Transistorized Stereo Tape Preamp

POPULAR ELECTRONICS

SEPTEMBER 1959

35 CENTS

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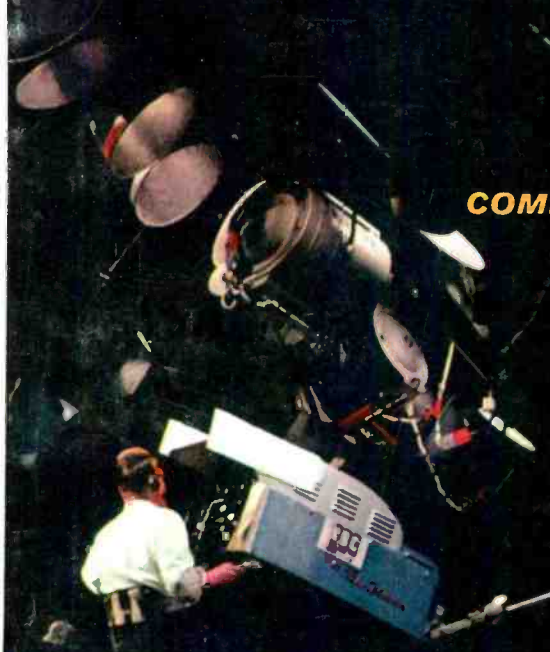

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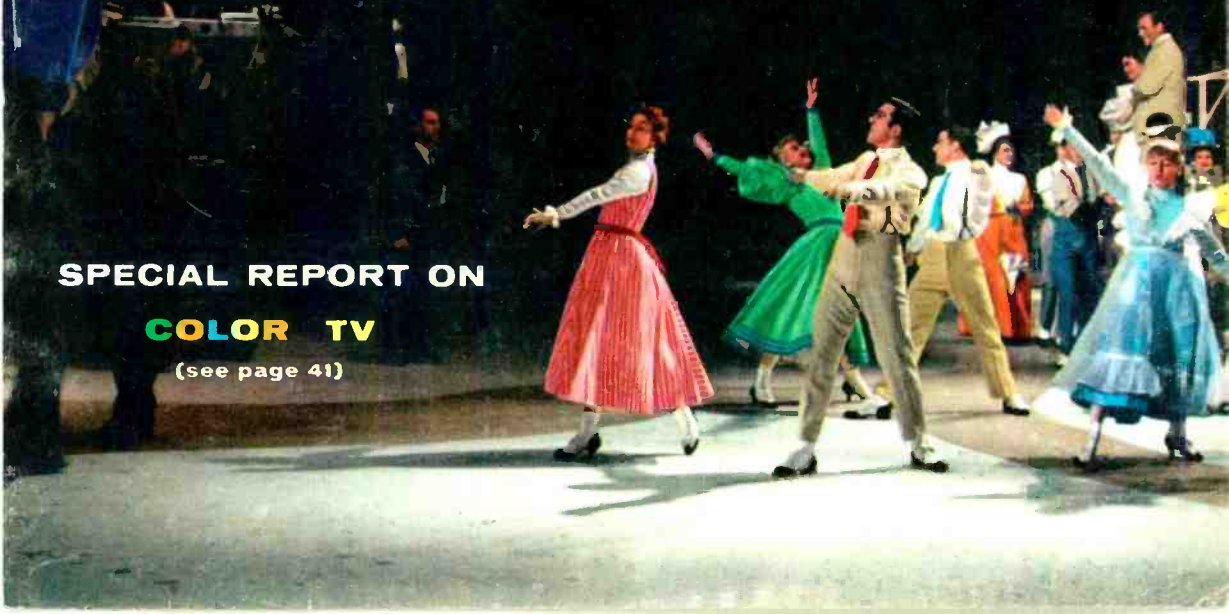

SPECIAL REPORT ON COLOR TV

(see page 41)

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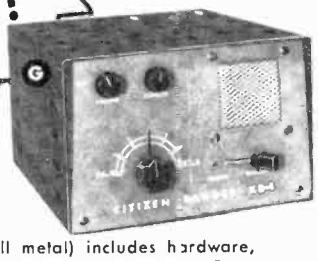
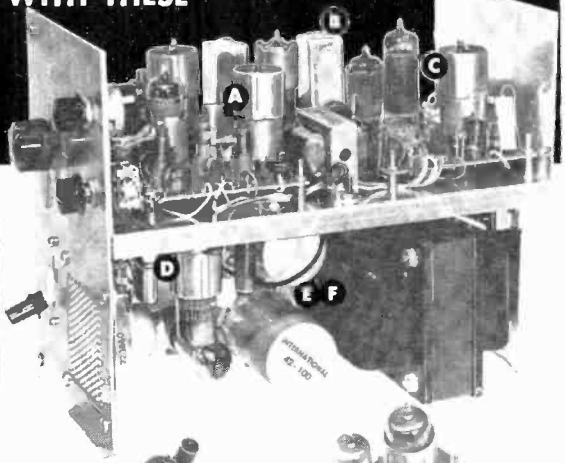
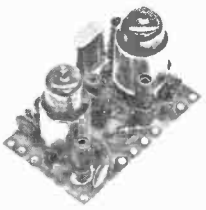
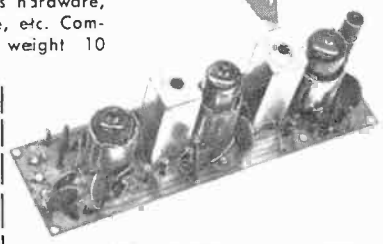




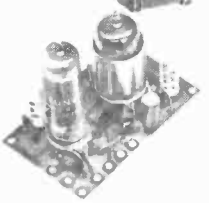
G Cabinet (all metal) includes hardware, switches, speakers, panel, case, etc. Complete instructions. Shipping weight 10 lbs. $20.00.



A RF Converter (printed circuit prewired), two-tubes, crystal controlled. Use with IF unit B. Shipping weight 2 lbs. $14.00.



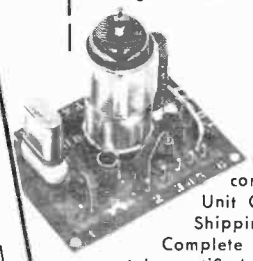
B IF Unit (printed circuit prewired) consists of mixer and tunable local oscillator feeding 262 KC IF stage. Includes noise-limiter and squelch circuits. Designed to work with units A and C. Makes dual conversion receiver. Shipping weight, 2 lbs. $16.00.



C Audio Unit (printed circuit prewired), speech amplifier for crystal or carbon microphone, first audio for receiver and power amplifier/modulator stage. Designed to follow unit B. Includes output transformer but not speaker. Shipping weight 2 lbs. $13.50.

E Power Supply 115 VAC (not prewired). All parts necessary to construct power supply to operate Units A, B, C and D. Shipping weight 10 lbs. $12.00.

F Power Supply 3-way 6 VDC, 12 VDC or 115 VAC (not prewired). Shipping weight 10 lbs. $20.00.



D Transmitter Unit (prewired and tuned) Oscillator and amplifier. Crystal controlled. Requires Unit C for modulation. Shipping weight 2 lbs. Complete with crystal and tube certified .005% tolerance. $14.50.

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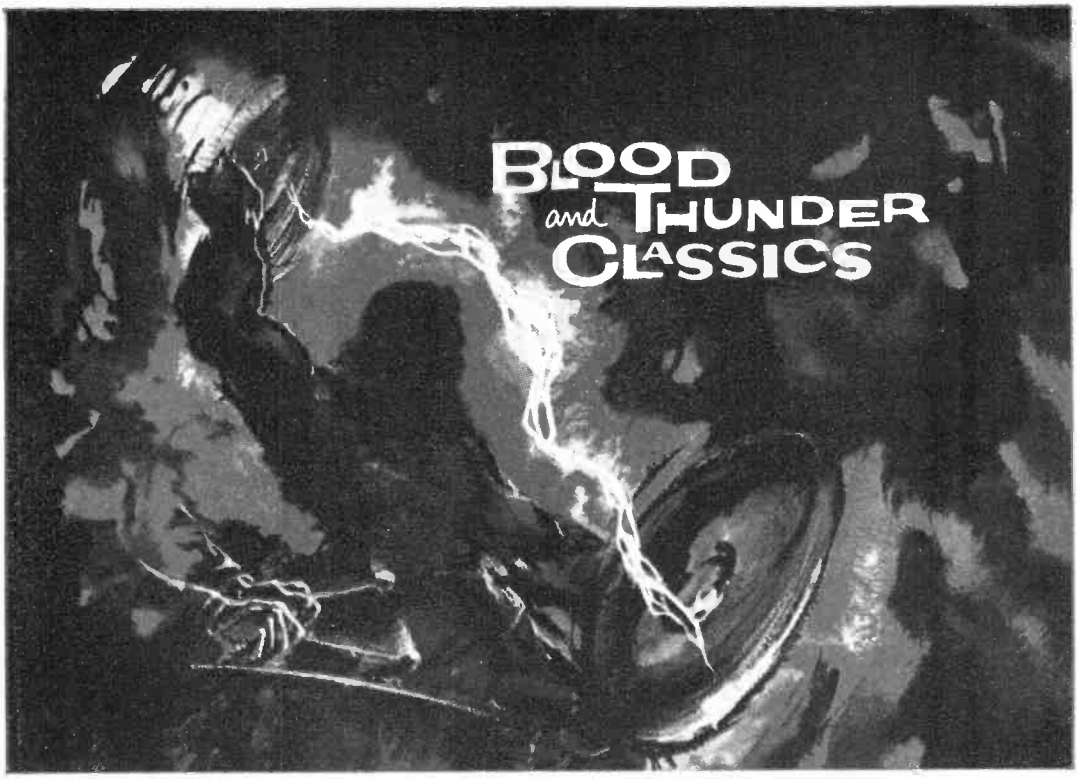

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Stravinski	Infernal Dance of King Kastchei, Finale (Firebird Suite)
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POPULAR ELECTRONICS

SEPTEMBER 1959

VOLUME 11 NUMBER 3

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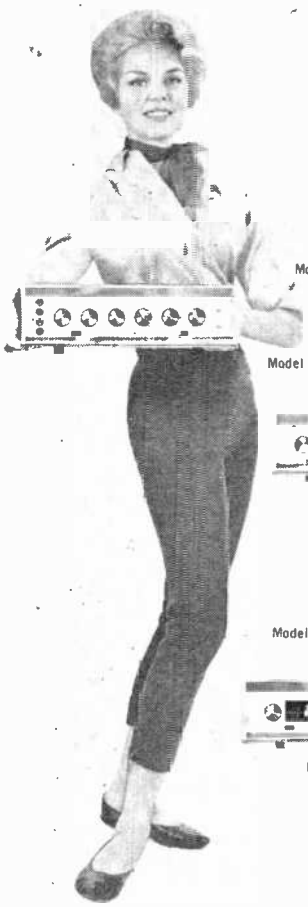

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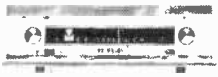

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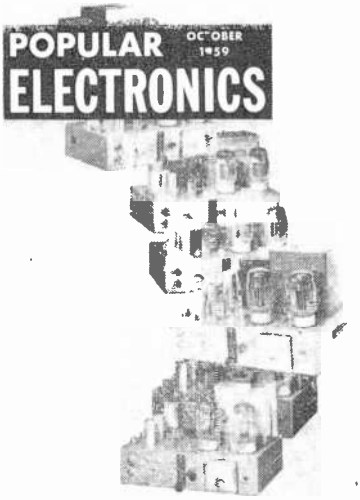

(ON SALE SEPTEMBER 22)

Next month we're having a special hi-fi stereo issue, and the October cover will picture a dual 60-watt amplifier which is featured in a construction article. This is a stereo basic amplifier that has everything, including simplexed circuitry, a silicon diode power supply, and a meter for reading bias, a.c. balance and d.c. balance.

If you're confused about the new four-track stereo tape systems, you'll want to read "Stereo Tape Is Back—to Stay." A complete report on the tape cartridge and four-track reel-to-reel systems, it also shows how they stack up against stereo records.

Ever consider joining a record club? If so, you'll be interested in an article which tells exactly how they operate, and points out their pro's and con's. Look for "The Low-Down on Record Clubs."

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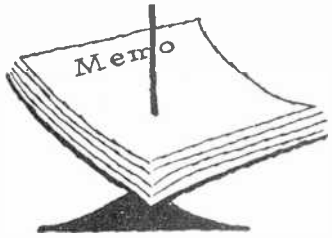

Notes from the Editor

POPULAR ELECTRONICS IS ON THE AIR. Boy, are we excited! We just received notification that our application for a ham station has been okayed. Under the call letters of WA2GNH, we will soon be talking to our ham readers all over the country.

The POPULAR ELECTRONICS Amateur Radio Club will conduct regularly scheduled sessions designed to promote radio knowledge and a feeling of fraternalism among amateur radio enthusiasts. For the first month, we'll be testing our rig on the 10-, 15- and 20-meter bands. If you're working these bands, keep your ears open for us.

STORY OF A STORY. The big problem in putting together any article is to organize the individual bits of information into an overall picture. For example, in the preparation of this issue's color TV article, so much information was accumulated that when it came time to put the story together, the raw material would have filled a good-sized book. Some of the areas researched included: color TV picture quality and circuitry, the history of color TV, the economic factors complicating its growth, consumer and service technician reaction, new types of color systems in development, and more.

Due to space considerations, it was impossible to include everything. But the problem of deciding what to put in and what to leave out presented an interesting challenge. How well this challenge was met you can determine by reading our ''Special Report on Color TV Today'' which begins on page 41.

READER MAIL. One of the best ways in which we can keep our fingers on the pulse of our readers' interests is through a careful reading of the letters which come in to our office every day—in almost fantastic quantity. If you have written in either to commend us or criticize us, we greatly appreciate your comments. Be assured that the points made by our readers are carefully considered and discussed at our editorial meetings.

Unfortunately, due to the sheer volume of mail, we are not always able to answer each letter individually. If you have written to make some suggestion and haven't received a direct answer, please try to understand our problem. One thing for sure, your letters are a tremendous help in planning future issues; so keep them coming!

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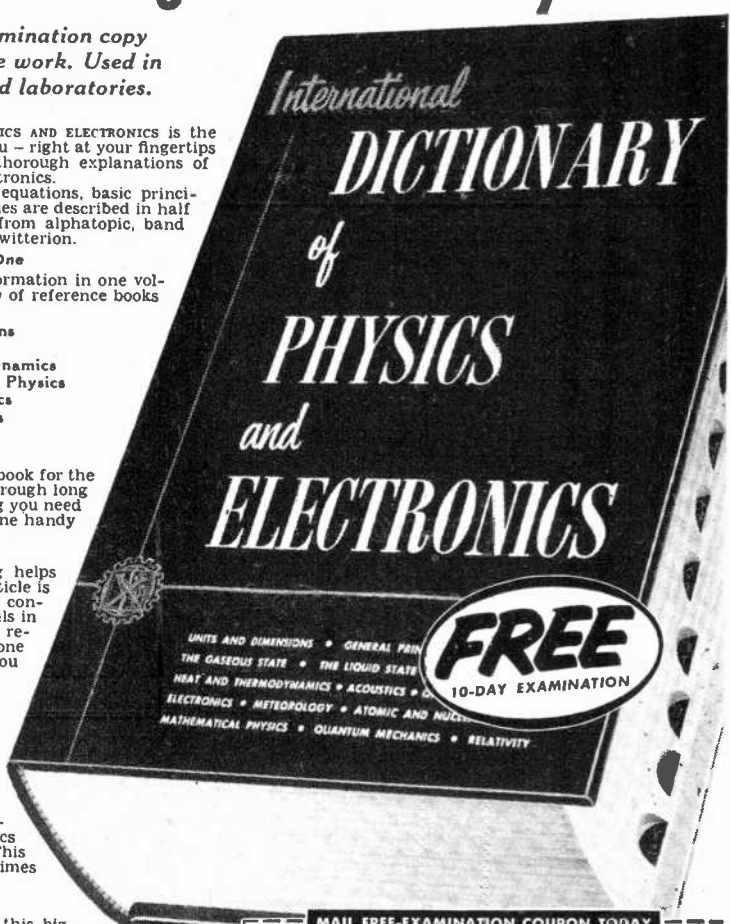

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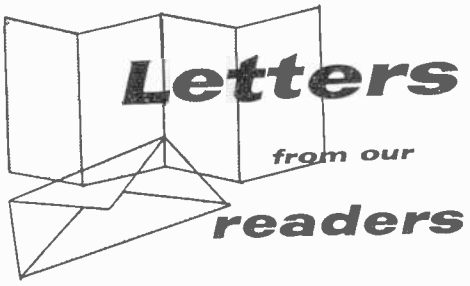
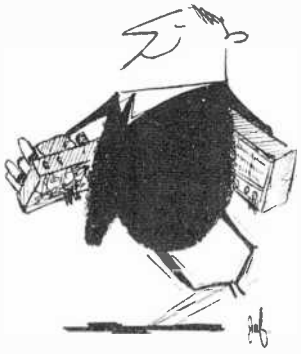


"Nifty Novice"

■ I built the "Nifty Novice" 15-meter transmitter described in the April 1959 issue, and have found it to be trouble-free and without the "chirp" which plagues other low-priced kits. My buddy, Bill Loveless, W7OWQ/5, made the following con-



tacts with the transmitter loading a dipole antenna: El Paso, Texas; Detroit, Mich., KN8OCO, RST 579; Chicago, Ill., KN9RJP, RST 589; Somerhill, Mass., KN1JOV, RST 479.

I have passed my Novice exam and have been waiting 51 days so far for my ticket. I am very pleased with the "Nifty Novice" transmitter, as it will load anything including a 12″ coax cable.

JOE GABUS
El Paso, Texas

■ I wish to call your attention to an error on page 149 of your April 1959 issue which describes a 21-mc. antenna. According to your pictorial, the over-all dimensions of the antenna are 10′ 11″. This should be 10′ 11″ for each leg, or 21′ 10″ over-all. Anyone who uses the original dimensions will have heap big headache.

M. J. BILLINGS, D.D.S., W2BIV
Brooklyn, N. Y.

You're right, Dr. Billings. We hope they don't write to us for aspirins.

VTVM User

■ I want to take this opportunity to express my appreciation to you and your staff for the interesting and helpful articles in the March issue. The one that helped me in particular was the article by Larry Klein on "Radio Repair with the VOM." It just so happened that I purchased an RCA WV77 Junior Voltohmyst (kit form) and was trouble-shooting an a.c.-d.c. "All-American Five" receiver when your article appeared. Although

Letters

(Continued from page 10)

the instructions accompanying this kit were helpful with respect to putting the VTVM in operation and calibrating it, they were not complete in "how-to-use-it" data. Just when I needed it most, along came this article with a step-by-step trouble-shooting method, and now the a.c.-d.c. set really blasts out with the music.

ALBERT C. BALKEMA, KN4ZFU
Maxwell Air Force Base, Ala.

Sound Level Meter Change

■ After building the transistorized sound level meter described in your April issue, I found that it became much more sensitive with transformer *T1* wired with the red lead going to the mike and the yellow going to the capacitor. Could it be that there was a mistake in the diagram?

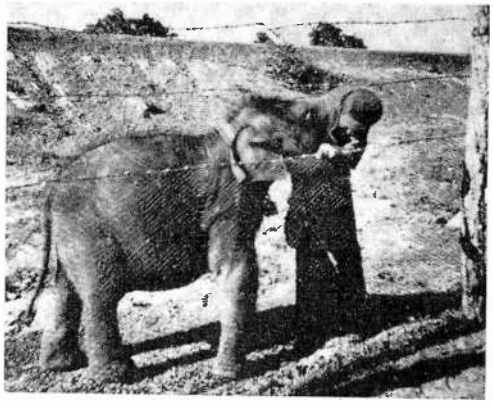
GEORGE TILLICH
Los Angeles, Calif.

You're right, we're wrong. The color coding indicated in the schematic is incorrect. The red transformer lead is the input and the yellow one is the output.

Praise from Afar

■ Just a note to tell you that you have loyal readers in far-off Cambodia. Here, Americans and Cambodians alike peruse each issue of POPULAR ELECTRONICS with great interest.

I thought you might be interested in seeing a picture of Josephine, our pet elephant. Josephine



belongs to Mr. Basil D.D. McIntyre, who brought her here half dead at the age of three months and has nursed her back to health. She is now the fattest little girl elephant in all of Indo-China. The picture shows Josephine giving a kiss to one of her close friends.

Keep up the good work in your magazine and best regards to our friends back in the States.

RALPH NAVARRO
Phnom Penh, Cambodia

"Police Special" Correction

■ In looking over the article "Police Special Receiver" in the July '59 issue of POPULAR ELECTRONICS, I noted something confusing in the parts designations. The pictorial diagram of the sub-

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Letters

(Continued from page 12)

chassis indicates that *L1* should be connected to *(B)* of *TB1*. According to the schematic diagram, *L2—not L1*—is connected to *TB1*.

DANIEL MERSEL
Frenchtown, N. J.

In the pictorial diagram on page 51, change coil L1 *to read* L2, *and coil* L2 *to read* L1. *Also, on the pictorial diagram on page 53, the wiring instructions of* TB1 (B) *should be changed to read "To center tap* L2." *Potentiometer* R5 *and capacitor* C8 *can have the values shown in the parts list or in the schematic diagram.*

Crystals for Citizens Band

■ Your article entitled "Build a Citizens Band Transceiver" in the June issue specified an International Crystal FO-150 in the transmitter parts list. This unit has a frequency tolerance of .01% —not within the .005% required for CB equipment. Only the Model FO-200 meets the requirement. You may want to bring this fact to the attention of your readers to prevent them from violating the FCC rules.

THOMAS J. MADDEN
Des Plaines, Ill.

Make a Mike Mixer

■ The story called "Maze of Mikes" in your July issue answered some of the questions I have had concerning the possibility of putting our little theatre productions on audio tape. However, I now find that I need a schematic for an audio console which will handle eight to ten mikes. Could you possibly publish one or advise me where one may be obtained?

B. E. JOLLEY
West Hartford, Conn.

Our March '59 issue carried plans for building a multiple-input mike mixer. See "One-Transistor Microphone Mixer" by Herb Cohen.

DX Anyone?

■ We are a 250-watt radio station operating on 1490 kilocycles with an all-day non-network musical format. Our operating hours are from 5:30 a.m. until midnight. We would appreciate hearing from your readers as to DX reception, distance, and quality.

BOBBY JONES, Announcer
WRMT, Rocky Mount, N. C.

That's High Enough

■ The frequency range of the square-wave generator described in your March '58 issue was described as being from 100 to 2000 cps. Would it be possible to extend the range to 15,000 cps?

C. R. HINDLE
Baltimore, Md.

This particular generator does not produce useful output much above 4000 cps. However, the square-wave generator in our June '59 issue ("Q-Square" Transistor Generator) offers outputs at 100, 1000 and 10,000 cps. —30—

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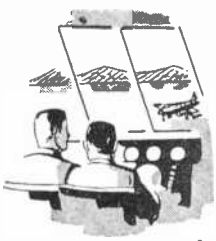

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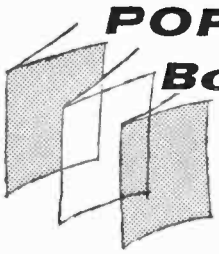

"SERVICING HI-FI—VOLUME 3 (AM-FM TUNERS)," published by Howard W. Sams & Co., Inc., 2201 E. 46th St., Indianapolis 6, Ind. 160 pages. Soft cover. $2.95.

Volume 3 of this series contains an editorial section titled "Highlights on FM," which covers the FM signal, a.f.c. circuits in FM receivers, and alignment techniques using a sweep generator. A second section provides complete photofact service data on 18 selected models of 1957-58 AM-FM tuners.

"ELEMENTS OF RADIO" by Marcus and Marcus. Fourth Edition. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y. 667 pages. $7.00.

This basic radio primer has been revised and brought up to date to include recent developments in the field. The subject matter falls into three general categories: electronic theory, radio transmitters, and radio receivers. At the end of each of the 42 chapters is a summary of the chapter, a glossary of new terms, and problems for self-testing. This book is recommended as a text for beginners in electronics and as a reference source for the advanced student or technician.

"CONCISE DICTIONARY OF SCIENCE" by Frank Gaynor. Published by Philosophical Library, 15 East 40th St., New York 16, N. Y. 546 pages. $10.00.

Here is an up-to-date dictionary which provides concise definitions of terms and concepts pertaining to the many branches of the scientific field. The author, well known as a contributor to the *Encyclopedia Britannica,* has included the newer sciences

(*Continued on page* 20)

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John W. Dempsey, Box 55, Rising Sun, Md.	1st	12
Donald H. Ford, Hyannis RD, Barnstable, Mass.	1st	12
Richard J. Falk, 2303 Holman St., Bremerton, Wash.	1st	22
Denson D. McNully, 1117 N. Houston St., Amarillo, Texas	1st	9
James D. Hough, 400 S. Church St., East Troy, Wisc.	1st	12
Odie B. Perry, Jr., Rt. #3, Zebulon, N. C.	1st	12
Milton C. Gee, Rt. #1, Washington, N. J.	1st	11

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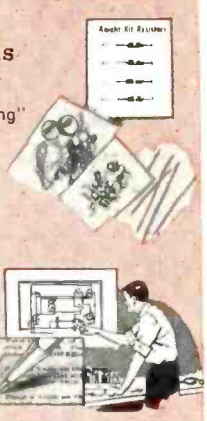

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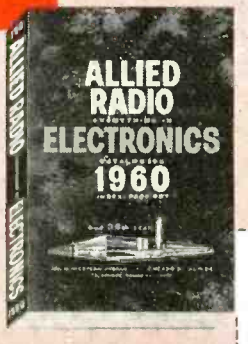

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"EXPERIMENTAL MUSIC" by Hiller and Isaacson. Published by McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. 196 pages. $6.00.

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"ELECTRONIC CIRCUIT THEORY" by Zimmerman and Mason. Published by John Wiley and Sons, 440 Fourth Ave., New York 16, N. Y. 564 pages. $10.75.

An excellent guide to the understanding of the theory of circuit design, this book is very comprehensive in its scope and is generously illustrated. Since it relies heavily on mathematical equations, including calculus, it is recommended only to the engineer or the engineering student.

"THE SOUND OF HIGH FIDELITY" by Jordan and Cunningham. Published by the Windsor Press, 200 East Ontario St., Chicago 11, Ill. 208 pages. $3.95.

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3BZ6	.55	5U8	.81	6BD6	.51	6CG7	.60	11CY7	.75	12BE6	.53				
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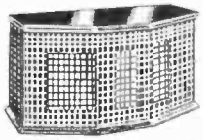

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basic electronics that underlie top-grade hi-fi performance. This book is very highly recommended both to the neophyte and the expert.

"SERVICING TRANSISTOR RADIOS: Vol. 3" published by Howard W. Sams and Co., Inc., 2201 East 46th St., Indianapolis 6, Ind. 160 pages. Soft cover. $2.95.

An informative volume on the repair of transistor radios, this book covers the late models of 23 manufacturers. Use of the well-known "Photofact" technique—photographs, schematics, parts lists and alignment instructions—makes the presentation crystal-clear. Included is a brief but helpful section on transistor circuit theory. Highly recommended.

Free Literature Roundup

Two new catalogs are available from Electro-Voice, Inc., Buchanan, Mich. Catalog 134 is a colorful and attractive 26-page guide to hi-fi equipment; it also contains an introduction to stereophonic sound and illustrates proper placement of stereo speaker systems. Catalogue 120A is a descriptive guide to E-V professional microphones and contains photographs, response curves, polar patterns, wiring diagrams, and other specifications for the complete E-V microphone line.

An entire series of science materials for use in teaching science to the younger set is described in an attractive 36-page catalog available from Science Materials Center, 59 Fourth Ave., Dept. M-4, New York 3, N. Y. The educational and instructional material covers such fields as electronics, electricity, physics, mechanics, engineering, radiation detection, and others.

"Facts About Storage Batteries" is the title of an interesting and informative 32-page booklet published by Exide Automotive Division, P. O. Box QB 6266, Cleveland 1, Ohio. It covers car, tractor and boat batteries, with explanations of how they work and how to get the maximum amount of service from them. —30—

JUST IMPORTED FROM ITALY!

WORLD'S FIRST PERSONAL SIZE DESK ADDING MACHINE!

Amazing Little Machine With Spinning Wheels and Trip Mechanism Adds Up To 9,999,999... Automatically!

Not a flat, vest pocket adder—not a gadget—no bewildering instructions to follow. Here for the first time is a real desk-type adding machine that works on the same scientific principle as electric office computing machines . . . but without electricity! It adds up bank statements, sales slips, inventories, expense accounts, super-market tapes, budgets, any adding jobs you have . . . within seconds of even $200.00 office adding machines! And then, this amazing machine clears itself with just a flick of your finger on the clearing bar. Yes! Instantly all the wheels inside spin back to normal—7 zeros flash into the easy-to-read answer windows—and it is ready for the next time saving, money saving adding job!

END MENTAL ADDING—FOREVER

No more adding figures in your head . . . scribbling numbers on paper . . . making mistakes that cost you time . . . and cost you money! Simply press the numbers down on this wonder-working little machine. The automatic trip wheel mechanism never makes a mistake. The total appears in big, clear, easy to read numbers in the answer windows—INSTANTLY and AUTOMATICALLY!

It keeps you within your budget . . . keeps you from overspending . . . protects you from the mistakes companies—even banks . . . often make . . . adds all the figures for your income tax . . . adds up stock dividends . . . checks expense accounts . . . plus a thousand other adding chores . . . and pays for itself a hundred times over in the money you save.

AN ITALIAN INVENTION

An eminent inventor in Italy discovered the secret of the fool-proof, electric, spinningwheel adding mechanism inside this machine. He had been trying for years to develop a real adding machine at a price for everyone . . . even in war-poor Europe. NOT another flat pocket adder that requires you to read long instructions before you can begin to operate it. Instead . . . he wanted a real, desk type adding machine . . . that anyone could operate, even a child . . . that would be automatic . . . fool proof . . . and, above all, within the pocketbook of everyone!

He found the answer after studying the spinning wheels inside electric computing machines. He came upon a way to let a person's hand supply the 'power' to the wheels . . . instead of electricity! Just imagine! He invented an adding machine designed so that the gentlest touch makes the wheels inside turn! After one complete turn . . . the first wheel automatically trips the next wheel . . . just like $200.00 electric machines! Nothing to remember. Nothing to do but press down the numbers to be added. Everything else automatic!

When the Italians . . . famous for smaller automobiles and smaller motorcycles . . . started manufacturing this revolutionary new smaller, non-electric adding machine, offices and individuals in Rome, Venice, Florence tried it. WHAT ACCLAIM IT MET WITH! Everywhere it added the longest columns of figures within seconds of the speed of electric machines. Giant companies gave it to secretaries . . . officers, salesmen. Efficiency of entire companies improved. Mistakes were cut down.

And from individuals came even more glowing stories. Instantly adding became a pleasure instead of an aggravating chore. Households became better managed . . . budgets stuck to . . . bills checked . . . mountains of figures added in no time . . . mistakes a thing of the past!

And when this remarkable adding machine was imported to this country, the acclaim was just as great! For here at last was what every home . . . every office . . . every store has been waiting for. The perfect, small, easy to use, automatic, desk model adding machine . . . in beautiful silver tone and blue finish, with big, easy to read numbers . . . and at a price so incredibly low that not a family or store or office can afford to be without it!

FREE TRIAL OFFER

How would you like to try this amazing new gleaming metal adding machine in your home, your office or your store entirely without risking a penny?

We want you to actually test it against automatic, electric adding machines. Compare it for speed, ease of use and accuracy. You must agree that it is almost as fast . . . and just as easy to use . . . you must agree that it will save you endless time, trouble, mistakes and money every week . . . or it won't cost you a penny.

Just push the numbers down. See how the most gentle pressure of your hand turns the wheels inside. See how it adds up to 9,999,999 automatically. And see how just a flick of the clearing bar on the side makes the numbers inside the answer window all whirl back to seven zeros . . . instantly!

Put this amazing adding machine on your desk. See how instead of being too busy to add . . . or in too much of a hurry to be bothered with a complicated pocket adder . . . from now on you will check every calculation . . . check all your bills, statements, estimates, inventories, budgets, reports . . . each in seconds . . . and never make costly mistakes again!

If you are in business, see how this precision adding machine will save you its unbelievable low price a hundred times over. Give one to every secretary, every clerk, every person who ever adds. See how it cuts out trips to your bookkeeper, saves time, improves the efficiency of your entire company.

You must be convinced that ADDIPRESTO is one of the most valuable and useful inventions you ever used or it won't cost you a penny.

Supply Still Very Limited
Mail Free Trial Coupon
TODAY

Yes, it is impossible for you to appreciate the beauty, speed and efficiency of ADDIPRESTO until you actually see it and use it. Let us send it to you for one week's completely free trial.

The price of ADDIPRESTO is only $14.95. Remember, it is a real adding machine with spinning wheels and automatic mechanism . . . the same type as $200.00 office computing machines. But ADDIPRESTO works from the pressure of your hand without electricity! It will save you its remarkable low cost many times over. Because you will USE it . . . over and over . . . day after day. Don't confuse it with flat, hard to use, complicated pocket adders.

However, the supply of genuine ADDIPRESTO machines is strictly limited. The factory in Europe cannot meet the demand. You must mail the free trial coupon below at once. ADDIPRESTO is not yet sold in stores. Act now and get yours by mail.

ADDIPRESTO is shipped with protective plastic cover and GUARANTEE CERTIFICATE.

FOR THE FIRST TIME —Your Own Personal Desk Model Automatic Adding Machine!

Now you can keep ADDIPRESTO on your desk at home or office and never add anything in your head again. In SECONDS . . . perform almost any adding chore. No more costly mistakes. ADDIPRESTO's spinning wheels and computer type mechanism do the 'figuring' automatically!

GUARANTEE

This original ADDIPRESTO is precision-made from the finest quality materials, and will give you a lifetime of accurate, effective performance. Unconditionally Guaranteed against defects in material or workmanship.

PROVEN IN USE

Don't confuse this desk-model real adding machine with flat pocket adders. ADDIPRESTO is used by offices, stores, institutions, for adding jobs that demand true speed and accuracy. Used by giant corporations. Saves time, saves mental work, saves money. A real adding machine.

MAIL THIS NO-RISK TRIAL COUPON

AGENTS! SALESMEN!

THE BIGGEST MONEY-MAKER YOU HAVE EVER KNOWN!

ADDIPRESTO is the greatest goldmine you ever saw. Simply show this beautiful, gleaming metal adding machine with spinning wheels and automatic trip mechanism . . . the same type as $200.00 electric computers. Then make this eye opening demonstration: add a 6-INCH LONG COLUMN OF FIGURES in 30 SECONDS! After that there's no selling . . . no arguing. You can't keep people from buying! It's true. 8 out of 8 sales is nothing. Every home, every office, every store needs it. Send for yours today and get started to the biggest money you have ever known. There is no competition. There is no other machine like ADDIPRESTO.

MAIL COUPON NOW!

OLIVER GARFIELD CO., INC., Dept. PE-99
108 E. 16th St.
New York 3, N. Y.

Yes, I want to try ADDIPRESTO, the new Italian Office Type Adding Machine. I will use the machine for one week without risk to me. It must be everything you say it is or I may return it and you will refund my money at once, no questions asked, and I will have used the machine entirely free.

☐ I enclose $14.95 (check or money order) as payment in full. This way I save over $1.00 in postage and handling charges. Same guarantee . . . same 7-day FREE trial.

☐ You may bill me for $14.95 (plus postage and handling) after my 7-day FREE trial period.

NAME .....

ADDRESS .....

CITY ..... ZONE .... STATE .....

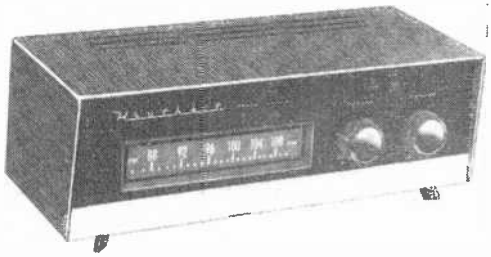
☐ QUANTITY BUYERS SAVE! 2 Machines only $13.95 each.
3 to 5 Machines only $12.95 each.

"Stop *playing* your pancakes and start *eating* them, or I'll take away that *Jensen Cartridge!*"

NEW products

FM TUNER KIT

Heath's Model FM-4 high-fidelity FM tuner kit features 2.5-microvolt sensitivity, automatic frequency control with defeat switch, and flywheel tuning. In addition to the normal audio output, a multiplex output is provided for use with a multiplex adapter. Ease of construction is assured by



prealigned i.f. transformers and a prewired, prealigned tuning unit. $34.95. *(Heath Company,* Benton Harbor, Mich.)

PROMOTIONAL TAPE OFFER

For the price of two 7" reels of unrecorded Audiotape #1251 plus $1.00, you receive a duo-pack which includes one reel of blank Audiotape plus one 7" reel of "Blood and Thunder Classics." This special stereo tape offer is being made by *Audio Devices, Inc.,* 444 Madison Ave., New York 22, N. Y. The prerecorded stereo reel includes Tchaikovsky's "Russian Dance" from the *Nutcracker Suite*, Sibelius' *Finlandia*, de Falla's "Dance of Terror" and "Ritual Fire Dance" from *El Amor Brujo*, Katchaturian's "Saber Dance," Stravinski's *Fire Bird Suite*, and other selections. The stereo program time is 30 minutes. A mono version, with one hour of music, is also available.

CITIZENS BAND TRANSCEIVER

The CD-5 "Citi-fone" five-channel transceiver for operation on the new Class "D" Citizens Band has been announced by *Multi-Products Co.,* 21470 Coolidge Highway, Oak Park 37, Mich. The transmitter section is rated at 5 watts input, is AM-modulated, and comes complete with

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YOU ARE NEEDED IN THE TELEVISION-ELECTRONICS-RADIO INDUSTRY! You can build a secure future for yourself if you get into Electronics NOW! Today's shortage of trained technicians creates tremendous opportunities. National Schools Shop-Method trained technicians are in constant and growing demand for high-pay jobs in Broadcasting and Communications, Electronic Research, Servicing and Repair, and many other branches.

Let National Schools, a Resident Technical School for over 50 years train you for today's unlimited opportunities in electronics! Our Shop Method trains you to be a MASTER-TECHNICIAN. Completely up to date, developed by experienced instructors and engineers, your Telerama Course will teach you all phases of the industry quickly, clearly and correctly. You can master the most modern projects, such as Color TV, printed circuits — even prepare for FCC License without taking a special course. You can handle sales, servicing, manufacturing, or make good money in your own business. SEND FOR FACTS TODAY!

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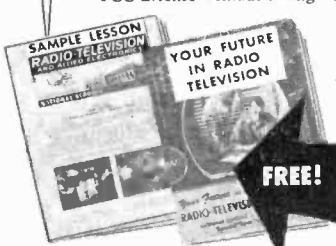

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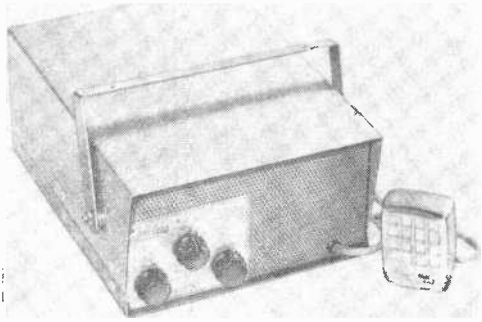
products

(*Continued from page* 24)

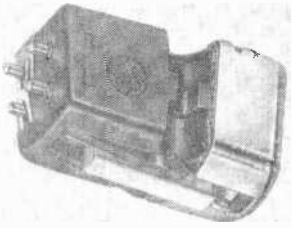
crystals for one channel. Features include a squelch control and noise limiter. A



ceramic-type crystal microphone is provided as well as license application Form 505. Price, $124.50.

MAGNETIC STEREO CARTRIDGES

Two additions to the *G.E.* line of stereo cartridges have been announced recently. The VR-225 is a variable reluctance design with a 0.5-mil diamond stylus for use with professional turntable systems. Frequency response is from 20 to 20,000 cps ±3 db, and channel separation is up to 30 db. Lateral compliance is 4×10^{-6} cm/dyne, vertical



compliance 2.5×10^{-6} cm/dyne. Price, $27.95.

The VR-227 is similar to the VR-225 but has a 0.7-mil diamond stylus and is for use with record changers. Frequency response is from 20 to 17,000 cps ±3 db. Lateral compliance is 3×10^{-6} cm/dyne, vertical compliance 2×10^{-6} cm/dyne. Price, $24.95. (*General Electric* Specialty Electronic Components Dept., West Genesee St., Auburn, N. Y.)

HANDY WIRE CUTTER

The "Little Snipper," manufactured by *E. V. Nielsen, Inc.*, 575 Hope St., P. O. Box

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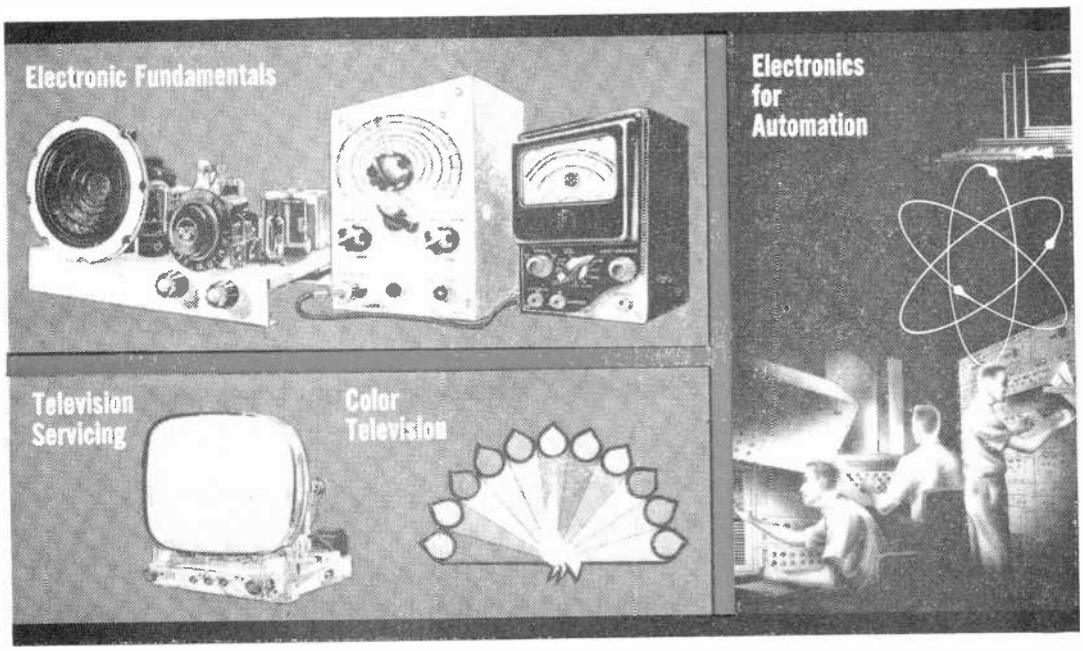

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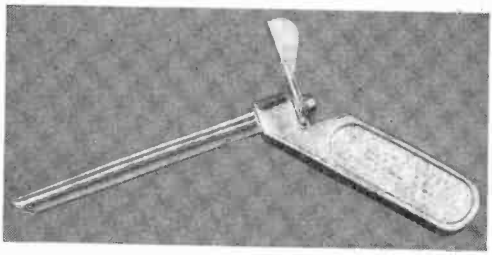
To save time, paste coupon on postcard.

products

(*Continued from page 26*)

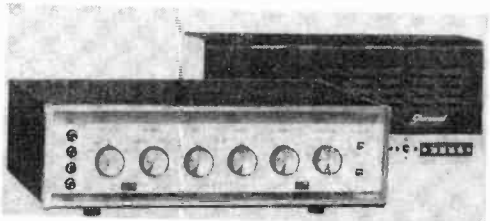
383, Glenbrook Station, Stamford, Conn., is easy to use, reaches into tight spots, and doubles as a pick-up pincers. It cuts steel wire in the smaller gauges and copper up to #12. The "Little Snipper" comes in standard lengths ranging from 2 to 18 inches; most popular are the 4" model at $4.25 and



the 6" model at $4.50. For prices on other lengths and further information, write to the manufacturer.

