Probes for the Stethoscope. As indicated in the schematic, the signal-tracer probe is built into a large ball-point pen housing. Holes are drilled in the end and side of the case for the connecting leads, and the ball-point pen tip is retained for use as a probe tip. Cut off all but about ½" of the ink cartridge, clean out the remaining ink, and solder *C1* to the inside of the tip. Both *C1* and *C2* should be coaxial lead ceramic or small mica capacitors so that they will fit

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With each lesson you receive an FCC-type test so that you can discover after each lesson just which points you do not understand and clear them up as you go along. In addition to the lesson tests, ten comprehensive Review Exams are given throughout the course.

Is the School Accredited?

Grantham School of Electronics is accredited by the Accrediting Commission of the National Home Study Council.

Is It a "Memory Course"?

Grantham School has never endorsed the "memory" or "learn by rote" approach to preparing for FCC license exams. This approach may have worked in the early days of broadcasting, to the extent that a man could get his license that way; but, Heaven help the employer who expected this man to be able to demonstrate abilities implied by possession of the license!

Fortunately for all concerned, it is no longer possible for a man to pass FCC exams by spilling out memorized information which is essentially meaningless to him. Advances in the field of electronics—and the desire of the FCC to have the license really mean something — have caused upgrading of the exams to the point where only the man who is able to *understand* and *reason* electronics can acquire the 1st class FCC license.

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I am interested in: ☐ Home Study, ☐ Resident Classes 33-K inside the case. Wire in the diode and other components. Use care (and a heat sink!) while soldering to avoid heat damage.

The hum probe is built into a plastic pill vial: you can get one the right size at your local drugstore. Coil *L1* is one winding of a discarded i.f. transformer. Remove the winding (it's a good idea to check for continuity) and cut down its ferrite core so that only about 1/4" extends out at each end. Install it and a miniature panel connector in the pill vial as shown in the schematic on page 61.

One other type of "probe" will come in handy for signal-injecting work and a variety of other applications. Nothing but a set of clip leads wired to a miniature phone plug, it is a convenient device for tapping off outputs from *J1* and *J2*, or feeding an input into *J3*.

The use of the signal-tracing probe is fairly obvious, but a few words might be said about the hum probe. To check it, plug it into *J2* and turn the volume control up full. When placed in the vicinity of an operating soldering iron, you should hear a loud hum with the probe 2' away. You can use the hum probe to trace concealed a.c. wiring as long as the wiring is carrying current (the more the better). Just move the probe along the wall and listen for hum. A similar technique can be used (at a lower gain setting) with electronic equipment such as hi-fi amplifiers.

A final word of advice: When tracing signals, keep the tuner section turned off. Otherwise, the tuner's oscillator may interfere. -30-

Double Duty EICO

(*Continued from page* 51)

then repeak *C10*.

The only step remaining is to tune the rig into your antenna using a field strength meter. Simply adjust *C9* and *C10* as before for maximum output. The two antenna trimmers must be adjusted whenever the 772 is switched between 10 and 11 meters in order to load the antenna properly. This is no great problem, however, since the trimmers are accessible through holes in the side of the cabinet.

How Does It Work? Conversion of the EICO 772 proved highly successful. On 10 meters, good signal reports were received over a surprisingly wide area considering the low power and the fact that the unit was being operated within the confines of New York City. While many people attempt to "hop up" the power of CB transceivers from 5 to 7 or 10 watts for ham use, the legal CB maximum proved to be perfectly adequate for the author's purposes.

Other advantages in converting this CB rig to ham use are the effective noise limiter and the high audio level—many times the guy on the other end will report no S-meter reading, but will still be able to copy perfectly.

As for CB operation, it is the same as before—good. But now 10 crystal receive channels make the rig more convenient to use than ever. -30-

Transistor Topics

(*Continued from page* 58)

L1. Base bias is supplied through *R1*. Audio modulation is injected into the emitter circuit by a carbon microphone (*Mic*) shunted by r.f. capacitor, *C3*.