STEREO AMP/PREAMP

Sherwood Electronic Laboratories, Inc., 4300 N. California Ave., Chicago 18, Ill., has announced a 36-watt add-on basic amplifier and stereo preamp to convert monophonic systems to stereo. Among the controls on the S-4400 are a presence-rise switch, phono scratch and rumble filter switch, "center-



set" loudness control, tape monitor switch, and an output tube balance control. Control features essential to stereo operation include the dual loudness control, stereo normal/reverse switch, and phase-reversal switch. Frequency response at 36 watts is 20 cps to 20 kc. ± 1½ db. Price, $159.50.

WALL-HUNG FOLDING TABLE

Do-it-yourself'ers can now make a convenient wall-hung table that folds flat against the wall when not in use. It can be done in minutes simply by attaching any counter top material to a pair of "Droptop" folding wall brackets. These

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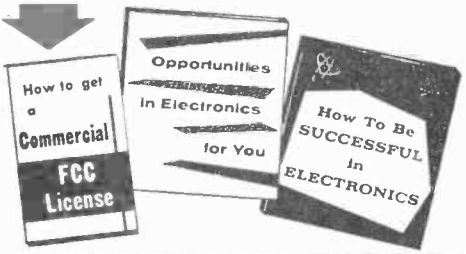

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Desk PE-55, 4900 Euclid Ave., Cleveland 3, Ohio

Cleveland Institute training results in job offers like these:

Radio Operators

TWA has opportunities for radio operators with a 2nd class license or better. Must be able to type at least 35 wpm. Free transportation for self and family. Vacation and many other benefits.

Electronic Technicians

Goodyear Aircraft Corp. has openings for electronic technicians, to work as assistants to engineers on developmental electronics projects such as missile systems, radar, antennas and analog computers.

And our trainees get good jobs

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"I am now employed by the Western Electric Company as an electronic tester. My status as a student of Cleveland Institute was an important factor in my being employed. Knowledge gained through the course has proved amazingly helpful and affords me a feeling of complete confidence."

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In what kind of work are you now engaged?_____

In what branch of Electronics are you interested?_____

Name_____ Age_____

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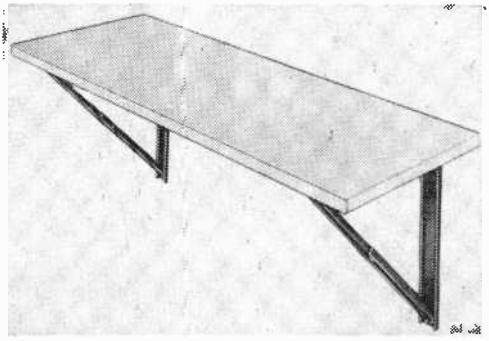
PE-55

products

(*Continued from page* 28)

brackets come packaged in a kit which contains two of the steel brackets, mounting hardware, and a wrench. Cost, $9.95 per



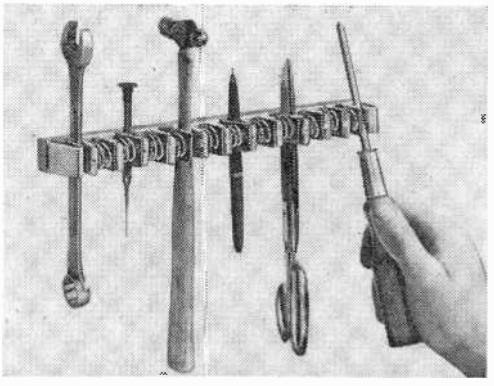
kit, postpaid. (*Sturdilite Products,* 2501 Peterson Ave., Chicago 45, Ill.)

STEREO TONE-ARM KIT

Components Corporation of Denville, N. J., has announced a new stereo tone arm in kit form. The Model AS "Auto-Set" tone arm features a single pivot bearing which is made of special heat-treated and polished alloy material. Unique mounting arrangements allow positioning of the arm for maximum tracking accuracy and all standard stereo and mono cartridges can be accommodated. Price, $19.50.

TOOL HOLDER

Holding up to 12 items, the "Lifetime Holder" ends clutter in workshop, garage, and kitchen. No item is too small to be



held in place. Three tension adjustments are available. The holder is 11" long and comes with screws for wall mounting. Price, $1.69. (*The Callahan Co.,* 5101 S. E. 17th Ave., Portland 2, Ore.) —30—

Lafayette Superior Quality Hi-Fi Kits

50 WATT INTEGRATED STEREO AMPLIFIER

KT-250 IN KIT FORM **64.50**

LA-250 COMPLETELY WIRED **89.50**

● RESPONSE 17-21,000 CPS ± 1 DB (at normal listening level) ● UNIQUE "BLEND" CONTROL ● PREMIUM EL86 OUTPUT TUBES ● 50 WATTS MONAURAL—25 WATTS EACH STEREO CHANNEL ● CLUTCH-OPERATED VOLUME CONTROL ● SEPARATE BASS & TREBLE CONTROLS

A completely new stereo high fidelity amplifier with a high quality of reproduction, remarkable versatility and new distinctive styling. Full range of controls include a unique "blend" control for continuously variable channel separation —from full monaural to full stereo, 4-position Selector, Mode, Loudness and Phasing switches plus outputs for 4, 8 or 16 ohm speakers. Harmonic distortion less than 0.25%, IM distortion less than 1%. Hum and Noise 74 db below full output. Assembly is simple—no special skills or tools required. Complete with deluxe cabinet and legs, all parts, tubes and detailed instruction manual. Shpg. wt., 26 lbs.

KT-250 Stereo Amplifier Kit 6.45 down .....Net **64.50**

LA-250 Stereo Amplifier, wired & tested—8.95 down
Net **89.50**

PROFESSIONAL STEREO CONTROL CENTER

KT-600 IN KIT FORM **79.50**

LA-600 COMPLETELY WIRED **134.50**

● RESPONSE 5-40,000 CPS ± 1 DB ● UNIQUE STEREO & MONAURAL CONTROL FEATURES ● PRECISE "NULL" BALANCING SYSTEM ● CONCENTRIC INPUT LEVEL CONTROLS

A truly professional stereo preamplifier and master audio control center—solves every stereo/monaural control problem. Features unique Bridge Control for variable cross-channel feed for elimination of exaggerated channel separation effects—plus controlled 3rd channel output. Has all-concentric controls—including clutch-operated Volume Balance control. Provides complete and advanced facilities for accepting, controlling and providing undistorted gain for any and all program sources. Sensitivity 2.2 mv for 1 volt out (low level inputs). Dual low impedance "plate follower" outputs 1500 ohms. Response 5-40,000 cps ± 1 db. Less than .03% IM distortion. Less than .1% harmonic distortion. Hum and noise 80 db below 2 volts (high level inputs). Uses 7 new 7025 low-noise dual triodes. Size: 14" x 4½" x 10¾". Shpg. wt., 16 lbs. Complete with all parts, tubes, deluxe cabinet and detailed instruction manual.

KT-600 Stereo Preamplifier Kit—7.95 Down .....Net **79.50**

LA-600 Stereo Preamplifier, wired and tested—13.45 Down
Net **134.50**

Outstanding Design—Incomparable Performance

STEREO/MONAURAL POWER AMPLIFIER KIT

KT-310 IN KIT FORM **47.50**

LA-310 COMPLETELY WIRED **69.50**

● 36 WATT STEREO AMPLIFIER—18 WATTS EACH CHANNEL ● EMPLOYS 4 PREMIUM-TYPE 7189 TUBES ● 2 PRINTED CIRCUIT BOARDS FOR SIMPLIFIED WIRING ● RESPONSE BETTER THAN 35-30,000 CPS ± ½ DB AT 18 WATTS ● LESS THAN 1% HARMONIC OR IM DISTORTION

A superb basic stereo amplifier in easy-to-build kit form. Unit may be used with a stereo preamplifier to provide two 18 watt stereo channels or, at the flick of a switch, as a fine 36 watt monaural amplifier. Controls include 2 input volume controls, Channel Reverse switch and Monaural-Stereo switch. Dual outputs for 4, 8, 16 or 32 ohm speakers. Input sensitivity .45 volts per channel for full output. Tubes are 2-6AN8, 4-7189, GZ-34 rectifier. Size 10-9/16" d x 5¼" h x 13¼" w. Complete kit with cage, all parts, tubes and detailed instruction manual. Shpg. wt., 22 lbs.

KT-310 Stereo Power Amplifier Kit—4.75 Down .....Net **47.50**

LA-310 Stereo Power Amplifier, wired and tested—6.95 Down
Net **69.50**

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KT-500 IN KIT FORM **74.50**

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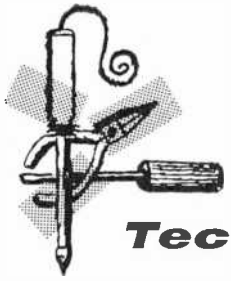
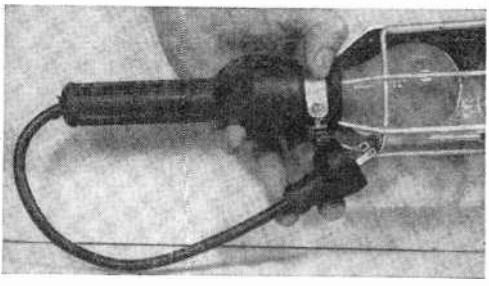


Tips and Techniques

EXTRA EXTENSION AT LOW COST

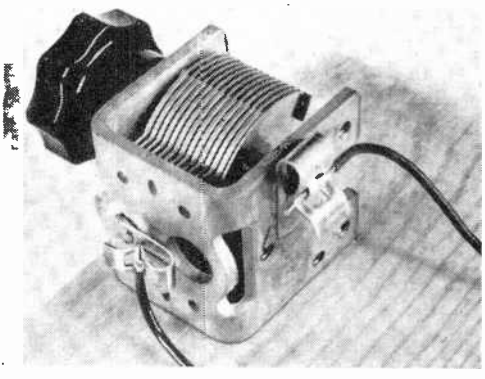
Ordinarily a droplight comes with 25 to 50 feet of electrical cord. To acquire an extra extension cord for use around the home, cut the cord about a foot from the lamp



socket and attach an a.c. plug. Fit a multi-outlet female receptacle to the open end of the a.c. cord. Actually the benefits derived are two-fold: not only have you gained a handy extension at little cost, but the droplight can be neatly and easily stored when not in use.—*Peter Barna, Wilmington, Calif.*

MOUNTING VARIABLE CAPACITORS

When hooking up experimental circuits on a "breadboard," it isn't necessary to make brackets or panels to hold variable



capacitors to the board—simply stick the capacitors down with Duco cement! Spread the cement on the edge of the capacitor frame, press the capacitor onto the board,

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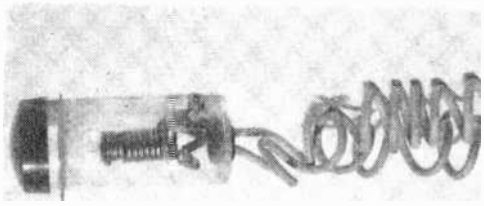
Tips

(*Continued from page 34*)

and allow the cement to set. When you want to remove the capacitor, simply pry it off the board and scrape off the dried cement. Quick and easy connections to the capacitors can be made with a pair of Fahnestock clips soldered on each capacitor.—*Art Trauffer, Council Bluffs, Iowa.*

LOW-COST INDICATOR LAMP

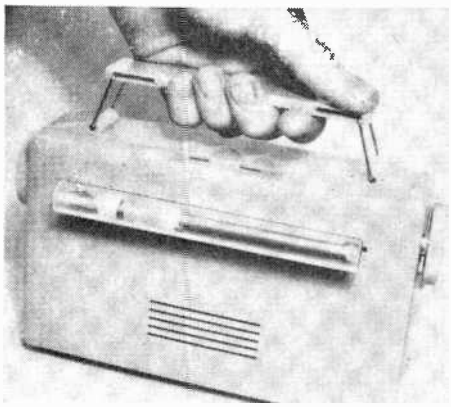
Small plastic containers with red tops which are used by dime stores to retail screws, nails, etc., make good indicator lamp holders. The lamp is mounted inside the container by a screw and nut through the lamp socket bracket and the container



wall. The completed lamp holder is mounted to the equipment by sandwiching the equipment panel between the red cap and a plastic ring cemented around the outside of the lamp holder.—*D. B. Tansley, Oshawa, Canada.*

IMPROVE PORTABLE RECEPTION

To improve the signal pickup and output volume of your transistor or tube portable, install the loopstick antenna on the outside



of the set. In effect, you will be increasing the distance between the chassis and the antenna and thereby eliminating the signal-robbing effect of capacitance between the

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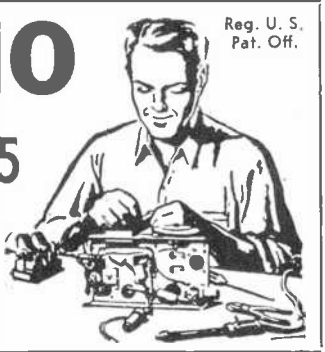

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You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

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You will receive all parts and instructions necessary to build 16 different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, Instruction Manuals, hook-up wire, solder, etc. In addition, you receive Printed Circuit Materials, including Printed Circuit Chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C.-type Questions and Answers for Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

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

FROM OUR MAIL BAG

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

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

PRINTED CIRCUITRY

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

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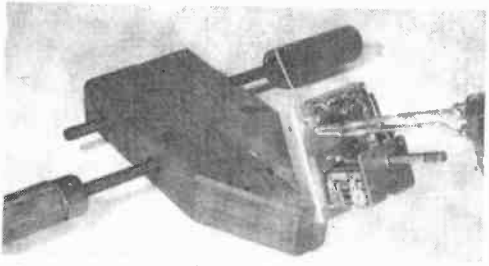
Tips

(*Continued from page 36*)

two. Not only will you notice a marked improvement in reception, but the life of the batteries will be extended since they will continue to provide sufficient volume when they begin to weaken.—*Charles Lang, San Francisco, Calif.*

CHASSIS POSITIONER

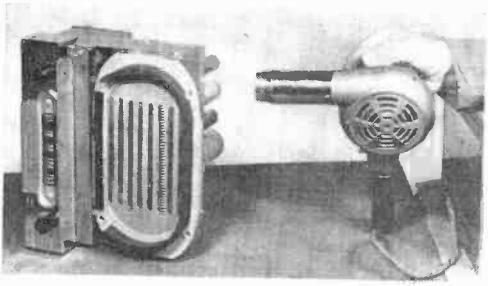
In soldering electronic equipment, it is often necessary to hold the chassis at odd



angles to control the flow of the molten solder. A good third hand for such work is the woodworker's adjustable screw clamp. An edge of the chassis is clamped in the jaws at the desired angle. The weight and broad base of the clamp easily supports a chassis of average size.—*Louis Golden, East Peoria, Ill.*

HAIR DRIER CLEANS RADIO

A small hair drier will blow away the dust from electronic equipment in quick order. Most driers have "hot" and "cold"



positions, allowing cold air to be used for dust and hot air for coils which may have absorbed moisture.—*H. Leeper, Canton, Ohio*

CARDBOARD-BOX CHASSIS "CRADLE"

When you have to turn the chassis of a radio, audio amplifier, or hi-fi component upside down for servicing, a large cardboard box makes a handy "cradle." It's better to rest the chassis in the opening of the

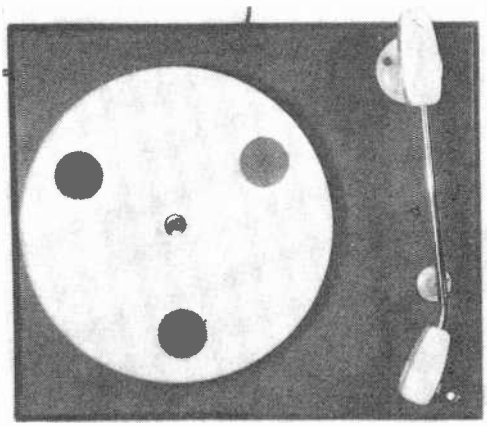
box than to let it sit on tubes, transformers, and other easily damaged components.—*John A. Comstock, Wellsboro, Pa.*

USES FOR TRAIN TRANSFORMERS

A toy train transformer makes a handy variable low-voltage a.c. supply. It can be used with selenium rectifiers to power transistor circuits, and the higher-wattage models can be used as battery eliminators. Another trick is to connect the secondary in series with the line to buck or boost the line voltage, depending on phase, and you have a cheap autoformer! Some of these transformers even have a built-in circuit breaker.—*Mark H. Wirth, K8IVJ, St. Joseph, Mich.*

"FLOAT" YOUR RECORDS

In these days of lightweight records and phono pickups, records can be "floated" to reduce dust pickup from the turntable and



vibration from the motor. I cemented three 1"-diameter soft rubber discs cut from a scrap of "Non-Skid" material onto the top of my turntable. The tripod arrangement of the rubber discs spaces the records away from the turntable and keeps them from slipping.—*Art Trauffer, Council Bluffs, Iowa.*

SPLICE WITH SQUARE KNOTS

When you splice thin stranded wire, skin the ends back sufficiently so that you can tie a square knot in the splice, then wrap any remaining bare wire around the splice. Such splices require no soldering for strength as they will withstand parting up to the breaking point of the wire. The tighter the splice is pulled, the better will be the connection.—*Harry J. Miller, Sarasota, Fla.*

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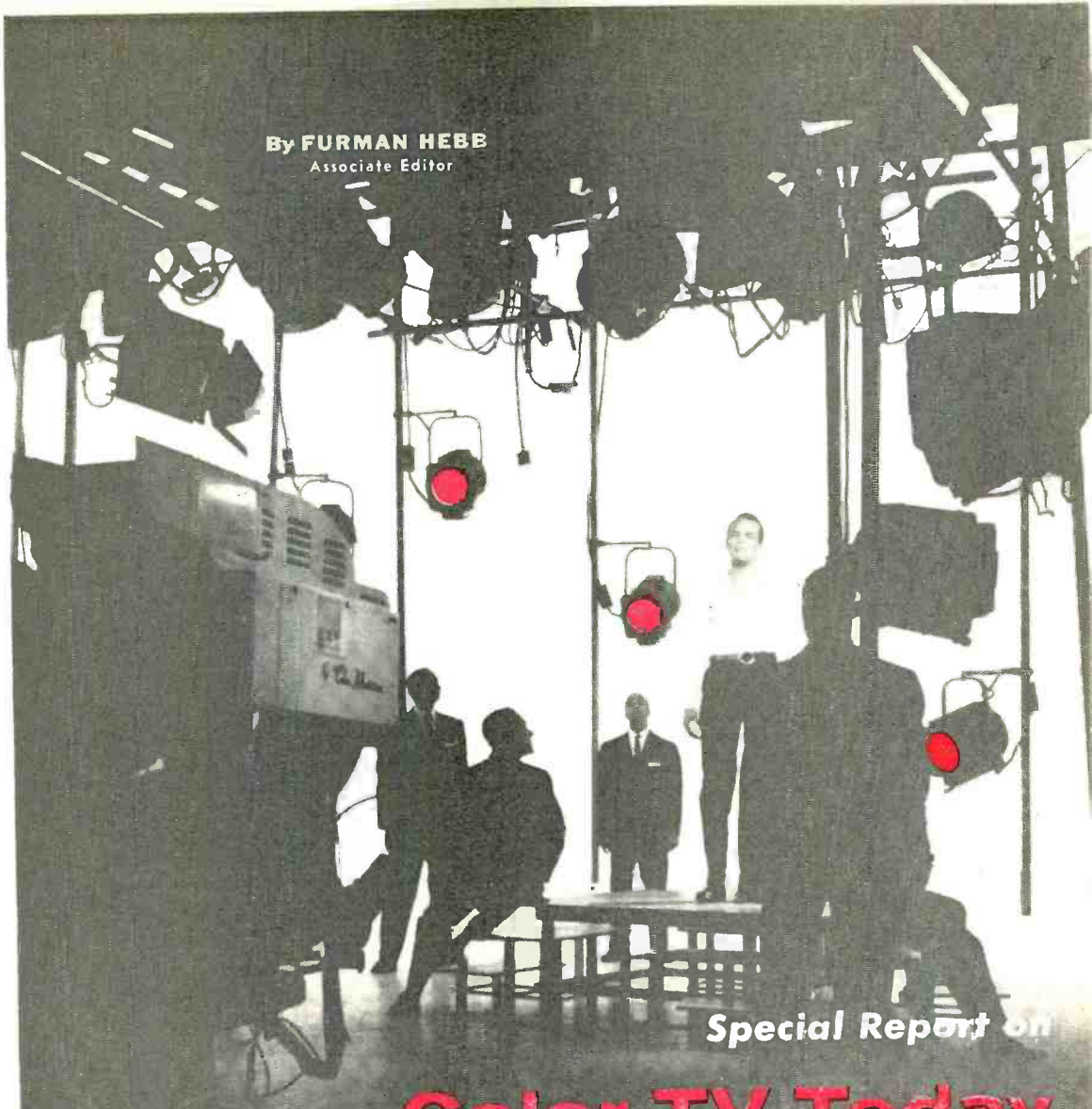
◀ See Page 38 for EICO'S BEST BUYS in "HAM" GEAR.



By FURMAN HEBB
Associate Editor

Special Report on

Color TV Today

What's the truth about color TV? Is it everything it's claimed to be? Here are the facts.

IN 1954, when color television first became a commercial reality, the experts all foresaw a rosy future for it. John Q. Public was supposed to march right down to his local appliance store and lay his money on the line for one of the new multi-hued models.

But this John Q. Public did not do, and five years and 130 million dollars later (RCA's estimated investment), what has been color TV's lot? Judged by any business man's standards, it has gone over like a

Musical and variety shows are naturals for color TV. The Dinah Shore show is particularly "colorgenic." Perry Como and Steve Allen are also color favorites. Note the color background possibilities.

lead balloon. Out of a total of 45 million TV sets now in use, less than 500,000, or only about 1%, are color sets.

Ask the man on the street what he thinks of color TV, and chances are he hasn't even seen it yet. If he has seen it, he will probably say: (1) the quality is poor, (2) it's too expensive, (3) it's too difficult to tune, (4) there aren't enough color programs, and (5) color sets break down too often.

Facts About Color TV. Despite the fact that RCA has spent millions of dollars advertising and promoting color TV, the foregoing impressions are strongly implanted in the minds of a great many people. The awful pity of the situation is that, for the most part, these impressions do not reflect the true facts.

After having surveyed a number of color TV set owners and service technicians all over the country, and after having lived with a color set for a period of four months, the writer has come to the following conclusions: (1) the visual quality of color TV usually varies from good to very good and is often truly superb, (2) the sets are not difficult to tune, (3) there is still not a wide choice of programs, but color programing appears to be getting stronger with each new season, (4) the service problem is not significantly more important than it is with a black-and-white set (excluding one major consideration which we'll get to later), and (5) as far as price is concerned, although color sets are undeniably expensive, the results of our survey of color set owners indicate that the great majority feel they have received full value from their sets.

Color Set Owners. To find out exactly what people who own color sets think of color TV, a number of owners were surveyed by mail. These people hailed from such diverse areas as: Lansing, Mich.; Elizabeth, N. J.; York, Pa.; Whittier, Calif.; Fishkill, N. Y.; Portsmouth, Ohio; Chicago; and Milwaukee.

Typical replies to the question, "What is your over-all impression of color TV?" were: "Beautiful," "Great," "Magnificent," "Exciting," and so on.

"Just one good color program a week offsets any additional cost of a color TV set," one enthusiastic fan wrote. "Color TV is far more natural than color movies."

Another commented, "After two years with a color TV set, we cannot contemplate any other means of home TV enter-

Special outstanding programs have been presented in color. The award-winning 'An Evening with Fred Astaire" was one. Others included the Old Vic presentation of "Ham et," and "The Green Pastures."

tainment. We seldom miss a color program. Only rarely do we go to movies because color TV is so satisfying."

The clincher was added by another fan. "We even enjoy commercials in color."

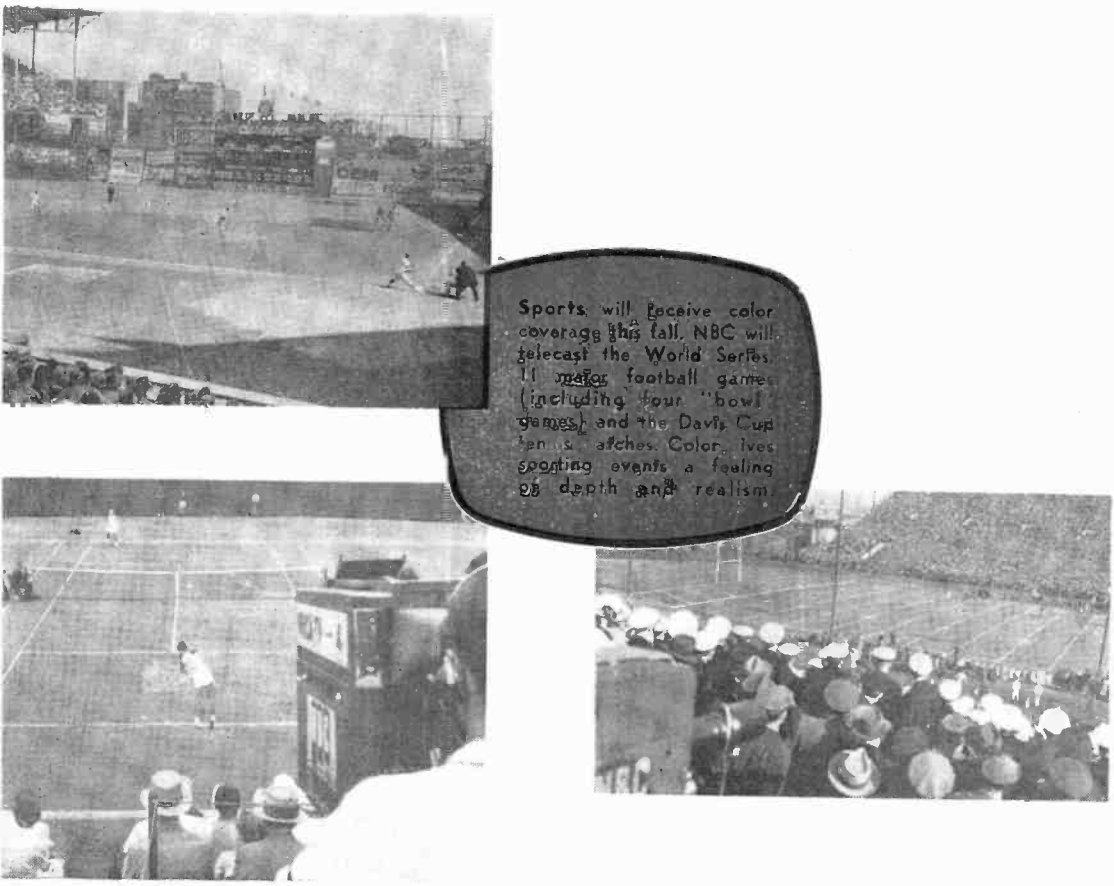
Almost unanimously, the owners reported that their sets have been easy to operate and have performed reliably. None had encountered problems in getting his set serviced. Most have found occasional adjustments of the controls necessary, but none considered these adjustments difficult to make.

When asked how well their color sets received black-and-white programs, the set owners generally agreed that a monochrome image is less sharp on a color set than on an ordinary set. In addition, most color set owners reported a slight color tint (usually a light bluish-green) on black-and-white programs. However, few people objected to either the "soft" monochrome image or the color tint on the screen. In general, the color set owners felt that black-and-white reception on their color sets was as good as on their monochrome sets.

Although antenna requirements are more demanding for color than black-and-white reception, the great majority of the color owners surveyed use their old antennas with their color sets. Some, indeed, located near TV transmitters, report that they use only an indoor "rabbit ears" antenna.

The concluding question on the questionnaire was, "Do you think the enjoyment made possible by your color TV set has been worth the money you paid for it?" To this most important question, the answer was a unanimous "Yes."

Service Technicians. In order to get opinions on color TV from the technical point of view, it was decided to quiz the men who service color sets. The service technicians surveyed were scattered from St. Louis to Sacramento, Chicago to Fort Worth, and from New Orleans to Garfield Heights, Ohio. They have been handling color TV set repairs for an average period of four years, and each turns out about 57



color repairs a month. They indicated that, although in their experience color sets require slightly more repair than black-and-white models, breakdowns of color sets are usually caused, not by defects in the color circuitry, but by failures which are common to both color and black-and-white sets—such as loss of sound, no vertical deflection, power supply failure, etc.

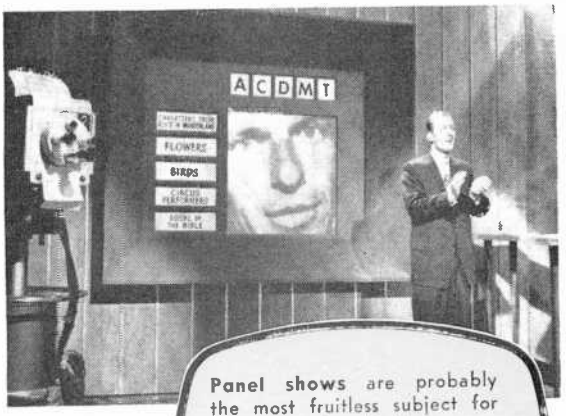
It was generally agreed that it is slightly more difficult to a repair a color set than a black-and-white set. The average repair cost reflected this; whereas the average repair bill for a black-and-white set was reported to be about $25.00, the average color set repair amounted to about $30.00.

Of the technicians surveyed, half already own color sets and the remaining half indicated that they plan to buy color sets. In general, they feel that color TV is "very good" and they would be very optimistic about its future if the number of color shows were to increase.

Tough Row to Hoe. Any discussion of color TV should point out that two closely linked corporations, RCA and its affiliate NBC, in truth, *are* color TV. These two colossi of the electronics world together have produced well over 90% of all the color programs transmitted and over 90% of the sets to receive them on. With very little support from the rest of the industry, they have taken on the task of selling color TV to the American public. At this time, with over 130 million dollars sunk into polychrome TV, it is most unlikely that they will slacken their efforts.

But RCA and NBC, in their efforts to popularize color TV, are confronted by a double-headed monster: price and programing. If these two problems could be solved, there is no doubt that color TV would fulfill every optimistic speculation of five years ago.

Obviously if there were a wider choice of color programs, a person would have a much greater incentive to buy a color set than he has presently. However, color programing will never be what it can be until



All photographs courtesy of National Broadcasting Company

Panel shows are probably the most fruitless subject for color TV. When the typical viewer sees "The Price Is Right" or "Haggis Baggis," in color, he may well say, "So it's in color—so what?"

more color sets are in use. NBC's biggest competitors, ABC and CBS, have made it quite clear that they will start doing a bang-up color programing job only when "the people want it"—meaning, of course, when enough people have color sets to make it economically attractive to sell color shows to sponsors. In the meantime, NBC has to keep color programing going practically single-handedly; ABC hasn't done anything in color and CBS makes only a token contribution to color programing.

Looking at things from a TV set manufacturer's viewpoint, you can't really blame him for being hesitant about going into the business of turning out high-priced color sets at a time when many people would refuse to buy them because of the lack of more color programing. Consequently, with both the networks and the TV manufacturers waiting for the others to make the first move, color TV is caught in the middle of a game of "let's-wait-and-see." The question is: Which will come first, the chicken (in the form of lower priced color sets) or the egg (more and better color programs)?

Quality of Color. As far as the visual quality of the finished product is concerned, as indicated earlier, it is variable—but rarely less than acceptable. Good color TV is a color experience as exciting and beautiful as any you'll ever run across—and this includes the results of any printing process and the highest quality color film.

If you have seen color TV in a store or in a bar and haven't been impressed, there can be two explanations: first, the set might not have been properly adjusted, and secondly, the level of illumination in the room may have been too high. In order for color TV to look its best, it must be shown in a considerably darker room than is suitable for black-and-white TV. If the room lighting is too bright, the picture will look weak and washed out; if the color control is turned up excessively in an attempt to give the picture more pep, it is almost impossible to achieve the correct color balance.

Live shows which originate under studio conditions generally provide the best color quality. The "Dinah Shore Chevy Show" comes live from California and is undoubt-

edly the top color show on the air. On the other hand, the "Steve Allen Show," which is also live, is less consistent in its color quality. This just proves it's not only the process, but the man behind the process, that counts. Dinah apparently has better technicians.

Filmed color, if expertly done, is almost as good as live color. "Northwest Passage," a filmed adventure series, generally has very good color, especially in the outdoor sequences.

To date, color-taped shows have been less satisfactory than either of the other two methods, with the color frequently appearing unsaturated and weak. Perhaps as the recorders and the tape are improved, color video tape will rival the other two processes. This would be very important economically, since color tape is about 15% cheaper than color film.

Truly poor color quality is almost always caused in the studio rather than in the receiver. Getting the light evenly distributed over the stage is a very ticklish problem. Occasionally a performer who is off-center falls into an area of illumination which is either "hot" or "cold." When this happens, his face may go out of color balance and turn either greenish or bluish-red. In severe cases, the unlucky actor may look as if he came from another planet. Improper color balance can be corrected in the studio, and distortions of this type will probably disappear as technicians become more skilled and as the equipment is made more self-correcting.

Depth and Realism. The most frequent words you'll find applied to color TV in the advertisements are "depth" and "realism." Now these don't mean much when you read them. They're just words. But the truth of the matter is that color does bring a genuine feeling of depth to the TV screen. When objects and people appear in their natural colors, you seem to see them *inside* the picture tube, rather than on the screen of the tube. It's not a true "3-D" effect, of course, but sometimes it comes remarkably close.

This feeling of depth accounts for part of the "realism" of color TV. But the different colors themselves add interest and realism. In color TV, as in painting, it is possible for the most banal subject to become a visually interesting experience by virtue of its color values alone. No matter what the subject matter, if color is handled skillfully, it can be enormously exciting.

The Sets Themselves. The first color sets had 15" screens, four controls for color alone, and were priced at a cozy $1000. In addition, the four controls worked together something like a combination lock. Each had to be set in just the right position before a good color picture could be received.

Color sets today have 21" screens, use only two extra "color" controls, and are priced as low as $495.00. This isn't exactly cheap, of course, but from time to time special offers bring the price down more.

From the user's point of view, the greatest improvement in today's color sets over earlier models is the ease of tuning. There is no longer just one correct "combination." If you misadjust one control, it is usually possible to compensate with either the other color control or the fine tuning, or by a slight re-orientation of the antenna (if it's handy).

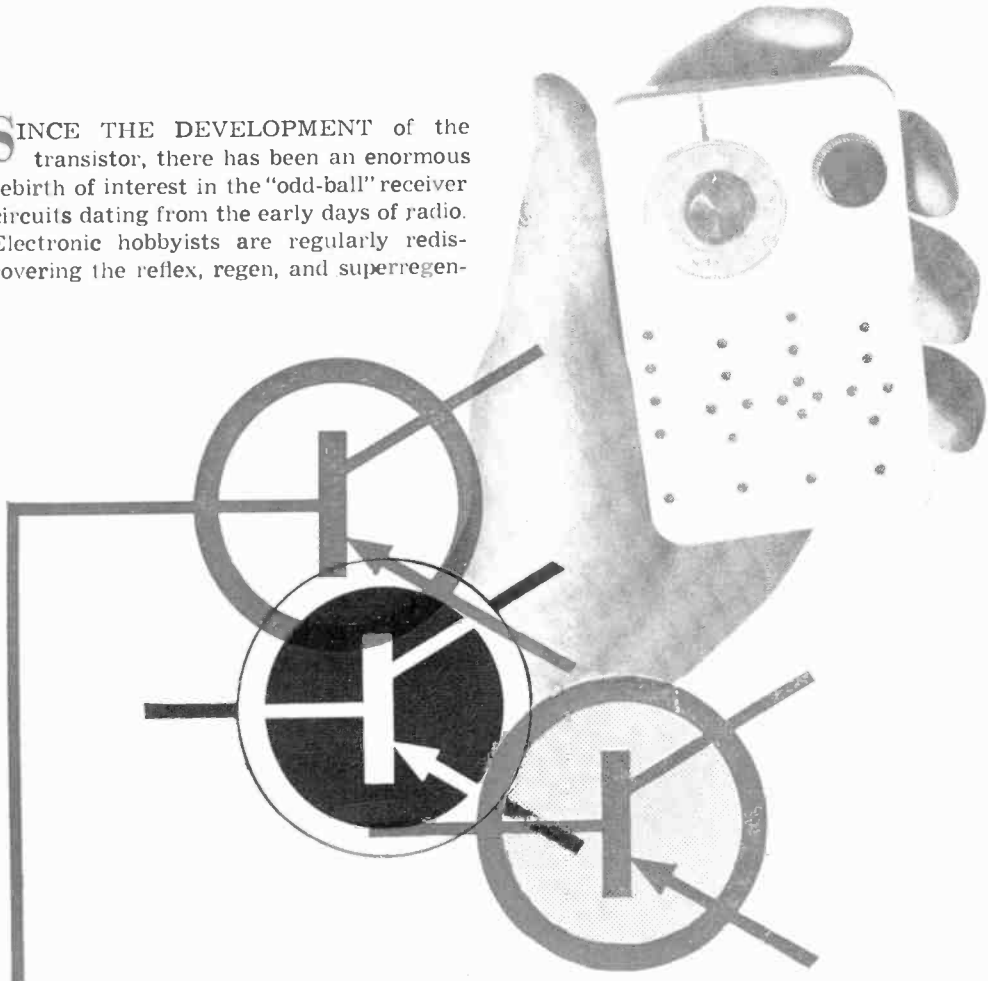
The two color controls are: (1) COLOR, which acts as a volume control, adjusting the *intensity* of the color, and (2) TINT, which varies the color *balance*. After the set is adjusted for normal black-and-white reception, when a color program comes on all you do is set the COLOR control for the minimum amount of color required to saturate the screen satisfactorily and then adjust the TINT, or color balance control, for natural flesh tones. If this is done, all colors will automatically come in with the correct balance.

The Servicing Problem. When the first color sets came on the market, the price for an RCA one-year service contract was $149.50. Today, the price has come down to $69.50. Included in the $69.50 is installation and one year's service, with all parts being factory-guaranteed for the first year. However, since the parts guarantee expires after the first year, the price of a service contract jumps up in following years.

For these succeeding years, RCA offers two types of service contracts: a complete-coverage plan for $119.50 per year; or a "Preferred Rate" plan for $79.50 a year. The latter contract covers all parts and "limited" service—meaning that a flat fee of $5.95 is charged for each service call after the first one.

Now, do you really need a service contract? It boils down to how much of a gambler you are. Look at it this way: since

(*Continued on page* 120)



Trans-3 Pocket Radio

Easily constructed unit offers loudspeaker operation with built-in antenna

By HARRY KOLBE

SINCE THE DEVELOPMENT of the transistor, there has been an enormous rebirth of interest in the "odd-ball" receiver circuits dating from the early days of radio. Electronic hobbyists are regularly rediscovering the reflex, regen, and superregenerative circuits so popular when the O1A was the "hottest" tube around.

The enormous sensitivity of these trick circuits is reason enough for their use, as it is every hobbyist's ambition one day to achieve loudspeaker operation using a single transistor and no external antenna. That day is not here yet, but the simple circuit described below demonstrates the terrific sensitivity and gain that *can* be achieved by a reflexed detector followed by a couple of stages of audio amplification.

The completed project, including a built-

in ferrite rod antenna, and 2¼" speaker, should run under $15.

Construction. Because a large number of components is placed in a relatively small plastic cabinet (Lafayette MS-302), extreme care in the layout and selection of the miniature components is required. Unless the constructor is familiar with miniature construction techniques, a slightly larger cabinet should be used.

Winding the antenna coil is the first construction step. Cut a 3¾" length of flat ¾"-wide ferrite strip. Then cover the strip with four layers of masking tape. The complete coil consists of 80 turns of No. 26 enamel-covered wire with a tap brought out at the 18th turn. Start the winding ½" from one end of the form and wind each turn so that a space the thickness of the wire exists between it and the next turn. Then coat the coil with coil dope and allow it to dry.

The cabinet and chassis are prepared next. If the MS-302 case is used, the raised rim surrounding the large tuning capacitor hole must be trimmed away. Drill about 20 ⅛" holes in the grilled front panel of the case. In the back panel drill three ⅛" holes approximately where the center of the speaker will be. Additional speaker and phone jack mounting holes are required.

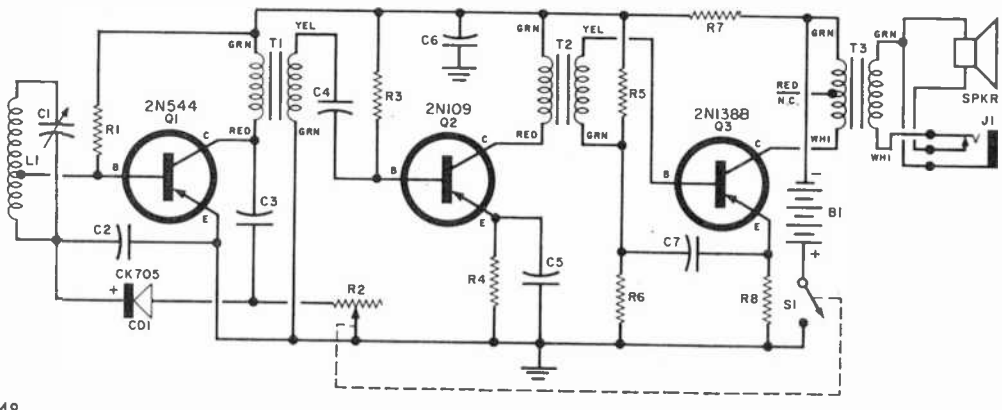
Cut the chassis from perforated phenolic board as shown. Flea clips are used for mounting the three transistors. Make the underchassis wiring and solder joints as flat to the chassis as possible. Mount the tuning capacitor in the hole provided using a large washer. The chassis is held in the case at one end by a washer and a bolt which screw into the nut imbedded in the case. The top end of the chassis is secured by the volume control mounting.

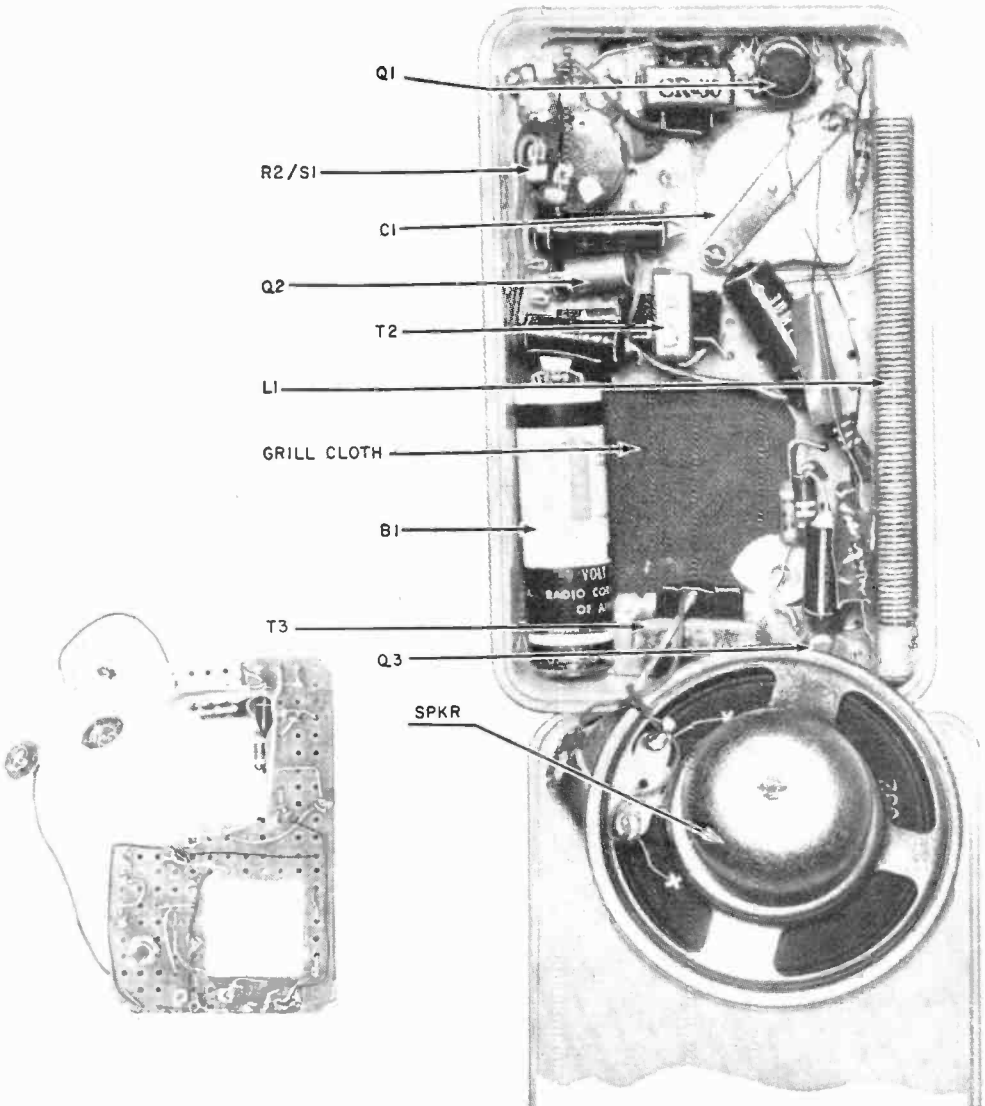
Construction is now complete except for the mounting of the antenna coil and speaker. Position the coil along the side of the case so that the tapped end of the coil is at the bottom end of the case. Secure the coil by cementing it to the side of the case with Duco cement.

The speaker is cemented or bolted to the back panel. It should be mounted with its cone facing three ⅛" back panel holes. This

PARTS LIST

B1—9-volt transistor battery (RCA VS-309A)
C1—365-μμf. tuning capacitor (Lafayette MS-445 or equivalent)
C2—.01 μf. — *All capacitors miniature electrolytic or ceramic disc types*
C3—.01 μf.
C4, C5, C7—10 μf., 6 volts
C6—30 μf., 15 volts
CD1—CK705 diode (Raytheon)
J1—Miniature closed-circuit phone jack
L1—Antenna coil (see text)
Q1—2N544 transistor
Q2—2N109 transistor
Q3—2N138B transistor
R1—100,000 ohms
R2—1000-ohm miniature potentiometer (with switch S1)
R3—330,000 ohms — *All resistors ½ watt*
R4—47 ohms
R5—4700 ohms
R6—560 ohms
R7—470 ohms
R8—82 ohms
S1—S.p.s.t. switch (on R2)
T1, T2—20,000-1000 ohm transistor interstage transformer (Calrad CR-60 or Argonne AR-104)
T3—500-3.2 ohm transistor output transformer (Calrad CR-80 or Argonne AR-119)
Spkr—2¼" speaker (Calrad PM-2¼, or Lafayette SK-65 if larger cabinet is used)
1—Plastic cabinet (Lafayette MS-302, or larger MS-162)
1—¾"-wide ferrite rod (Lafayette MS-334)
1—Perforated phenolic board
1—Pack of transistor flea clips
Misc. mounting screws, nuts, etc.





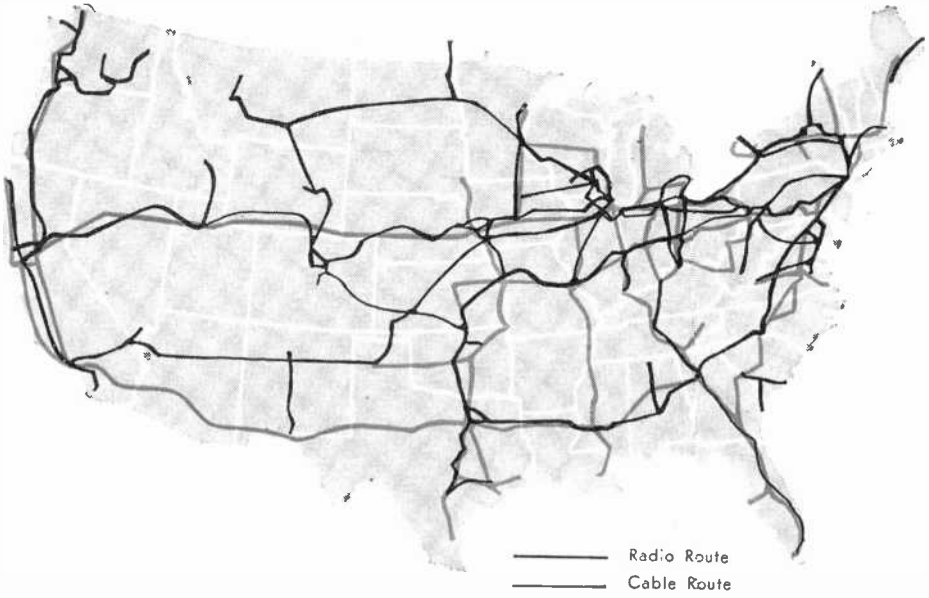
technique "front loads" the speaker and improves its tone quality.

Install the battery, slip on the back cover, and the radio is ready for use.

Operation. Volume control *R2* controls the amount of detected audio signal fed back to the detector input. As the feedback audio signal is increased, a point of instability is reached and oscillation (squealing or a rushing sound) starts. The sensitivity is greatest just before oscillation.

To use the receiver, advance *R2* to the point where oscillation begins and then back it off until oscillation just stops. Now just tune in the desired station. If volume is too loud, simply decrease the sensitivity. A phone jack is provided for earphone operation when desired. -30-

In wiring the receiver, be sure to use enough wire between the speaker and the output transformer. This will allow you to remove the speaker from the case for repairs or adjustments. If larger components are used than those suggested, rearrange the parts accordingly; a slightly larger cabinet than the one specified will be necessary.



The Magic of Cross-Country

Here's how telephone calls and TV programs are sent from coast to coast

By ART ZUCKERMAN

IF YOU'VE been reading your mail lately, you may recall a letter from your local telephone company. This letter was about the new system of direct long-distance dialing which makes it possible for you to call Aunt Minnie in Minneapolis just by dialing 612, the area code number, plus her phone number.

Ingenious new switching circuits make such long-distance dialing possible. But these fancy new techniques wouldn't be worth a nickel without a way of getting messages across the country quickly and economically. At the present time, we have two efficient carriers of the cross-country electronic mailbag. These are the *coaxial cable* and the *radio relay* systems. Some 16,000 miles of American real estate are covered by the radio relay towers of the American Telephone & Telegraph Co., while another 10,000 miles hold A T & T's buried coaxial cables.

Through Earth and Air. Although one sends its messages through underground tubes and the other goes through the air, radio relay and coaxial cable use the same basic techniques to handle thousands of telephone calls at the same time. Network television programs are routed around the country on these same carriers, right along with your phone call.

Actually, a coaxial cable and a relay antenna carry a broad band of frequencies. Some of the latest equipment covers eight

times the frequency span of the entire broadcast radio band. An individual telephone conversation occupies only a narrow channel of the band, much as a single radio program represents only a part of the total signal picked up by your receiving antenna.

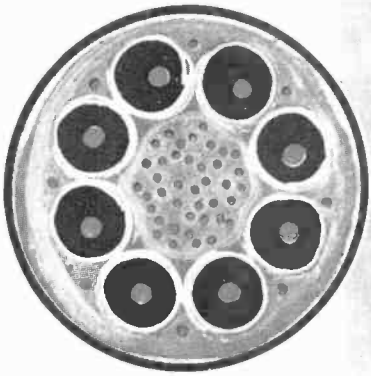
In the same way that your radio receives and separates many stations, so coaxial cables and radio relay can carry an enormous composite signal and separate the many individual voice channels at the receiving stations and cable terminals.

Why are there *two* systems? There are several reasons. First of all, the type of terrain to be covered can determine whether coaxial cable or radio relay should be used. In a mountainous area, radio relay is almost always called for, while coaxial cable is favored in open country.

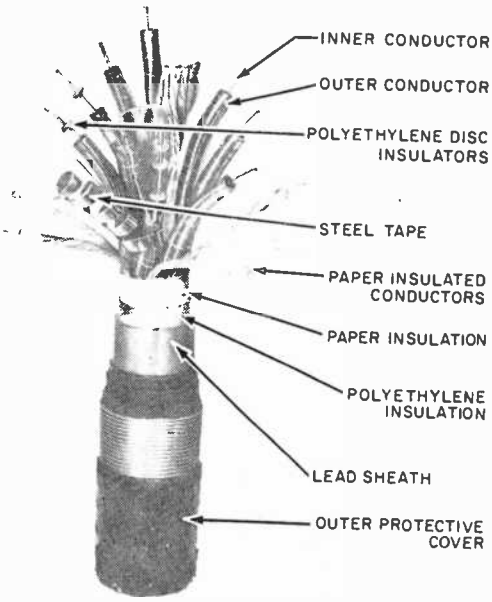
Another factor is local needs. Other things being equal, the system which best suits local traffic requirements at a given time will receive the nod. At one point

Photos courtesy of American Telephone & Telegraph Co., Long Lines Dept.

Communications



The two carriers of the cross-country electronic mailbag are the coaxial cable and radio relay systems. Above is an inside view of a coax cable. At right is an antenna tower at a radio relay station.



Coaxial cable is made up of eight coaxial tubes plus a number of standard wire conductors. Spacers made of polyethylene position the center wires inside the hollow copper outer tubes.

in the game, radio relay may offer the greatest message-handling capacity; at another time, cable equipment may forge ahead.

The costs of the two systems tend to average out. While radio relay is cheaper to install, cable is cheaper to maintain and operate.

The Cable System. Coaxial cable is a marvel of design. About as big around as a man's wrist, it's really a collection of eight copper tubes, together with a number of standard wire conductors for maintenance and short-haul telephone purposes. These are all encased in a gas-filled lead sheath.

Each copper tube is roughly the diameter of a fountain pen. A copper wire runs down the center of each tube, held in place by polyethylene insulating discs spaced about an inch apart. Because the tube and the wire have the same axis, the tubes are called "coaxial." This design offers unusually good shielding properties. It prevents interference with other conductors in the same cable and protects against outside electrical disturbances.

For telephone purposes, the tubes are used in pairs—each transmitting in one direction. When equipped with the latest design of related apparatus, some 1860 simultaneous conversations can be handled by each pair of coaxials.

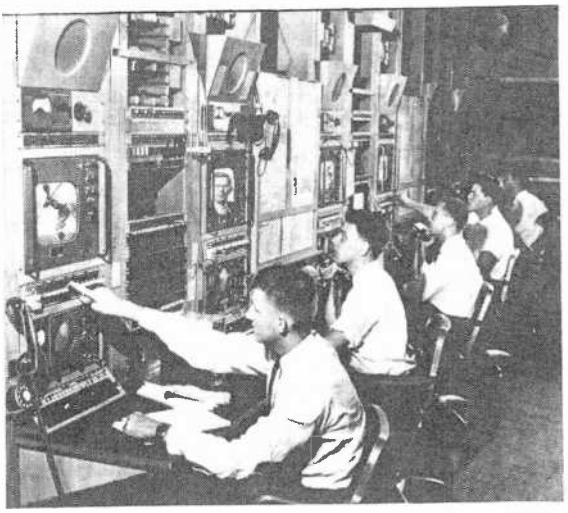
Since signals carried by the cable weaken rapidly, a chain of booster amplifiers spaced four to eight miles apart is necessary to refresh them. Depending on the particular system, these repeater stations are mostly small, unattended units that draw their power from the cable itself. A series of main stations supplies this power and also provides over-all maintenance.

Automatic Trouble-Shooters. The cable has an amazing ability to look out for itself. Not so long ago, for instance, a farm hand in the South was digging post holes

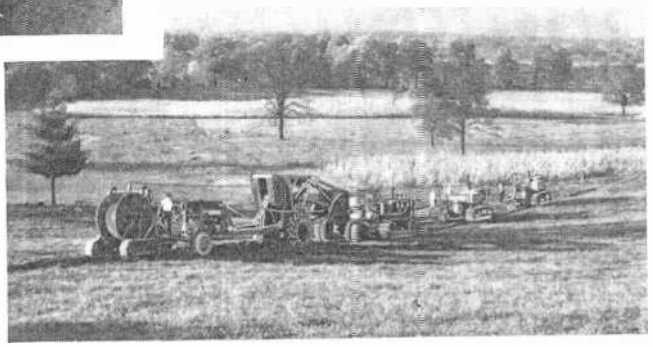
Radio relay antennas, shaped like tapering horns, focus microwaves into tight beams and aim them at the next station down the radio relay chain.

when he hit something. The man was startled when the mysterious object started hissing at him. He was almost as surprised when a Bell System maintenance man showed up in short order.

The object our farm hand struck was, of course, a "coax." The hissing came from gas—either nitrogen or dehumidified air—escaping through a break in the casing. The gas serves two purposes. First, by escaping under pressure, it keeps moisture from entering the break. Second, it sets



Television control terminals monitor programs coming in either on radio relay or coaxial cable. One TV program ties up the equivalent of 600 telephone circuits.



"Mickey Mouse" plow train can cut through most types of terrain, planting coaxial cable and filling its trench as it goes along.

off an alarm at a main repeater station and allows maintenance personnel to locate the damage from gauges that show the point of lowest gas pressure.

Signal problems and power failure are other occasional sources of trouble in the cables. Here, too, the coax has built-in safeguards. For example, only six of the eight tubes are usually in operation. Two are kept in reserve for emergencies, one set to handle signals in one direction and the other ready to transmit in the opposite direction. If the commercial power should fail, batteries are automatically cut in. Should these go out, emergency generators take over.

Different locations require somewhat different safeguards. In areas where the soil offers a high resistance to electricity, a polyethylene insulating layer wards off lightning damage. Where gophers are found, a wrapping of steel tape deprives the critters of a tasty lead-sheath snack.

Radio Relay. Natural and man-made hazards are less of a problem with radio relay. Since it operates in the microwave frequency range, it isn't affected by static caused by lightning, nearby ignition systems, or even sunspots.

A radio relay chain is made up of a number of stations about 30 miles apart. Each one must be within the line of sight of the station in front and behind, because the microwaves they handle are highly directional and are focused into extremely sharp beams. The relay stations are placed in a zigzag path rather than in a straight line, so that there is no danger of a station's overshooting its mark and being picked up by the next station down the line.

Because it uses such tightly focused beams, microwave relay employs power very sparingly. It takes less than a watt—about enough to light up a pocket flashlight bulb—to span the gap between stations. The tight focusing arrangement also conserves frequencies at a station that feeds two or more relay chains. The station can send out the same frequency in different directions without danger of interference.

In regular practice, however, a relay station receives a transmission on one frequency band and then converts it to another frequency for relaying to the next site. Here, the transmission is again sent out on the original frequency, and the alternation of frequencies continues right on down the line. This practice eliminates the possibility of part of a station's transmission feeding back into its own receiving antenna.

The amplifiers that give the relay stations their punch really pack a wallop. They can take a weakened signal and send it on with a millionfold gain in strength.

As with coaxial cable, the radio relay system contains a number of built-in safe-

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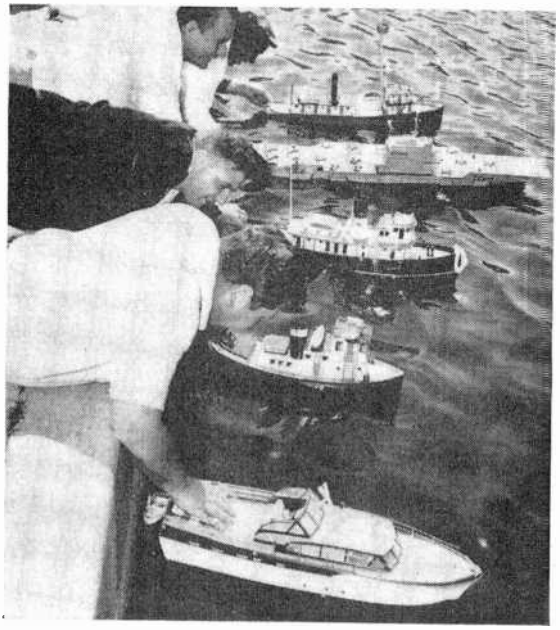
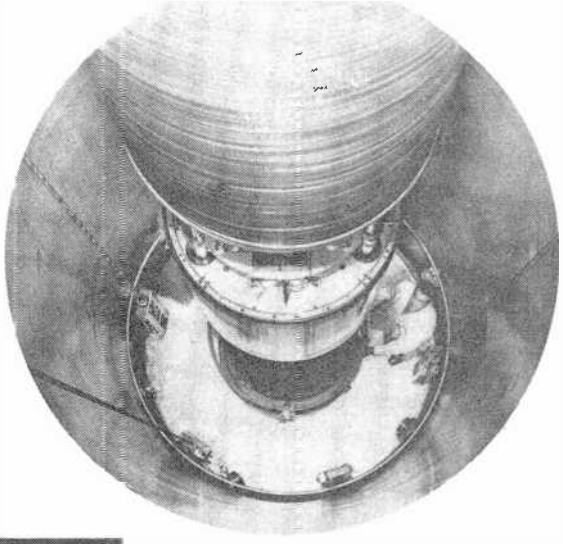


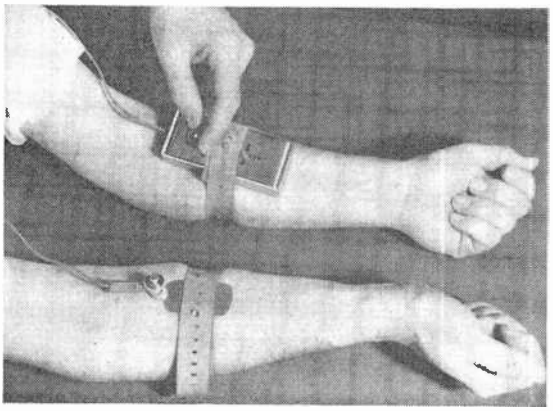
LAUNCH HOUR

Space-age engineers take time out for relaxation by sailing radio-controlled boats during lunch hour at International Telephone and Telegraph's Guided Missile and Space Laboratory in Nutley, N. J. During working hours, these lunch-time skippers design "electronic brains" for guided missiles such as "Lacrosse," "Talos," and "Bomarc." In their spare time, they take things easy by designing and building souped-up remote control equipment for their boats. (UPI photo)

ATOM SMASHER

The tiny technician at right gives you an idea of the size of the new particle accelerator at Britain's Atomic Weapons Research Establishment in Aldermaston. This low-energy 12-million-electron-volt van de Graaff generator is the largest of its kind in the world. By firing billions of atomic particles into a metal "target," the 100'-high generator makes its contribution to mankind's knowledge of the atom. It is expected to provide data which will lead to more peaceful applications for atomic power.





HEART MONITOR

A new "heart monitor" is expected to reduce surgical risks by signaling physicians when emergency measures are necessary. The instrument translates electrical impulses from the heart into audible "beeps." When the monitor is strapped to the patient's forearm, an electrode attached to the other arm completes the sensing circuit. This device is being distributed by the National Cylinder Gas Division of the Chemetron Corporation.

Multi-Purpose Pulser

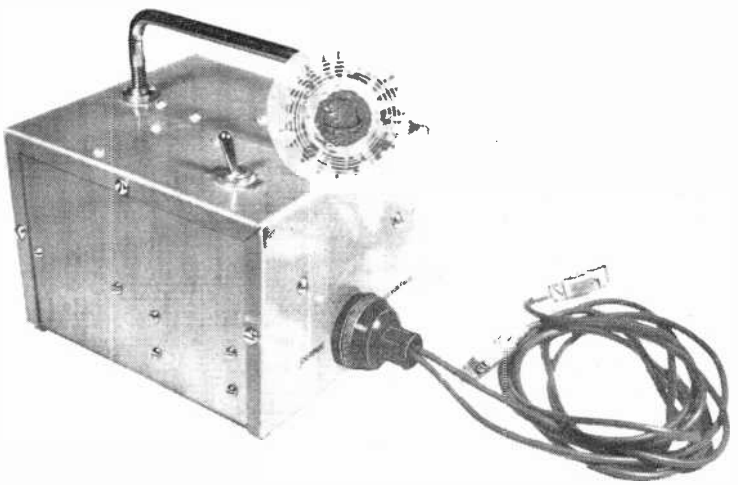
Three-transistor pulse generator features high voltage output

By
J. E. PUGH, Jr.

A HIGH-POWER transistor pulse generator has many interesting applications for the experimenter. For example, it can be used as a portable neon communicator, or marker light, an emergency flasher, an electronic fence charger, and a dog-and-thief discourager. Other possibilities that can be investigated include its use as a worm digger, a portable electronic fish guide, etc.

The pulse generator to be described here is very simple. It has a peak power output of 10 - 30 watts, depending on the load resistance. Battery drain is low, and the output voltage can be changed for different applications with a different output transformer. Seven type "D" flashlight cells are employed as these cells have a large current capacity and are available everywhere at low cost. They should last several weeks with normal use.

Construction. Since the pulse generator was designed for portable use, it is housed in a durable aluminum case with a con-



For general use, alligator clips are employed at ends of output leads. Special applications require other type connectors.

venient carrying handle. Total weight including batteries is about 4½ pounds. All components except the batteries are mounted in the top half of the case, with the case itself serving as the chassis.

There is plenty of space available, but take care to keep the parts from shorting out to the batteries when the case is closed. Mount the battery clips low on the sides of the case, as shown. Keep *T2* close to the top but low enough to allow room for the handle mounting screws.

Transistors *Q1* and *Q2* are soldered to the terminal strips, with the usual precautions, and *Q3* is mounted to the chassis by means of two machine screws. *Q3*'s collector is the shell and must be insulated from the chassis with fiber washers or a power transistor insulating mounting kit.

The collector connection is made with a flat solder lug under one of the fiber washers. Use a lock washer between this washer and the nut for a positive contact. After you mount *Q3*, check with an ohmmeter between its collector (shell) and chassis to be sure that the insulation job is effective.

Connectors for the *Q3* base and emitter are taken from a miniature 7-pin tube socket. Put a small piece of mica or paper between these connectors and the transistor body to prevent accidental contact.

Heavy peak currents flow in the *Q3* output circuit and in the battery circuit, so be sure that all connections are good and that the battery holders contact the batteries firmly. Bend in the terminal ends of the holders to increase contact pressure.

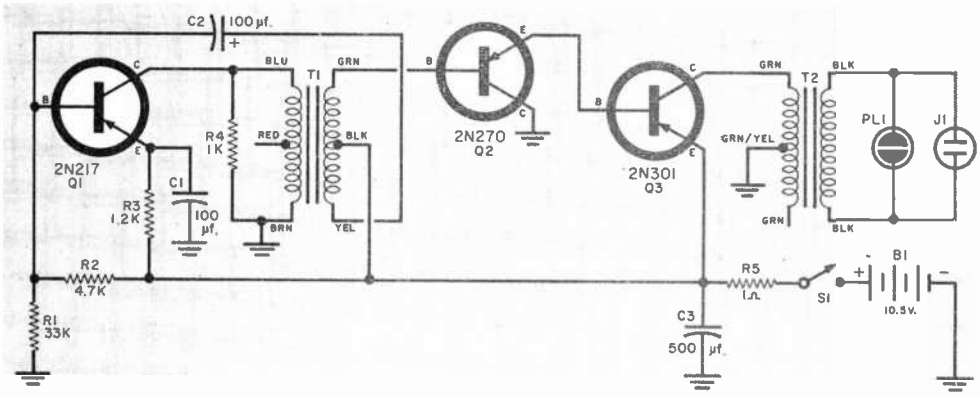
To avoid damage to the transistors by

How It Works

Transistor *Q1* is a blocking-oscillator-type pulse generator which develops stable, short, high-level pulses. A low pulse rate is preferred normally because it keeps battery drain low, but the rate can be changed by varying the values of *R1*, *R2*, and *C2*. The width of the pulse can be changed by *C2*.

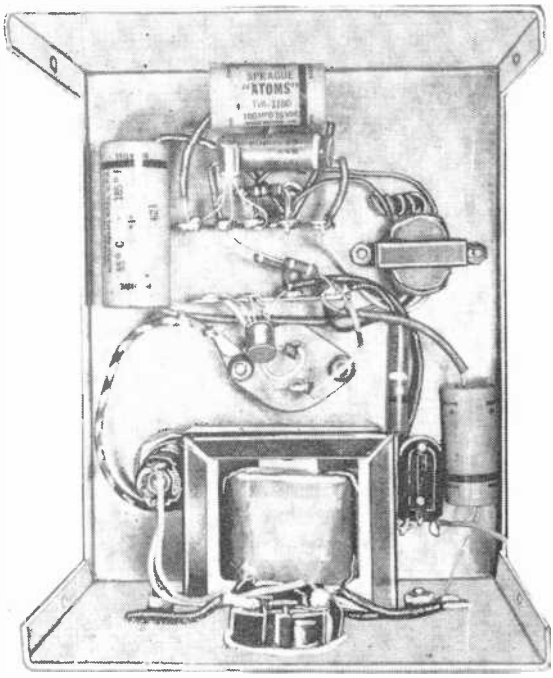
Pulses generated by *Q1* are applied to *Q2* by the secondary of *T1*, which also supplies feedback to make *Q1* oscillate. Transistor *Q2* amplifies the pulses without inverting them. *Q3* further amplifies them and *T2* reverse-connected - steps up the voltage before applying it to the output receptacle (*J1*).

The secondary of *T2* is isolated from the metal case to reduce the chance of shock. Neon pilot lamp *PL1*, connected across the output, shows that the pulser is working properly.



Parts List

B1— 10.5-volt battery (seven series-connected type "D" flashlight cells)
C1, C2—100-µf., 15-volt electrolytic capacitor
C3—500-µf., 15-volt electrolytic capacitor
J1—Panel-mounting a.c. receptacle
PL1—Neon pilot light assembly (Dialco 95408X or equivalent)
Q1—2N217 transistor
Q2—2N270 transistor
Q3—2N301 transistor
R1—33,000 ohms
R2—4700 ohms
R3—1200 ohms
R4—1000 ohms
All resistors ½-watt composition unless otherwise indicated
R5—1 ohm, 1 watt
S1—S.p.s.t. toggle switch
T1—Transistor audio transformer, 500 ohms CT to 500 ohms CT (Thordarson TR-1 or equivalent)
T2—Filament transformer, 117-volt primary; 6.3-volt, 3-amp. secondary
1—4" x 5" x 6" aluminum cabinet (Bud 29442 or equivalent)
2—Holders for two "D" cells (Acme #12)
3- Holders for single "D" cell (Acme #11)
1—Four terminal tie strip (1 lug grounded)
1—Five-terminal tie strip (1 lug grounded)
2—Pin connectors for Q3
2—Fiber shoulder washers and sleeves
Misc. handle, screws, nuts, solder lugs, wire, lock washer, rosin core solder



The battery holders should be located carefully on the chassis lid, or the lid will not close properly.

reverse battery polarity, put a small dab of red paint or nail polish on the positive terminal of each battery holder.

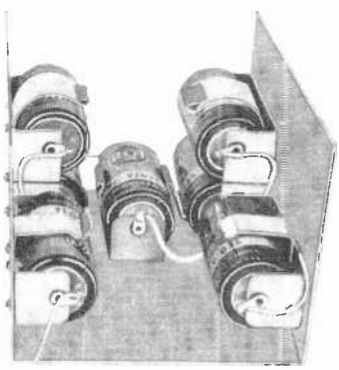
Applications. With the parts listed, the pulse rate is about 90 per minute, the open-circuit voltage is over 600, and 125-volt pulses are obtained across a 500-ohm load. This is suitable for medium loads such as a large neon lamp in a portable marker light or an emergency flasher.

When the pulse generator is used as a fence charger or dog-and-thief discourager, larger open-circuit pulses will be needed—which means that *T2* must have a larger turns ratio. Try using the center-tap and one filament lead of a 2.5-volt filament transformer as the "primary." The d.c. resistance of the low-voltage "primary" winding connecting to *Q3* should be no more than 1 ohm for best results. You'll find that almost any well-insulated transformer with the proper turns ratio will serve nicely as *T2*.

For light communication work, use a 3-watt neon lamp and change *R1* to 1000 ohms and *C2* to 20 μfd. to obtain about 60 pulses per second. The telegraph key can be placed in the *Q1* emitter return just below the *R2-R3* junction, in the *Q1* collector return between *T1*'s brown lead and ground, or across *R2*.

The output power is somewhat low for best worm "turning" and fish guiding, but some interesting results are still possible. For these and other loads below 500 ohms, use the full 6.3-volt winding of *T2* as the primary instead of using the center-tap as shown in the schematic diagram.

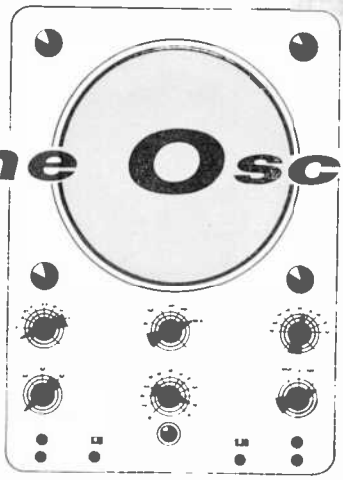
Two fork-like probes, each consisting of three or four ⅛" rods about 12" long, will



be needed for worm digging. The upper ends of the rods can be mounted about three inches apart in a strip of metal, or in wood with the upper ends soldered together. Attach a wooden handle to each probe to avoid shock. The separation between the two probes will generally be about two to four feet depending on how wet the earth is. A few trials will show which is best in each case. (See "Don't Dig Those Crazy Worms" in the May 1957 issue of POPULAR ELECTRONICS.)

For electronic fish guiding (see the November 1956 issue), one probe can be a metal boat bottom or a sheet of metal foil tacked to the hull, and the other a sheet of foil tacked to a wooden pole. The second probe can be held by the operator or suspended in the water from the side of the boat. The heavy load placed on the pulser by the water will limit the electric field between the probes to a small area, but any fish entering the field will be attracted to the positive electrode. Experiments should be limited to fresh water because the resistance of salt water is too low for the pulser to work properly. —30—

Test Instruments



The Oscilloscope

Part 1

How Cathode-Ray Tubes Work

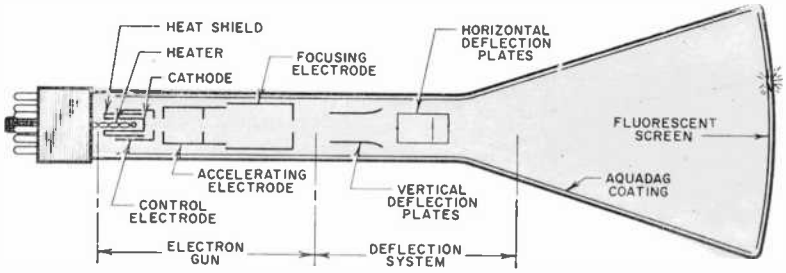
By **LARRY KLEIN**
Technical Editor

WHENEVER a science fiction movie or TV show wants to appear ultra-scientific, chances are that an oscilloscope will be shown with some interesting-appearing trace fluttering across the face of its cathode-ray tube. With its profusion of control knobs and input facilities, the oscilloscope is probably the most impressive-looking instrument on the technician's test bench. But the very diversity of functions of this multi-talented instrument also makes it one of the most difficult to understand and use to full advantage.

On the Beam. Since the heart of the modern oscilloscope is the cathode-ray tube or CRT, let's see how it works first. A type of CRT familiar to most people is the picture tube in their television sets.

In the neck of the picture tube, the designers have placed an electron gun (Fig. 1) which shoots, not bullets, but electrons—about six billion of them per second—in a

Fig. 1. Physical arrangement of the electron gun elements and the deflection plates. Specific design problems may result in different arrangements of elements.



concentrated high-velocity beam toward the phosphor-coated face of the tube. This thin coating fluoresces under the electron bombardment. A TV set with its yoke disconnected or an oscilloscope with its horizontal and vertical gain controls turned down would let you see the small luminous dot caused by the electron stream hitting a single point.

How do we cause this dot to form a TV picture or oscilloscope trace? The answer lies in making use of the particular properties of an electron beam. It seems that a stream of electrons can be deflected (or bent) by either a *magnetic* field (such as is produced by the yoke in a TV set) or an *electrostatic* field. The internal design of the CRT determines which type of deflection system should be used with the tube. In general, TV sets are designed to use the magnetic system and oscilloscopes to use the electrostatic system.

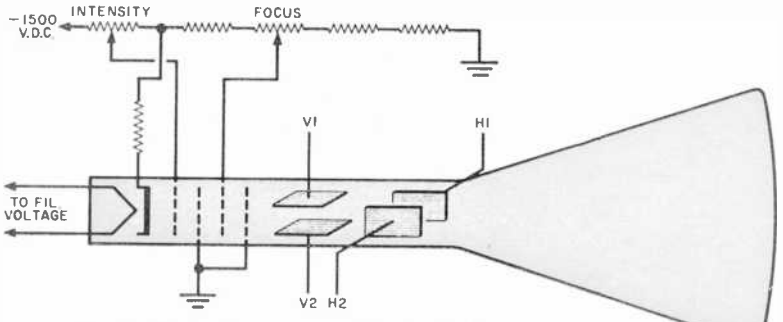


Fig. 2. Electrode arrangement in standard oscilloscope cathode-ray tube. Elements responsible for focus and intensity of beam are shown connected to potentiometers which enable a wide range of adjustment.

Designed for Deflection. Electrostatic deflection, which is the type that concerns us here, is not at all mysterious. If you've ever noticed the way a hair comb can pick up lint on a dry day, you've seen electrostatic attraction at work.

Figure 2 is the schematic diagram of the inside of a typical 5" oscilloscope tube showing the arrangement of the tube elements and how the operating voltages are applied. If all the elements are doing their jobs correctly, a focused beam of electrons is shot out from the electron gun to the tube face.

In its travels, this beam passes between two separate pairs of deflection plates—*H1, H2* and *V1, V2*. These plates will bend the beam either right or left, or up or down, or any combination of horizontal or vertical, depending upon the voltages present on the pairs of plates.

The action which takes place is illustrated in Fig. 3. With zero difference in potential between the two plates, the beam is centered. If 50 volts d.c. are applied across the horizontal plates in the manner shown, the spot will move about 1" right or left. (The actual distance moved depends on the CRT's sensitivity.) Applying 100 volts d.c. will move the spot about 2", etc.

A reversal of the polarities shown in Fig. 3 will move the spot an equal distance in the opposite direction. The same story, of course, applies to the vertical plates for up and down motion of the spot.

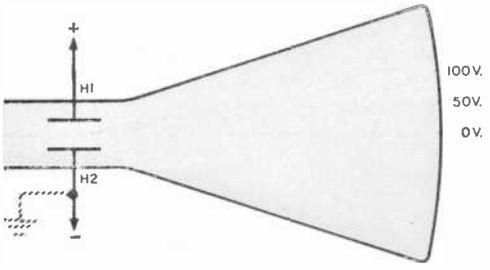
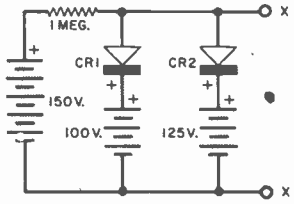


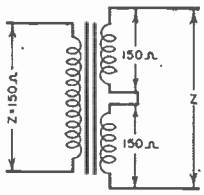
Fig. 3. A positive voltage on a deflection plate attracts the negative electron beam. Amount of deflection is directly proportional to the applied voltage. The negative supply may either be at ground or below-ground potential.

Once we understand the basic operation of the CRT, we are equipped to examine the rest of the oscilloscope and find out how the deflection voltages are developed and what role they play in the final presentation of a trace on the scope face. Next month we'll look at some saw-tooth waveforms and check out the vertical and horizontal amplifiers used with scopes. —30—



1 Chris Tal found this circuit in a notebook he had saved since his school days. At a glance he knew what the voltage across points X should be. What was once a tough problem for him is now a snap. How about you?

—Dale F. Betz

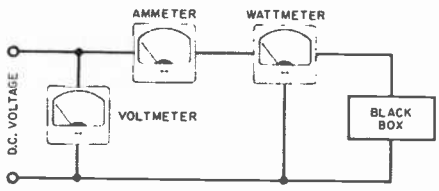


2 Needing a 150 to 300 ohm impedance-matching transformer, a ham friend of ours turned up a transformer with two 150-ohm secondary windings. He connected the windings as shown but the results were unexpected. Why?

—Garbis Saatjean

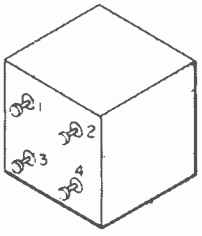
Electronic Sticklers

(Answers on page 126)



3 Here is a "black box" problem that could trip even the experts. With the circuit connected as shown, the ammeter reads 1 ampere, the voltmeter reads 10 volts, but the wattmeter shows zero. What is in the black box?

—A. G. Swan



4 Ed Surplus found this black box having four numbered terminals. In an attempt to figure out the contents, he applied 1 volt a.c. to terminals 1 and 2. His VTVM showed 1 volt a.c. at terminals 3 and 4. But to his dismay, he measured 1 volt a.c. at any two terminals when he applied 1 volt a.c. to the other two. Ed gave up in disgust. Would you?

—Cesar E. Marestaing

POPULAR
ELECTRONICS
Builds a
Citizens Band Transceiver

2W4116 Unit 2 calling 2W4116 Unit 1. Come in, please.

2W4116 Unit 1 to 2W4116 Unit 2. Hi, Hon. Hurry home. Supper is almost ready. Over.

I'm on the way. Coming down U. S. 4 now. Will keep tuned to Channel 12 in case you call. 2W4116 Unit 2 over and out.

Model CB-1 Heath transceiver puts 2-way radio within everyone's reach

TESTED BY POPULAR ELECTRONICS

18W3325 calling 2W4116, Unit 2. Do you read me, OM? I'm calling you from downtown Chicago. Over.

2W4116 Unit 2 to 18W3325. Hear you 5-by-5. I am in New Jersey near the George Washington Bridge. Man, we must be 750 miles apart.

ONCE inhabited only by hams, the 11-meter band is now known officially as the Citizen's Radio Band. The man-in-the-street having no technical know-how can now enjoy two-way radio with endless possibilities for pleasure and business.

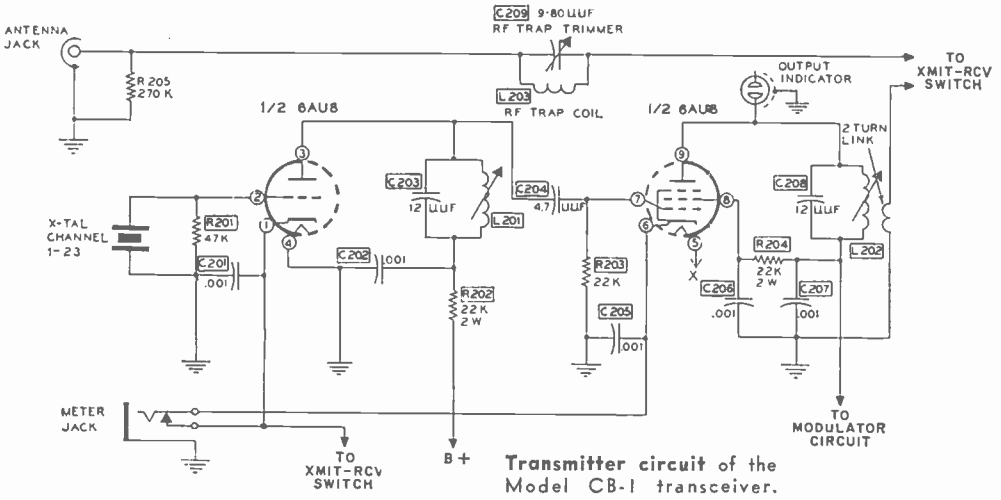
One of the first transceiver kits for this new band is produced by the Heath Company (Benton Harbor, Mich.). Moderately priced at $42.95, the Model CB-1 is as easy to build as it is to operate.