Our experience indicates that most of the problems encountered with this type of circuit can be resolved into two general troubles: (a) improper feedback and (b) incorrect base bias. Unfortunately, either (or both) of these conditions may be present *even* when the project is assembled from a tested circuit

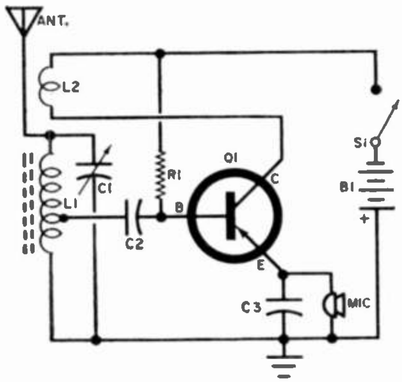

Fig. 4. Typical wireless microphone. Parts values are not given as they differ with frequency.

published in a magazine article or book, for specified component values are based on average transistor characteristics. If the individual builder happens to use a high (or low) gain transistor, some readjustment of either feedback or bias may be necessary for best performance.

If feedback is of incorrect polarity, the circuit will not oscillate. In practice, this can be corrected by reversing the connections to the feedback coil (*L2*, Fig. 4).

If too little feedback is used, the circuit will oscillate weakly . . . little output may be obtained, and oscillation may stop when modulation is applied. A similar condition may be caused by a low-gain transistor. This condition can be corrected by adding turns to the feedback coil (*L2*) or by increasing the coupling to the tuning coil.

If too much feedback is used, the output signal will be distorted and rich in harmonics. Under some conditions, blocking and "self-modulation" may occur, which may result in a squeal or tone signal superimposed on the voice modulation. Similar complaints may be caused by a high-gain transistor. Proper correction procedure is to reduce the turns on the feedback coil (*L2*) or to reduce the coupling to the tuning coil.

If too low a base bias is used, the circuit may still oscillate, but will deliver a distorted signal. In addition, operation may be sporadic. Some of the complaints encountered may approximate those caused by excessive feedback. The remedy is to increase the base bias by reducing the size of the base resistor (*R1*, Fig. 4).

If too high a base bias is used, the transistor will operate near saturation. Again, distortion can occur and the output signal may contain spurious harmonics. Excessive power consumption will result. Under some conditions, the transistor may overheat and be damaged. The condition may be corrected by reducing the bias current . . . that is, increasing the size of the base resistor (*R1*).

Optimum base bias for oscillation may not permit adequate modulation. Here, the circuit will emit a strong r.f. signal, but the modulation percentage will be low, even when a sensitive microphone is used. This condition results when the transistor is biased for linear class A operation—nonlinear operation is essential for adequate modulation. Again, the solution is to readjust the base bias current, generally to a lower value (by increasing the value of *R1*).

A useful technique for determining the optimum bias value is to install a potentiometer in place of *R1*. This control is then adjusted (gradually) until best performance is obtained. Finally, the control is replaced with a fixed resistor of approximately the same value. Typical bias resistor values will range from 50,000 to 500,000 ohms, depending on battery voltage, transistor characteristics, amount of feedback used, and similar factors.

July is a good month to dream of the day when you'll be able to buy (or build) an all-electronic air conditioner. Until next month, then . . . keep cool!

—*Lou*

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- White-noise signals to allow the stereo channels to be matched in level and in tonal characteristics.
- Four specially designed tests to check distortion in stereo cartridges.
- Open-air recording of moving snare drums to minimize reverberation when checking stereo spread.

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The Model 211 Stereo Test Record is a disc that has set the new standard for stereo test recording. Due to the overwhelming demand for this record, only a limited number are still available thru this magazine. They will be sold by POPULAR ELECTRONICS on a first come, first serve basis. At the low price of $4.98, this is a value you won't want to miss. Make sure you fill in and mail the coupon together with your check ($4.98 per record) today.

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Short-Wave Report

(*Continued from page* 69)

section. The *VOA* installations are located west, northeast, and southeast of the city, in a triangular pattern. The receiving site is the area to the west of the city. All of the sites have modern buildings made of cement and glass.

Notably visible outside of the buildings at the western site are the receiving antennas and the microwave tower to which programs are relayed from the main studios in Washington, D. C. Inside are the impressive master control room, the receiver room, and the teletype area. In addition, the receiving site is completely equipped with a bunkroom, food storage space, kitchen, and offices.

The transmitter sites have identical, although larger, buildings. On the cleared, level ground stand the orange and white "curtain antennas" some 400 feet high. Each of the transmitter buildings houses eleven transmitters, three in each of the larger power categories, and two 5000-watt units. They flank the master controls which are on an open dais.