The complete transceiver is housed in a handsome, lightweight 8" x 6" x 9¾" cabinet. Its small size makes it convenient not only for home use but for cars where under-the-dashboard space is at a premium.

Mobile Operation. Although the Model CB-1 can be operated from a.c. house current, a handy power plug on the rear apron of the unit permits a quick disconnect for other power sources. All that is needed for mobile operation is a standard 6- or 12-volt vibrator supply with an output of 260 volts at 60 ma. Transceiver filaments are also operated directly from either a 6- or 12-volt auto power system.

Front panel controls include receiver "*Volume*," "*Tuning*," and a "*Transmit-Receive*" switch. A neon power-on indicator operates with any power source used, and another neon indicator flashes when the unit is transmitting. A ceramic hand mike plugs into a front panel jack.

Several types of antennas are available



Transmitter circuit of the Model CB-1 transceiver.

from Heath. We chose the whip, which can be mounted on the rear of the cabinet.

Circuit Features. The r.f. section of the transmitter consists of a single 6AU8 dual triode-pentode tube. The triode section operates as a crystal-controlled oscillator and drives the pentode final amplifier to the 5-watt maximum permitted by FCC regulations. All the coils are of the slug-tuned type and are easy to adjust.

The r.f. from the final tank coil is link-coupled to the antenna jack and resultant harmonics that might interfere with your neighbor's TV are minimized by a series r.f. trap. The trap also keeps strong local TV signals out of the receiver portion.

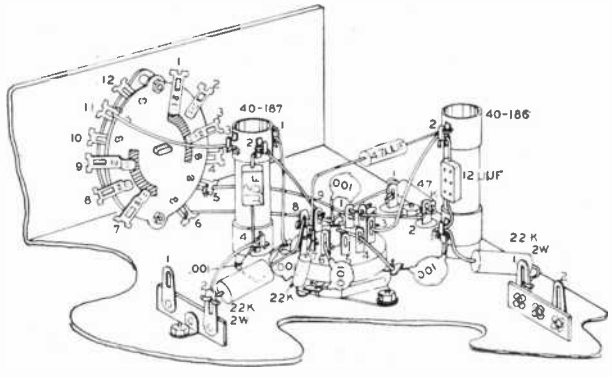
Receiver design is simplified by the use of a single 6AN8, which functions as a broad-tuned r.f. stage and a tuned supergenerative detector. The transceiver's audio section consists of a 12AX7 and a 6AQ5 and provides a healthy 1 watt of power to the 3½" speaker. This same section also is used as a modulator for the transmitter.

Silicon diodes featured in the power supply are in a voltage doubler circuit, thus eliminating the usual heat-producing rectifier tube.

Construction Hints. The Heath instruction manual lets you build directly from pictorial diagrams without referring to the very large schematic diagram which is included. But read the whole manual before you lift a soldering iron. And don't try to finish the kit in a single evening, or you may find yourself getting too tired to do a good construction job.

One thing to watch is the installation of the transmitter power neon indicator. Do not clip off one lead as instructed. Instead, leave about ¼" of lead. Touch a screwdriver or insulated wire to this lead while tuning the transmitter final. The added capacity to ground will allow the neon indicator to strike quickly and make adjustment easier.

On Trial. When the CB-1 was hooked up and tried out, stations from several time zones throughout the country were received loud and clear. With the transmitter operating from a car, a station a few miles away reported a strong signal with high modulation. —30—



Parts placement at transmitter tube socket is critical. Slug-tuned oscillator and final coils are mounted near socket. Switch is shown partly wired.

AUDIO
FREQUENCY FILTER

By
HARLOW VAN METER
K6RFS

VARIABLE BANDPASS FILTER for the Ham and SWL

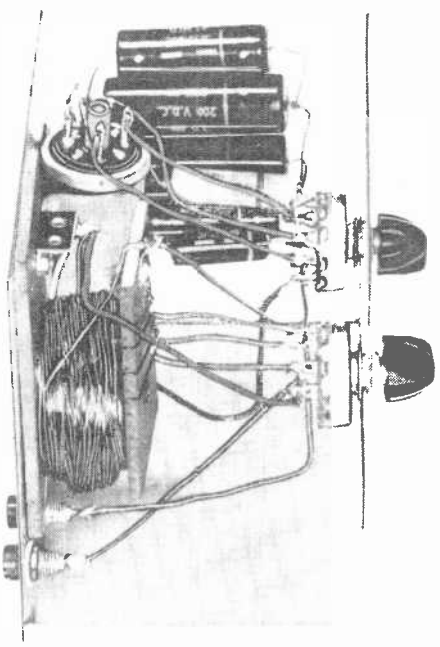
Improve your S/N ratio with this easily constructed filter

MANY radio amateurs and short-wave listeners operating near commercial areas are plagued with high background noise and local interference from neon signs, fluorescent lights, motors, etc. One way to make weak voice stations intelligible under these conditions is to attenuate the frequencies below 500 cycles and above 3000 cycles. Part of the audio signal is lost, of course, but the remaining portion has high intelligibility, and power line noise and adjacent station heterodyning will no longer tend to swamp out the signal.

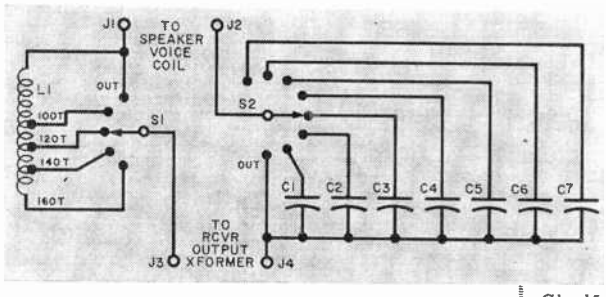
This filter inserts a variable bandpass circuit in series with the receiver's speaker voice coil. By switching in various values for *L* and *C*, a series-resonant circuit with a desired bandpass can be selected while you are listening to a station.

Coil *L1* is wound on a wooden dowel ¾" in diameter and about 1½" long. Glue and tack stiff cardboard or Masonite retainers on the ends of the dowel to support the coil tap connections. Wind about 160 turns of enameled or Formvar-covered copper wire (#18-#20) on the coil form with taps at the 100-, 120- and 140-turn points.

Connect coil *L1* to a five-position rotary switch and the capacitors to a 12-position switch of the same type. On both, the "Out" (off) position bypasses the filter if



Internal view of bandpass filter shows direct point-to-point wiring employed. Note that four positions of the 12-position switch are unused.



high or low frequency cutoff is not needed. Note that there will normally be a drop in loudspeaker volume as the degree of frequency attenuation is increased, but in most cases the very great improvement obtained in the signal-to-noise ratio will more than compensate for the volume loss.

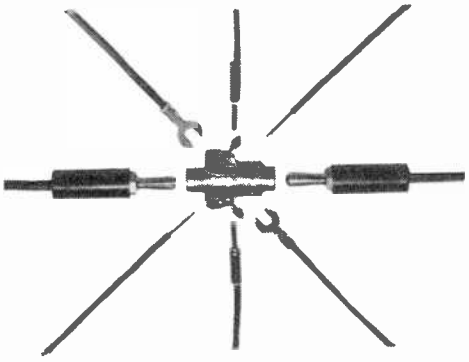
The speaker impedance, receiver characteristics, acoustical conditions, and your own ears will determine the coil taps and capacitor values used. Remember, you're listening for intelligibility and not fidelity, so don't expect too much in the way of natural-sounding speech reproduction. Proper setting of the controls will limit the noise frequencies reaching the speaker to such an extent that good copy will be possible under conditions that formerly made even partial copy impossible. —30—

PARTS LIST

C1—15 μf.
C2—10 μf.
C3—5 μf.
C4—2 μf.
C5—1 μf.
C6—0.5 μf.
C7—0.1 μf.
All capacitors are paper or electrolytic types, 25 volts or higher rating
J1, J2, J3, J4—Five-way terminal post
L1—Approximately 160 turns of #20 enameled copper wire (see text)
S1—S.p., 5-pos., non-shorting rotary switch (Mallory 3215J or equivalent)
S2—S.p., 12-pos., non-shorting rotary switch (Mallory 32112J or equivalent)
1—6" x 4" x 5" chassis box (LMB 142)

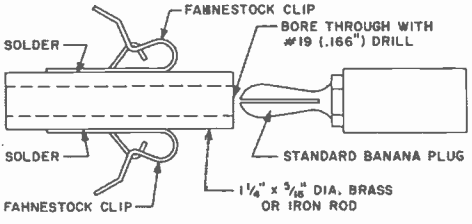
Versatile Electrical Connector

BY ART TRAUFFER



IN EXPERIMENTAL and repair work, when it is necessary to join temporary wire leads having various types of terminations, this easily made connector can save you much time and trouble. It is simply a 1¼" length of brass, iron, or copper tubing, having a bore of the right diameter to accept standard banana plugs. Two or three ¾"-long Fahnestock clips are soldered onto the tubing. If you have any trouble finding metal tubing with the right size bore, you can make your own as shown.

You can join two banana plugs by pushing one into each end of the connector. Two phone-cord-tips can be joined by placing one in each clip. Or, you can join two spade lugs, or two plain wire leads, by putting them in the clips. There are many possible combinations of quick connections that can be made. Since the connector costs only a few cents to make, you will probably want several of them. —30—



Build a Power Footswitch

. . . for your ham shack, darkroom, or workshop

By
HENRY SEVCIK

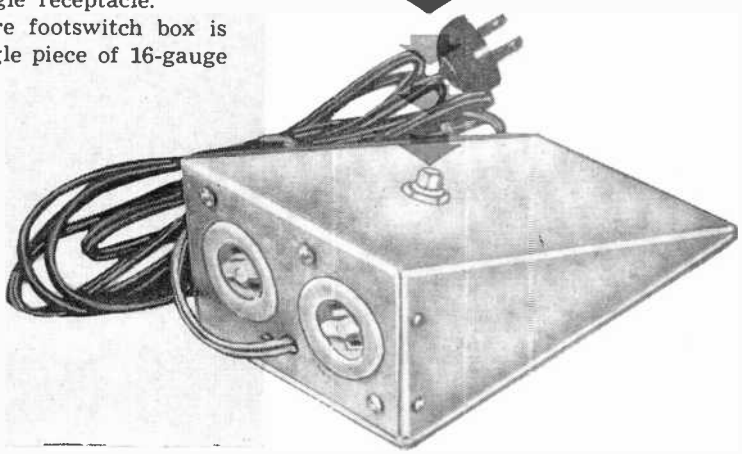
A FOOTSWITCH is a useful device for operating a drill press, bench saw or other piece of machinery when it is desirable to have both hands free. Also, it is a great convenience in the darkroom; you can switch from safelight to enlarger and back in two easy "steps."

A snap-action s.p.d.t. switch with a 10 to 20 amp. rating is used. For darkroom work, both the enlarger and safelight are plugged into the footswitch receptacles. One step takes the power off one receptacle and puts it on the other. A second step reverses the situation.

If the footswitch is to be used for operating machinery alone, either power receptacle can be used, or the footswitch can be designed for a single receptacle.

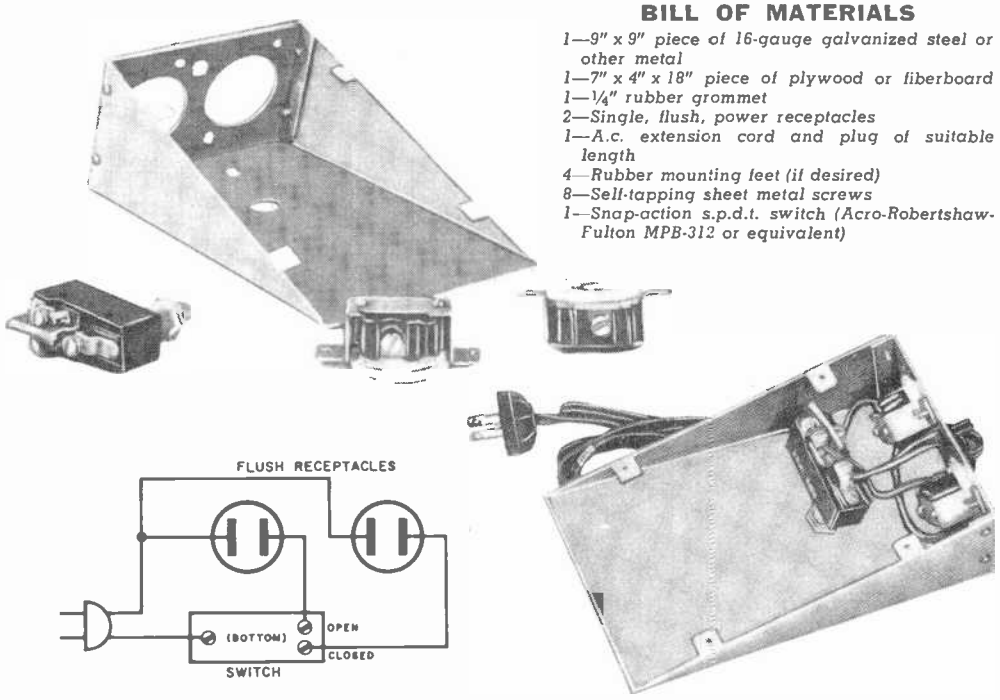
Note that the entire footswitch box is fabricated from a single piece of 16-gauge sheet metal. You'll find aluminum easiest to work.

First, cut the metal to shape with a pair tinsnips, and drill and punch all the required holes. The box is then formed by bending the metal in



BILL OF MATERIALS

1—9" x 9" piece of 16-gauge galvanized steel or other metal
1—7" x 4" x 18" piece of plywood or fiberboard
1—¼" rubber grommet
2—Single, flush, power receptacles
1—A.c. extension cord and plug of suitable length
4—Rubber mounting feet (if desired)
8—Self-tapping sheet metal screws
1—Snap-action s.p.d.t. switch (Acro-Robertshaw-Fulton MPB-312 or equivalent)

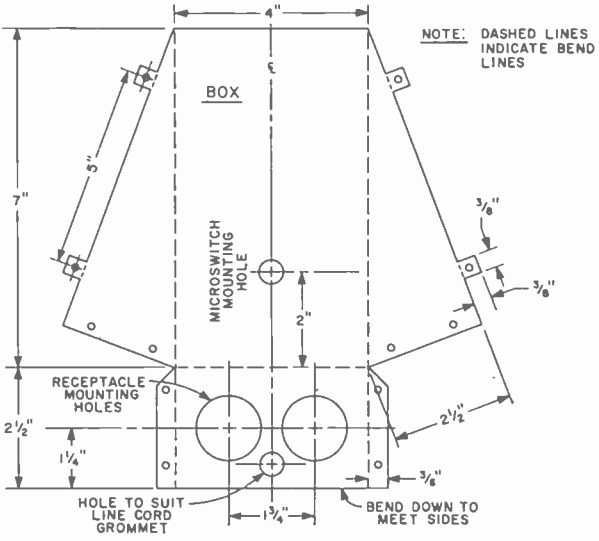


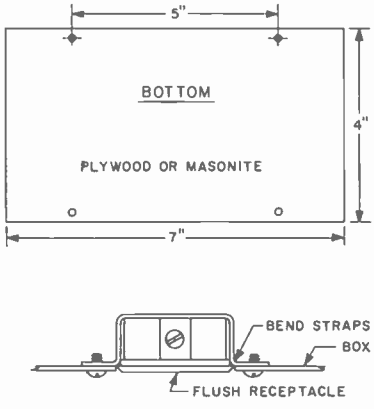
a vise or a homemade bending brake fabricated from a couple of blocks of wood and a pair of hinges.

Secure the sides of the box with rivets, self-tapping sheet metal screws, or with solder. Then cut a bottom cover from a piece of ⅛" plywood or fiberboard, being careful to drill and countersink the holes where the mounting tabs are located.

Mount all parts and wire the unit as shown in the dimensional drawing. Receptacle mounting straps must be bent slightly for true flush mounting. The bottom cover can be secured to the box with *6-32* flat-head machine screws; or you can use longer screws fitted with rubber feet.

The footswitch is now ready for use. Plug in the power cord and insert the enlarger and safelight cords in the outlets. If the footswitch is used for power tools, remember not to exceed the current rating of the switch. —30—





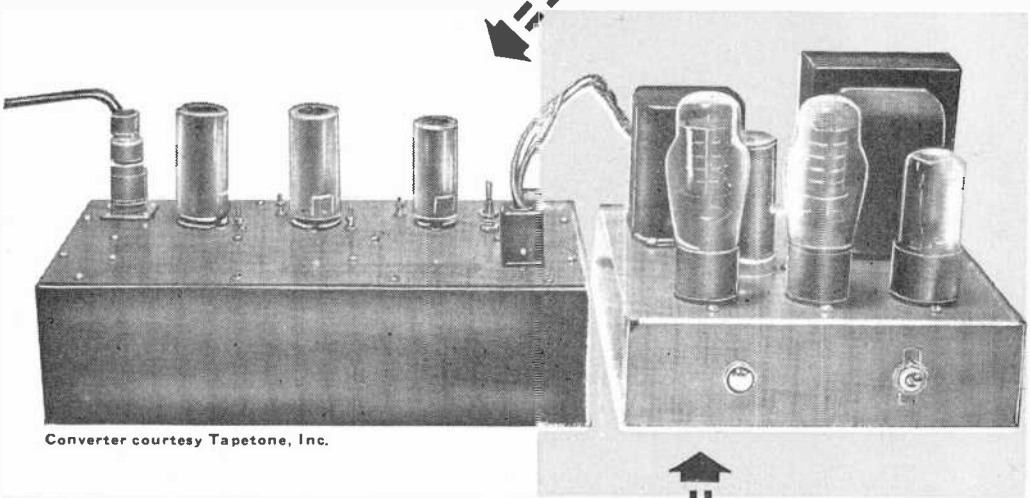
The footswitch box can be constructed following the template at left, or another layout may be used if desired.

Power Your Converter with a REGULATED POWER SUPPLY

By DONALD A. SMITH, W3UZN

MANY crystal-controlled converters are available to the v.h.f. enthusiast and to the satellite listener, but most of them require external filament and B+ voltage supplies. Some converters, such as the Tapetone XC-51, need voltage-regulated supplies. The VR supply to be described here will furnish power to most popular converters, including the satellite types.

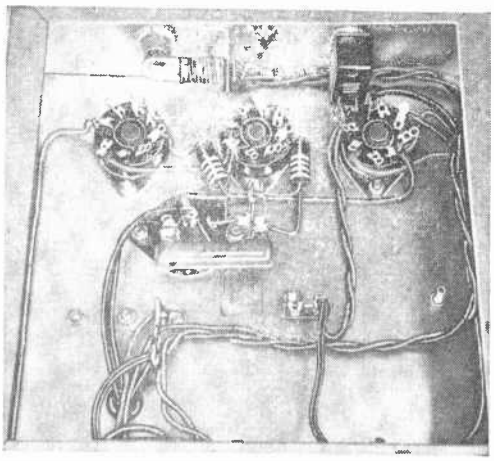
In working with several different types of crystal converters, it was found that 150 volts d.c. was most often required. The noise figure was improved in some converters by using 150 volts when the manufacturer called for 150 to 250 volts. In fact, a regulated power supply will improve the results with any converter, whether recommended or not.



Converter courtesy Tapetone, Inc.

Substitutions. This VR supply will furnish 150 volts, d.c., with loads between 10 and 70 ma., plus 6.3 volts, a.c., at 3 amperes. Transformer *T1* must have at least 175 volts each side of center-tap on the high-voltage winding, at 90 ma. or more.

If a different power transformer is used, the value for resistor *R1* will vary depending on the value of the high-voltage winding on *T1*. It is not hard to calculate the resistance of *R1*, however. Simply take the



Layout is not critical. However, leave enough space between tubes for heat dissipation.

HOW IT WORKS

The VR supply uses a 5Y3 full-wave rectifier (*V1*) and two VR-150/0D3's (*V2* and *V3*) in parallel as voltage stabilizers. All the rectifier plate current is returned through the center-tap of the high-voltage winding via jumpers inside each VR-150 to protect the powered equipment.

Resistor *R1* serves to limit the output current passing through the voltage regulator tubes to a safe value. Resistors *R2* and *R3* help balance tube current.

Tubes *V2* and *V3* can each regulate loads from 5 to 35 ma. The two tubes in parallel handle 10 to 70 ma. In spite of large variations in current through *V2* and *V3*, the voltage across them remains constant. These tubes drain more or less current depending on the output voltage at the pi-filter and changes in the load.

PARTS LIST

C1a/C1b—20/20-μf., 450-volt dual electrolytic can capacitor
CH1—5-henry, 100-ma. choke
F1—2-ampere fuse and mounting assembly
PL1—6.3-volt pilot lamp and assembly
R1—Sliding-tap variable resistor (see text and diagram)
R2, R3—68-ohm, 1-watt resistor
S1—S.p.s.t. toggle switch
T1—Power transformer, 520 volts CT., 90 ma.; 6.3 volts, 3 amp.; 5 volts, 2 amp. (Stancor PC-8404 or equivalent)
TS1—Four-screw terminal strip
V1—5Y3 tube
V2, V3—VR-150/0D3 tube
1—7" x 7" x 2" chassis
3—Octal tube sockets
Misc. hardware and ⅜" grommet

high-voltage potential between the center-tap and one side and subtract 170 from it. Then divide the answer by one-half the load current. For example, if your converter drains 70 ma., divide by 35 ma. (.035).

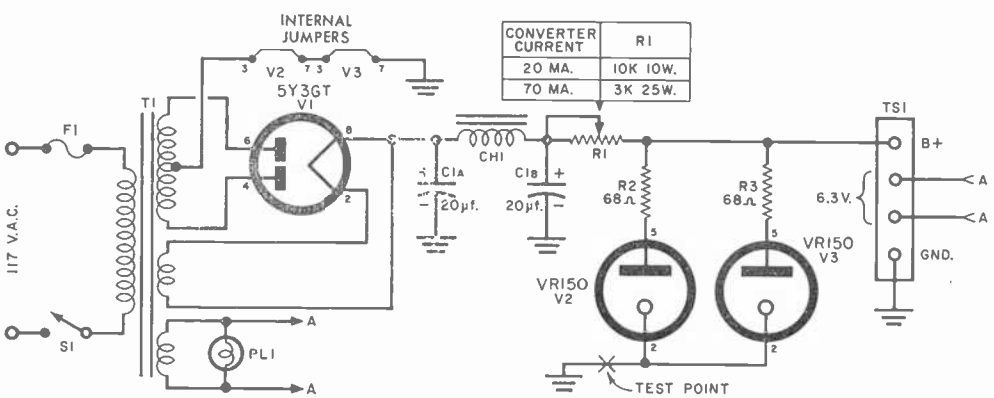
Typical values for *R1* using the specified power transformer are shown in the schematic diagram.

Construction. A 7" x 7" x 2" chassis was used although other sizes are suitable. A four-terminal strip is mounted on the back of the chassis with the wires coming through a ⅜" grommet from inside the chassis. Make up a cable with the type of power supply connector which your converter uses and connect the other end of the cable to the supply.

One side of the 6.3-volt a.c. filament line is left ungrounded. See the instructions accompanying your converter regarding filament grounding.

This supply is used regularly with a Tapetone XC-51 and International Crystal Company's FCV-1 and FCV-2 converters, as well as a home-brew converter draining 65 milliamperes.

Adjustments. The exact value for *R1* should be determined experimentally. After *R1* has been set to its approximate value using the formula outlined above, insert a 0-100 ma. meter at test point "X" on the schematic diagram. With no load connected, adjust *R1* for a meter reading equal to one-half the load current. Make sure you don't set *R1* to zero resistance—you might ruin *T1* or the regulator tubes. —30—



International Crystal Command Model at left and Polytronics Labs Model PC - 1/12 below

Listening on the 27-mc. Citizens Band

By
TOM KNEITEL
2AØ3Ø5

WE AREN'T ONES for whooping it up in the prediction department, but every now and then something so terrific pops up that we can't help but venture a peek into the future. We'll make the prediction that the new 27-mc. ("Class D") Citizens Band will be the hottest thing since the Chicago Fire, and within a very short time!

What does this mean to Joe DX'er? It means that there will be scads of new stations on the air for him to monitor; and not only that, they will be low-powered stations, offering a bit of a challenge.

The 27-mc. stations are allowed to have a maximum of 5 watts input to the final stage; and, as many of you know, the adjacent 10-meter ham band (28 mc.) often comes up with some pretty healthy DX stations using power just as low, or even lower. These Class D stations may operate on 23 frequencies, each designated by a channel number (see Table 1) like TV channels. Most stations, however, are equipped for operation on just one or two of the available frequencies.

Citizens Net. We were most fortunate in being able to take a close-up look at this band, using one of the many inexpensive transceivers now on the market. We went up on the roof of the house here in New York, flipped on the set, and found ourselves listening to a local "net" which meets on this band most nights to discuss everything from new radio equipment to Casey Stengel.

We sat patiently absorbing the conversation for a while; then it occurred to us that it took only the press of the mike button for us to become part of the net. Well, we

Channel No.	Frequency (mc.)	Channel No.	Frequency (mc.)
1	26.965	13	27.115
2	26.975	14	27.125
3	26.985	15	27.135
4	27.005	16	27.155
5	27.015	17	27.165
6	27.025	18	27.175
7	27.035	19	27.185
8	27.055	20	27.205
9	27.065	21	27.215
10	27.075	22	27.225
11	27.085	23	27.255
12	27.105		

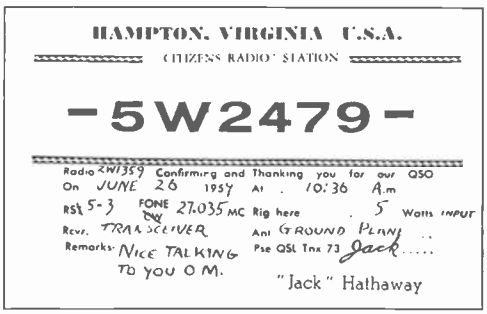
Table 1. Citizens Band channels are numbered like TV channels. Channel 4 is generally used as the calling frequency by stations with more than one transmitting channel.

Table 2. Prefixes and locations of Citizens Band stations. There are 27 call areas as compared to only 10 for amateur stations.

Prefix No.	Location
1	Conn., Maine, Mass., N.H., R.I., Vt.
2	Northern N.J., Southeastern N.Y.
3	Northern Del., Southern N.J., E. Pa.
4	Southern Del., Eastern W.Va., Md. & N. Va. (except D.C. areas)
5	Eastern N.C., Southern Va.
6	Georgia, Western N.C., Ala. (except Mobile area)
7	Fla. (exc. Pensacola, West-Central areas)
8	Ark., La., Miss., areas of Mobile, Ala., Pensacola, Fla. & Texarkana, Tex.
9	Southeast Tex. (except Beaumont area)
10	Okla., Northern & Western Tex. (except Texarkana area)
11	Ariz., Southern Calif. (except San Diego area), Las Vegas, Nev., area
12	N. Calif., Nev. (except Las Vegas area)
13	Oreg., S. Idaho, S.W. Wash.
14	Mont., N. Idaho, Wash. (exc. S.W. area)
15	Colo., Utah, Wyo., N.M., Northwestern Nebr., Southwestern S.D.
16	Minn., N.D., S.D., (except S.W. area), N. Peninsula of Mich., Northern Wis.
17	Kans., Mo., Nebr. (except N.W. area), Western Iowa
18	Ill., E. Iowa, S. Wis., W. Ky.
19	Ohio, Eastern Ky., S. Peninsula of Mich., W.Va. (except Eastern area)
20	N.Y. (except S.E. area), Western Pa
21	Hawaii & Pacific Islands
22	Puerto Rico, Virgin Islands
23	Alaska
24	D.C., areas of Md. & Va. near D.C.
25	Area of West-Central Fla.
26	Area of Beaumont, Tex.
27	Area of San Diego, Calif.

"dood" it, and sure enough, we were welcomed warmly into the merry group.

After the introductions were completed all around, we made ourselves at home. We learned that some of these boys are also hams who get their kicks from working low power on the Citizens Band. They report that excellent DX can be worked on


HAMPTON, VIRGINIA U.S.A.

CITIZENS RADIO STATION

-5W2479-

Radio 2W1359 Confirming and Thanking you for our QSO
On JUNE 26 1959 At 10:36 A.m
RST 5-3 FONE 27.035 MC Rig here 5 Watts INPUT
Rcvr. TRANSCEIVER Ant GROUND PLANE
Remarks: NICE TALKING TO YOU O M. Pse QSL Tnx 73 Jack
"Jack" Hathaway

A QSL from a distant station worked by a Citizens Band operator. QSL'ing between Citizens Band stations is the latest sideline to this new hobby.

the band when "skip" conditions are right, and that New York-Texas contacts are not uncommon.

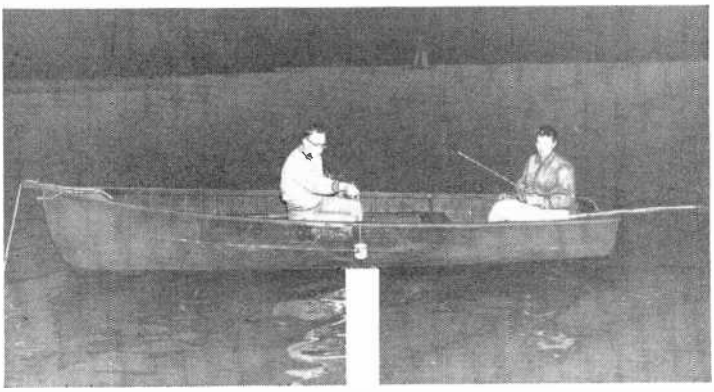
Call Signs. When you hear a Citizens Band station, you'll note that it is assigned a pretty odd-ball call sign. First there are one or two numbers, designating the geographic area where the station is located (see Table 2). Following the geographic numbers, there is a "W," and then four numbers (2W1377, 2WØ3Ø5, 19W3118).

You space-cramped city dwellers will be happy to hear that a 9'6" vertical doublet or whip will give good results when you are monitoring on 27 mc. It should be placed as high as possible.

But why just *monitor* the Citizens Band when you can easily join in the swim yourself. You can if you are at least 18 years of age, a U. S. citizen, and are willing to make a nominal investment in a transceiver (see the various advertisements in POPULAR ELECTRONICS for some pretty hot rigs). Or if you have an itchy soldering iron, you can whip together the set described on page 48 of the June issue of POP'tronics.

Stick to the Rules. Unless you are anxious to try Alcatraz as a DX site, you must ask the FCC for their Form 505, fill it in, send it to Washington, *and wait for your*

(*Continued on page* 131)



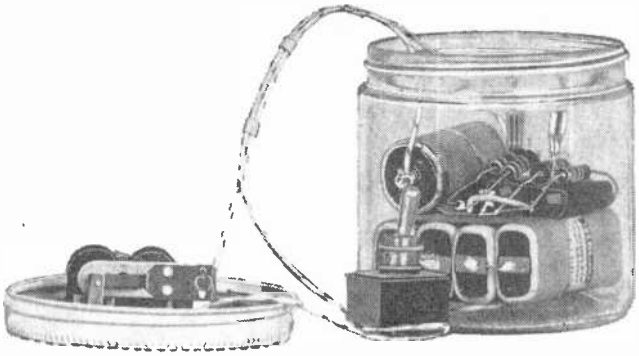
Build an Electronic Fish Lure

Flashing lights and buzzer attract fish

By
JAMES G. BUSSE

FISH LURES come in practically all shapes and sizes. Whether it be a simple spinning reflector or the weirdest creation of an artistic angler, the fish lure's job is to attract fish to the hook. While conventional fish lures sometimes successfully employ light reflectors and motion to gain the attention of the fish, they fail to take advantage of the extreme sensitivity of the fish to the faintest underwater sounds. If a sound is not loud enough to frighten fish, experiments have shown that they may be attracted to it.

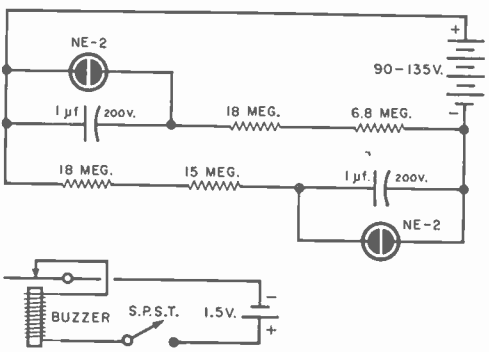
For some time now, a few cunning fishermen have sealed tiny electric buzzers in watertight jars and lowered them into the water at their favorite fishing spot. The



faint steady vibration from the buzzer seems to create the illusion among the fish that a large tasty insect has fallen into the water. They swim around the jar until their disappointment is forgotten among all the other tempting bait offered by the fishermen.

This buzzer-in-the-jar idea has been expanded into an electronic fish lure. And, as an extra attraction, a dual neon flasher circuit has been added. The completed unit is entirely self-contained. The buzzer and neon flasher are on separate circuits so that one or the other or both can be used, as desired.

Assembly. Putting an electronic fish lure together is quite simple since placement of parts is not critical. Battery voltages from 90 to 135 volts can be used. The rate at



The high-value resistors can be made up from several series-connected resistors of lower value. Since current demands are low, the blinker battery may be a weak unit salvaged from your junk box.

which the bulbs fire depends upon the values of the resistors, capacitors, and battery voltage. The rate can be slowed down by using larger value capacitors and resistors or a lower battery voltage. To conserve space, no switch was used in the neon flasher circuit. And even if the batteries operate continuously, they will outlast the fishing season, as power consumption for the blinker is only a fraction of a milliampere.

The buzzer shown is powered by a single flashlight battery. A somewhat more expensive buzzer, sold by the electronic supply houses, can be adjusted to operate at a number of different frequencies. If this type is used, adjust the control to the highest available frequency. A s.p.s.t. switch is employed in the buzzer circuit to silence the buzzer when the lure is not in use. To save space the buzzer circuit as well as the neon flasher circuit could be activated simply by connecting and disconnecting a couple of pairs of leads.

Size of the power pack and the other components used in the electronic fish lure will determine the size of the jar required. Choose the smallest size possible with a tight-fitting, screw-type cover. The individual cells of the battery pack are taped together and placed in the bottom of the jar for ballast.

The buzzer is mounted to the inside of the cover, which acts as a diaphragm to radiate the sound through the water. If the mounted buzzer makes a very tinny sound, try inserting a thin piece of rubber between it and the cover. Remember, too loud a vibration will most likely scare away the fish, not attract them. It may even be necessary to add a small resistance in series with the buzzer to produce the desired faint buzzing. In air, the buzz from the sealed jar should be hardly audible. Sound travels much better in water, and fish can hear sounds too weak to be heard by the human ear.

A small metal eye is attached to the top of the cover, through which a length of heavy fishing line is threaded. Be sure to seal every hole made in the cover with some type of waterproof cement.

Operation. Almost anyone can use an electronic fish lure successfully. Simply activate the buzzer and neon flasher circuits and screw on the cover tightly. Check for possible leaks. Then lower the electronic lure into the water, keeping it at least four feet from your fishing lines. If you are fishing in shallow water, let it lie on the bottom. Otherwise, keep it a foot or two above the level of your baited hooks. Now get set for action! If your electronic lure has a tendency to move about, weigh it down with some lead sinkers or a heavy stone.

The fun of fishing with an electronic fish lure comes from the fact that you never know what the thing will attract! Although no state prohibits the use of sound to attract fish, some forbid any use of light for this purpose. To be on the safe side, check with your state conservation commission. If the lights are out, the buzzer part of the circuit can still be used with success on your next fishing trip. —30—

HOW TO CHOOSE A RECORDING TAPE

By DICK ENGER

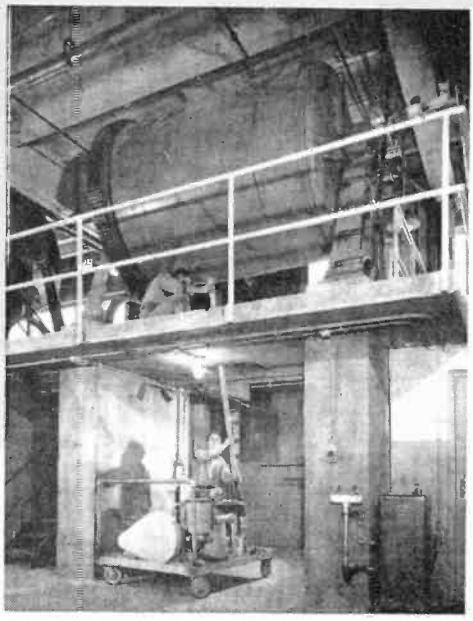
SHOPPING for magnetic recording tape 12 years ago must have been a cinch—there was only one type commercially available: "Scotch" Brand No. 100, a black oxide product on a paper backing.

Today if you are in the market for recording tape you have decisions to make. Do you want tape with acetate or polyester backing? With 1½-mil, 1-mil, or ½-mil thickness? With standard, high-output, low-print, or perhaps even tensilized characteristics?

Confusing though it may be, such a variety of recording tape has become necessary to meet the diversified uses found for tape since its embryo days of 1947. Perhaps you are a recording engineer and require a special tape for long-term storage. If so, you have needs quite different from

The basic ingredient of recording tape's magnetic coating is iron oxide. Interestingly enough, the oxide is not magnetizable before being processed.

Photographs courtesy of Minnesota Mining and Manufacturing Company



Treated oxide and the binding agents are mixed together in ball mills. As the drum rotates, steel balls pulverize the oxide. Here, men are shown pumping the finished coating material into storage tanks.

those of a geophysicist who uses tape to help locate pools of oil far beneath the ground.

Similarly, a tool control technician who uses tape to direct automatic milling machine operations has different tape requirements than does a TV producer who puts his production on video tape. Then, too, the missile-man who uses tape to record outer space data doesn't use the same tape as the home recordist who wants to make high-fidelity audio recordings for his own personal use and enjoyment.

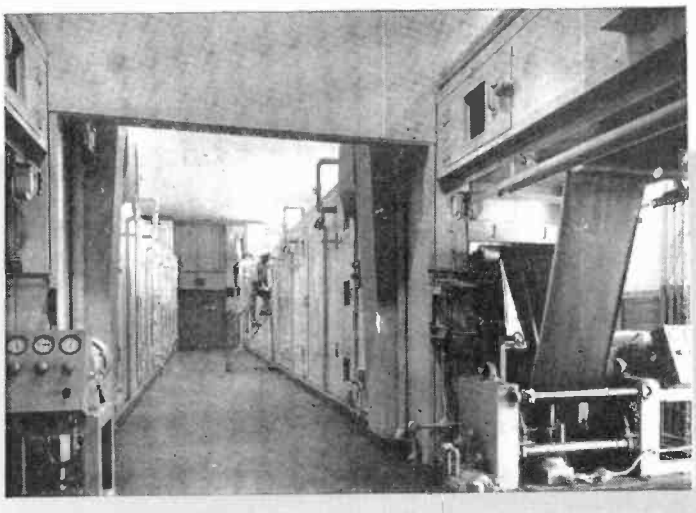
Whatever your game, though, the tape you are using is basically the same as that used for every other purpose—whether it be sound or electronic signal recording. Magnetic tape is nothing more complicated than plastic "ribbon" coated with finely powdered iron oxide.

All tape would be alike if various uses didn't demand differences in:

- Kind of material used for backing
- Thickness of backing
- Formulation of oxide and binder.

Backing Materials. Two plastic materials are commonly used for magnetic tape backing—cellulose acetate and polyester film. Unless otherwise specified, the word "plastic" on a box of recording tape means that the backing is made of cellulose acetate. This tape is very popular because it meets all normal recording requirements and costs the least per foot of tape.

Under conditions of excessive heat or humidity, polyester backing—better known as Mylar—is worth its extra cost. Mylar is actually a film form of Dacron and has greater resistance to heat and humidity and greater strength than does acetate. It is



After the tape has been coated with oxide, it travels through a drying oven, part of which is shown at left. The tape is processed in twenty-four-inch widths.

Hundreds of thousands of listening hours could be recorded on the tape in this storage area. "Jumbo rolls" are kept here before being cut and wound onto separate reels.

especially useful for long-term storage because it contains no plasticizers. In acetate tape, these plasticizing agents may eventually evaporate, leaving the tape brittle.

However, Mylar has a disadvantage. Under extreme tension, it may stretch. Although the likelihood of this happening is the exception rather than the rule, it is troublesome if the stretched tape contains critical information. Acetate tape will stretch only slightly before it breaks and any breaks can be repaired by splicing. For this reason, most of the major record companies make their master recordings on acetate-backed tape.

Thick or Thin. Tape is commonly available in three backing thicknesses. For greatest strength, it is produced with the 1½-mil backing which provides 1200 feet of tape on a standard 7" reel. To obtain half again as much playing time, manufacturers put out 1-mil tapes, thus obtaining 1800 feet of tape on the same diameter reel. This reduction in thickness reduces the strength of the tape, but 1-mil Mylar is actually stronger than 1½-mil acetate tape. However, it is more prone to stretching than is 1½-mil acetate.

Decreasing backing thickness even further to ½-mil makes it possible to put twice as much tape on the same reel, providing twice as much playing time. However, paring the thickness of the backing to ½ mil cuts its strength still further. To compensate for this loss of strength and the stretching problem, polyester-backed tape has been developed which is pre-stretched (usually referred to as "tensilized" or "tempered" tape). This tape is twice as strong as 1-mil Mylar. It is also roughly about 40% more expensive per foot than 1-mil Mylar.

The big advantage of double-length (½-mil) tape is that a full hour may be recorded on a standard 7" reel at the speed of 7½ ips—as opposed to the half hour possible with a reel of 1½-mil tape.

Special Tapes. As tapes became thinner and thinner, recording engineers discovered

(*Continued on page* 127)

How NOT to Use Transistors

Courtesy of General Transistor Corp.

Ignore the published ratings and exceed them. You'll have a real "hot" transistor —for a moment or two.

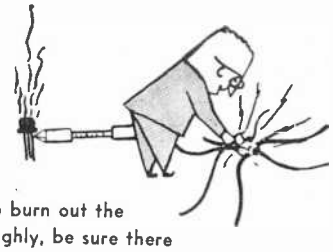
Insert the transistor into the test equipment while the power is on, making sure the order in which the leads make contact is switched around. This may cause immediate ruin.

Twist and yank the leads excessively when you install the transistor. If you listen closely you will hear the snap.

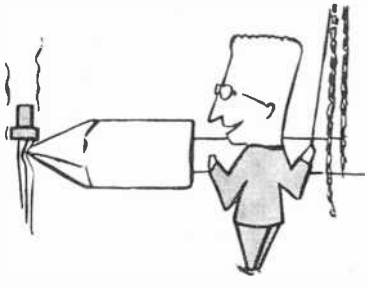
We've all heard how sturdy and indestructible the transistor is . . . but nothing is perfect. Any qualified engineer, equipped with the proper educational background can, with a little ingenuity, reduce the transistor to a midget jellyfish. The accompanying quips are by no means all-inclusive, but they will start you on your way to becoming a big transistor user.

If the transistor does not fit into the equipment properly, put a screwdriver on the case and hammer it into place.

Overheat the leads with a big soldering iron. Leads are going out of style anyway.

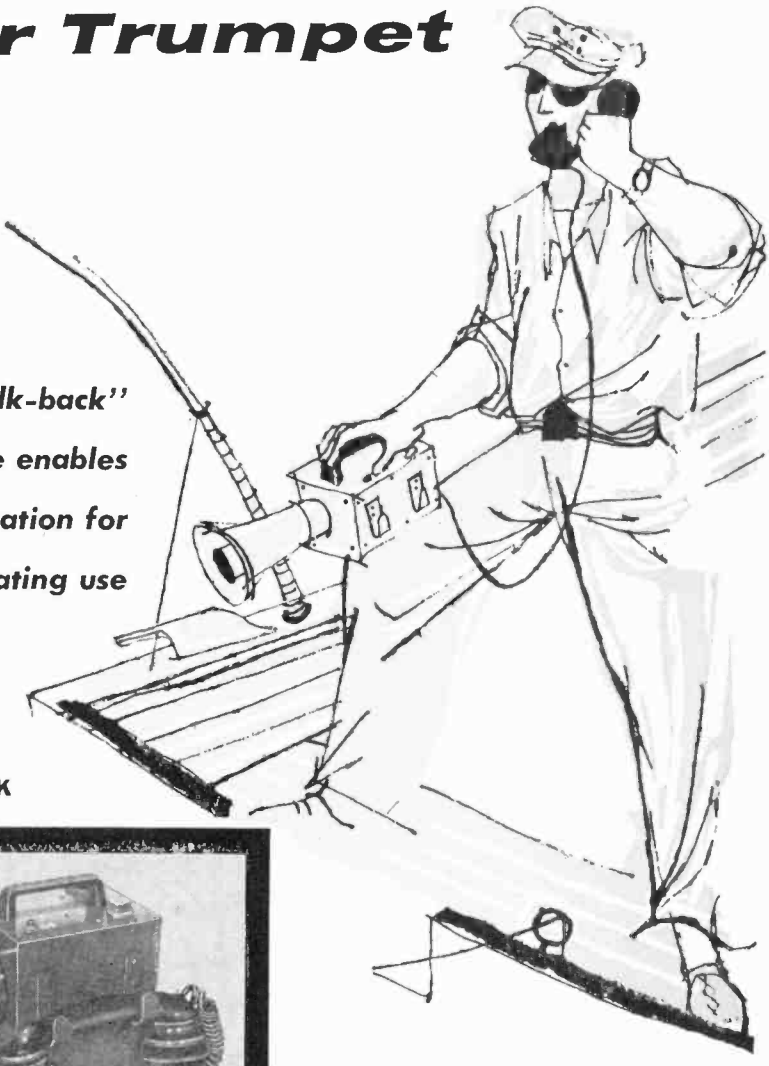


In order to burn out the transistor thoroughly, be sure there is leakage to the power line in the soldering iron.

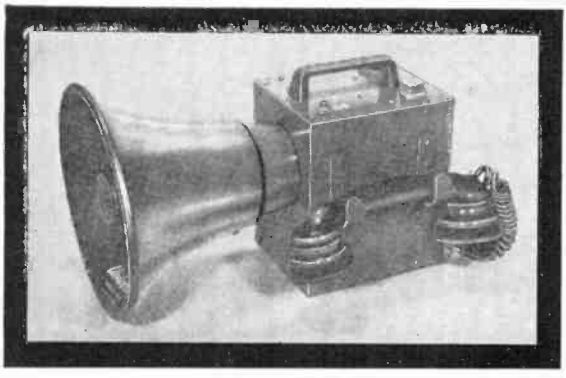


Transistorized Two-Way Power Trumpet

Special "talk-back" feature enables two-way communication for p.a. or boating use

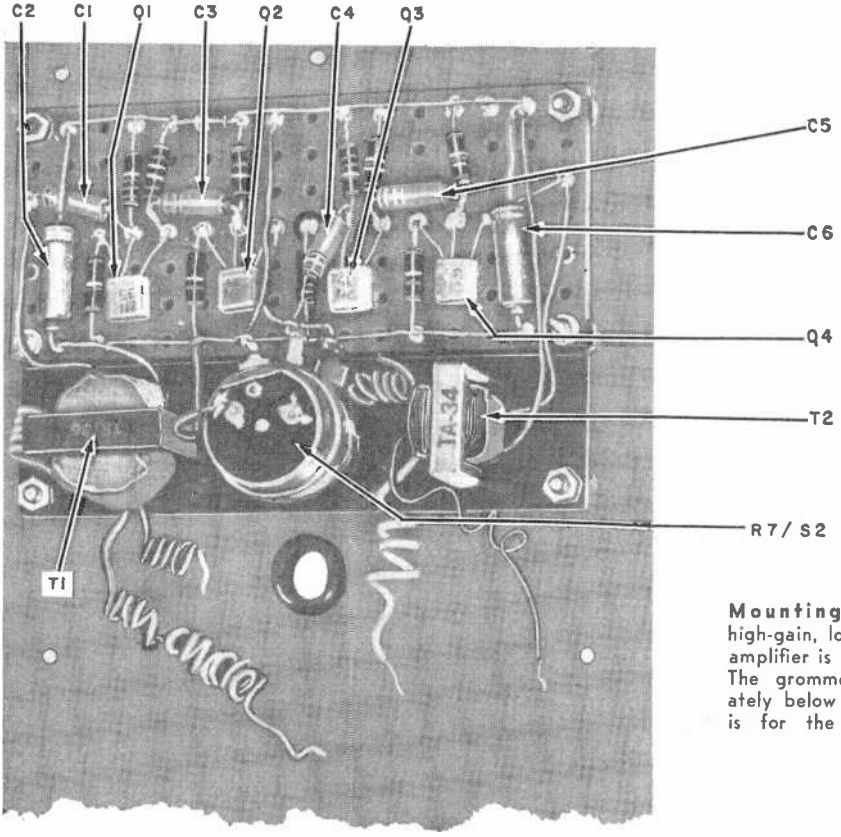


By R. L. WINKLEPLECK

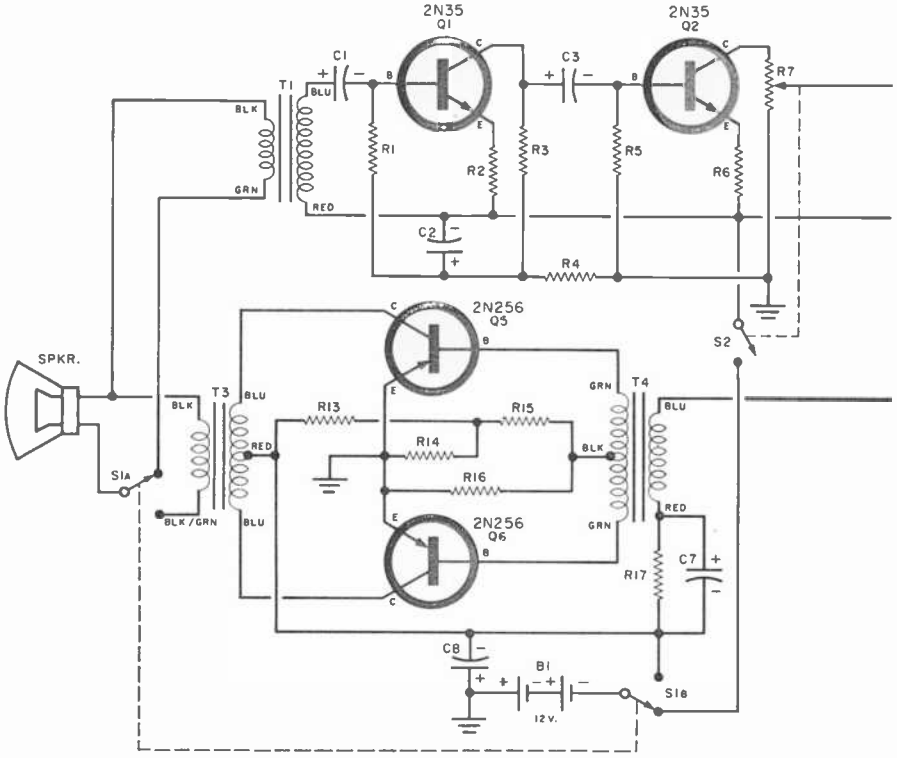


PORTABLE voice amplifiers of the type used to direct crowds, instruct groups of workers and supervise games are a real convenience, and more and more are being used. The advent of power transistors has made possible size reductions and economical battery operation not previously attainable.

After using one of these handy devices for a while, you recognize that they have one weakness: the man with the horn can make his wishes known over a large area, but it's seldom that a reply is loud enough to be intelligible. What's needed is a "talk-back" or intercom type of power trumpet so that you can hear as well as talk.



Mounting plate of the high-gain, low-power "listen" amplifier is box's back panel. The grommet hole immediately below gain control R7 is for the handset cable.



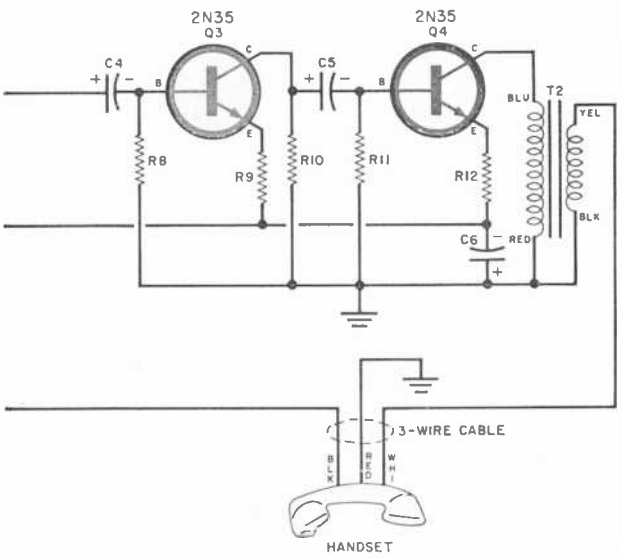
Relatively inexpensive and compact, the unit presented here combines a ten-watt power trumpet with a second high-gain amplifier that can convert the sound of an approaching automobile into that of a roaring avalanche. It's completely transistorized and, except for the flaring horn and the telephone handset, is contained complete with batteries in a 5" x 6" x 7" aluminum cabinet.

To use the trumpet, simply turn on the "listen" amplifier and adjust the volume knob at the back of the case. Pick up the handset and hear everything going on around you, with special emphasis on sounds originating in the 90° pickup and dispersion angle of the trumpet. When you want to talk, push the button on the top of the box next to the handle. This disconnects the "listen" amplifier from the trumpet, and turns on and connects the "talk" amplifier.

The box can be constructed of sheet aluminum, aluminum angle stock and self-tapping screws, or a commercial cabinet can be used. The entire circuit is wired and mounted to the box panels before the box is assembled. In this way you avoid the problem of working in tight corners.

The "talk" amplifier mounts on the underside of the top panel and the "listen" amplifier is fastened to the inside of the back panel. Two six-volt batteries are housed in the bottom of the box. All interconnecting wires terminate at a tie strip mounted near the battery.

The "talk" amplifier parts placement and lead dress are not critical. But it's im-



HOW IT WORKS

The "talk" amplifier employs two CBS 2N256 power transistors in a class "B" push-pull circuit using the common-emitter configuration. These are driven, through driver transformer *T4*, by the F-1 carbon button microphone in the Western Electric E-1 handset. The output rating of the amplifier is a powerful ten audio watts—adequate for virtually every need.

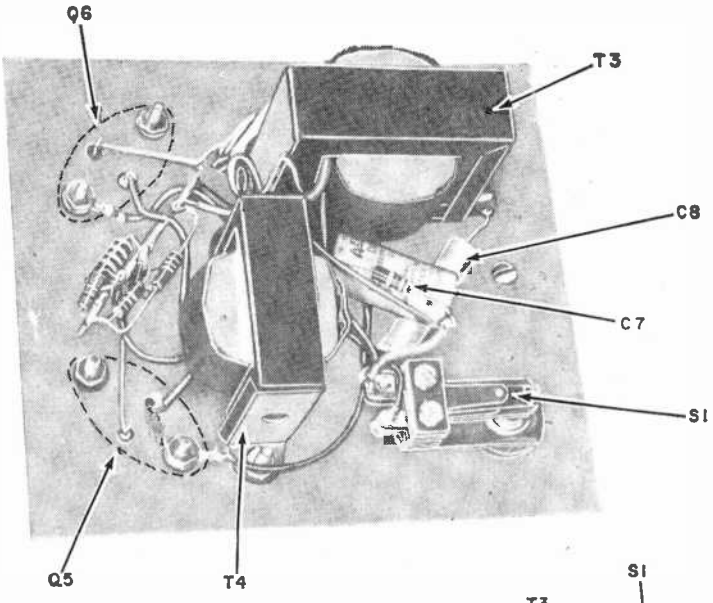
The driver and output transformers specified in the parts list provide good impedance matching. Note that the d.p.d.t. push-button switch *S1*, when depressed, both supplies power to the amplifier and connects the trumpet to the amplifier output. Thus, this amplifier, which may draw an ampere or a bit more when hard-driven, consumes battery current only when the "push-to-talk" switch is actuated.

The "listen" amplifier is a four-stage *RC*-coupled transistor unit using 2N35 *n-p-n* transistors. With a maximum over-all voltage gain of approximately 2500, current drain from the battery is about 5 ma. Potentiometer *R7* adjusts sensitivity for good intelligibility and a low level of background noise. Degeneration, provided by the 1000-ohm resistors in the emitter circuits, produces an input impedance of approximately 40,000 ohms and increases stability.

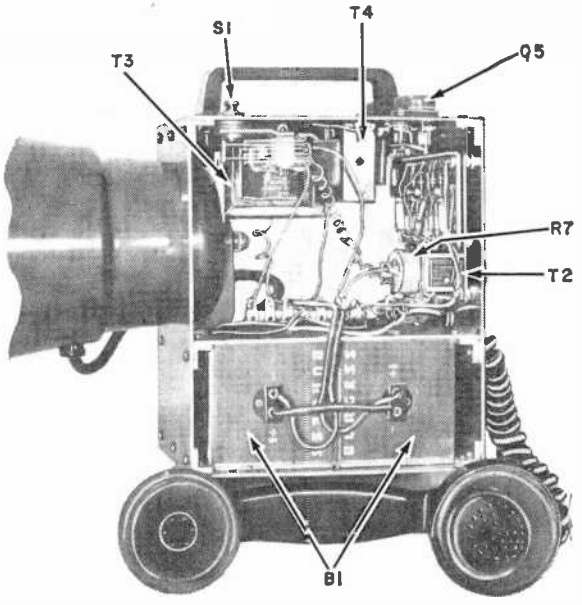
The input transformer specified offers a good impedance match between the amplifier input and the 8-ohm trumpet which substitutes as a dynamic microphone for "talk-back." The output transformer *T2* closely matches the receiver in the E-1 handset. If some other handset is used, another transformer may be required for good matching.

PARTS LIST

B1—Two 6-volt batteries (Burgess F4P1)
C1, C3, C4, C5—1 μf. — *All capacitors*
C2, C6, C7—10 μf. — *12-volt*
C8 —100 μf. — *electrolytics*
Q1, Q2, Q3, Q4— 2N35 transistor (Sylvania)
Q5, Q6— 2N256 power transistor (CBS)
R1, R5, R8, R11—1 megohm — *All resistors*
R2, R6, R9, R12—1000 ohms — *½-watt*
R3, R10—10,000 ohms — *composition*
R4— 22,000 ohms
R7—10,000-ohm audio taper potentiometer
R13— 150 ohms
R14 100-ohm resistor or Vesco 21W1 thermistor (see text)
R15 100 ohms
R16 3.3 ohms
R17— 470 ohms (see text)
S1 D.p.d.t. push-button switch
S2 S.p.s.t. switch (on R7)
T1— Thordarson TR-36 transformer (or equivalent)
T2 Stancor TA-34 transformer (or equivalent)
T3 Triad TY-64x transformer (or equivalent)
T4 Triad TY-61x transformer (or equivalent)
Spkr.—University Model 1B-8 trumpet
1—Western Electric E-1 handset (or equivalent)



Top panel, at left, is the mounting base for the two power transistors and the transformers of the "talk-back" section. Assembled unit, below, shows relative placement of panels. "Listen" amplifier is mounted on panel opposite rear of horn.



possible with the arrangement illustrated to keep the input and output well separated; so transformers *T3* and *T4* must be placed at right angles to each other. This reduces the possibility of magnetic coupling and feedback.

The shells of the power transistors *Q5* and *Q6* are their collector connections and must be insulated when they are mounted on the top panel. Thin fiberglass, mica or composition sheets provide good electrical insulation and still let the heat generated flow into the chassis. Be very careful to remove all burrs from around holes in the insulation before mounting the transistors. With the new fiberglass insulation, even a small projection may punch through when the power transistor is tightened in place.

Output volume may be fairly well controlled by varying the level of the speaking voice. If a volume control is desired, and one will be necessary if the unit is used in a restricted area, current limiting resistor *R17* can be replaced with a 1000-1500 ohm pot hooked up as a rheostat. If the unit will be exposed for hours to the hot summer sun, resistor *R14* should be replaced by a Veco 21W1 thermistor to prevent thermal runaway.

Some of the older carbon buttons tend to develop quite a bit of hiss. If this is loud enough to be objectionable, it can be eliminated by connecting a .01-.04 μf. capacitor across the red and blue leads of transformer *T4*.

The "listen" amplifier, its input and output transformers, and the volume control may be assembled on a 3" x 4" phenolic board with metal clips at the points where the components are interconnected. The circuit board is then mounted on the rear

(*Continued on page* 128)

POPULAR
ELECTRONICS

Builds a

Modulator-Driver

Versatile EICO 730 delivers 50 watts of audio for phone transmissions

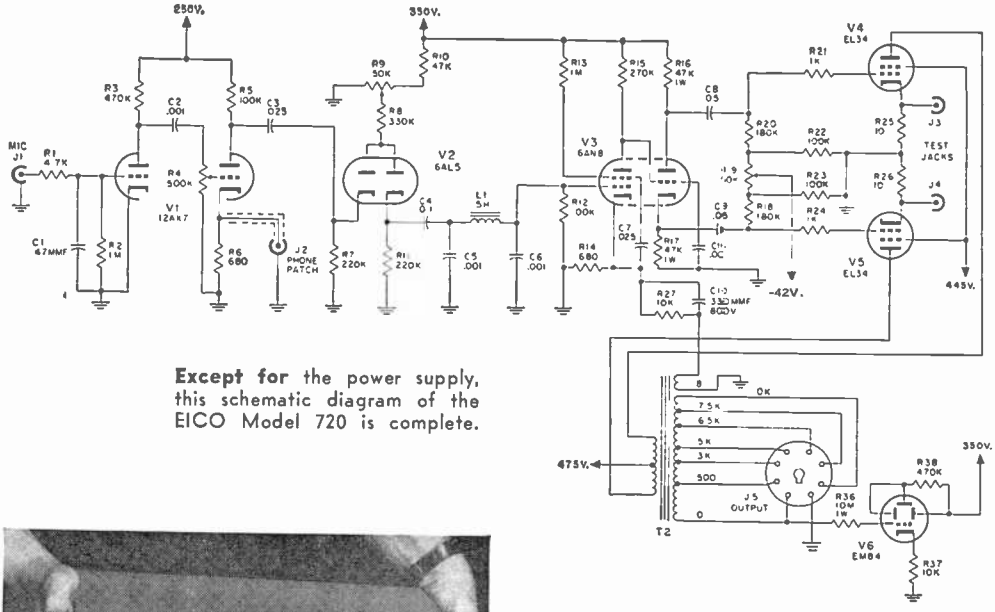
AFTER a Novice goes General, the phone bug bites him. The key is tossed aside and is replaced by a mike. Unfortunately, most Novice c.w. transmitters do not have a built-in modulator. So, the next item to add to the ham shack is a modulator unit.

POPULAR ELECTRONICS built and operated the EICO 720 Modulator-Driver and found it to be a suitable unit for modulating most 100-watt transmitters. The modulator output transformer is tapped to match final r.f. amplifier loads from 500 to 10,000 ohms.

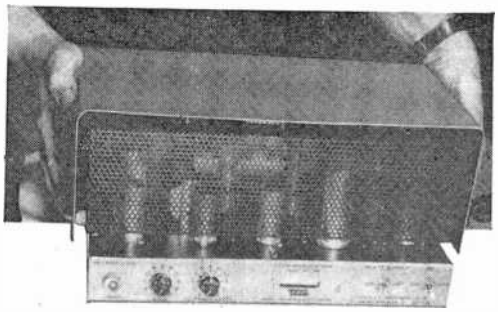
Assembly. If you ever assembled a hi-fi power amplifier, you will have absolutely no problems with this modulator-driver. Just follow the instruction book carefully, using standard audio practices when wiring.

If tight corners cause difficulty in wiring the indicator tube socket, loosen the socket bracket mounting screws and tilt the socket bracket forward. One other gripe which is common in building kits, concerns the connection of too many wires to a grounding lug. Fortunately, in this case an extra

TESTED By POPULAR ELECTRONICS



Except for the power supply, this schematic diagram of the EICO Model 720 is complete.



An optional steel cover dresses up the modulator-driver for desk-top use. Front and rear screens provide ample ventilation.

ground lug was packed in the kit, and two of them were used where only one was called for.

How It Operates. Dual-triode tube *V1* is used as the microphone preamplifier, with the gain control (*R4*) in the grid circuit of the second stage. A phone patch jack (*J2*) is also located at a low-impedance point in the second stage. If the gain control is not set at minimum, mixing with the microphone is possible. An r.f. filter (*R1, C1*) is employed at the input of the first stage to reduce any possible tendency towards r.f. feedback.

A 6AL5 dual-diode (*V2*) is employed as a series-type clipper, with the clipping level controlled by potentiometer *R9* in a voltage divider circuit. The clipper output is fed through a low-pass filter (*L1, C5* and *C6*) to suppress high-order harmonics generated by peak clipping. The clipper prevents over-modulation and raises the effective speech level of the signal 8-12 db for added "punch" under QRM conditions.

A 6AN8 pentode triode (*V3*) is used as a pentode voltage amplifier direct-coupled to a triode split-load phase inverter; negative feedback from the secondary of the modulation transformer is introduced at the cathode of the voltage amplifier. And a pair of EL34 audio power amplifier tubes (*V4* and *V5*), are operated in push-pull, class AB1, with fixed bias.

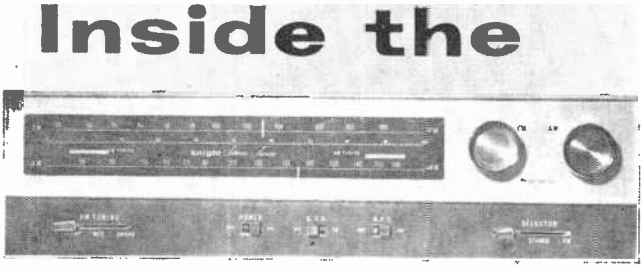
Visual indication of over-modulation is provided by an EM84 electron-ray tube (*V6*) when the Model 730 is employed as a plate modulator. Potentiometer *R9* should be set so that the indicator bars approach each other closely but do not overlap. This indication corresponds to 100% modulation.

Getting on the Air. Following the instruction manual closely, the modulator-driver was connected to the EICO 720 transmitter. A crystal mike was used, with favorable results. QSA5 reports are still coming in.

If operation with a transmit-receive switch is desired, most receiver and transmitter manuals will give the necessary schematic diagram required. If you have any problems interconnecting the modulator-driver with a transmitter, just drop a line to EICO (Electronic Instrument Co., Inc., 33-00 Northern Boulevard, Long Island City 1, N. Y.)

—30—

Inside the



Hi-Fi Tuner

By JOSEPH MARSHALL

IN MANY AREAS of the country the availability of good music from FM and AM stations has made the hi-fi tuner the cheapest and most convenient source of high-fidelity program material. Some 100 stations are today broadcasting AM-FM stereo simulcasts or experimental multiplex. The Federal Communications Commission has under consideration several proposals for multiplex transmissions—not only on FM stations but also on AM. All of this has greatly increased interest in hi-fi tuners.

Basically, a hi-fi tuner is a refined and specialized radio receiver. The big difference is that the tuner has no audio amplifier or speaker. It amplifies the radio signal, demodulates it, equalizes it (if necessary) and then delivers the audio component at a level of about 1 to 5 volts to the control unit of a hi-fi system.

Basic Principles. All commercial hi-fi tuners today are superheterodynes. The principle of the superheterodyne is no doubt familiar to most of our readers.

Figure 1 (A) is the block diagram of a superheterodyne AM tuner. The incoming radio signal, after being induced into the antenna, goes into the radio frequency amplifier where it is amplified at the original station frequency. The converter, consisting of a mixer stage and an oscillator, converts the incoming signal to a lower frequency. This conversion is also accompanied by additional amplification. The signal is further amplified by the i.f. (inter-

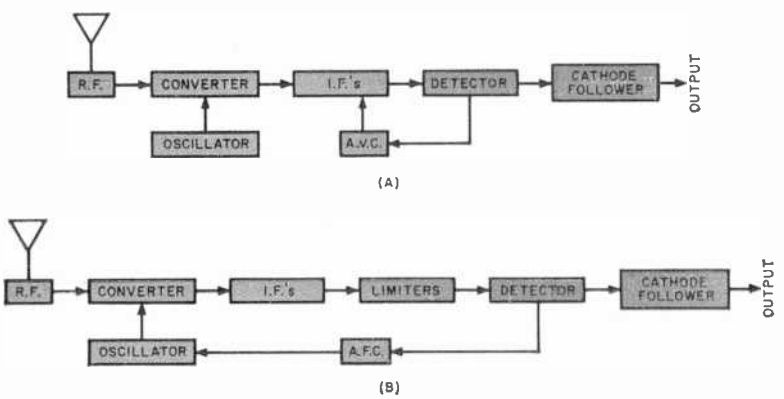


Fig. 1. Block diagram of superhet AM tuner is shown in (A). Typical FM tuner circuitry is illustrated in (B).

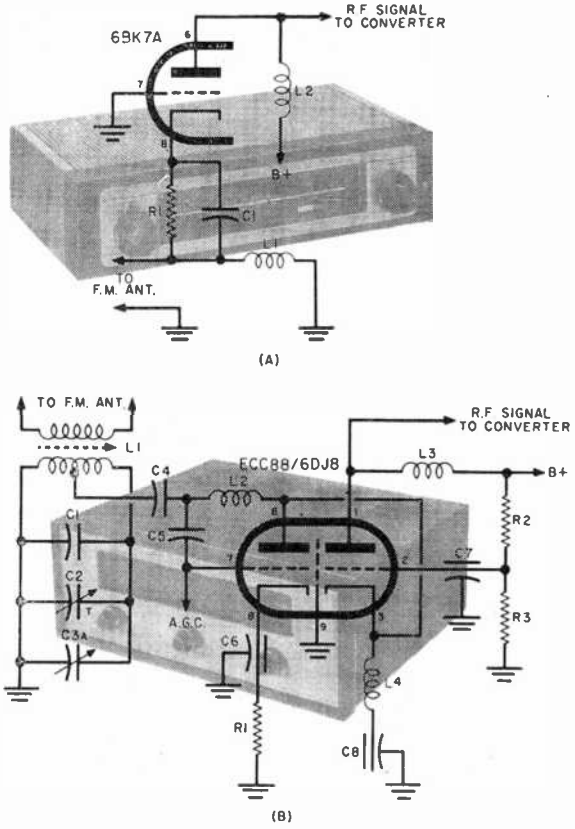


Fig. 2. Grounded-grid r.f. amplifier circuit shown in (A) is used in the Harman-Kardon FM-100 tuner. The cascode r.f. circuit of (B) is employed in the new Fisher FM-100.

mediate frequency) amplifier at the new, lower frequency.

Next, the demodulator or detector separates the audio from the carrier. Sometimes a stage of audio amplification is employed to give the signal one last boost and then it is sent on to a cathode-follower output stage. This circuit couples the tuner to a hi-fi amplifier with little interaction and modification of the audio signal.

Only in specific particulars does FM circuitry differ from the AM circuitry outlined above. There may be an automatic frequency control circuit, and the i.f. amplifiers are usually followed by one or two stages of limiting. The FM demodulator or detector is also different from an AM detector. A block diagram of a typical FM tuner is shown in Fig. 1 (B).

Front Ends. The r.f. stage is one of the most important elements of a tuner because it determines how weak a signal the tuner can receive satisfactorily. Any electrical element, including a tube, generates some noise when a current flows through it. Thus, a signal that is introduced into a tube faces the competition of noise from the tube and its circuitry. Once noise gets into a circuit, it is amplified right along with the signal at every step of the way. Consequently, it is of utmost importance to keep noise to a minimum in the r.f. amplifier, the very first circuit.

The two most widely used types of r.f. amplifier circuits are the grounded-grid triode and the dual-triode cascode circuit. See Fig. 2. Triodes are favored over pentodes in FM r.f. stages because of their low-noise characteristics. However, the conventional grounded-cathode triode is not suitable for use in r.f. amplifiers due to problems of oscillation. Consequently, the grounded-grid circuit of Fig. 2 (A) was evolved. This circuit is very stable and, in addition, has excellent noise characteristics. Unfortunately, however, it is not capable of very high gain.

The cascode circuit of Fig. 2 (B) is capable of both high gain and low noise. This interesting circuit uses two triodes wired in series, with the plate of the left triode connected to the cathode of the right one. The left portion is a normal grounded-cathode stage; it does not oscillate because the right tube loads it too heavily to sustain oscillation. The right section is a grounded-grid amplifier; because its input is ideally loaded by the output impedance of the left tube, it produces much more gain than if it were used directly at the input and loaded by the antenna. The result is an r.f. stage which has the gain of a pentode but the noise figure of a triode. In addition to being used in hi-fi tuners, the cascode r.f. circuit is also commonly employed in TV receivers.

Automatic Frequency Control. The local oscillator of an FM tuner presents some big problems in stability. Ideally, once the tuner is tuned to a given station, the oscillator should maintain the exact same frequency. If it shifts frequency, distortion will result. If the oscillator frequency shifts as much as 200 kc.—and this is easily pos-

sible at FM frequencies—the i.f. frequency produced by the converter may be completely outside the bandpass of the i.f. amplifier and the signal will not be heard at all. Constant adjustment would be necessary to keep the station in tune and to minimize distortion.

There are a few tuners using temperature compensation, permeability tuning and other special precautions that maintain oscillator stability within 25 kc. At least one tuner, the Karg, employs a crystal-controlled oscillator and thus achieves even greater stability, but this requires an individual crystal for each station to be received. Many manufacturers feel it is easier and much cheaper to solve the problem with an automatic frequency control circuit.

The principle of a.f.c. is not hard to understand. A tube can be circuited so its input or output capacitance will vary in step with the bias on its grid. By varying the bias on such a tube, we have in effect an electronic variable capacitor. If we connect this electronic variable capacitor, or "reactance tube," across the frequency-determining tank of the oscillator, we can vary the frequency of the oscillator over a narrow range by varying the bias on the reactance tube.

Most happily for the operation of a.f.c. circuits, at the output of an FM detector we have not only demodulated audio but also a d.c. voltage which can be used to "key" the a.f.c. tube. When the station is exactly tuned in, this voltage is zero. But when the station is detuned one way, the voltage becomes positive; when it is detuned the other way the voltage swings negative. All we have to do is use this voltage as bias for our reactance tube.

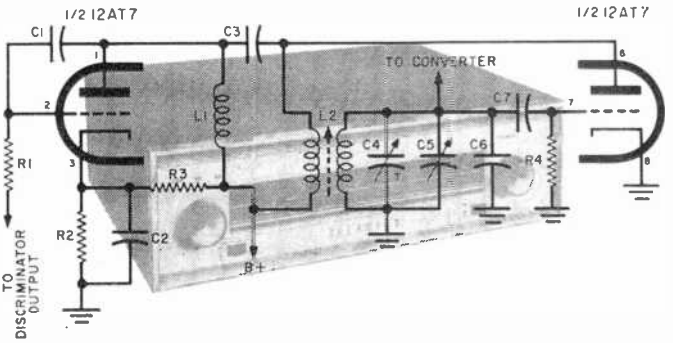


Fig. 3. Automatic frequency control circuit used in the Sherwood S-2000 tuner. Triode on left is "keyed" by the d.c. voltage from the discriminator and presents a varying capacitive load to the oscillator tube at right. This keeps the oscillator circuit tuned to the proper output frequency.

When the oscillator tube starts drifting in frequency, the resultant change of bias applied to the reactance tube causes a change in the reactance tube's output capacitance. This capacitance is applied to the oscillator tank circuit and results in the retuning of the oscillator to its proper frequency. See Fig. 3. By proper design we can obtain correction in this way to take care of as much as 500-kc. drift, and thus automatically maintain the stability we need for proper reception.

Automatic frequency control is not all peaches and cream, however. Weak stations close to strong ones may be completely blanked out by stronger ones. Con-

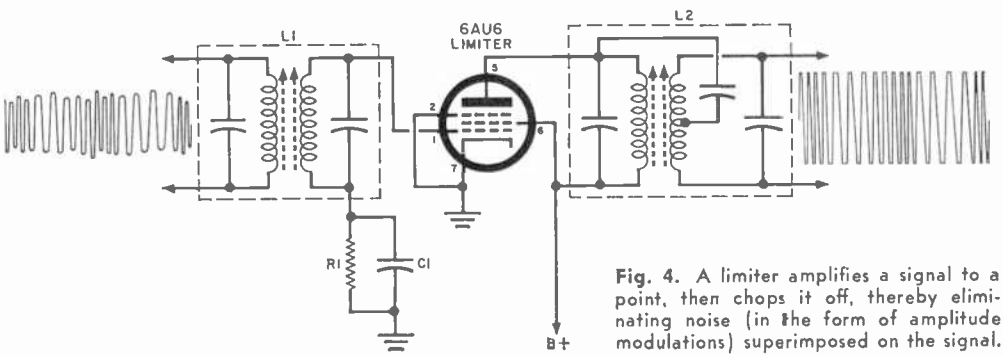


Fig. 4. A limiter amplifies a signal to a point, then chops it off, thereby eliminating noise (in the form of amplitude modulations) superimposed on the signal.

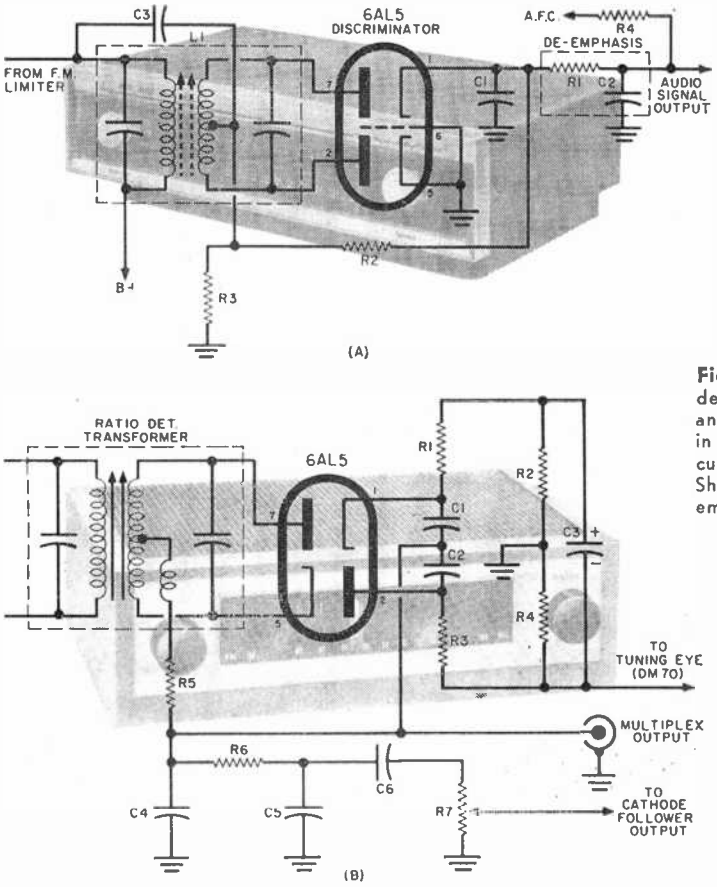


Fig. 5. The two most popular FM detectors are the discriminator and the ratio detector. Shown in (A) is the discriminator circuit used in the Bell 2520 tuner. Shown in (B) is the ratio detector employed in the EICO HFT-90.

sequently, many FM tuners provide a switch for switching out the a.f.c. when desired. Some have adjustable a.f.c. controls to allow variable amounts of a.f.c. action. And a.f.c. is not a "cure-all" for oscillator drift. For maximum sensitivity and lowest distortion, the oscillator should be designed to be as stable as possible before the addition of the automatic frequency control.

Some manufacturers of high-quality FM tuners, led by H. H. Scott, have gotten away from a.f.c. altogether by the use of extremely wide band i.f. stages and detectors in their tuners. Should the oscillator drift slightly, the wide bandwidth will still pass the errant i.f. signal without distortion.

The I.F. Amplifier. In AM tuners a single i.f. stage, when added to an r.f. stage and a converter, can produce enough gain for hi-fi reception. Sometimes, however, two i.f. stages are used to increase the gain and to control the bandwidth more exactly. FM tuners usually have at least two i.f. stages, plus one or two limiters which also provide gain on weak signals.

In AM, the audio response depends on the i.f. bandwidth—the wider the bandwidth, the better the high-frequency response. Unfortunately, under present allocations in the AM band, with stations only 10-kc. apart, the modulation of stations on adjacent channels causes the 10-kc. space to be shared between them. Thus, only when there is no station on either of the adjacent channels is it possible to receive anything resembling the full audio range without interference. In addition, the tuner's bandwidth would have to be from 20 to 40 kc. But, with such a broad bandwidth, the tuner could not separate stations on adjacent channels.

For this reason, more and more de luxe AM tuners are incorporating some type of variable i.f. bandwidth control. This allows the tuner to be adjusted for sharp tuning when there are adjacent stations, or broad tuning when there are no adjacent stations. "Narrow-band" operation usually provides a frequency response to about

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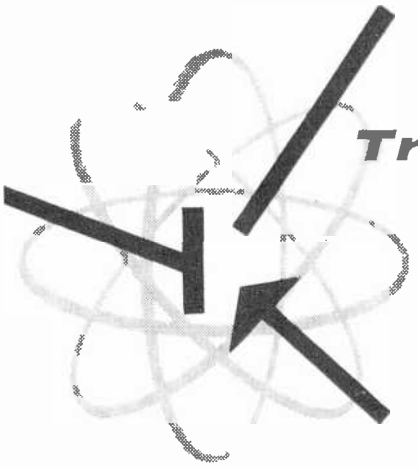


Transistor Topics

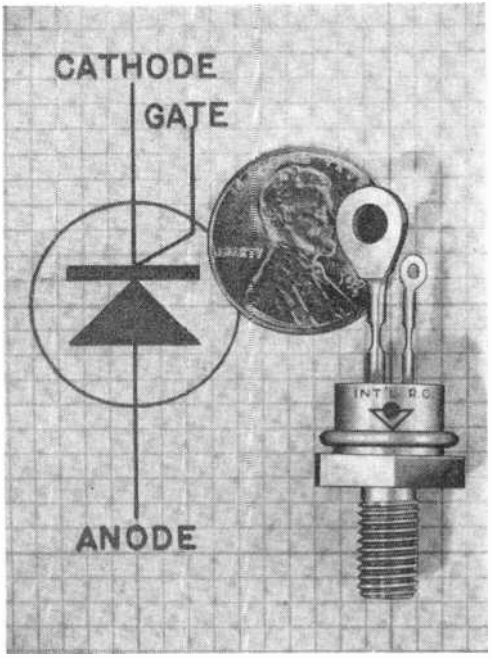
By LOU GARNER

AS OF the latest count, well over a thousand different types of transistors have been introduced by semiconductor manufacturers, with new types announced almost on a month-to-month basis by nearly every major producer. If we add to this the several thousand types of diodes and rectifiers available, we find that the total *number of types* of semiconductor devices in current production far exceeds the total number of vacuum tube types. Unless some move is taken towards standardization, the day is not far distant when a several-hundred-page book will be needed simply to list available semiconductor devices.

This brings up a question which plagues the engineer, experimenter, factory technician, serviceman, and parts distributor alike: *why so many types of semiconductor devices?* As you might expect, there are several answers.

First, there is a definite tendency on the part of manufacturers to use type numbers peculiar to their own products. Transistors with very similar—if not identical—characteristics produced by different manufacturers are likely to carry different type numbers; this is in contrast to vacuum-tube manufacturing, where several firms may produce a single tube type.

In addition, most manufacturers tend to use different type numbers for even slightly modified versions of a specific component. Thus, a transistor may carry one type number if it comes in a conventional "flat" case, another in a round JETEC-30 case or a subminiature case, another if it is equipped with long flexible leads instead of short pins, another if its basing arrangement is changed, and perhaps still another if it is selected for low noise . . . *even though its basic electrical characteristics remain the same.*



This controlled rectifier, introduced by International Rectifier Corporation can handle currents up to 10 amperes at PIV ratings of up to 200 volts.

A third important factor is the rate at which new developments are made. Semiconductor devices which are "impossible" today may become commonplace within a few short months as new design and production techniques are developed. This alone could lead to the introduction of scores of new types each year; it is offset,

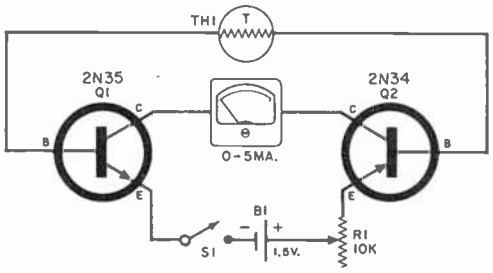


Fig. 1. Robert Bari's thermistor amplifier.