The transmitters, receivers, and related devices were installed at Greenville by LTV's Continental Electronics Systems, Inc., and the construction was done by the Alpha Corp. of Texas, Inc. Work on the $23-million project originally began in November, 1960.

Current Station Reports

The following is a resume of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Eastern Standard and the 24-hour system is used. Reports should be sent to P.O. Box 254, Haddonfield, N.J., in time to reach your Short-Wave Editor by the eighth of each month; be sure to include your WPE Monitor Registration and the make and model number of your receiver. We regret that we are unable to use all of the reports received each month, due to space limitations, but we are grateful to everyone who contributes to this column.

Belgium—Brussels has discontinued the Eng. language program to the African continent. A short Eng. section will be included as the last part of the "Horizon" program which is broadcast on 21,510 and 9720 kc. at 1505-1600 with Eng. on Mondays and Thursdays only; the remainder of the broadcast is in Dutch and French.

Brazil—*Radiodifusora do Amazonas*, Manaus, 17,795 kc., listed as inactive, was tuned recently from 1510 with pop records. Further monitoring requested.

China—Peking is noted on 6270 kc. from 1653 to 1657 s/off with Oriental music and language; on 12,055 kc. with news at 1203 and s/off at 1256; on 15,040 kc. with s/on at 1930 in native language, talks and music. An ID for *R. Tirana* is given just prior to the 1957 s/off. This xmsn, supposedly from Tirana (Albania), is widely believed to be aired over Peking's xmtrs. English to N.A. is given on 9480 kc. from 2000 to 2055 s/off.

Colombia—*Ecos de Pasto*, Pasto, formerly a medium-wave station only, is now on 6085 kc. where it was tuned from 2230 to 0007 s/off mostly with records and talks and a few commercials. An Eng. message is given just after s/on and before s/off requesting airmailed reports.

Horizonte! Emissora Colombiana, Bogota, presumably a new station, was noted only once on 5610 kc. from 2045 to 2200 s/off with eastern European and international pop tunes. The IS was a horse race bugle call. All Spanish. Reports requested.

Cuba—Havana's most recent schedule reads: 0600-1330 on 15,135 kc.; 0600-0730 and 1700-2200 on 6135 kc.; 0750-1030 on 17,855 kc.; 1050-1330, 1700-1800, 1900-2100, and 2130-0100 on 15,340 kc.; 1700-0100 on 9765 kc.; and 2200-0100 on 6060 kc. Bear in mind that this schedule is subject to frequent changes. Late reports also indicate reception on 11,865 kc. to Europe around 1540 in Eng., and on 6110 kc. in Spanish around 0215.

Egypt—Cairo has been monitored on 9475 kc. at 1645 daily with Eng. news; on 9795 kc. from 2134 to 2145 s/off with music; on 11,720 kc. at 1100-1230 with Arabic music—Italian followed, with a newscast at 1400; on 17,690 kc. at 1300 with *Voice of Africa* program (may run dual to or operate only on 17,875 kc.); and on 17,910 kc. at 0813-0912 with native music and an Eng. newscast at 0845.

Finland—The latest schedule for *R. Finland*, Helsinki, reads as follows: to Europe on 15,190, 11,805, and 9555 kc. at 1100-1130 on Mondays and Fridays, and a repeat on 6120 kc. at 1600-1630 on Fridays only; to N.A. on 15,190, 11,805, and 9555 on Tuesdays and Saturdays at 0630-0700. A DX program is given on the first and third Saturday of the month.

Formosa—Taipei has Eng. xmsns daily at 2150-2250 on 6095, 7130, 11,860, 15,345, 17,785, and 17,890 kc.; at 0510-0555 on 6095, 7130, 9720, and 11,860 kc.; and at 1000-1115 on 6095, 7130, 9685, and 11,825 kc. The "Dragon Show" is aired at 0730-0800 (to 0825 on Sundays) on 6095, 7130, 9720, and 11,860 kc. The ID is *The Voice of Free China*. Reports are welcomed and should be sent to 53, Sec. III, Jen Ai Road, Taipei, Taiwan.