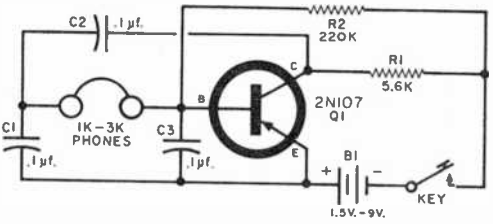


Fig. 2. Ron Remmel's code practice oscillator.

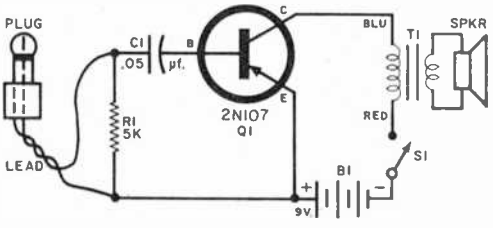


Fig. 3. Jock McTavish's booster amplifier.

in part, by the gradual obsolescence of older types.

But the chief reason for the present overwhelming profusion of "types" is the basic manufacturing technique. Transistor and diode electrical characteristics depend on "impurity" concentrations on the order of a *few parts per billion* and on such hard-to-control things as area of impurity diffusion and rate of crystal growth. Thus, these devices are not produced in batches of identical types as are vacuum tubes. Instead, a production run will have units of varying performance characteristics, which must be sorted, *after manufacture,* into specific types. Often the final price of a given device is determined by the *yield* of that type obtained from a production run: where the yield is small, the price is high, and vice-versa.

In many instances, low-cost "experimenter's" transistors are units culled from various production runs after more expensive types have been selected. While *all* the transistors of a given experimenter's type will meet the *basic* specifications of the type, they may have widely varying individual characteristics; in a given batch, you may find some that work well at r.f. (even though listed as "audio"), some that have exceptionally high gain, and some that have very low noise.

If you have several transistors of a given type available, and are working with an especially critical circuit, you'll find it worthwhile to try each of your units . . . finally installing the one which gives best over-all performance.

Readers' Circuits. About 70% of the circuits sumbitted by readers are of simple broadcast-band receivers, and about 20% are of simple "earphone" amplifiers. The remaining 10% are of more complex receivers, audio amplifiers, instruments, and "gadgets." This month we are featuring three circuits from the latter group.

Reader Robert Bari (207 N. Washington Ave., Bergenfield, N. J.) sent in the circuit shown in Fig. 1. Combining a *thermistor* (*Th1*) with two transistors, this circuit offers a number of experimental possibilities and can be easily modified to meet special requirements.

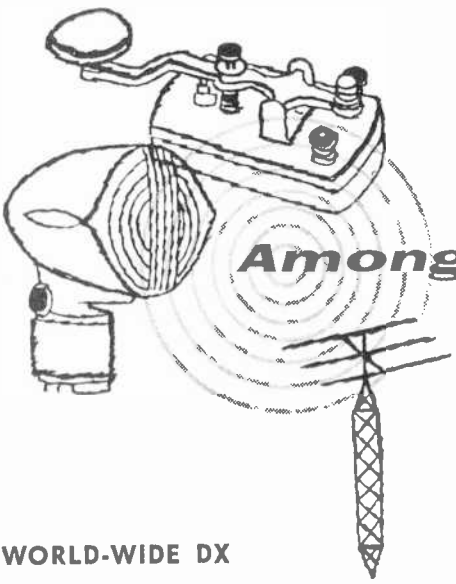
Bob used the arrangement shown as an electronic *thermometer,* but indicates that it can be used as a temperature control device if the meter is replaced with an appropriate sensitive relay (one requiring less than 5 ma. at 1.0 volt for operation). The unit may be assembled quite easily in a single evening using standard, readily available components. Neither layout nor lead dress should be critical.

Referring to the schematic diagram, the thermistor is a Veco Type 31D7 unit. Battery *B1* is a penlight cell and *S1* is a push-button switch. In operation, the current passing through the meter is dependent on the bias current applied to the two transistors (*Q1* and *Q2*). This, in turn, depends on *B1*'s voltage, potentiometer *R1*'s setting, and the thermistor's value.

Since the thermistor's resistance varies with temperature, the current through the meter (or relay, if one is used) varies also. As the thermistor's resistance is *lowered,* meter current increases, and vice-versa. The Type 31D7 thermistor has a negative

(*Continued on page* 114)

By
HERB S. BRIER
W9EGQ



Among the Novice Hams

WORLD-WIDE DX

HOW would you like to work Australia, and Arabia, and many other foreign countries on the Novice bands? Well, they are there to be worked, and DX conditions are already improving after the usual summer letdown. In previous years, several Novices have worked over 100 different countries, and many have worked 50 or more. You can work your share if you are on the ball and do not have too much trouble making run-of-the-mill contacts.

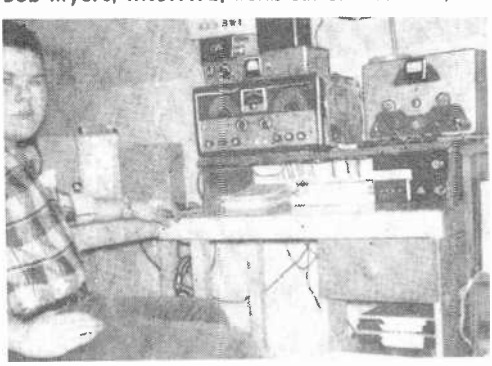
To Whet Your Appetite. Ivor Strafford, VK3XB, 16 Byron St., Box Hill South E-11, Victoria, Australia, may have already called you if you do much early-morning operating on 40 meters. Ivor's ambition is to work Novices in all the states on 40 meters—as of this writing he has worked over 100 Novices in 15 states.

The sad part of this tale is that, although VK3XB calls Novices by the dozens in all call areas, they usually come back to a Novice in a neighboring state or call CQ again. But once Ivor raises a Novice and alerts him to the fact that his signal is traveling 9000 miles, they usually have little trouble working each other on subsequent mornings, proving that the first contact was no accident.

With two exceptions, the Novices that VK3XB has worked recently know it. But it will be news to KN4ZUC that he did not work K3XBV on May 14; he did work VK3XB! The same goes for KN5RVU on May 17!

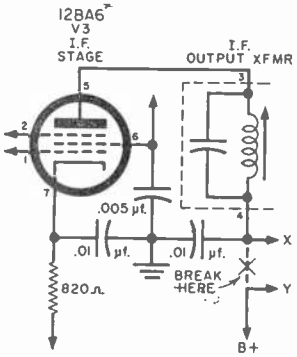
Nasir, 9K2AN, in Kuwait, Arabia, DX's on 21 mc.

Bob Myers, KN3HWL, works out of Meadville, Pa.

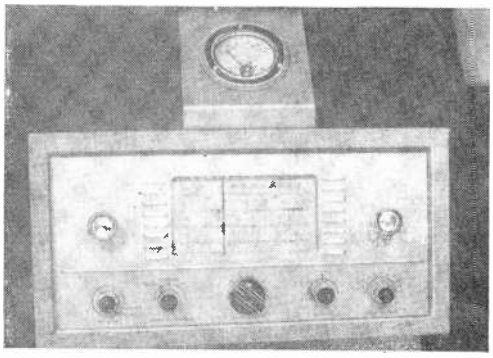


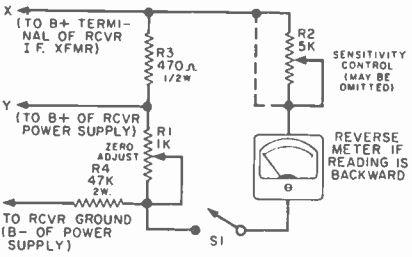
Watch for VK3XB on 7149/7150 kc. between 0300 and 0800 EST. Ivor operates on that frequency regularly to call "CQ Novice" or to call individual Novices. He tunes the entire Novice band for replies to his CQ's.

Alhaj Nasir Hussain Khan, 9K2AN, P.O. Box 736, Kuwait, Arabia, will also be looking for Novices this season. Nasir has been in Pakistan during the summer, but he will be back on the air by September 1. Look for him on 21 mc. When you work him,



The S-meter circuit below can be used with i.f. amplifiers having a.v.c. In the photo the constructed S-meter is shown with a Heathkit AR-3 receiver. The schematic diagram of the AR-3 (at left) tells you where to break in the S-meter circuit. See page 134 for more details.





Nasir will QSL promptly upon the receipt of your card.

DX'ing All Countries. Before we discuss how to work DX, it might be well to decide how far away a station should be before it can be considered DX. Most General Class DX-chasers classify any station over 2000 miles away and in a different country as DX. Most Novices, however, would probably rate any station over 1000 miles away as DX on 80 and 40 meters. On 15 meters, any station in another country, with the possible exception of Canada, is DX to most Novices. You might govern yourself accordingly when answering a "CQ DX."

The following discussion refers specifically to working foreign DX, but there is really no difference between working a new country and a new state, except that the competition is usually less for the new state.

Fifteen meters has been the Novice DX band up to now, and it will probably continue to retain the title. Nevertheless, as the present sunspot cycle continues its downward trend, the periods of good 15-meter DX conditions will be somewhat fewer, and of shorter duration, compared to last year. On the other hand, DX conditions on 80 and 40 meters are definitely improving. This is good news for night owls. For while DX is usually best when at least part of the signal path is through daylight on 15 meters, DX is an all-darkness proposition on 80 and 40 meters.

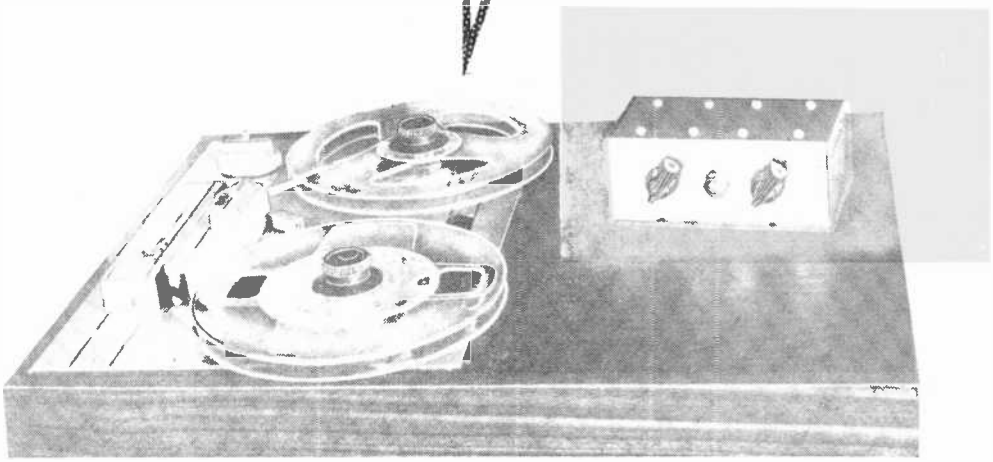
Let me emphasize that you do not need super equipment to work DX. Reading "News and Views" and observing the equipment used by the fellows who report working DX will prove this. Naturally, the better your equipment is, the easier it is to work DX—or locals. But more important than equipment in establishing a good record will be your operating.

Get a good map. You can use the country list in the back of the ARRL logbook to identify the countries you hear. But you will need a special world DX map centered on the United States to determine their distance and true great-circle direction from you. The multi-colored 30" x 40" ARRL Amateur Radio World DX Map, available from amateur supply houses, is excellent for the purpose. Smaller maps of this type are printed in the Call Book. It may be enlightening to compare one of these maps with a conventional world map.

Listen! Over half your success in working DX will depend on how well you listen. Naturally, you should concentrate on the weaker signals. But this does not mean

(*Continued on page* 133)

By
DONALD L. STONER
W6TNS



Build a Noise-Free Transistorized Stereo Tape Preamp

DESIGNED for the stereo tape fan, this fully transistorized preamplifier can be used directly between a stereo tape deck and two basic or integrated amplifiers to form a complete professional-quality NARTB-equalized playback system. As for noise and hum pickup, it will outperform any vacuum-tube device anywhere near its price range.

Hum is inaudible, even with the gain full up. With no "moving parts" in the transistor, microphonics are nonexistent. At 2.5-millivolts tape head input, "hiss" is about 68 db below full output (1.5 volts or higher), barely audible with the volume control(s) wide open.

Construction. The two identical amplifier circuits are contained in a 2" x 3" x 5" aluminum chassis box. Most of the components are secured on lug-type terminal strips mounted on the bottom of the chassis. Two volume controls and a voltage adjustment potentiometer are

mounted on the front apron. The input jacks, output leads, and battery are installed on the rear apron. Since parts layout is not too critical, the preamp can be built in a larger box, for example, a 5" x 7" x 2" box.

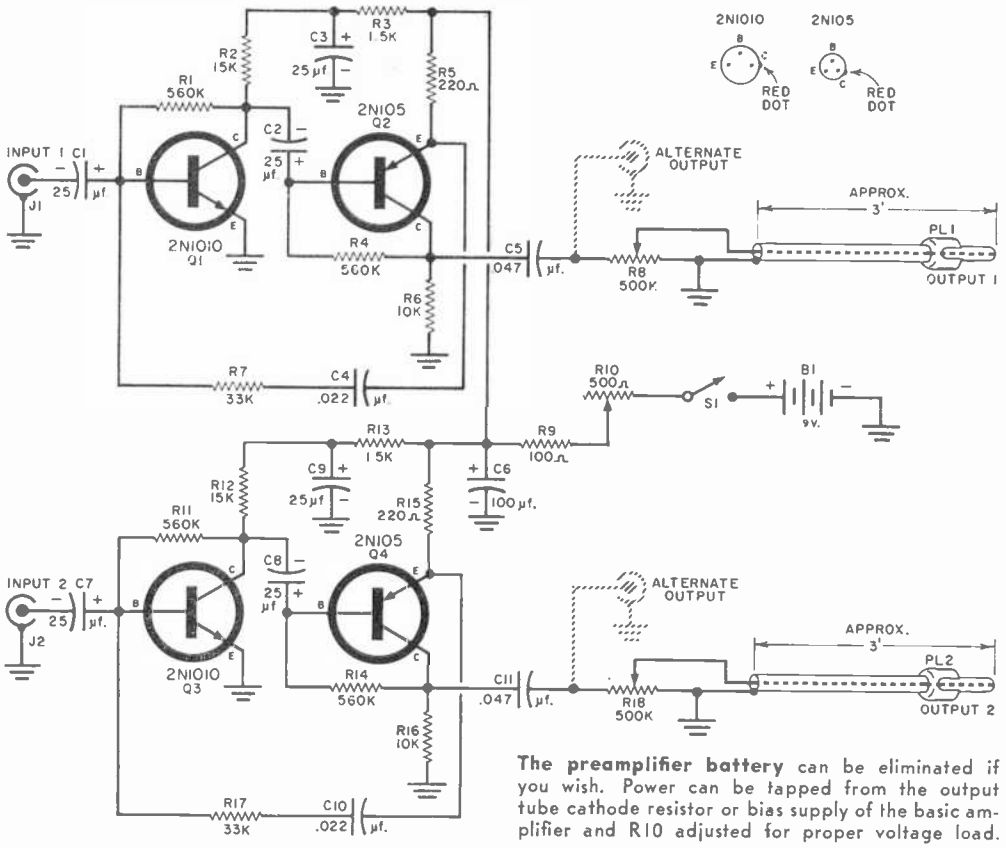
PARTS LIST

B1—9-volt battery (RCA VS309)
C1, C2, C3, C7, C8, C9—25-μf., 25-volt capacitor
C4, C10—.022-μf., 200-volt paper capacitor
C5, C11—.047-μf., 200-volt paper capacitor
C6—100-μf., 15-volt miniature electrolytic capacitor
J1, J2—Phono jack (RCA type)
PL1, PL2—Phone plug (RCA type)
Q1, Q3—2N1010 transistor (RCA—new type available at most supply houses)
Q2, Q4—2N105 transistor (RCA)
R1, R4, R11, R14—560,000 ohms
R2, R12—15,000 ohms (All resistors ½-watt)
R3, R13—1500 ohms
R5, R15—220 ohms
R6, R16—10,000 ohms
R7, R17—33,000 ohms
R8, R18—500,000-ohm audio taper potentiometer (one with s.p.d.t. switch S1)
R9—100 ohms
R10—500-ohm linear taper potentiometer
S1—See text
1—2"x3"x5" chassis box (L. M. Bender #136)
Misc. knobs, hardware, terminal strips, grommet, and shielded wire

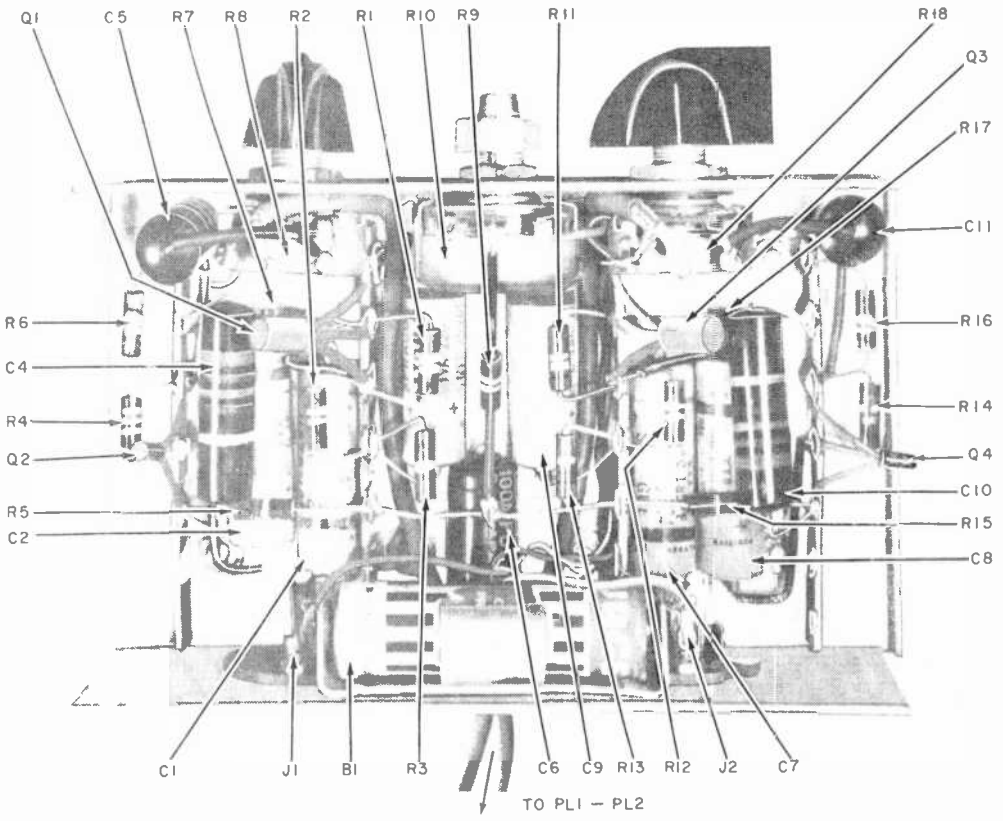
Drill the chassis as shown in the photographs. Note that one end lug is cut from each terminal strip so that it will fit between the edges of the chassis box. Mount the four strips so the lugs "face" the nearest open end of the chassis. The mounting feet of the tie lugs should "face" toward the center of the chassis.

Following the photos, install the capacitors first and then the resistors. Components *R7*, *R17*, *C4*, and *C10* control equalization and their leads should not be wrapped around the terminal lugs if equalization adjustment is desired. Note also that a common tie-point is made at the junction of *R5*, *R9*, *R15*, and *C6*, halfway between the amplifier channels.

The jacks and potentiometers should be mounted and wired next. Pots *R8* and *R18* can be omitted if volume can be controlled at the amplifiers. In this case, output phono jacks (similar to *J1* and *J2*) can be used with *C5* and *C11* connected directly to the "hot" terminals of the jacks. Output lead length is not critical.



The preamplifier battery can be eliminated if you wish. Power can be tapped from the output tube cathode resistor or bias supply of the basic amplifier and R10 adjusted for proper voltage load.



Install a 9-volt battery (*B1*) and holder on the rear apron of the box. Include a power switch in series with the battery. This switch may be external or ganged with either of the input level pots. If the potentiometer-mounting switch is used, mark the panel so the control knob can be reset easily when the preamp is switched on.

When you install the transistors, make sure to protect them from heat by grasping each lead with long-nose pliers, between the solder point and the transistor body, to conduct away the heat.

Testing. Wire a 0-10 ma. d.c. meter in series with the negative battery lead to chassis ground. When the preamp is turned on, the meter should "pop up" (as the capacitors charge) and then drop to about 2 ma. (between 1.5 and 2.5 ma. is okay). If the meter reads higher or lower, there is probably something wrong you can tell which half of the preamp is at fault by separating the circuits at *R5* and *R15*.

If the test circuit reading is correct, disconnect the meter. Set pot *R10* to maximum resistance. With a VTVM or 20,000 ohms/voltmeter connected across *C6*, adjust *R10* for an 8-volt reading (± ½ volt). This completes the adjustment.

HOW IT WORKS

The transistor stereo tape preamplifier has two channels, each with a two-stage amplifier. Since the two sections of the preamp are identical, only one channel will be discussed. The two transistors in each section are resistance-coupled.

Input transistor *Q1* is connected in a common emitter circuit, with bias obtained through *R1*. Capacitor *C1* blocks the bias voltage from the tape head. The amplified signal appears across *R2* and is coupled through *C2* to transistor *Q2*, which is in a modified common emitter circuit. Bias for this stage is provided through *R4* as in the first stage, with additional stabilization obtained by *R5* in the emitter circuit. The highly amplified signal voltage appears across *R6* and is coupled to the power amplifier through *C5* and volume control *R8*.

Frequency response of the preamp is equalized to correspond to the NARTB playback curve. This is accomplished by applying negative feedback through *RC* network *C4* and *R7* from the emitter of *Q2* to the base of *Q1*.

Setting Equalization. The values shown for *R7* and *C4*, and *R17* and *C10* provide NARTB equalization for the Viking Model "85" tape deck. If you use the preamp with a different tape head or prefer more bass

(*Continued on page* 121)

He Did It With Mirrors

DILIGENTLY studying the final plans for the best tracking route that would allow my latest project—a solar battery plant—to follow the sun around our yard, I failed to hear friend wife approaching the workshack until, too late, she was through the doorway and upon the scene. Naturally, she carried a coffee pot and a pair of cups.

"What's with all the mirrors?" she demanded, indicating the large, parabolic mirrors and the small, flat mirrors littering the workshack. "You gone nuts over the sight of your own face or something? I always thought it was your alleged mind you were in love with."

"Spare me the witty dialog," I said. "You don't know it, of course, but you are literally surrounded by the components of a plan which, put into effect, will free us forever from the clutches of the public utilities people. Can your domestic mind grasp the vastness of that concept, hey? No more electric bills! No more gas bills! I may even install a water pump and power it with juice from my own solar power plant!"

I laughed triumphantly, but it came out mildly hysterical. "Can't you see their faces when I order them to disconnect our utility service! We'll be free! FREE! *As free as the sunlight pouring abundantly down from the open skies!*"

Friend wife studied me closely.

"Come to think of it, you *have* been out in that hot sunshine an awful lot, lately. Maybe I better get you a couple of aspirins to go with the coffee."

"Oh, I can hardly *wait,* I . . . tell . . . you!" I babbled, rubbing my hands together briskly. "Perhaps my brave stand will constitute a veritable social revolution, a mass exodus away from the current dependency upon those greedy public utilities. Naturally, I'll charge a pretty penny for the use of my schematics, my tower-design blueprints —and we'll live in utter luxury, utter luxury . . ."

"Look . . . Mac . . ." she jabbed an emphatic finger into my brisket. "If this utter luxury you're yakking about don't include hot water, gas for cooking and electric lights—start looking for another helpmeet right now. I don't mind achieving weekly miracles with that miserly pittance you call a household budget, and I can stand watching other girls wear ermine and mink while I gad about in good, sensible woolens—but I either live in a pad that has the utilities turned on or you can mail my alimony checks to mother's address!"

"Ahhhh, fret not!" I told her, an impish grin playing about my mouth. "You shall have all the light, all the heat, all the power to run a household—in fact, enough to run a hundred such households—that your avaricious little heart desires! What I'm pleading with you to understand is that none of it will cost us one, red cent beyond the sum necessary to build the tower, install the mirror system and energy-converter, and bring all that gorgeous, *free* power into the house!"

"You're gonna get *electricity* from *sunshine?*"

"Sure am!"

She backed off toward the door, a wary step at a time. "Why," she whined, "can't

By CARL KOHLER

you just ruin the electrical appliances and short out the TV set like other husbands?"

SIX WEEKENDS of consecrated thought and labor later, I stood in the backyard gazing hopefully up to the top of the 20' steel tower where I had just finished installing the most brilliantly conceived and constructed solar battery plant ever to be modified from standard, unimaginative plans sold anywhere.

Suddenly, the wife stepped onto the porch behind me.

"How come it's not *doing* anything?"

"Mainly," I said patiently, between molars already ground to the gums from patience, "because I haven't thrown the switch that will activate the motor which will, in turn, start the heliostat on its journey."

She didn't even bother to muffle her snicker.

"This . . . uh . . . heliomajig—what's the bit, anyway?"

"By an ingeniously modified tracking mechanism, I have set up the heliostat to follow the sun's direct rays and simultaneously direct them to the larger mirror—the parabolically ground one—which, in turn, will transfer the energy-laden rays into the storage cells located in that housing just below the whole works."

"And how're ya gonna keep this gismo running if the electric company turns off the power? Answer me *that!* You just finished saying you had to—"

I crossed my arms over my chest and leered.

"Yes, we must depend upon outside current—for a brief time until the solar plant has absorbed enough natural energy to allow us to run it, from its own batteries, upon solar converted electricity which it obtained itself."

"I don't dig the explanation, but leave me out of that 'we' business," she said. "Whatever happens, I'm just an innocent bystander who is entitled to alimony if you alienate the power people. Personally, though, I think this gimmick is –"

Quietly, I threw the switch which fed juice to the tracking motors. Smoothly, silently, the entire tracking mechanism began its rotation cycle– barely perceptible to the eye. I made a notation of position for checking later in the day.

"Well?" demanded the wife.

"It's working It's simply a matter of an occasional position check for the next couple of days—to make certain the mirror is staying in proper reference to the direct rays of the sun."

"I have a premonition," she murmured darkly.

"You've got a million of them," I observed sourly.

"Something's wrong, *somewhere*," she persisted. "That gismo should be hissing or sparking or burning—or doing *something* goofy and unexpected."

"It's doing precisely what it was *built* to do," I gloated. And I went off to enjoy a nap during the heat of a triumphant Saturday afternoon.

SOME HOURS afterward—just as I was in the middle of a superb, technicolor

(*Continued on page* 132)

Transistor Amplifier for Toy Telephones

By
J. E. PUGH, Jr.

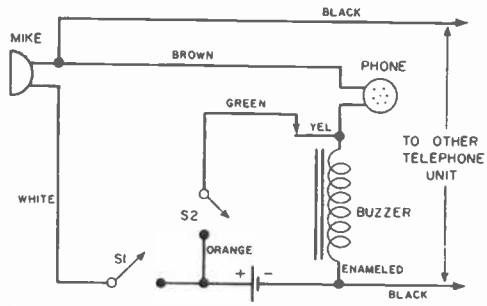
TOY TELEPHONE SETS found in most department stores usually have one major defect —low volume. The addition of a simple one-transistor amplifier not only "soups up" the volume but improves intelligibility.

The telephone set used in this conversion was a Zimphone, with each hand unit in the set consisting of a carbon microphone, a magnetic earphone, and a single flashlight cell. Any similar set—including conventional telephones now available on the surplus market—should work just as well. "Before" and "After" diagrams show the simple electrical modification on the Zimphone.

Identify all the wires in your set, both internal and external, and compare them with the wire color code in the "Before" diagram. If your color code is different, change the coding on the diagram to conform.

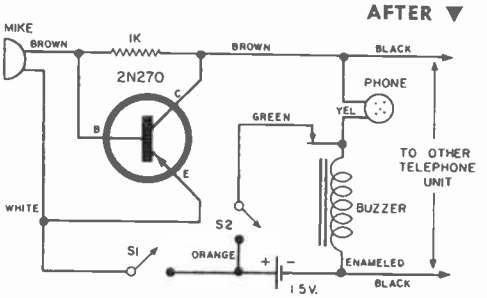
After soldering the transistor and resistor in place, tape all connections and gently press all internal wires and parts down into the back of the telephone handle. Be careful when you solder inside the handle because it is made of meltable plastic. And apply solder to the negative battery terminal quickly as this terminal is anchored in the plastic.

Put a dab of red paint on the positive battery terminal to aid in placing the battery in correctly. Reversed polarity can ruin the transistor. —30—



BEFORE ▲

AFTER ▼



HOW IT WORKS

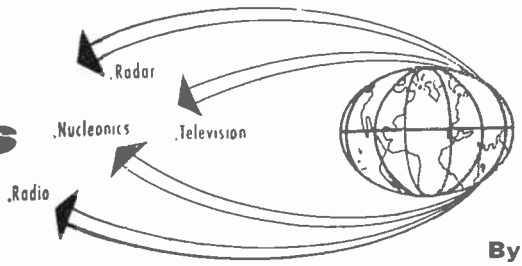
In the original circuit, switch *S1* connects the microphone to the battery and to the two parallel-connected phones (its own and that in the second telephone unit). The signal from the microphone is applied direct to the earphones without amplification. In the modified circuit a simple transistor amplifier is placed between the mike and two phones to boost the signal before it reaches the phones.

A medium-power transistor is used to give good power transfer as its input and output impedances are a reasonably close match for the mike and phones. The carbon microphone and a 1000-ohm resistor are used to bias the transistor base.

When the amplifier is in use, the mike resistance changes, and thus changes the base bias. The amplified collector output current flows through the load (the two magnetic earphones in parallel) to give a comfortable listening level. An identical amplifier in the second telephone unit sends an amplified signal back to the first earphone.

The original buzzer circuit is satisfactory and does not need to be modified.

After Class



By
ED BUKSTEIN

WAVE SHAPING

MENTION the word *distortion* to a hi-fi enthusiast or a broadcast engineer and his emotional response will be about the same as that of a forest ranger at the sound of the word fire. But distortion does not always play the role of a villain; sometimes it is both intentional and helpful.

Many radar, computer and industrial electronic circuits use intentional distortion as a means to an end. Most such circuits fall into the general category of *wave shaping* circuits which are useful for changing one waveform into another—a sine wave to a square wave, a square wave to a pulse, a pulse to a saw-tooth waveform, etc.

Top Chopping. The grid limiter squaring circuit shown in Fig. 1 converts a sine-wave input to a square-wave output. The cathode of the tube is operated at ground potential and, as a result, the grid is more positive than the cathode during the positive half-cycle of the sine-wave input. So, grid current flows, and produces a voltage drop across resistor R as in Fig. 1.

Since the positive half-cycle of the sine-wave input is dropped across R, it is effectively eliminated. An oscilloscope connected to the grid side of resistor R would show a half-wave pattern with the positive alternations missing.

The peak of the negative half-cycle of sine-wave input drives the grid below cutoff and is therefore clipped. Since the positive alternation and the peak of the negative alternation are eliminated, all that remains of the original sine-wave is a "slice" out of the center. As shown in Fig. 1, this slice is essentially a square wave.

Such a circuit is operated with large-amplitude input signals and with low values of B voltage so that the tube can be more easily driven to cutoff. For the same reason, a sharp cutoff tube is commonly used. Because the tube is driven into saturation during the positive half cycle and into cutoff during the negative peaks, the circuit is often referred to as an overdriven or a distortion amplifier.

It's a Pip! The differentiator circuit, familiar to the TV technician, is shown in Fig. 2. This circuit converts a square-wave input to a series of positive and negative "pips." As the voltage rises during the leading edge of the square-wave input, capacitor C charges through resistor R. This charging current produces a voltage drop across R which constitutes the positive pip of the output.

The time constant of the circuit is very short as compared to the period of the square-wave input, so C becomes fully charged in a very short time. It is for this reason that the output pip is narrow.

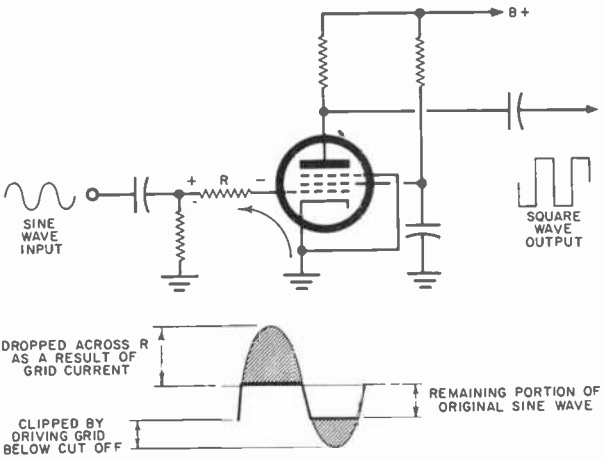


Fig. 1. In the grid limiter squaring circuit, positive alternation is clipped as a result of grid current through resistor R. The negative peak is clipped by driving the grid below cutoff.

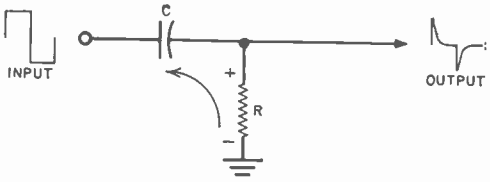


Fig. 2. Positive output pip is voltage drop across R, produced when capacitor C charges to positive value of square-wave input. On negative alternation of input, C charges in opposite direction.

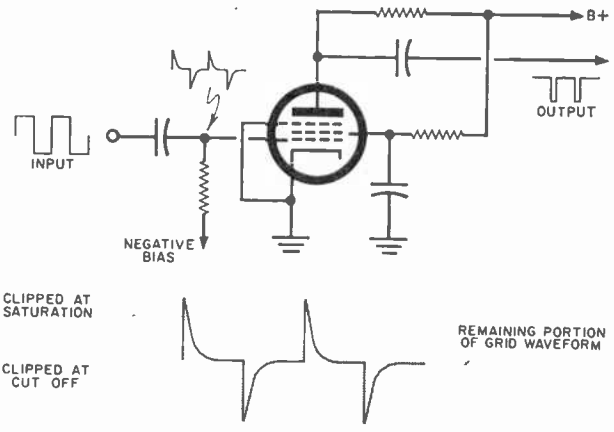
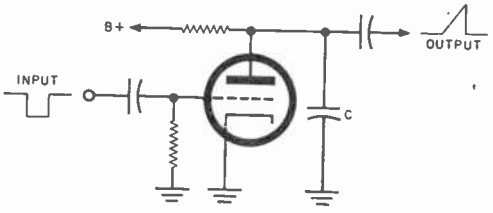


Fig. 3. Grid waveform consists of positive and negative pips. The upper portion of the positive pip is clipped at saturation. The negative pip and lower portion of the positive pip are clipped as grid is driven below cutoff.

Fig. 4. When tube is cut off by a negative input pulse, the plate voltage rises and capacitor C charges. When the tube conducts again, C discharges.



During the trailing edge of the square wave, the input voltage drops rapidly from its positive level to zero and then increases in the negative direction. This causes capacitor *C* to discharge and then recharge in the opposite direction. Since the current flow through *R* is now in the opposite direction, the voltage drop across it produces a negative output pip.

Taking a Pulse. In the circuit shown in Fig. 3, distortion is employed to change a square-wave input to a series of narrow pulses. The coupling capacitor and grid resistor are chosen to have a very short time constant as compared to the period of the square-wave input. Consequently, these components act as a differentiator and a series of positive and negative pips appear at the grid.

A negative potential, applied to the grid, biases the tube below cutoff so that only the positive pips bring the tube up into its conducting region. Each positive pip on the grid therefore produces a flow of plate current, and the plate voltage decreases because of the drop across the plate load resistor. Thus, the plate waveform consists of negative-going pulses.

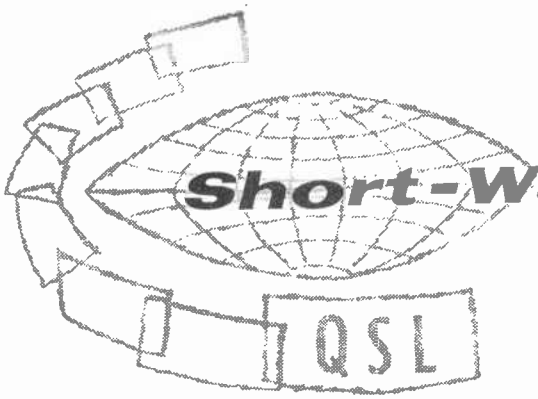
The positive pips on the grid not only bring the tube above cutoff but drive it all the way to saturation. As a result, the sharp tip of the input is clipped off. Because it produces narrow output pulses, this circuit is often referred to as a pulse-narrowing stage.

One-Shot Saw. The single-sweep circuit shown in Fig. 4 produces a saw-tooth output each time a negative pulse is applied to the input. Because the tube is operated without bias, it draws considerable plate current and most of the supply voltage is dropped across the plate load resistor.

Capacitor *C* charges to the low voltage at the plate of the tube. If a negative pulse is now applied to the input, the grid of the tube will be driven below cutoff. Since the plate current is now reduced to zero, the plate voltage of the tube rises and capacitor *C* charges to a higher level. It is this increasing charge that produces the rise of the saw-tooth waveform.

Capacitor *C* continues to charge for the duration of the negative input pulse. When this pulse is completed, the tube is no longer cut off and the plate voltage decreases to its initial low value. Capacitor *C* now discharges rapidly through the conducting tube, producing the back edge of the saw-tooth waveform.

As the foregoing circuits illustrate, distortion is a useful method of wave shaping. Because of the increasing use of pulse circuitry in all phases of the electronic art, the technician should learn to think of distortion as a tool. —30—



Short-Wave Report

By HANK BENNETT
W2PNA/WPE2FT

OUR featured DX'er this month is Lloyd Alford of 811 Riverside Drive, London, Ontario. He is a business merchant and, with his son, Graham, deals in retail auto accessories and sporting goods.

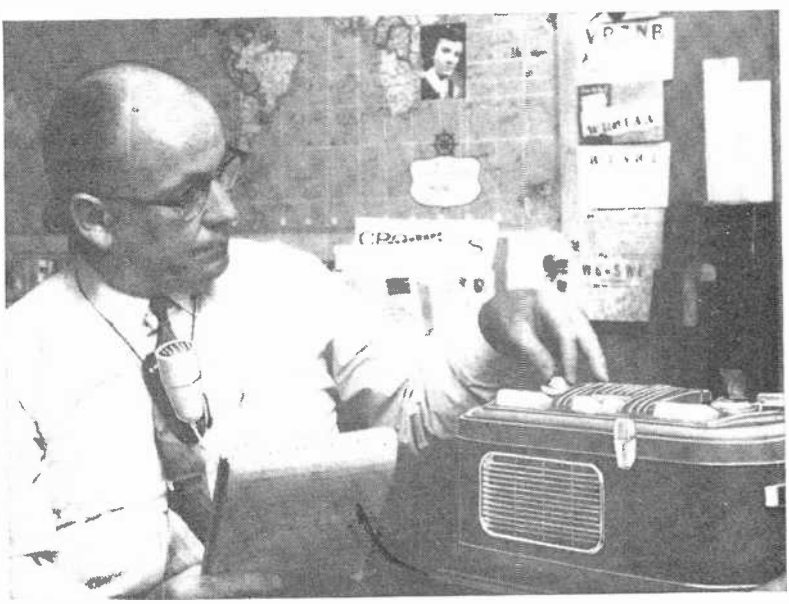
A fairly recent newcomer to the ranks of DX'ing, Lloyd started about three years ago. He has consistently kept your Short-Wave Editor informed of his DX'ing activities, and a short time ago he became the proud owner of Canadian amateur license VE3CRG.

Besides DX'ing, Lloyd's hobbies include photography, tapesponding, and building equipment. So, while his listening post features a Hallicrafters SX-100—connected to a WRL doublet antenna with wave traps—and a Bach-Simpson wave meter, you will also find there two tape recorders, a complete stereo setup, and numerous pieces of test equipment that he built from kits. In all, Lloyd has assembled 28 Heathkits, ranging from a crystal receiver to a DX-100 transmitter. His latest project is the Apache kit.

Lloyd does very little reporting to the short-wave stations, but he is a member of the Newark News Radio Club and the International Shortwave League. His favorite band is 20 meters and his preferred frequency range for amateur transmissions is the 80-meter band. Watch for him operating around 3600 kc.

VE3CRG will be glad to work anyone on the air, but requests that you hold your code to about 13 words per minute until he is able to build up his speed.

(*Continued on page* 138)



Lloyd Alford, of London, Ontario, combines three of his many interests: DX'ing, tapesponding and kit building. He is shown here using one of his two tape recorders. (Photograph courtesy of London Free Press)

By
JOHN T. FRYE
W9EGV

Carl and Jerry

The Surrogate Mother

IT WAS a beautiful morning in late August, and Carl and Jerry, with Carl's dog, Bosco, perched between them, were sitting on Jerry's front steps trying desperately to think of something interesting to do. After all, school started in another week, and time was a-wastin'!

"Hey, Joe, what you got in the basket?" Carl called to a boy who was walking along the sidewalk with a market basket on his arm.

"Pups," Joe answered, and he walked over and tilted the basket to reveal two tiny squirming little fellows with tightly closed eyes. "I'm taking them down to the veterinary to have them chloroformed."

"How come?" Jerry asked as he stroked one of the whimpering little dogs with his finger. "They look kind of cute to me."

"Yeah," Joe said with a voice suddenly gone hoarse; "they do to me, too. But their mother was killed by a car last night, and they're too young to get along without a mother. Dad says putting them to sleep is the only humane thing to do. We men know things like that have to be done sometimes, but he's going to have a tough job selling the idea to my kid brother, Davey. Davey's only five, and he's talked of nothing but those pups since they were born a couple of days ago. He's going to take it real large when he learns what happened to them."

For a few moments the three boys were silent, remembering how they would have felt at Davey's age. It was obvious from the way Carl's arm tightened about Bosco's neck that he wasn't feeling much different right now.

"Let us have them!" Jerry suddenly blurted.

"Why? What will you do with them?" Joe asked with a puzzled frown.