France—The only Eng. listing in the newest schedule from Paris is at 0800-0815 to the Far East on 15,245, 17,765, and 21,620 kc., although the French lesson at 0245 to England on 7160 kc. may be partially in English.

Gabon—*Radiodiffusion Nationale Gabonaise*, Libreville, operates—according to their

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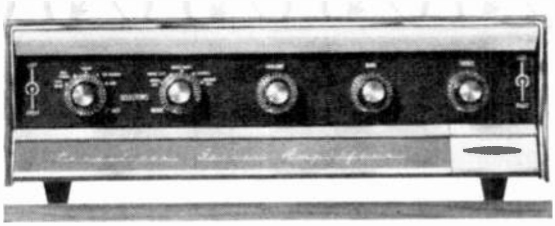

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schedule—weekdays at 0000-0130, 0500-0800, and 1200-1600 (to 1800 on Saturdays) and on Sundays at 0200-1600 on 4777 kc. mornings and evenings (local time) and 7270 kc. afternoons (local time).

Germany (West)—*The Voice of Germany,* Cologne, has made quite a few changes in broadcasts to the Western Hemisphere. The schedule now reads: to South America at 1710-1800 in Portuguese and to South and Central America at 1800-1850 in Spanish on 6145, 11, 795, and 15,295 kc.; to Eastern N.A. at 2035-2115 in Eng. and at 2115-2155 in French on 6160 and 9640 kc.; to Western N.A. at 2355-0035 in Eng. on 6145, 9735, and 11,795 kc., plus a new xmsn at 1010-1050 in Eng. on 11,795 and 15,405 kc. The latter broadcast replaces the 1530-1610 xmsn on 9735 and 11,795 kc. Other Eng. xmsns: to Australia and the Far East at 0345-0440 on 15,375, 17,845, and 21,705 kc., and at 1610-1700 on 7205 and 9735 kc.; to Indonesia at 0745-0825 on 15,405 and 17,815 kc.; to S. Asia at 0230-0340 on 15,275, 17,845, and 21,705 kc. and at 1050-1120 on 15,295 and 17,875 kc.; to Africa at 0105-0135 and 1115-1210 on 15,275 and 17,845 kc. and at 1520-1550 on 11,785 and 15,275 kc.

Greece—*Radio Athens* has reportedly suspended all foreign-language programs without notice. It is known that the station was "weak" due to heavy QRM. A new 100-kw. short-wave xmtr has been proposed as well as increased coverage domestically with a network of 38 xmtrs.

Guinea—Conakry has been found on 6160 kc. around 0215-0245 with African rhythms and French language.

Haiti—*La Voix Evangelique,* Cap Haitien, is scheduled daily at 0600-0900 and 1200-2015 (to 2300 on Fridays, Saturdays, and Sundays) on 11,835 kc. (no call); 9770 kc. (4VEH); 6120 kc. (4VE); 2450 kc. (no call); and 1035 kc. (4VEF). Reports are welcomed.

India—Delhi has been noted at 1745 in native language on 11,740 and 11,920 kc.; from 0715 to 0730 s/off with Indian music on 11,720 kc.; at 1205 with Indian music and Hindi and Eng. announcements on 3925 kc.; and at 0900-1000 with Eng. talks, news, and music on 15,225 kc. The latter xmsn is not heard on Saturdays or Sundays.

Japan—The Far East Network, Tokyo, has been noted on 6165 kc. at 0700 with time, news, sports, and feature stories; all English.

Korea (South)—HLK52, Seoul, 6035 kc., has been noted at 0631 with talks in Korean. An ID is given at 0659.

Lebanon—New frequencies in use from Beirut are 11,785 kc. to S. Africa at 1330-1500 and 11,755 kc. to S. America at 1515-1615.

Netherlands—The "Happy Station Program" is broadcast Sundays only as follows: to Australia, New Zealand, and Pacific areas on 21,480 and 9630 kc. at 0100-0225; to Europe, Far East, and Pacific areas on 21,665, 21,480, 6020, and 5980 kc. at 0530-0700; to Africa, Middle East, and Europe on 17,775 kc., and to the Near East, S. Asia, Africa, Antarctica, and Europe on 15,425 and 620 kc. at 1100-1225; to S. America on 11,730 kc., Spain and Portugal on 7165 kc., and Central Europe on 6020 kc. at 1600-1730; and to N.A. on 9630 and 6035 kc. at 2100-2230.

Netherlands West Indies—The xmtrs for *Trans-World Radio*'s Curacao outlet are to be completed by October, 1963. The medium-wave outlets are rated at 50 kw., the short-wave units at 260 kw.

Philippines—The latest schedule for the Far East B/C Co. reads: to Australia, New Zealand, and Malaya on 17,810 and 15,300 kc. at 1655-1930; to Formosa on 15,370 kc. and to Hong Kong on 7230 kc. at 1830-1930; and to Formosa and S. Asia on 15,380 kc. at 2000-2100. Other xmsns: 17,810, 15,300, 11,920, and 9730 kc. at 2100-2200 (Sundays to 0900, and 11,850 kc. from 0030 on Sundays); 17,810,

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Bob Wood *(VE3PE1SM)*, Tilbury, Ont.
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Margaret Hinkson *(VP4PE1B)*, Port of Spain, Trinidad & Tobago
Radio Australia, Melbourne, Australia
Radiodiffusion-Television Francaise, New York, N. Y.
Radio Nederland, Hilversum, Netherlands
Bernard Brown, Derby, England
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Wallace Glavich, Eureka, Calif.
Joe Piechuta, Meriden, Conn.
Bill Pollard, Vienna, Va.
Mike Ryan, Redwood City, Calif.
Miriam Stockton, 4VEH, Cap Haitien, Haiti
Steve Wilhelm, Philadelphia, Pa.

15,300, 11,850, and 9730 kc. at 0330-0900 (15,380 kc. from 0400 to 0500, 7230 kc. from 0545 to 0830). All English.

Portugal—Lisbon is currently scheduled to N.A. at 2100-2145 (Sundays to 2130) and at 2245-2330 (Sundays from 2300) on 6025 and 6185 kc.; to S. E. Asia at 0815-0845 on 15,125 kc.; to Africa on 11,935 and 15,380 kc. and to Europe on 6025 kc. at 1315-1430. Medium-wave stations noted include: *Voice of the West* on 755 kc. at 1815-1833 (Eng. to 1830); and CSB9 on 782 kc. at 1845-1930, with all-Portuguese language and a mixture of recorded music including some U.S. tunes.

Portuguese Guinea—CQM, Bissau, has moved from 4782 kc. to 4947 kc. and was noted at 1635 with pop tunes; s/off at 1802. The 7947-kc. xmsn appears to have been discontinued.

Sierra Leone—Freetown, 5980 kc., is noted at 0159 with an ID and a short Eng. xmsn, then a London news relay. The dual 3316-kc. outlet is heard better.

Spratly Island—A previous listing for this country can be ruled off; it has proven to be a hoax perpetrated by two or more European listeners. The island itself does exist, however.

St. Pierre and Miquelon—DX'ers needing this country, especially those living in the northeast, should try for the medium-wave outlet on 1375 kc. around 0500. Virtually all of the xmsns from *R. St. Pierre* are in French.

Sweden—*R. Sweden* now operates on 7270 kc. to Eastern N.A. at 2000-2115 (Eng. from 2045) and to Western N.A. at 2130-2245 (Eng. from 2215). Spanish to Central America is given at 2300-2330. The 0900-0930 xmsn to N.A. on 17,840 kc. is unchanged.

Tunisia—*R. Tunis* has been noted on 6204 kc. (a move from 6113 kc.) at 1600 in Arabic; also at 0000. It may close around 1827. The medium-wave outlet on 629 kc. has been tuned in dual.

Uganda—*R. Kampular* has Eng. daily at 1445-1500 on 4976 kc. with news and weather.

USSR—*R. Khabarovsk* is a new outlet on 6195 kc. The ID is given three minutes before the hour and/or half hour. The station was noted around 0530 with orchestral music.

Vietnam (South)—The latest schedule from Saigon reads: Vietnamese on 11,920, 7245, 6165, and 4877 kc. at 0100-1900, and on 7265 kc. at 0100-0215, 0630-0800, and 1200-1530; Eng. on 7265 kc. at 0215-0245, 0800-0845, and 1600-1715; Thai on 7265 kc. at 0245-0315 and 1530-1600; French at 0200-0300, 0730-0800, and 1400-1730, Chinese at 0300-0415, 0800-0945, and 1200-1300, and Cambodian at 1300-1400, all on 9620 kc.