"I've got an idea I want to try. If it works, we'll save the pups for Davey. If not —well, Carl and I can still do what you were planning."

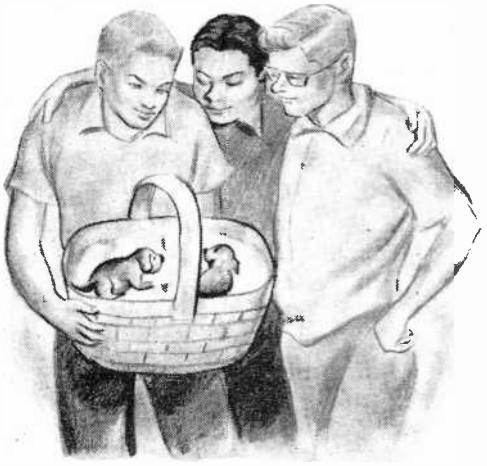
"Buddy, you've got yourself a deal!" Joe exclaimed, setting the basket on the step and straightening up as though he had rid himself of a tremendous burden. "I'll just tell Davey the pups are in a kind of hospital where maybe they can be saved. At the worst, that will let him down easy. I'll go right home now and give him the word before Dad tells him they're dead."

"Are you planning for us to spend all the time left before school starts baby-sitting with those pups?" Carl asked Jerry.

"Nope, I intend to turn that job over to a surrogate mother."

"To a what kind of mother?"

"Surrogate. That's a fancy scientific word meaning 'substitute.' A while back I was reading where the American Psychological Association has been experimenting



with surrogate mothers for little monkeys. A block of wood was covered with sponge rubber; terry cloth was stretched over this; and a light bulb was placed behind the arrangement to radiate heat. The result was a monkey mother that was always warm and soft and tender. Once the infant monkey was accustomed to the substitute, he ran to it for protection and showed as much affection for it as for a real mother. My idea is for us to make a surrogate mother for the pups; and from that whimpering they're doing, we'd better be about it. I'll bet they're getting plenty hungry. Bring them down to the lab."

IN THEIR basement laboratory the boys began assembling parts for the "mother," improvising as they went along. A stout cardboard carton about two feet square and a foot deep was selected. A piece of heavy, coarse screen was bent in a U-shape and arranged so that the open end of the U could be fastened against one side of the box. The outside of the U was covered with an inch-thick layer of soft foam rubber. Matching holes were cut in the side of the box, the screen, and the foam rubber, so that two nursing bottles could be inserted in openings in the side of the box and the nipples would protrude through the foam rubber. The bottles slanted downward at about a 45° angle.

Next, a 40-watt lamp bulb and an old thermostat of the mercury-switch type were installed in the hollow space of the U and connected to the light line, so that the thermostat turned the light bulb on and off with changes in temperature and kept the temperature inside the hollow nearly constant.

"Now we've got to know the skin temperature of a dog," Jerry announced. "I suppose I better scamper upstairs and see if I can find it in the encyclopedia."

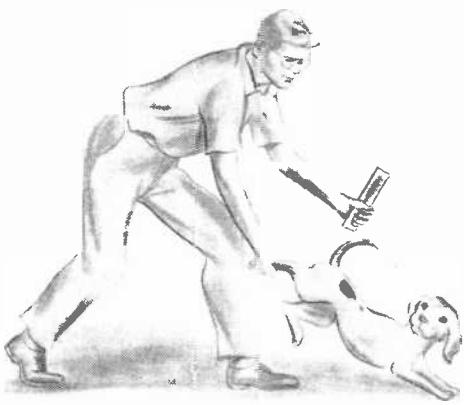
"Perish the thought!" Carl exclaimed as one long arm picked a small thermometer off the wall and the other grabbed the dog, Bosco, by a hind leg. "A true scientist never relies on other sources of information when he can make his own observation."

The wild-eyed, apprehensive Bosco was flipped over on his back, and the thermometer was tucked firmly between an upper foreleg and his body. There it stayed for a couple of minutes in spite of his squirming, growling protest. Then Carl removed the thermometer and read it quickly.

"A dog's skin temperature is about ninety-two degrees," he announced.

With the thermometer placed against the foam rubber, the thermostat was adjusted to hold the temperature constant at this figure. Next, the boys filled the bottles with milk and put them in position. The puppies were transferred from the basket to the box and were coaxed and cajoled into nursing from the bottles. This took a little patience and doing, but once the little dogs got the idea, they took the milk warmed by the light bulb hungrily and noisily.

"Well, now," Jerry said proudly as he watched the puppies; "I'd say Alma Mam-



ma was a huge, if not a 'howling,' success; wouldn't you?"

"Almost perfect," Carl agreed.

"What do you mean, 'almost'?" Jerry demanded. "What could a real mother do for the pups that Alma Mamma can't?"

"Well," Carl said slowly, looking at one of the puppies that had wandered blindly into a far corner of the box and was whimpering disconsolately, "a real mother would hear that little dog crying and comfort him by nuzzling and licking him; but of course we can't make Alma Mamma do that."

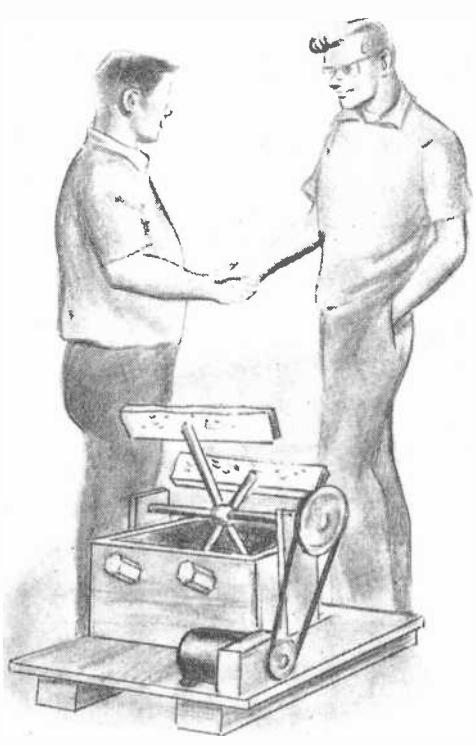
"Why-y-y-y not?" Jerry demanded with a rising, challenging inflection made famous by a TV comedian. "Go over and get your voice-control unit while I see if I can find that geared-down little motor of ours. Bring your lapel mike, too."

WHEN Carl returned, Jerry was already busy fastening slabs of sponge rubber to a section of broom-handle so as to form a four-bladed paddle wheel. Each sponge blade was just wide enough to fit inside the box; and when the broom-handle shaft

was arranged in a couple of bearings across the top of the box, the blades brushed the bottom of the box as the shaft was revolved. A belt went from a pulley on the end of the broom-handle to a smaller pulley on the slow-speed shaft of the gear-box of the little motor. When the motor was running, the rubber blades moved across the bottom of the box at the rate of one every five seconds.

The voice control, or VOX, unit was an electronic device that permitted sounds picked up by a microphone to close the contacts of a relay and hold them closed for two or three seconds. Such a unit is often used with a transmitter, especially a single-sideband suppressed-carrier type, to turn on the transmitter when the mike is spoken into and to turn it off when the operator stops speaking.

They fastened the lapel mike inside the top of the box and connected it to the



VOX unit. The relay contacts of the unit turned on the motor when they closed, and a cam on the broom-handle operated a microswitch in parallel with the contacts. The cam was arranged so that once the VOX unit started the shaft turning, the cam-operated switch took over and kept it going for a complete revolution. Then it stopped until a sound striking the microphone started it again.

Jerry dampened the sponge blades, and the boys watched in silence to see how the Rube Goldberg device would work. Soon one of the little dogs gave another whimper. Instantly the motor started, and the yielding, soft rubber blades moved caressingly over the tiny body, nudging it gently back toward the milk supply and leaving its hair slightly damp as though it had been licked. The puppy stopped whimpering, and at the same time the paddle wheel stopped.

Carl and Jerry shook hands in a gesture of mutual congratulation and then tiptoed out of the basement. Several times during the day, though, they checked on the pups and their surrogate mother; and each time they found things just fine. Before going to bed, Jerry replenished the bottles with clean, fresh, sweet milk and dampened the sponges of the "nuzzling and licking" device again.

SOMETIME during the night, Jerry awakened at the sound of a violent thunderstorm roaring about the house. As he lay there in the darkness, he was aware of a disturbing sound that was not part of the growling thunder or pouring rain. It was a rhythmic and muffled "thump, thump, thump" and seemed to be coming from the furnace register.

He slipped out of bed and went to investigate. As he turned on the basement light, he saw a stream of water as thick as his arm pouring in through an open basement window, and the floor was already covered with an inch or so of water. The water was coming from a downspout that had broken just above the window, and the drain in the floor had clogged.

Jerry called his father, and the two of them quickly cleared the drain and diverted the water from the broken downspout away from the window. It was not until then that Jerry had time to think of the pups and their surrogate mother. The box was gone!

As he searched wildly about the wet basement, Jerry heard the same thumping sound that had awakened him. Then he saw the cardboard carton wedged against the side of the gas furnace with its paddle wheel turning.

Water had floated the two-by-four platform on which the carton was placed to keep it up off the damp floor and to provide

(*Continued on page* 110)

get a real head start in work you like!

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...before
enlistment

It's up to you! The Army's new "Choose-it-Yourself" System lets you choose your vocational training before you enlist! Here's how it works:

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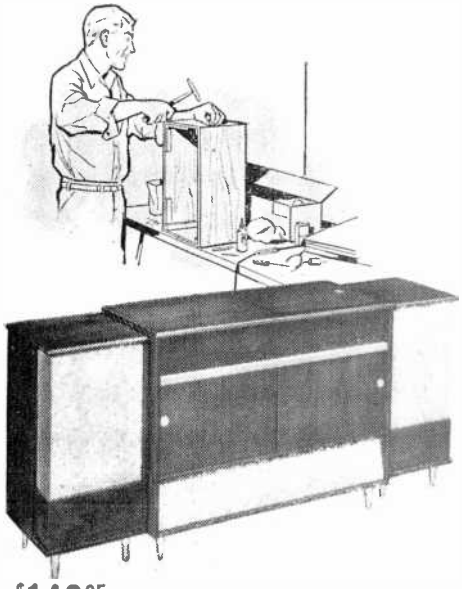
US ARMY

HEATHKIT

do-it-yourself kits put top quality within easy reach

With absolutely no previous experience or knowledge of electronics you can assemble your own HEATHKIT hi-fi system, Ham station, test equipment or marine gear. Easy to understand step-by-step instructions, along with large pictorial diagrams, guarantee your success—and you save ½ or more on the highest quality equipment available today at any price!



STEREO EQUIPMENT CABINET KIT

A thing of beauty as well as utility, this stereo equipment cabinet ensemble houses your complete stereo hi-fi system. It consists of a stereo equipment center flanked by two stereo speaker enclosures. The kit is supplied with mounting panels pre-cut to accommodate Heathkits and interchangeable blank panels are also furnished. The pre-cut panels accommodate the Heathkit AM-FM Tuner (PT-1), Stereo Preamplifier (SP-2), and Stereo Record Changer (RP-3-S). The changer slides out smoothly for easy record loading. Convenient record and tape storage space is provided. Ample room is provided in the rear of the center cabinet for a pair of matching Heathkit amplifiers from 12 to 70 watts. The stereo wing speaker enclosures are open-backed, cloth-grilled cabinets designed to hold the Heathkit SS-3 or similar speaker enclosures. The cabinets are available in beautifully grained ¼" solid core Phillipine mahogany or select birch plywood suitable for the finish of your choice. Entire top features a shaped edge. Hardware and trim are of brushed brass and gold finish.

$149.95 each (shpg. Wt. 162 lbs.)

STEREO EQUIPMENT CABINET KIT
Model SE-1B (birch)
Model SE-1M (mahogany)

$39.95 each shpg. wt. 42 lbs.)

STEREO WING SPEAKER ENCLOSURE KIT
Model SC-1BR (birch—right end)
Model SC-1BL (birch—left end)
Model SC-1MR (mahogany—right end)
Model SC-1ML (mahogany—left end)

MODEL MF-1
$26.95

DIAMOND STYLUS HI-FI PICKUP CARTRIDGE

Get the most from your LP microgroove records. Designed to Heath specifications by Fairchild Recording Equipment Corporation, the MF-1 is one of the finest pickup cartridges on the market today. Shpg. Wt. 1 lb.

ENJOY A HOME HI-FI SYSTEM NOW! PAY LATER . . .

Heath's convenient Time Payment Plan allows you to buy all of your hi-fi components right away . . . and pay for them in easy installments. Only 10% down on purchases of $55 or more. Send coupon today for FREE Heathkit catalog with full time-pay details.

TRADITIONAL
Model CE-2T (mahogany)

CONTEMPORARY (not shown)
Model CE-2B (birch)
Model CE-2M (mahogany)

$43.95 each

CHAIRSIDE ENCLOSURE KIT

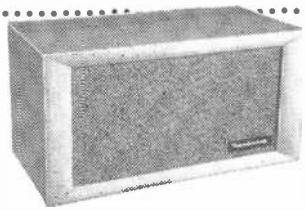
Put your entire hi-fi system right at your fingertips with this handsome enclosure. Available in either traditional or contemporary models and constructed of beautiful veneer-surfaced plywood suitable for the finish of your choice. It is designed to house the Heathkit AM and FM Tuners (BC-1A and FM-3A), the WA-P2 Preamplifier, the RP-3 Record Changer, and adequate space is provided for any Heathkit amplifier designed to operate with the WA-P2. All parts precut and predrilled for easy assembly. Shpg. Wt. 46 lbs.

NEW

HEATHKIT EA-3
$29.95

NEW! 14-WATT HI-FI ECONOMY AMPLIFIER (EA-3)

From HEATHKIT audio labs comes an exciting new kit . . . New Styling, New Features, Brilliant Performance! Designed to function as the "heart" of your hi-fi system, the EA-3 combines the preamplifier and amplifier into one compact package. Providing a full 14 watts of high fidelity power, more than adequate for operating the average system, the EA-3 provides all the controls necessary for precise blending of musical reproduction to your individual taste.



Build it in one Evening

HEATHKIT SS-2
$39.95

"BASIC RANGE" HI-FI SPEAKER SYSTEM KIT

With performance comparable to speakers costing many times more, the SS-2 employs a Jensen 8" woofer and compression-type tweeter to provide total frequency response of 50 to 12,000 CPS. Shpg. Wt. 26 lbs.

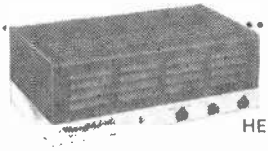
ATTRACTIVE BRASS TIP ACCESSORY LEGS: convert the SS-2 into handsome consolette. Shpg. Wt. 3 lbs. No. 91-26. $4.95.

BASIC FIR MODEL: same as SS-2 except constructed of non-premium plywood without trim or grille cloth. Shpg. Wt. 26 lbs. Model SS-3. $34.95.

HEATHKIT FM-3A $26.95

HIGH FIDELITY FM TUNER KIT

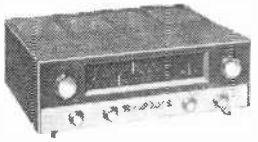
The thrills of FM entertainment are yours at budget cost with this handsomely styled tuner. Featuring broad-banded circuits for full fidelity and better than 10 microvolt sensitivity for 20 db of quieting, the FM-3A pulls in stations with clarity and full volume. Shpg. Wt. 8 lbs.



HEATHKIT W-7M $54.95

"EXTRA PERFORMANCE" HI-FI 55 WATT AMPLIFIER KIT

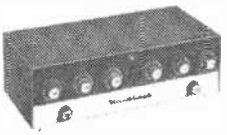
Offering full fidelity at less than a dollar per watt, the power output of this remarkable amplifier is conservatively rated at 55 watts from 20 CPS to 20 kc with less than 2% total harmonic distortion throughout this entire range. Shpg. Wt. 28 lbs.



HEATHKIT PT-1
$89.95

MONAURAL-STEREO AM-FM TUNER KIT

This professional quality 16-tube tuner offers you outstanding AM, FM or stereo AM/FM performance at minimum expense. Features include individual flywheel tuning and automatic frequency control. A multiplex jack is also provided. Shpg. Wt. 24 lbs.



HEATHKIT SP-2
$56.95

MONAURAL-STEREO (two channel mixer) PREAMPLIFIER KIT

Control your entire stereo system with this 2-channel preamplifier. A remote balance control with 20' of cable allows balancing the stereo system from listening position. Shpg. Wt. 15 lbs.

HEATHKIT TR-1A $99.95

Includes tape deck, tape recorder electronics, microphone and roll of blank tape.

HIGH FIDELITY TAPE RECORDER KIT

Whether making your own recordings or playing pre-recorded tapes you'll enjoy the many fine features of this tape recorder kit. Included are fast forward and rewind functions and choice of 7½ or 3¾ IPS tape speeds. Printed circuit boards simplify assembly. Shpg. Wt. 24 lbs.

HEATHKIT RP-3
$64.95

(stereo model RP-3S $74.95)

AUTOMATIC HI-FI RECORD CHANGER KIT

Combining the convenience of an automatic record changer with true turntable quality the RP-3 obtains full fidelity from your hi-fi and stereo records while treating them with the care they demand. A "turntable pause" feature prevents records from dropping on moving turntable or disk. Plays at 33⅓, 45, 78 and 16 RPM. Shpg Wt. 19 lbs.

HEATH COMPANY
Benton Harbor, Mich.

A Subsidiary of Daystrom, Inc.

HEATHKIT

HEATHKIT TX-1
$234.95

"APACHE" HAM TRANSMITTER KIT

Features 150 watt phone input and 180 watt CW input. Provision for single-sideband transmission using the SB-10 External Adapter. Shpg. Wt. 110 lbs.

HEATHKIT RX-1
$274.95

"MOHAWK" HAM RECEIVER KIT

Covers from 160 through 10 meters on 7 bands with an extra band calibrated to cover 6 and 2 meters using a converter. Outstanding SSB reception. Shpg. Wt. 66 lbs.

HEATHKIT SB-10
$89.95

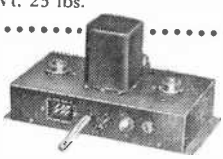
SINGLE SIDEBAND ADAPTER KIT

A compatible plug-in adapter unit for the "Apache" Transmitter, the SB-10 covers 80, 40, 20, 15 and 10 meter bands. Produces USB, LSB or DSB signals, with or without carrier insertion. Shpg. Wt. 12 lbs.

HEATHKIT DX-40
$64.95

PHONE AND CW TRANSMITTER KIT

Providing phone and CW operation on 80, 40, 20, 15, and 10 meters, the DX-40 features built-in modulator and power supplies. Shpg. Wt. 25 lbs.



HEATHKIT MP-1
$44.95

MOBILE POWER SUPPLY KIT

Furnishes all power required to operate both MT-1 Transmitter and MR-1 Receiver from 12-14 volt battery. Delivers full 120 watts continuously or 150 watts intermittently. Kit includes 12' battery cable, tap-in studs for battery posts, power plug and 15' connecting cable. Shpg. Wt. 8 lbs.

Mobile Fun! With all New Heathkit Mobile Ham Gear

HEATHKIT MR-1
$119.95

"COMANCHE" MOBILE HAM RECEIVER KIT

Handsome styling, rugged construction, top quality components and economy are all wrapped up in the "Comanche". It is an 8-tube superheterodyne receiver operating AM, CW and SSB on the 80, 40, 20, 15 and 10 meter amateur bands. Operates from 12 volt car battery through the MP-1 Mobile Power Supply. Can be converted in minutes to a fixed station unit by using an AC power supply. Shpg. Wt. 19 lbs.

MOBILE ACCESSORIES

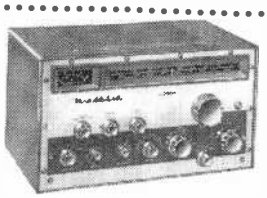
Quality 5" PM speaker in rugged steel case with mounting brackets. Heathkit AK-7. $5.95. Shpg. Wt. 4 lbs.

Mobile base mount holds both transmitter and receiver. Universal floor mounting bracket. Heathkit AK-6. $4.95. Shpg. Wt. 5 lbs.

HEATHKIT MT-1
$99.95

"CHEYENNE" MOBILE HAM TRANSMITTER KIT

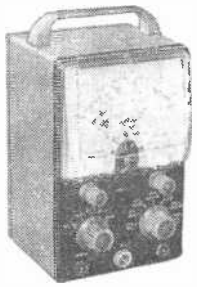
The fun and convenience of mobile operation are yours with the compact and efficient "Cheyenne" Transmitter. Featuring high power with minimum battery drain, the unit provides up to 90 watts phone input and covers 80, 40, 20, 15 and 10 meters. Featured are a built-in VFO, modulator, 4 RF stages with a 6146 final amplifier pi network (coaxial) output coupling. The "Cheyenne" is designed as a companion to the "Comanche" receiver and is powered by the MP-1 Power Supply. Shpg. Wt. 19 lbs.



HEATHKIT VHF-1
$159.95

"SENECA" VHF HAM TRANSMITTER KIT

General, technician or novice class hams wishing to extend transmission into the VHF region will find the "Seneca" ideal. A completely self-contained 6 and 2 meter transmitter, the VHF-1 features up to 120 watts input on phone and 140 watts input on CW in the 6 meter band. Included are controlled carrier phone operation, built-in VFO for both 6 and 2 meters, and four switch-selected crystal positions. Shpg. Wt. 56 lbs.



HEATHKIT V7-A
$25.95

ETCHED CIRCUIT VTVM KIT

World's largest selling VTVM, the V7-A measures AC voltage (RMS), AC voltage (Peak-to-peak), DC voltage and resistance. Features 7 AC (RMS) and DC voltage ranges of 0-1.5, 5, 15, 50, 150, 500 and 1500. In addition there are 7 peak-to-peak AC ranges of 0-4, 14, 40, 140, 400, 1400 and 4000. Seven ohmmeter ranges are provided. Battery and test leads are included with kit. Shpg. Wt. 7 lbs.

HEATHKIT TC-3
$39.95

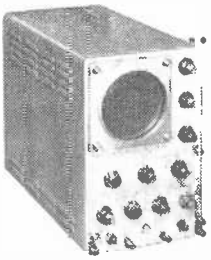
TUBE CHECKER KIT

An invaluable aid to servicemen, the TC-3 tests for open, short, leakage, heater continuity and quality of all tube types commonly encountered in radio and TV servicing. Checks 4, 5, 6 and 7-pin large, 7 and 9-pin miniature, 7-pin sub-miniature, octal and loctal tubes and pilot lamps. A blank socket provides for future tube types. Shpg. Wt. 12 lbs.

Model 355.

TV PICTURE TUBE TEST ADAPTER

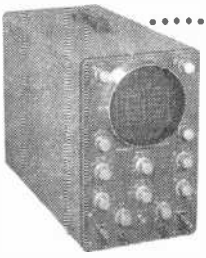
For use with TC-3 or earlier model TC-2. Includes 12-pin TV tube socket, 4' cable. Octal connector and data. No. 355. Shpg. Wt. 1 lb. $4.50.



HEATHKIT OP-1
$179.95

"PROFESSIONAL" 5" DC OSCILLOSCOPE KIT

Offering complete versatility, the OP-1 features DC coupled amplifiers and also DC coupled CR tube unblanking. Triggered sweep circuit operates on internal or external signals and may be either AC or DC coupled. Transformer operated power supply has silicon diode rectifiers. Shpg. Wt. 34 lbs.



HEATHKIT OM-3
$39.95

"GENERAL PURPOSE" 5" OSCILLOSCOPE

Ideal in servicing as well as routine laboratory work, the OM-3 features wide vertical amplifier frequency response, extended sweep generator operation and improved stability. Vertical response is within ±3 db from 4 CPS to 1.2 mc. Sweep range covers 20 CPS to over 150 kc. Shpg. Wt. 22 lbs.

HEATHKIT T-4
$19.95

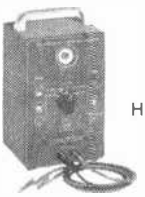
VISUAL-AURAL SIGNAL TRACER KIT

Doubling as a utility amplifier, test speaker, or substitution transformer, the T-4 represents an outstanding buy. Traces RF, IF and audio signals in AM, FM and transistor-type radios. Shpg. Wt. 5 lbs.

HEATHKIT SG-8
$19.50

RF SIGNAL GENERATOR KIT

Aligns RF, IF and tuned circuits of all kinds. Provides extended frequency coverage in five bands from 160 kc to 110 mc on fundamentals and up to 220 mc on calibrated harmonics of the fundamental frequencies. Shpg. Wt. 8 lbs.



HEATHKIT CT-1
$7.95

IN-CIRCUIT CAPACI-TESTER KIT

Check capacitors for "open" or "short" right in the circuit. Detects open capacitors from 50 mmf up and checks shorted capacitors up to 20 mfd. Checks all bypass, blocking and coupling capacitors of the paper, mica and ceramic types. Shpg. Wt. 5 lbs.

HEATHKIT TO-1
$16.95

TEST OSCILLATOR KIT

Provides fast and accurate selection of test frequencies most used by servicemen in repairing and aligning modern broadcast receivers. Five fixed-tuned frequencies are quickly selected for trouble-shooting. Shpg. Wt. 4 lbs.

HEATH COMPANY
Benton Harbor, Mich.

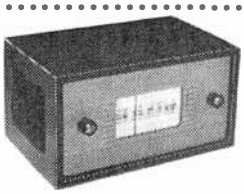
A Subsidiary of Daystrom, Inc.

add that "extra" speaker

HEATHKIT US-1
$7.50

12" UTILITY SPEAKER

This high quality auxiliary speaker offers many possibilities in audio, radio and TV work and will handle up to 12 watts with a frequency response from 50 to 9,000 CPS ±5 db. Speaker impedance is 8 ohms and employs a 6.8 ounce magnet. Shpg. Wt. 7 lbs.



HEATHKIT BR-2
$18.95
(less cabinet)

BROADCAST BAND RADIO KIT

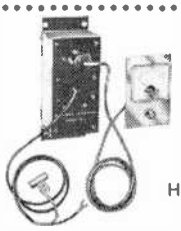
Fun to build, and a fine receiver for your home. Covers complete broadcast band from 550 to 1600 kc. Built-in 5½" PM speaker and rod-type antenna. Transformer operated power supply. Excellent sensitivity and selectivity. Shpg. Wt. 10 lbs.

Cabinet optional extra: No. 91-9A. Shpg. Wt. 5 lbs. $4.95.

HEATHKIT AK-1
$9.95

MICROPHONE ACCESSORY KIT

Useful in countless applications, this kit consists of a rugged high fidelity crystal mike and three holders; a mike stand adapter, a lavalier neckband and desk stand. An 8' cable with phone plug is included. Shpg. Wt. 1 lb.



check engine RPM

HEATHKIT TI-1 $25.95

ELECTRONIC TACHOMETER KIT

Easy-to-build and simple to install. Operates directly from the spark impulse of any 2 or 4 cycle engine with any number of cylinders. Operates on 6, 8, 12, 24 or 32 volt DC systems and is completely transistorized. The easy-to-read indicator shows RPM from 500 to 6,000. A calibration control is also provided. Shpg. Wt. 4 lbs.

Fun for the whole family

HEATHKIT XR-1P
$29.95

6 TRANSISTOR PORTABLE RADIO KIT

This easy-to-build portable radio offers fun and enjoyment for the whole family. Features 6 transistors, large 4" x 6" PM speaker for "big-set" tone quality, and built-in rod-type antenna. Uses standard size "D" flashlight cells for extremely long battery life (between 500 and 1,000 hours). The modern molded plastic case with pull-out carrying handle is two-tone blue with gold inlay and measures 9" L. x 7" H. x 3¼" D. Shpg. Wt. 6 lbs.

Complete Engine "Tune-Up" Facilities!

HEATHKIT IA-1A $59.95

ELECTRONIC IGNITION ANALYZER KIT (IA-1A)

Just clip the two test leads to operating engine (400 to 5,000 RPM) and check condition of coil, condenser, points, plugs and wiring. Shows either primary or secondary circuit patterns, parade or superimposed secondary patterns. Shpg. Wt. 20 lbs.

MODIFICATION KIT for IA-1 Models: Provides switch selection of primary and secondary circuit patterns, or, choice of parade and superimposed secondary patterns. Shpg. Wt. 2 lbs.
Heathkit MK-6 . . . . . **$4.95**

Let your boy learn radio

HEATHKIT CR-1 $7.95

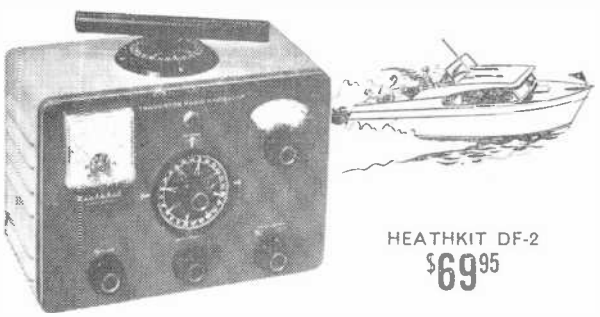
CRYSTAL RADIO KIT

Any youngster interested in radio or electronics will enjoy building and using this fine little crystal receiver. Frequency coverage is from 540 to 1600 kc. A sealed germanium diode is used for detection —no critical "cats whisker" adjustment. Headphones included. Measures 6" L. x 3" W. x 2⅛" D. Shpg. Wt. 3 lbs.

HEATHKIT TK-1
$9.95

COMPLETE TOOL SET

This handy tool kit provides all the basic tools required for building any Heathkit. Includes pliers, diagonal sidecutters, screwdrivers, and soldering iron with holder. Pliers and sidecutters are equipped with insulated rubber handles that provide protection from electrical shock. All of the tools are of top quality case hardened steel for rugged duty and long life. Shpg. Wt. 3 lbs.



HEATHKIT DF-2
$69.95

2-BAND TRANSISTOR RADIO DIRECTION FINDER KIT

Economically powered by 6 standard flashlight cells, the DF-2 provides you with a completely portable 6-transistor standard and beacon band receiver of unusual quality and performance. Covers the beacon band from 200 to 400 kc and broadcast band from 540 to 1620 kc. A tuning dial light is provided for night operation. Large 4" x 6" speaker provides superb tone reproduction. Shpg. Wt. 9 lbs.

HEATHKIT MC-1
$39.95

MARINE CONVERTER KIT

Charge your 6 or 12 volt batteries at dockside even while your boat's electrical system is in use. Provides up to 20 amperes continuously for charging 6-volt batteries or 10 amperes continuously for charging 12-volt batteries, regardless of type. Charging current is continuously monitored by a 25 ampere meter. Shpg. Wt. 16 lbs.

MARINE BATTERY CHARGE INDICATOR KIT

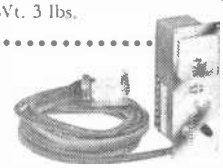
See at a glance the exact percentage of charge in your boat batteries. Checks from 1 to 8 storage batteries instantly. Operates on 6, 8, 12 or 32 volt systems. Note: for mounting on non-ferrous metals or wood only. Shpg. Wt. 3 lbs.

HEATHKIT CI-1
$16.95

HEATHKIT PC-1
$24.95

12 VOLT POWER CONVERTER KIT

Household electricity right on your boat or in your automobile is yours with this 12-volt power converter kit. Operate your radio, electric razor, lights, etc., directly from your 12-volt boat or car battery. Power rating is 125 watts continuously and 175 to 200 watts intermittently. Note: not recommended for record players, tape decks, power tools or radio transmitters. Shpg. Wt. 8 lbs.

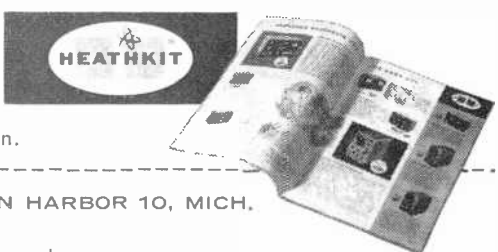


HEATHKIT FD-1-6 (6 volt)
FD-1-12 (12 volt)
$35.95 each

FUEL VAPOR DETECTOR KIT

Protecting against fire and explosion on your boat, the FD-1 indicates the presence of explosive fumes and shows immediately if it is safe to start the engine. The kit is complete including spare detector unit. Shpg. Wt. 4 lbs.

Free Send now for latest Heathkit Catalog describing in detail over 100 easy-to-assemble kits for the Hi-Fi fan, radio ham, boat owner and technician.



HEATH COMPANY BENTON HARBOR 10, MICH.

a subsidiary of Daystrom, Inc.

pioneer in do-it-yourself electronics

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NAME

ADDRESS

CITY ZONE STATE

QUANTITY	KIT NAME	MODEL NO.	PRICE

Carl and Jerry

(*Continued from page* 102)

a place to mount the paddle wheel bearings and the motor. As the box was pushed against the side of the furnace, it slewed slightly on this base. This caused the rubber blades to catch on the side of the box as they went around. As each one flipped free, it slammed into the thin metal side of the furnace.

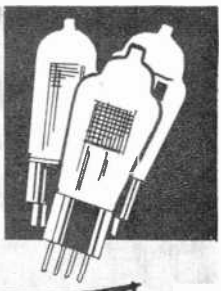
One of the thumps produced by this action came at just the right time each revolution to trip the VOX unit and keep the shaft turning. The pups were safe, and the carton wasn't even damp.

MR. BISHOP shook his head in admiring wonder as Jerry explained the chain of events. "Well, you boys certainly built a dandy surrogate mother there," he said with a chuckle. "No real mother could have done better. When her babies were in danger, she took care of them and summoned help. Not only did she save her puppies, but she kept us from having a flooded basement as well. I feel as though I want to pat her or give her a bone or something!"

And about three weeks later, when Joe brought Davey over to get his pups, and Carl and Jerry watched the small boy gather the plump, frisky little dogs lovingly into his arms, the boys felt exactly the same way. —30—

announcing

TRU-VAC®



REMARKABLE TUBE VALUES AT 1950 PRICES

ALL TUBES INDIVIDUALLY BOXED, CODE DATED AND BRANDED "TRU-VAC®"

Typical TRU-VAC® Bargains!

THIS IS A PARTIAL LIST Thousands More Always In Stock

6SN7GT .....ALWAYS 30c
6W4GT .....ALWAYS 30c

OY4	3AU6	6A6	6B8	6CH8	6S7	7B4	12AT6	12SA7	36
OZ4	3BC5	6AB4	6BA6	6CL6	6S8GT	7B5	12AT7	12SJ7	38
1A7GT	3BN6	6AC7	6BC5	6CM6	6SA7	7B6	12AU6	12SK7	39/44
1B3GT	3BZ6	6AF4	6BC8	6CM7	6SD7GT	7B7	12AU7	12SN7GT	41
1C6	3CB6	6AG5	6BD6	6CN7	6SF5	7B8	12AV6	12SQ7	42
1C7	3Q4	6AH4GT	6BE6	6CQ8	6SF7	7C4	12AV7	12V6GT	43
1F4	3S4	6AH6	6BF5	6CR6	6SG7	7C5	12AX4GT	12W6GT	45
1F5	3V4	6AK5	6BG6G	6CS6	6SH7	7C6	12AX7	12X4	50A5
1G4	4BQ7A	6AL5	6BH6	6CU5	6SJ7	7C7	12AZ7	14A7/12B7	50B5
1H5GT	4B58	6AM8	6BJ6	6CU6	6SK7	7E5	12B4	14B6	50C5
1L4	4BZ7	6AN8	6BK5	6D6	6SL7	7E6	12BA6	14Q7	50L6
1L6	4CB6	6AQ5	6BK7	6DE6	6SQ7	7E7	12BA7	19	56
1N5GT	5AM8	6AQ6	6BL7GT	6DG6GT	6SR7	7F7	12BD6	19AU4GT	57
1R5	5AN8	6AQ7	6BN6	6DQ6	6T4	7F8	12BE6	19BG6G	58
1S5	5AT8	6AR5	6BQ6GT	6F5	6U8	7G7	12BF6	19J6	71A
1T4	5AV8	6AS5	6BQ7	6F6	6V6GT	7H7	12BH7	19T8	75
1U4	5AZ4	6AT6	6BR8	6H6	6W6GT	7N7	12BQ6	24A	76
1U5	5BR8	6AU4GT	6BS8	6J4	6X4	7Q7	12BR7	25Z6GT	77
1V2	5J6	6AU5GT	6BY5G	6J5	6X5GT	7S7	12BY7	26	78
1X2	5R4	6AU6	6BZ6	6J6	6X8	7X6	12CA5	27	80
2AF4	5U4	6AU8	6BZ7	6J7	6Y6G	7X7	12CN5	35	84/6Z4
2BN4	5U8	6AV5GT	6C4	6K6GT	7A4/XXL	7Y4	12D4	35A5	117Z3
2CY5	5V4G	6AV6	6CB6	6K7	7A5	7Z4	12F5	35B5	
3A4	5V6GT	6AW8	6CD6G	6N7	7A6	12A8	12K7	35C5	
3A5	5X8	6AX4GT	6CF6	6Q7	7A7	12AB5	12L6	35W4	
3AL5	5Y3	6AX5GT	6CG7	6S4	7A8	12AQ5	12Q7	35Z5	

35¢ ea.

$33 PER HUNDRED

For any used or factory second tube!

1 YEAR GUARANTEED PICTURE TUBES

Brand New* Allied A-1 Tubes Brand New

Below Listed prices do not include dud. Add Additional $5.00 Deposit on tube sizes to 20"; on 21" and 24" tubes - $7.50. Deposit refunded immediately when dud is returned prepaid. Aluminized tubes - $4.00 extra.

Picture tubes shipped only to continental USA and Canada — All tubes F.O.B. Harrison, N. J.

10BP4	7 99	16HP4	12 19	17CP4	16 99	19AP4	18 39	21ATP4	18 79	21FP4	18 39	21YP4	18 39
12LP4	10 49	16KP4	11 99	17GP4	17 89	20CP4	15 89	21AMP4	17 99	21KP4	18 39	21ZP4	17 49
14B/CP4	11 99	16MP4	12 19	17MP4	16 99	20DP4	15 89	21AU4	18 79	21MP4	22 39	24AP4	39 49
16AD4	16 09	16RP4	11 99	17TP4	16 99	20MP4	17 89	21AVP4	18 79	21YP4	18 39	24CP4	27 79
16DP4	12 19	17AVP4	15 49	17QP4	13 89	21AP4	21 49	21AWP4	17 49	21WP4	17 49	24DP4	29 79
16GP4	16 09	17BP4	13 49	17TP4	16 99	21ALP4	18 79	21EP4	17 29	21XP4	17 49		

SENSATIONAL $100,000 GIVE-AWAY

We want 100,000 new customers by Nov. 1st. For every new order of $25 or more received by that date, we will send you a crisp, new dollar bill.

FREE FUSE CLIP!

Sent With Any Order Of $5 Or More

GUARANTEE

Only TRU-VAC guarantees to replace free any tube which becomes defective in use within one year of date of purchase.

USED TV CONSOLES

GUARANTEED To Work When You Receive Them

10" & 12"	$29
14" & 16"	$37
17"	$45
19"	$59
20" & 21"	$70

All sets shipped in two cartons to avoid breakage. Sets shipped express to continental U.S.A. and Canada only. F.O.B. Harrison, New Jersey.

FREE BONUS—RABBIT EARS

$7.95 Value

FREE with each set purchased

ATTENTION QUANTITY USERS!
Big Discounts Are Yours . . . Call or Write For Our 1000 Tube "Private Label" Special! Attention Branding Dept. MGR.

MONEY CHEERFULLY REFUNDED WITHIN FIVE (5) DAYS, IF NOT COMPLETELY SATISFIED!

TRU-VAC® PAYS YOUR POSTAGE
On orders of $5 or more in U.S.A. and Territories. Send approximate postage on Canadian and foreign orders. Any order less than $5 requires 25c handling charge. Send 25% on C.O.D.'s. All orders subject to prior sale.

Complying with Federal regulations, the following statement appears in all Tru-Vac advertising: Tubes appearing in this ad may be FACTORY SECONDS or USED tubes and are clearly marked.

Write Dept. L For FREE LIST Of Other Tube Types and Products Sold By TRU-VAC®

TRU-VAC® Electric Company

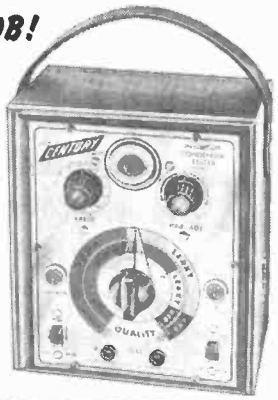
Harrison Avenue Box 107 Harrison, New Jersey
HUmboldt 4-9770

Visit Our Huge Testing Dept. In The Heart Of Harrison N. J.'s Electronics Industry

SHIPPED ON APPROVAL

an IN-CIRCUIT CONDENSER TESTER THAT *DOES THE WHOLE JOB!*

IN-CIRCUIT CONDENSER TESTER Model CT-1



The CT-1 actually steps in and takes over where all other in-circuit condensers fail. The ingenious application of a dual bridge principle gives the CT-1 a tremendous range of operation . . . and makes it an absolute 'must' for every serviceman.

in-circuit checks:

- Quality of over 80% of all condensers even with circuit shunt resistance . . . (This includes leakage, shorts, opens, intermittents)
- Value of all condensers from 200 mmfd. to .5 mfd.
- Quality of all electrolytic condensers (the ability to hold a charge)
- Transformer, socket and wiring leakage capacity

out-of-circuit checks:

- Quality of 100% of all condensers . . . (This includes leakage, shorts, opens and intermittents)
- Value of all condensers from 50 mmfd. to .5 mfd.
- Quality of all electrolytic condensers (the ability to hold a charge)
- High resistance leakage up to 300 megohms
- New or unknown condensers . . . transformer, socket, component and wiring leakage capacity

OUTSTANDING FEATURES

- Ultra-sensitive 2 tube drift-free circuitry
- Multi-color direct scale readings for both quality and value . . . in-circuit or out-of-circuit
- Simultaneous readings of circuit capacity and circuit resistance
- Built-in hi-leakage indicator sensitive to over 300 megohms
- Cannot damage circuit components
- Electronic eye balance indicator for even greater accuracy
- Isolated power line

WHY THE CT-1 SURPASSES ALL OTHERS IN THE FIELD

INSTRUMENT	IN-CIRCUIT PERFORMANCE					PRICE
	Leakage	Value	Open	Short	Electrolytics	
CENTURY CT-1	Yes	Yes	Yes	Yes	Yes	$34.50
Advertised Instrument A	Yes	No	No	Yes	No	$79.95
Advertised Instrument B	No	No	Yes	Yes	No	$92.50
Advertised Instrument C	No	No	Yes	Yes	No	$34.50
Advertised Instrument D	Yes	No	No	No	No	$44.95
Advertised Instrument E	No	Yes	No	No	No	$69.95

Model CT-1—housed in sturdy hammertone finish steel case complete with test leads . . . only

$34.50 Net

SIZE: W-6" H-7" D-3¼"

IN-CIRCUIT RECTIFIER TESTER

Model SRT-1

Checks all power rectifiers in-circuit whether SELENIUM, GERMANIUM, SILICON, etc.