Clandestine—*R. Libertad, La Voz de Anti-Communista de America* gives the announced schedule of 0700-1100 and 1800-0100 on 4005, 5075, 6240, 7308, 7804, 9325, and 15,050 kc. Other unlisted xmsns have been tuned on 4030 kc. at 0130-0146 and on 6750 kc. at 2030. —30—

Hula-Hoop Antenna

(Continued from page 30)

the tubing. By threading the screw in and out of the tubing, adjust for minimum reading on the reflected power scale of the SWR meter. Measure the exposed length of screw, remove the screw and lightly tin the inside of the copper tubing to afford a better bite for the screw threads. Replace the 2" screw with a 3" screw and adjust for the same exposed length. As you make the final adjustments, close the car doors and stand well back from the car. It will probably take several attempts to secure the minimum SWR reading.

With the antenna resonated, adjust the antenna feed point for a further reduction in SWR. Slide the transmission line connection to the antenna element back and forth between the top of the grounding stub and a point about 4" from this stub. After the minimum SWR point is found, touch up the antenna length-adjustment screw and again touch up the feed point adjustment for minimum SWR. Now replace the temporary antenna feed wire with a length of the insulated conductor removed from a piece of RG-8/U coaxial cable and solder the connections.

Wrap the PL-259 connector with plastic tape to keep water out of the coaxial fittings. Loosen the suction cups and thoroughly clean the inside of the cups and the roof of the car. Then apply a liberal coating of glycerin to the entire inner surface of the cups and fully collapse the cups in their original position. And once again touch up the antenna element length adjustment screw for minimum SWR.

Now touch up the tuning of the transmitter in accordance with the manufacturer's instructions. Little change of the tuning and loading adjustments should be required and the standing-wave ratio should not increase. Page 29 shows the on and off resonance standing-wave ratios that may be expected.

Remove the SWR meter, connect the antenna, and prepare yourself for some of the best mobile ham or CB operation you have ever experienced. —30—

Extracurricular Education

(*Continued from page 65*)

on the edge of the bottom of the dash. "When I drag the contact wire across these notches," he said, "the rapid make-and-break of the primary current will produce an almost continuous arc across the gap."

AFTER Dave finished his job, Jerry turned on the switch and dragged his wire across the notches. But there was no sparking to indicate the presence of current. "The points must be closed," he said. "Gig the starter a bit and see if we can't get them to open."

Carl did, and at the second try the motor stopped with the points open. Dave reported that a fat blue spark leaped across the gap when Jerry's contact wire stroked the serrated rim of the dash.

Very deliberately, over and over, Jerry brushed the wire along the dash so as to spell out in slow International Morse: "SOS SOS TRAPPED UNDER WRECKED CAR ON OLD RIVER ROAD." When he grew tired, Carl spelled him. There was no talking. The only sounds came from the night insects, the rhythmic hissing of the spark, and an occasional low moan from Phil.

They had been at this for a good hour when Dave suddenly shouted, "Hey! I see headlights coming down the road. Help! Help!"

A few seconds later they heard a car stop and the sound of someone sliding down the bank. When he spoke, they recognized the voice of the deputy sheriff:

"So it wasn't a hoax! Who's under the car? What's wrong with the leg?"

Dave quickly explained the situation, and the officer climbed back up the bank to radio for an ambulance and a wrecker.

"Listen, you guys," Dave called. "I've been lying here thinking what a stupid jerk I am, dean's list or not. My driving got us into this, and then I panicked. You kept your heads and figured a way out. It's not the brains you're supposed to have that count, it's the ones you use when you really need them. I want you to know I'm sorry."

"Knock it off," Carl said gruffly. "No one twisted our arms to make us go on this ride. We're in it together. It took a lot of guts to wrestle around and do what you did with that broken leg. I guess we all got a lesson tonight."

The deputy came back and explained that the distress call had been picked up by a 13-year-old boy watching TV directly across the river. The boy had been studying the code to get a ham license, and he noticed that the flashing of his screen had a dot-dash rhythm to it. Laboriously he wrote out the message, getting a few more letters each time it was repeated. He called the sheriff's office, and the deputy was sent to investigate.

"That kid's going to have some grateful help in studying for his license," Jerry promised, "and I'll never gripe again about ignition interference."

The wrecker and ambulance soon arrived. The end of the car was carefully winched up until Carl and Jerry could slide Phil out and get out themselves.

Just as Phil was being loaded into the ambulance alongside Dave, he opened his eyes and grinned feebly.

"That last bump was a doozy!" he observed. –30–

On the Citizens Band

(*Continued from page* 72)

parties may contact Moe at 1 St. Francis Blvd., Chateauguay P.Q., Canada.

Jack Leach, KHG1227, publicity chairman of the South-Lynd Radio Club of Lyndhurst, Ohio, forwarded us a copy of this club's first newspaper—a clean-cut, neatly organized effort which should net the group a lot of respect as an organized association. While a few clubs have jammed their pages with cartoons and uninformative chatter, possibly to create an impression of might, the South-Lynders must be commended for definitely starting out on the right "channel." Their three-page bulletin makes interesting reading front-to-back, and leaves no doubt of the clubs' aims.

The Dixie Five Watters CB Club of Alabama has announced the election of new officers; Curtis Pope, president; Eddie Blackwelder, vice president; and Benny Bangs, secretary-treasurer. Now in its second year, this organization points to the installation of a CB unit in the City Hall as its most recent major achievement. The purpose of the installation was to create a control point for local CB units in times of emergency.

Our sincere thanks go to the hundreds of CB clubs who are mailing their newspapers and bulletins to *On the Citizens Band* each month. This is *your* column; its success depends on *your* information. Help us tell CB'ers throughout the United States and Canada what's happening in your neck of the woods. While space limitations prevents our squeezing in *everything* that's going on, we'll certainly try to get the most interesting items printed on these pages. And don't forget the pictures!

I'll CB'ing you,

Matt, 18W4689

Across the Ham Bands

(*Continued from page* 75)

Install a shielded wire between the plate terminal of the receiver's mixer tube (6BE6, 6SA7, etc.) and a connector on the rear of the receiver chassis or to an unused terminal on the receiver accessory socket, to accommodate the output terminal (*P1*) of the Q-multiplier. After the lead is installed, tune in a steady signal on the receiver, and carefully retune the primary winding of the first i.f. transformer for maximum signal strength. This must be done to compensate for the capacity added to the primary tuned circuit of the i.f. transformer by the shielded lead.

Then plug in the Q-multiplier, adjust capacitor *C1* and resistor *R1*, and adjust coil slug *L1* for maximum signal strength. Retard control *R1* as necessary during this operation to prevent the Q-multiplier from breaking into sustained oscillation (indicated by a steady squeal from the loudspeaker or by the receiver suddenly going dead). Also, the value of resistor *R3* may be increased or decreased if necessary to give resistor *R1* full control.

Operation. In operation, receiver selectivity is maximum when resistor *R1* is adjusted just below the oscillation point. Capacitor *C1* acts as a vernier tuning control, permitting the desired signal to be picked out of a mess of interference.

News and Views

Francis M. Muter, KN7URC, 116-15th Ave., S., Nampa, Idaho, must like radio. He works for broadcast station KATN and operates a 100-milliwatt AM and FM station with a range of about 50 yards—which covers an old folks home and a couple of apartment buildings; and as a radio amateur, he operates on 80, 40, and 2 meters! His ham gear includes a Globe Chief 90A transmitter, and a Hallicrafters S-43 receiver, plus a Q-multiplier for the lower frequencies; and a 30-watt FM unit covers 2 meters. . . . A few weeks ago, your Amateur Radio Editor had his first experience with amateur television. The occasion was the dedication of the $10,000 amateur radio station, W9DVJ, and electronics clinic installed for the use of the patients at the Veterans Administration Research Hospital in Chicago. W9EGQ made

Mounted on a mobile tower truck, this parabolic dish is relaying a ham TV broadcast to Chicago from the QTH of W9EGQ, Gary, Ind. Herb participated in the dedication of W9DVJ via this TV remote pickup.

the dedication address to the guests at the hospital from his home in Gary via amateur television—an airline distance of 27 miles. Bob Gill, W9JEC, and Bill Craig, W9ZZS, engineered the TV circuits and supplied the equipment, which included two complete TV stations. Other hams helping in the project included Beverley, K9HGY, George, K9HGZ, Darryl, K9OGE, "Kap," W9QKE, and Jim, W9TKW. . . . **Sheldon Traeger,** 2128 Cedarview, Beachwood, Ohio, reports that he memorized the alphabet in 35 minutes with the aid of the code chart in our March column; he is now copying code at a speed of 5 wpm.

Bill Thompson, WA8FLM, 3075 Hyannis Drive, Cincinnati 39, Ohio, is a week-old General. As a Novice, he worked 35 states, all on 40 meters, using a slightly modified version of the simple transmitter described in our January, 1962, column, feeding an antenna 12 feet high. Bill's first receiver was a "surplus" BC-455; his present one is a Lafayette KT-320. . . . **Bruce MacClements, KN1ZWF,** 4 Bourn Ave., Hampton, N.H., cranks his Heathkit DX-20 transmitter up to 50 watts to drive an off-center-fed antenna. He receives on a Knight-Kit Span Master. Eleven states and 45 contacts in two months compose his "brag list." Bruce would like to be nominated for the Rag Chewers' Club. . . . **Craig Blaine, WN2FVE,** 41 Sergeant St., Johnson City, N.Y., is also WPE2HUB. This fact led to his getting his ham ticket, when a local ham, to whom he had sent an SWL card, offered to help him study for his ham license. In turn, Craig and his dad, Pete, WN2GFM, now offer their help to other prospective hams. Craig and Pete share a Johnson Ranger transmitter feeding a 40-meter dipole about 20 feet high, and a Hallicrafters SX-110 receiver. Both receiver and transmitter were bought used, and Craig recommends used gear for those with expensive tastes and small pocketbooks.

Larry Meyers, WV2ZOF, 222 Frankhauser Rd., Buffalo, N.Y., looks back to his year as a Novice and finds that he made 667 contacts in 42 states, Canada, Puerto Rico, and Bahrein Island near Saudi Arabia. All this was done with an EICO 720 transmitter feeding a 40′ end-fed antenna. Two receivers, a Hallicrafters S-108 and a National NC-60, sit on Larry's operating desk; he SWL's as WPE2GPC while waiting for his General Class license. . . . **Tom Watson, WN5FAA,** 223 College St., Pittsburgh, Texas, has really been making his station earn a return on his license in the three months he has had it. Thirty-four states (32 confirmed), Mexico, and several Canadian hams appear in the pages of his logbook. For the lower frequencies, Tom's antenna is a dipole 30 feet high, his receiver is a Lafayette HE-30, and his transmitter is an EICO 720; for two meters, he has a Heathkit Twoer. . . . **Raymond Theis, WNØCVA,** 1010 Elm, Burlington, Iowa, was hoping to pick up the missing three states for his Novice WAS before the Novice ticket expired. Even if he didn't quite make it, 47 states, all confirmed, Canal Zone, Mexico, Puerto Rico, and Canada is a Novice record to be proud of. A Heathkit DX-35 transmitter, Lafayette KT-200 receiver, helped along by a Q-multiplier and some audio filters, and a Hy-Gain doublet all contributed to Ray's good results. . . . In an interesting letter to your Amateur Radio Editor, **Carl C. Drumeller, W5EHC,** 5824 N. W. 58th St., Oklahoma City, Okla., objects very strongly to the practice of calling licensed radio amateurs "hams." He says the term has derogatory implications, and he can't understand why many radio amateurs are proud to be called "hams." Obviously, Carl doesn't go along with William Shakespeare's idea that a rose by any other name will smell as sweet.

Once again, we've used up all our space. As always, we invite you to send your "News and Views," station photos, ideas for construction projects, etc., to *Across the Ham Bands*. Until next month, 73,

Herb, W9EGQ

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July 1963

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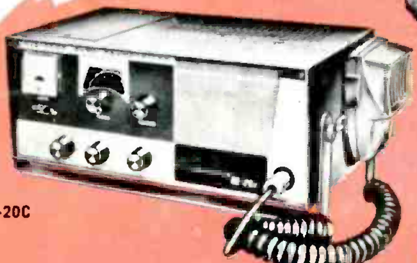

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