With the growing trend towards compactness, portability and low price, TV manufacturers are resorting more and more to producing series-string TV sets employing selenium, germanium or silicon power rectifiers. Now the need for an in-circuit rectifier tester is greater than ever.

THE SRT-1 CHECKS ALL POWER RECTIFIERS IN-CIRCUIT AND OUT-OF CIRCUIT WITH 100% EFFECTIVENESS FOR:

✓ Quality ✓ Fading ✓ Shorts ✓ Opens ✓ Arcing ✓ Life Expectancy

Model SRT-1—housed in sturdy hammertone finish steel case complete with test leads **$29.50 Net**

SIZE: W-6" H-7" D-3¼"

SPECIFICATIONS

- Checks all types of power rectifiers rated from 10 ma. to 500 ma. (selenium, germanium, silicon, etc.) both in-circuit or out-of-circuit.
- Will not blow fuses even when connected to a dead short.
- Large 3" highly accurate multi-color meter . . . sensitive yet rugged.
- Separate meter scales for in-circuit and out-of-circuit tests.
- Cannot damage or over heat rectifier being tested.

SIMPLE TO OPERATE Just clip SRT-1 test leads across rectifier under test right in the circuit without disconnecting rectifier from circuit. Press test switch and get an instant indication on the easy-to-read three-color meter scales. . . .

TRANSISTOR TESTER Model TT-2

AN INEXPENSIVE QUALITY INSTRUMENT DESIGNED FOR ACCURATE AND DEPENDABLE TESTS OF ALL TRANSISTORS AND DIODES QUICKLY AND ACCURATELY

Every day more and more manufacturers are using transistors in home portable and car radios . . . in hearing aids, intercoms, amplifiers, industrial devices, etc. Since transistors can develop excessive leakage, poor gain, shorts or opens, the need for TRANSISTOR TESTER is great.

SPECIFICATIONS

• Checks all transistors, including car radio, power output, triode, tetrode and unijunction types for current gain, leakage, opens, shorts, cut-off current • Checks all diodes for forward to reverse current gain • All tests can be made even if manufacturers' rated gain is not available • Less than half a minute required for tests of either transistors or diodes • Large 3" meter is extremely sensitive yet rugged . . . with multi-color scales designed for quick easy readings • Power is supplied by an easy to replace 6-volt battery — current drain so small, service life almost equal to shelf life. Battery cannot be drained due to accidental shorting of test leads • Cannot burn-out its own meter or damage transistor or diode under test • Long test leads and insulated test clips enable tests without entirely removing transistor from circuit • Test leads are identified by E.I.A. color code so that connection to the correct terminal is assured • Comes complete with replaceable transistor set-up chart that fits into a special rear compartment.

Model TT-2 — housed in sturdy hammertone finish steel case complete with test leads **$24.50 Net**

SIZE: W-6" H-7" D-3¼"

IMPORTANT FEATURE: The TT-2 cannot become obsolete as the circuitry is engineered to enable you to check all new type transistors as they are introduced. New listings will be furnished periodically at no cost.

EASY TO BUY IF SATISFIED
see order form on facing page

FOR 10 DAY *FREE* TRIAL

Convince yourself at no risk that CENTURY instruments are indispensable in your every day work. Send for instruments of your choice without obligation . . . try them for 10 days before your buy . . . only then, when satisfied, pay in easy-to-buy monthly installments — without any financing or carrying charges added

NEW Battery Operated Peak-to-Peak VACUUM TUBE VOLT METER Model VT-1

WITH LARGE EASY-TO-READ 6" METER —

featuring the sensational new MULTI-PROBE • *Patent Pending*

No extra probes to buy! The versatile MULTI-PROBE does the work of 4 probes

❶ DC Probe ❷ AC-Ohms Probe ❸ Lo-Cap Probe ❹ RF Probe

The VT-1 is a tremendous achievement in test equipment. With its unique MULTI-PROBE it will do all the jobs a V.T.V.M. should do without the expense of buying additional probes. No longer do you have to cart around a maize of entangled cables, lose time alternating cables or hunting for a misplaced probe. With just a twist of the MULTI-PROBE tip you can set it to do any one of many time-saving jobs. A special holder on side of case keeps MULTI-PROBE firmly in place ready for use.

SIZE: W-7⅜" H-9" D-4½"

FUNCTIONS

DC VOLTMETER . . . Will measure D.C. down to 1.5 volts full scale with minimum circuit loading, and give accurate readings of scale divisions as low as .025 volts . . . Will measure low AGC and oscillator bias voltages from .1 volts or less up to 1500 volts with consistent laboratory accuracy on all ranges . . . Zero center provided for all balancing measurements such as discriminator, ratio detector alignment and hi-fi amplifier balancing.

AC VOLTMETER . . . True Peak-to-Peak measurements of any wave form including TV sync, deflection voltages, video pulses, audio in hi-fi amplifiers, AGC and color TV gating pulses . . . Scale divisions are easily read down to .1 volts . . . Measures RMS at 1/20th the circuit loading of a V.O.M. . . . Unlike most other V.T.V.M.'s there is no loss in accuracy on the lowest AC range.

ELECTRONIC OHMETER . . . Measures from 0 to 1000 megohms . . . Scale divisions are easily read down to .2 ohms . . . Will measure resistance values from .2 ohms to one billion ohms . . . Will detect high resistance leakage in electrolytic and by-pass condensers.

RF and LO-CAP MEASUREMENTS . . . With these extra VT-1 functions you can measure voltages in extremely high-impedance circuits such as sync and AGC pulses, driving saw tooth voltages, color TV gating pulses, mixer output levels, I.F. stage-by-stage gain and detector inputs.

OUTSTANDING FEATURES

• Completely portable — self powered with long life batteries — permits use everywhere • New advanced pentode amplifier circuit assures amazingly low battery drain • Large 6" 100-microampere meter, many times more sensitive than meters used in most V.T.V.M.'s • Laboratory accuracy performance — 2% of full scale on DC, 5% of full scale on AC • Simplified multi-color easy-to-read 4-scale meter • No heat operation assures rigid stability and accuracy • Immune to power line fluctuations • Amplifier rectifier circuit with frequency compensated attenator — a feature found only in costly laboratory instruments • Meter completely isolated — practically burn-out proof • Hand-crafted circuitry eliminates the service headaches of printed circuitry • 1% resistors used for permanent accuracy • Separate RF ground return for low-loss RF measurement • Microphone type co-axial connector • Matching cover protects instrument face — snaps on and off instantly.

SPECIFICATIONS

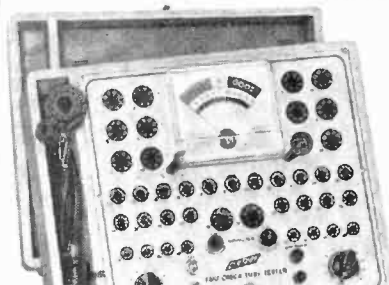
- DC Volts — 0 to 1.5/6/30/150/300/600/1500 volts
- AC Volts (RMS and Peak-to-Peak) — 0 to 3/12/60/300/1200 volts
- Ohms — 0 to a billion ohms, 10 ohms center scale — Rx1/10/100/1K/10K/100K/1M
- RF — Peak reading demodulator supplied for use on all DC ranges
- Zero Center — available on all DC volt ranges with zero at mid-scale
- Decibels — from —10 Db to +10/22/36/50/62 based on the Dbm unit: 0Db-1MW in 600 ohms
- Impedance — 11 megohms DC, 1 megohm AC, 10 megohms Lo-Cap
- Input Capacity — 330 mmfd. RMS, 250 mmfd. Peak-to-Peak, 25 mmfd. Lo-Cap

Model VT-1 — fully wired and calibrated, housed in handsome hammertone finish steel case complete with MULTI-PROBE and thorough instruction manual covering all the applications in detail. **$58.50** Net

FAST-CHECK TUBE TESTER Model FC-2

Simply set two controls . . . insert tube . . . and press quality button to test any of over 700 tube types completely, accurately . . . IN JUST SECONDS!

Over 20,000 servicemen are now using the FAST-CHECK in their every day work and are cutting servicing time way down, eliminating unprofitable call-backs and increasing their dollar earnings by selling more tubes with very little effort. See for yourself at no risk why so many servicemen chose the FAST-CHECK above all other tube testers.



SIZE: W-14⅜" H-11¼" D-4⅜"

Model FC-2 — housed in hand-rubbed oak carrying case complete with CRT adapter **$69.50** Net

PICTURE TUBE TEST ADAPTER INCLUDED WITH FAST-CHECK

Enables you to check all picture tubes (including the new short-neck 110 degree type) for cathode emission, shorts and life expectancy . . . also to rejuvenate weak picture tubes.

RANGE OF OPERATION

- Checks quality of over 700 tubes types, employing the time proven dynamic cathode emission test. This covers more than 99% of all tubes in use today, including the newest series-string TV tubes, auto 12 plate-volt tubes, 0Z4s, magic eye tubes, gas regulators, special purpose hi-fi tubes and even foreign tubes.
- Checks for inter-element shorts and leakage.
- Checks for gas content.
- Checks for life-expectancy.

SPECIFICATIONS

• No time consuming multiple switching . . . only two settings are required instead of banks of switches on conventional testers • No annoying roll chart checking . . . tube chart listing over 700 tube types is located inside cover. New listings are added without costly roll chart replacement • Checks each section of multi-section tubes and if only one section is defective the tube will read "Bad" on the meter scale • 41 phosphor bronze beryllium tube sockets never need replacement • 7-pin and 9-pin straighteners mounted on panel • Large 4½" D'Arsonval type meter is the most sensitive available, yet rugged — fully protected against accidental burn-out • Special scale on meter for low current tubes • Compensation for line voltage variation • 12 filament positions • Separate gas and short jewel indicators • Line isolated — no shock hazards • Long lasting etched aluminum panel.

NOTE: The Fast-Check positively cannot become obsolete . . . circuitry is engineered to accommodate all future tube types as they come out. New tube listings are furnished periodically at no cost.

CONVENIENT TIME PAYMENT PLAN — NO FINANCING CHARGES

ALL CENTURY INSTRUMENTS ARE GUARANTEED FOR ONE FULL YEAR

The extremely low prices are made possible because you are buying direct from the manufacturer.

CENTURY ELECTRONICS CO., INC.

111 Roosevelt Avenue, Dept. 309, Mineola, New York

CHECK INSTRUMENTS DESIRED

- ☐ Model CT-1 In-Circuit Condenser Tester . . . . . $34.50 — $9.50 within 10 days. Balance $5 monthly for 5 months.
- ☐ Model SRT-1 In-Circuit Rectifier Tester . . . . . $29.50 — $4.50 within 10 days. Balance $5 monthly for 5 months.
- ☐ Model TT-2 Transistor Tester . . . . . $24.50 — $4.50 within 10 days. Balance $5 monthly for 4 months.
- ☐ Model VT-1 Battery Vacuum Tube Volt Meter . . . . . $58.50 — $14.50 within 10 days. Balance $11 monthly for 4 months.
- ☐ Model FC-2 Fast-Check Tube Tester . . . . . $69.50 — $14.50 within 10 days. Balance $11 monthly for 5 months.

Prices Net F.O.B. Mineola, N. Y.

Please rush the instruments checked for a 10 day free trial. If satisfied I agree to pay the down payment within 10 days and the monthly installments as shown. If not completely satisfied I will return the instruments within 10 days and there is no further obligation. It is understood there will be NO INTEREST or FINANCING charges added.

Name .....

Please print clearly

Address .....

City ..... State .....

Transistor Topics

(*Continued from page 88*)

temperature coefficient, with the resistance *decreasing* as temperature *increases;* thus, meter current increases with increasing temperature.

The simple "transformerless" code practice oscillator circuit given in Fig. 2 was submitted by reader Ronald Remmel (2221 W. Raleigh Ave., Milwaukee 9, Wis.). Needing relatively few components, the unit may be wired "breadboard" fashion or put in a small plastic or metal box, whichever you prefer.

Ronald used a CK722 transistor for *Q1,* but almost any transistor should work in his circuit if *R1* and *R2* are adjusted experimentally until proper operation is obtained. Generally, *R1* will have a value between 1000 and 10,000 ohms and *R2* a value between 100,000 ohms and 1 megohm.

Basically a modified shunt-fed Colpitts oscillator, Ronald's circuit uses the inductance of the headphones as part of its tuned circuit. *C1* and *C3* serve both to "tune" the headphones and as a capacitive voltage-divider. Resistor *R1* serves as *Q1*'s collector load, with base bias current furnished through *R2*. *C2* provides signal feedback from *Q1*'s collector to the tuned circuit.

Reader Jock F. McTavish (75 Heston St., Calgary, Alberta, Canada) designed the "booster" amplifier circuit in Fig. 3. Using a single *p-n-p* transistor (*Q1*) as a common-emitter audio amplifier, this instrument is employed with small transistor radios in place of standard headphones, providing moderate loudspeaker volume. Use as large a PM loudspeaker as you can; "Mac" put a 5" speaker in his model but the larger the speaker, the more efficient the amplifier's operation.

Mac suggests trying different output transformers from your junk box for *T1,* finally installing the one which gives best performance; if you prefer, you can install an Argonne Type AR-167 here. And you may wish to experiment with *R1*'s value; try from 500 to 5000 ohms, using as large a value as you can before "clipping" and distortion occurs.

Note that *Q1* is operated *without* separate base bias. Mac has relied on the transistor's internal leakage to provide the small bias needed for operation. In a few cases, it may be necessary to connect an external bias resistor. If so, use a ½-watt

Learn Radio-TV Electronics

by Practicing at Home in Spare Time

Without Extra Charge You Get special NRI kits developed to give actual experience with Radio-TV equipment. You build, test, experiment with receiver or broadcasting circuits. Keep all equipment.

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resistor between *Q1*'s base and *B1*'s negative terminal—try values from 100,000 ohms to 2.2 megohms.

New Semiconductor Devices. From Bell Telephone Laboratories comes news of a "field-effect" tetrode device which can be used as a transformer, impedance-changing device, modulator, or as a stable negative resistance. This unit (Fig 4) is made up of a disc-shaped semi-conductor having a diffused *n-p* junction. A circular trench is etched in each face of the disc to within a thousandth of an inch of the junction. Leads are then attached to each face, both

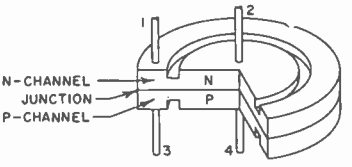


Fig. 4. Construction of Bell Laboratories' new field-effect tetrode.

inside and outside the trench. In operation, various bias currents are applied to each of the four electrodes, with the unit's mode of operation determined by the polarity and amplitude of each bias.

RCA (Semiconductor Division, Somerville, N. J.) has announced what may be the first of a whole family of dual-purpose semiconductor devices—a diode-triode transistor. It consists of an alloyed *p-n* junction diode and a *p-n-p* triode built up on a single germanium pellet so that the *n*-type base is common to both units. The construction thus provides a direct connection between the diode and triode, permitting the device to serve both as a detector and as an audio amplifier, while requiring a minimum of external components. This dual device is also very well suited for amplified a.g.c. circuits.

A controlled rectifier has been introduced by the International Rectifier Corporation (1521 E. Grand Ave., El Segundo, Calif.). Electrically the solid-state equivalent of a gas thyratron, the new unit can handle load currents up to 10 amperes at PIV ratings of up to 200 volts. In operation, it combines some of the basic characteristics of the rectifier and the power transistor, and can be used to switch relatively large currents when a signal is applied to its "gate" electrode. It can also be employed for motor and generator control, static switching, cur-

rent regulation, and industrial control applications.

Transistorized Ignition. Our discussion of transistorized automobile ignition systems in the June column brought forth a small flood of inquiries for "construction details." Unfortunately, your columnist has no construction plans available. However, we understand that Technical Services Institute, 5234 Fourth St., N.E., Washington 11, D. C., is offering detailed plans and instructions at $2.50 per set, postpaid.

Product News. Lafayette Radio (165-08 Liberty Ave., Jamaica 33, N. Y.) has just introduced one of the cleverest items we've seen in some time . . . a pair of sunglasses with a transistorized radio built in the frame! Operating power is supplied by a self-contained button-sized nickel cadmium battery. Stock No. is F-436.

From Allied Radio (100 N. Western Ave., Chicago 80, Ill.) comes news of a fully transistorized mobile p.a. amplifier. With a rated output of 25 watts, this unit can operate on any 12-volt d.c. source, and has both low and high impedance input jacks. A separate battery-powered record player is available as an accessory item.

The Delco Radio Division (General Motors) has developed a new transistorized garage door opener which operates on frequencies between 5 and 10 kc. The receiver uses five transistors, two diodes, and a rectifier. The transmitter, mounted in the car, uses two transistors . . . one as an oscillator and another as a power amplifier. By limiting each channel to a bandwidth of 100 cycles, Delco has squeezed 50 operating channels in the 5 to 10 kc. band.

That covers the news for now, fellows. See you next month . . .

Lou

"I'm working on some pretty big projects."

Color TV Today

(*Continued from page* 46)

a color set has more tubes than a comparable black-and-white set, it's common sense to expect more breakdowns from a color set. For some reason, though, the incidence of color set repair has not been nearly as high as some people expected.

Anyway, let's assume you'll have just a little more trouble with a color set than a black-and-white set. Let's say, for example, that instead of calling a service man three times every two years, you call him twice a year. If the average cost of a color set repair were $30.00, you would pay only $60.00 a year as opposed to either $119.50 or $85.45 ($79.50 plus one free call and one $5.95 call) in service contracts.

If a color set didn't have a hidden "joker," it would seem to be a pretty safe risk to go without a service contract. But there's one little item in a color set that isn't found in a black-and-white set—the color picture tube. If your color picture tube burns out, you will suffer the ultimate disaster. You can figure on paying about $150.00 for color picture tube replacement *plus* service.

So, when you buy a service contract, to a great extent you are paying insurance on the picture tube. While there has been no unusual amount of difficulty with color picture tubes (replacements are currently running in about the same ratio as black-and-white picture tubes), you can see why it takes quite a gambler to operate a color set without a service contract.

Future of Color TV. There are several indications that color TV may really get going either this year or next year. First of all, NBC has announced a very attractive schedule for the fall which outlines 250 hours of color programing, 30% more than was presented during the same period last year. The NBC line-up will include all the NBC color regulars such as Dinah Shore, Perry Como, Steve Allen, etc., and will feature numerous color "specials"—musicals, plays, educational programs, comedy and sports. Included in the sports coverage will be the World Series and 11 major football games. Accompanying this truly excellent color schedule will quite likely be a full-scale advertising campaign for color TV.

Also, news that the Admiral Corporation is plunging into the production of a complete line of color sets points to a new confidence in the future of color TV. Admiral

envisages a mass market opening up in 1961.

As mentioned earlier, the two things holding up color TV are price and programing. With NBC's increase of color programing this fall, at least part of the problem is being solved. It is doubtful, however, that any tremendous breakthrough will come until the price of the sets comes down. When color sets are priced within $100 of comparable black-and-white models, then color TV will come into its own. Until that time it seems probable that it will make steady but unspectacular progress.

Color TV and You. Now for the $64 question—or more exactly, the $495 question: Should *you* buy color TV now?

Very frankly, it all depends on how much money you have. If you can afford a boat, or an extra car, or an automatic dishwasher, then the enjoyment you will get from a color TV set should be well worth what you pay for it. And even if you can't really "afford" a set, it might still be worth $495 to you.

One word of warning, though, if you get a color set, don't tell your friends—unless you're prepared to spend your evenings demonstrating it. And don't forget to order the beer and pretzels! —30—

Stereo Tape Preamp

(*Continued from page* 93)

or treble, you may want to change these values.

Increasing the size of the capacitor will reduce the bass, while reducing the size of the capacitor will have the opposite effect. If the resistor is made larger, the highs will be boosted; decreasing the resistor will cut the highs. Do not change values more than 200%, however, because they interact and will affect the gain.

If the preamp is not grounded properly, it is possible to get a considerable amount of hum. In addition to the shielded output cables, separate ground wires from the tape deck to the preamp—and then on to the main amplifier—may be necessary.

You can also use this preamp with monaural tape systems. If you wish to do so, build only half of the circuit, and double the size of *R9* and *R10*. The battery voltage adjustment procedure remains the same. —30—

Inside the Hi-Fi Tuner

(*Continued from page* 86)

4000 cps and some of the wide-band circuits go up to 10,000 cps.

Tuners with broad i.f. bandwidths usually have a 10-kc. or "whistle" filter to attenuate the 10-kc. beat note between carriers of adjacent channel stations.

In FM tuners the tendency is also toward wide bandwidths. Whereas 150-kc. bandwidths used to be the rule, at present bandwidths of 200 kc. are not uncommon.

FM. Limiters. One of the great virtues of FM is its ability to minimize static. This is possible since noise *amplitude*-modulates the radio signal. In AM, the audio is also amplitude-modulated, so we cannot remove the noise without damaging the audio. But in FM the audio signal is *frequency*-modulated, and it is possible to remove the amplitude-modulated noise without affecting the audio information.

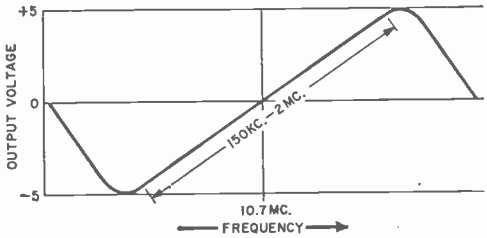


Fig. 6. Characteristic output curve of an FM detector. The linear, or straight, portion of the curve should have a bandwidth of at least 150 kc. to avoid distortion. Some detector circuits have bandwidths as wide as 2 mc.

In the FM tuner, most noise reduction takes place in the limiters, which follow the i.f. amplifiers and are a special type of amplifier themselves. They amplify a weak signal, but after the signal reaches a certain level, they saturate and in effect chop off the rest of the signal. See Fig. 4. The noise superimposed on the FM signal is removed while the "intelligence" carried by the signal—the frequency variations—is not affected by the limiting process.

Detectors. The most popular FM detector circuits employed today are the discriminator, shown in Fig. 5 (A), and the ratio detector, shown in Fig. 5 (B). Though each of these circuits has its advantages, both are capable of good results. They both

operate more or less as specialized forms of slope detectors, and their output curve is, or should be, a straight line inclined as in Fig. 6. The FM carrier frequency should lie at the center of the straight portion of the curve; one set of sidebands will then produce negative voltages, the other side positive voltages.

The straight portion of the curve must cover at least 150 kc. to handle the combined deviation of both sides of the transmitted signal. However, if the straight portion is *only* 150-kc. long, the tuner must be precisely tuned to avoid distortion on either of the two sidebands. Thus, the detector bandwidth is usually designed to be considerably greater than 150 kilocycles. In fact, some of today's best FM tuners have detector bandwidths up to 2 megacycles. Wide-band detectors minimize distortion and make tuning less critical.

Squelch Circuits. As tuners are made more sensitive for fringe-area reception, they become noisier between stations. There is a trend to include a squelch or muting circuit in very sensitive tuners. This circuit functions like an electronic switch which mutes or squelches the audio portion of the tuner when no station signal above a certain threshold is present, but opens it when a station is tuned in.

As we have already seen, at the detector output we have not only the audio component but a d.c. component. At one point of the output network this d.c. component will be greatest when a signal is tuned in, and lowest when there is no signal. If this voltage is used to bias a tube which is connected into the circuit of the audio amplifier, this "squelch" tube will be biased to cutoff when a station is tuned in and it will not cut off the audio tube. When the tuner is tuned off a station, the bias on the squelch tube changes and it then cuts off the audio tube.

Tuners today—especially the FM portions—are far superior to those of the past. One or two have sensitivities below 1 microvolt. With a good antenna, high-fidelity FM reception is possible over ranges previously considered impossible—up to 200 miles, and even more, where the receiving and transmitting antenna heights are favorable.

Next month we will take a look at the design considerations necessary for the production of a high-fidelity loudspeaker. —30—

On the Citizens Band

By TOM KNEITEL, 2AØ3Ø5

EACH WEEK sees more and more stations on 11 meters, the Class D Citizens Band; and each week we seem to hear of a new and novel use for Citizens Radio.

Among the clever tasks that CB has been asked to take on is one put to it by a smart service-station operator in the West, whose station is located along a desolate stretch of highway. There are signs along the road for 15 miles in each direction which read: "Need help? For prompt road service call Harrington's Service Station via Citizens Radio on channel 1 or 4" (the popular channels in the area).

This station uses an International Crystal 2-channel rig. So that both receiving channels can be monitored simultaneously, a Kuhn Electronics 315A converter is used in conjunction with another receiver. Aside from just selling gas, Harrington's sells crystals for, you guessed it, channels 1 and 4.

This is a perfect example of what the FCC intended CB to be used for. As a matter of fact, it has been reported that recently issued CB licenses are coming through with a little note attached stating that CB was not intended to be a replacement for ham radio, and that "CQ'ing" is frowned upon. However, the FCC Rules (Paragraph 19.61a) state that a CB station is authorized to work other stations in the same service. Do you follow the FCC Rules as they are written in Part 19, or do you take their subtle hint pinned on your license? We don't know.

Speaking of the FCC, waiting for your license to come through can be a pretty long and drawn-out business. The latest word is that you shouldn't hold your breath for the time you are going to have to wait over the FCC's announced 60-day period (Paragraph 19.13c of the Rules). Just be patient, and don't think you've been forgotten. They have been swamped with applications for CB licenses and their staff is

working on the applications as fast as possible.

By the way, when you get your license, you will receive a set of call letters. Don't forget to announce them at the beginning and end of each contact, and at least once every ten minutes during a long-winded session.

Signals are improving on 11 meters, and even some of the formerly weak stations seem to have picked up. This is a result of better antennas.

Many stations started out using horizontal antennas, and most have now been changed to the more effective vertical types. Also, a number of high-gain ground plane antennas have started popping up on the band. There are a few really "socko" stations using something called a "Dual Ground Plane" antenna, which makes men out of boys.

One manufacturer has been using his noggin and has come up with a little gizmo that plugs into the crystal socket of a fixed channel receiver and makes it tunable; it'll be on the market soon for about $20. Also planned are a low-cost phone patch and an automatic signaling device that enables you to signal one specific CB station in your area to let the operator know you want to talk.

Station activities in the New York area are still on the upswing, with Al, 2W1369, giving Fred, 2W1352, a run for his money with his new antenna. Even so, during a recent band opening, 2W1352 was called by an 11-meter ham in The Union of South Africa who heard Fred and couldn't resist giving him a shout. Fred is still wiping the tears from his eyes about not being allowed to reply because of regulations.

Channel 11 is pretty busy these days, being inhabited by scores of mobile units using Gonset rigs. It appears that Gonset transceivers are furnished with the channel 11 crystal. Gonset has a popular set, and no wonder, as it is well made and attractive in appearance.

The Heathkit CB sets have been given some nice references by the boys now using them. We hear that they are easy on the nerves when you are putting them together.

Please keep us posted regarding your 11-meter activities, and we'd like to receive any suggestions you may have for pepping up CB equipment and signals. Anybody know of unusual applications for CB which are now in use?

—30—

Answers to Electronic Sticklers

on page 60

1. The voltage across points X is 100 volts, neglecting the small forward voltage drop across diode *CR1*. Both diodes are biased for forward conduction, but when *CR1* conducts, *CR2* is biased for reverse conduction and effectively becomes an open circuit.

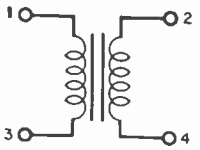
2. If our ham friend had recalled his transformer theory, he would have used the following formula:

$$\frac{Z_{in}}{Z_{out}} = \left(\frac{\text{Primary turns}}{\text{Secondary turns}}\right)^2$$

and figured out that he'd end up with an output impedance of 600 ohms instead of the 300 ohms he wanted.

3. The black box contains a set of contacts which are continually opening and closing at 100 cycles per second. When the contacts are open, there is a voltage across them which can be measured by the voltmeter, but no current flows. When the contacts are closed, the voltage drop across the contacts is zero and a current flows through the ammeter. The ammeter and voltmeter needles cannot follow the contact switching rate, so they indicate an average reading. The wattmeter indicates zero because the current and voltage required to cause a reading do not occur at the same time. The current is limited by the internal resistance of the power supply.

4. The box contained a one-to-one ratio transformer. Because the VTVM has a very high input impedance, the voltage drop across the relatively low resistance windings is practically zero. The box acts as a transformer with power applied to terminals 1-3 or 2-4, and as coils in series with power applied to terminals 1-2 or 3-4.



If you know of a tricky Electronic Stickler, send it in with the solution to the editors of POPULAR ELECTRONICS. If it is accepted, we will send you a $5 check. Write each Stickler you would like to submit on the *back of a postcard*. Submit as many postcards as you like but, please, just one Stickler per postcard. Send to: POPULAR ELECTRONICS STICKLERS, One Park Ave., New York 16, N. Y. Sorry, but we will not be able to return unused Sticklers.

How to Choose a Recording Tape

(*Continued from page 75*)

a new problem—"print-through," the transfer of a signal from one layer of tape to another when the tape is stored for long periods of time. Only the backing of the tape prevents the magnetic field on one layer from magnetizing the next layer.

Special types of "low-print" tape have been developed to reduce print-through. By using a modified form of oxide dispersion, the print-through is cut by about 8 db, enough to make it a minor problem. Of course, print-through can also be minimized by keeping the recording volume low. If you want to keep recorded tape for an extremely long period of time, however, the extra 15% you pay for low-print tape will be money well-invested.

Another tape headache is oxide rub-off. This is especially bothersome in computer applications where every "bit" of information is vital. Recently "sandwich" tape has been developed to reduce this problem. This tape's oxide coating is protected by a 50 micro-inch plastic layer which prevents the oxide from contacting any part of the recording system, thereby eliminating wear on the oxide itself.

Practically all magnetic tapes, however, feature some type of built-in "anti-wear" system. Silicon lubricants are frequently used to fill in the spaces between the oxide particles and the resin. This reduces wear on the tape heads, eliminates squeal, and increases tape life by allowing the tape to glide smoothly past the heads without causing distortion. Similar to lifetime anti-friction bearings, the lubricant lasts the life of the tape.

So-called "high-output" tapes provide extra output for increasing the dynamic range in sensitive recording applications. Such tapes achieve signal-to-noise ratios from 6 to 12 db greater than conventional tapes and prevent "overloading" in passages where the dynamic range varies widely. Because of its greater potency, high-output tape has made possible narrower magnetic tracks without sacrificing output level.

Pick a Tape—Any Tape. If you are just starting to use magnetic tape, you are probably somewhat puzzled by the profusion of tape types from which to choose. To make things simpler, here are some tips.

If your recording needs are about normal, start off by using 1½-mil acetate

tape—it's your most economical choice. If you are in a hot or humid climate, you might consider the advantages offered by Mylar. Assuming that you do most of your recording at 7½ ips, if you want to extend the playing time of the tape from 30 minutes in each direction to 45 minutes, try 1-mil Mylar. If you desire super-long-playing tape, ½-mil Mylar is your best choice, but only if your tape recorder handles tape very gently (don't forget the stretch problem).

The special tapes such as low-print, high-output, tensilized, etc., are worth their premium prices only if you really need them. Low-print tape, of course, is preferred when you want to record something that is irreplaceable—such as a baby's first words. High-output tape is recommended when the material to be recorded has an extremely wide dynamic range.

To decide which tape you should buy, first figure out your own special requirements. Then buy the least expensive tape that will satisfy these needs. It's as simple as that! —30—

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Two-Way Power Trumpet

(*Continued from page 80*)

panel of the aluminum box with the shaft of the volume control protruding through the back.

When you wire the "listen" amplifier, save the transistors for last since they are easily damaged by heat. Be careful to hold each transistor lead with long-nose pliers while it is being soldered, and for a moment afterward, until the lead has cooled.

Final assembly of the box is done after the "talk" and "listen" amplifiers and batteries are wired and assembled on their respective panels. Leave one side of the box off while attaching trumpet, handset, and amplifier leads to the terminal tie strip just above the batteries.

The batteries can be secured in place with cardboard if desired since they last for an unbelievably long time. When necessary, they may be quickly and easily replaced by removing a side or bottom panel.

Aside from the very practical advantages of a two-way power trumpet, it has side benefits which may be amusing or confusing. Many people in the crowd you're addressing simply never realize that you can listen in on their private comments. —30—

Short-Wave Monitor Registration

The POPULAR ELECTRONICS short-wave fraternity is growing by leaps and bounds each month. Tom Kneitel, WPE2AB, Director of Monitor Station Registration, has been swamped with registration forms, but his loving XYL pitched in and now the certificates are really moving. To get yours, just fill out the form below and mail to: Monitor Registration, POPULAR ELECTRONICS, One Park Ave., New York 16, N. Y. Please include ten cents to help cover cost of mailing and processing the certificate.

(Please Print)

Name .....

Address ..... City ..... State .....

Receiver — Make ..... Model .....

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

Principal SW Bands Monitored ..... Number of QSL Cards Received .....

Type of Antenna Used .....

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

Cross-Country Communications

(*Continued from page* 53)

guards. It, too, has spare emergency channels for use in case of trouble. Storage batteries and motor-driven generators are ready to supply emergency power. An alarm system spells out any trouble on a coded diagram at the nearest control office.

Multi-Purpose "Highway." Television and telephone traffic are carried together on both radio relay and coaxial cable. The average TV circuit ties up the equivalent of 600 telephone circuits. But, unlike telephone, it only goes one way, and thus uses only half the two-way circuits involved.

Interestingly enough, the television picture and the audio portion of the show are normally carried on separate channels. This means that technicians in the control centers must coordinate the two sections of the program at the end of the line.

Since the audio is carried on lower-priced lines, network television doesn't offer too much for the hi-fi enthusiast. Bell Telephone can supply circuits with a top audio frequency response of either 5000, 8000, or 15,000 cps. The higher the response, the higher the price of the service. For this reason, though some TV circuits are occasionally rigged for the higher frequencies, the networks generally content themselves with a 5000-cycle audio cutoff. Regular telephone frequency response, incidentally, ranges from about 300 to 3000 cycles.

Ground Work. A lot of planning goes into the construction of either system. For radio relay, topographical maps are used to locate clear paths between sites and to avoid reflective surfaces, such as flat land or lakes, that might harm the signal. Portable transmitters, receivers, and antennas are spotted for field tests of prospective sites. Borings and soil samples tell what kinds of foundations are in order.

Cables are laid in open country by tractor-drawn plow trains. A 27-ton job, tagged the "Mickey Mouse," is the most powerful type in use. This monster's hydraulically controlled plowshare can cut through almost any kind of terrain, feeding cable into the ground and filling in the trench as it moves ahead.

In cities, on the other hand, or under highways and railroads, the cable is generally placed in a conduit or pipe. Sometimes it must be run over bridges. Or, at river crossings where there are no bridges,

the cable may be laid by barges and dredges using high-pressure water jets to trench it in the stream bed.

Aside from consideration of local problems, the telephone companies think it is just plain good sense to use both radio relay and coaxial cable, instead of putting all their eggs in one basket, since a disaster that affects one system isn't likely to harm the other. This way, there is a good chance that an alternate route will always be available should something go wrong with the prime channel.

And if this belt-and-suspenders approach is important under everyday conditions, from the viewpoint of national defense it could be a matter of life and death. —30—

The 27-mc. Citizens Band

(*Continued from page* 70)

license to be sent to you by the FCC before you transmit. If you are building your own transceiver you must be very careful not to exceed the FCC's maximum power input limitation, or the allowable transmitting crystal tolerance, which is .005% or less. Citizens frequencies, like all others, are monitored by the FCC, and if you don't stick to the rules you'll bite off a big chunk of trouble with your Uncle Sam.

A copy of Part 19 of the FCC Rules will give you complete information on Citizens Band do's and don't's, and you are required to have a copy of Part 19 *before* you apply for your license. It's available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for 10 cents in coin. Specify that you want the edition which became effective on September 11, 1958. (See the article entitled "Tips for Citizens Band Applicants" in the August issue for the complete story.)

You may want to put a transceiver in your car and one in the house, store, or office. The rigs are darn handy for use between buildings on a farm, on hunting or fishing trips, for just chewing the fat with your cronies, or 1001 other uses.

Most of the available equipment is designed to work from 6 or 12 volts d.c., in addition to 110 volts a.c. In other words, the Class D Citizens Radio Service covers a satchel-full of communications needs, and offers the DX'er some choice morsels. Why not get on the air yourself in time for the coming DX season? —30—

He Did It With Mirrors

(*Continued from page* 95)

dream wherein tons of green, green money were being shoveled to me by the buyers of The Kohler Home Solar Power System —I awoke to find a wife gone mad with fear, hysterically mouthing tiny sounds of terror and clawing at my shoulder.

"What is it?" I hollered, leaping to my feet. *"What's WRONG?"*

She jibbered, pointing spiritedly to the window.

I glanced out to see a cherry-red steel tower atop which a metal housing glowed incandescently white! The Solar Power System was melting itself! *Worse, it was taking a utility company's transformer*—also glowing a beautiful, horrible orange-ish—*right along with it.*

"Quick!" I shrieked, hurling myself through the doorway and sprinting into the yard. "We've got to break those heliostat mirrors and cut off the destructive power of the sun's rays! *Throw rocks, throw rocks!"* I scooped up a handful of stones and began feverishly pelting them at the parabolic mirror high above.

"Try killing it with a stick!" howled the wife, whose terror had—at the sight of anguished me destroying my own device—vanished into pure, sadistic good humor. "I knew *something* had to be wrong!"

I was far too busy, lobbing rocks, to attempt any kind of reply. . . .

After all the fire department trucks, the police cars and the horde of several hundred morbidly curious bystanders had departed, I stood beside the wife and sadly contemplated the twisted remains of the steel tower. Frequently, I glanced at the fire-citation slip clutched in my hand. Finally, I risked a glance up to the charred, badly melted utility company's transformer. The thought of what the replacement charges would be chilled the marrow and stunned the mind. I shuddered, and turned my eyes away.

"Got any notion what happened?" inquired the most callous-minded wife in the world.

"Somehow . . . in some way, that whole mechanism managed to become what amounted to a *solar furnace.* Maybe it was the tracking mechanism that failed to function. Or maybe I went, unknowingly, into error when I courageously made the mirror modifications. Either way—" I broke off, fighting back a strange urge to beat my head against the bricks of the barbecue pit.

. . . "Got any notion what happened?" inquired the most callous-minded wife in the world . . .

"Some furn-ace, eh, kid!" jibed the cruelest wife in the whole, wide world. "Well, it's back to blowing fuses with the garden variety electricity supplied by those villains down at the power company!"

I ventured another horrified glance at the maimed transformer upon which temporary repairs had been made until a new one could be installed.

"What a *bill,"* I whispered hoarsely, *"that's* going to be!" —30—

Among the Novice Hams

(*Continued from page 90*)

that DX is always weak. A better cue is the fluttery sound that many DX signals acquire in their long journey through the ionosphere.

A good DX man hears far more DX than he calls. For example, if he hears a strong "G" (England), and he has already worked England, he may pass it by to listen for new countries from that area. He knows that they should be coming through, too, and he could miss a new country while working an old one.

He also knows that a strong DX signal will attract many DX'ers, and while they are busy with it, he may be able to locate and call a rarer station. This can be a big advantage, because it is usually competition, rather than the inability to put a signal on the DX station's receiving antenna, that prevents you from getting through.

Keep an ear on what other Novices are working. By doing so, you can frequently locate DX they are working when they stand by.

Calling DX. No matter how you locate a DX station, you will be lucky to raise it on your first call. More often than not, you will have to call, wait for the DX'er to sign with the station he answers, and call again,

JAMBOREE-ON-THE-AIR

The Boy Scouts International Bureau in Ottawa, Canada, has announced the Second Annual Jamboree-on-the-Air, from 0001 GMT October 23 to 2400 GMT October 25, 1959.

Members of the Boy Scouts who are radio amateurs are invited to participate, exchanging Scouting greetings and messages. This is not a contest and there is no prescribed exchange. Operations will be on authorized amateur bands.

The International Bureau will operate a station and will QSL all contacts with a special

card. The "Boys' Life" Radio Club station, K2BFW, will also send special QSL's to all stations worked and to SWL's submitting reports.

and again, and again. A ham with a good DX record is a patient man!

Many DX station operators, like most Novices, tend to listen near their own frequencies for calls; therefore, the closer you can get to the DX station's frequency, the better your chance of raising it will be. This makes a good supply of crystals a good investment for a Novice DX'er. But don't assume that a DX operator is replying to stations on his own frequency simply because you hear many stations calling on that frequency. More careful listening may reveal that he is actually replying to calls on different frequencies.

But if the DX'er is actually listening only on his own frequency, your best chance of making contact is to get in there and call each time the DX'er signs with another station along with the rest of the pack.

A good operator does not call the DX station until both stations involved have sent their final SK's. He does not "tune up" on the frequency for long periods at a time. After he works the DX station or gives up hope of doing so, he does not call a long CQ or start chatting with a station across town on that frequency. The poor operator or "lid" never seems to stop calling the DX station, no matter who is transmitting. This may be why he seldom raises the DX, which makes him so mad that he indulges in unsportsmanlike conduct.

CQ DX? Most DX men agree that CQ DX by low-power U. S. amateurs is an inefficient way to raise foreign DX, but you may want to learn it for yourself.

AN EFFECTIVE S-METER

On page 90 is the diagram of an S-meter circuit that can be employed with any shortwave receiver which has a.v.c. A 1-ma. d.c. meter is used and the unit is built into a Bud CM-1935 meter box.

To adapt your receiver for the S-meter, examine its circuit diagram to locate a tube on the a.v.c. line. Connect the S-meter circuit in series with the B+ lead to that tube. The first i.f. tube is a good choice. Assuming it is the tube chosen, disconnect the B+ lead from the second i.f. transformer and connect the B+ lead to the Y terminal of the S-meter circuit. Then, connect the X terminal of the S-meter circuit to the i.f. transformer terminal. Connect $R4$ to the common receiver ground.

In the Heathkit AR-3 receiver, the B+ terminal of the second i.f. transformer

serves as a common tie point for several B+ connections. To use the S-meter with it, I moved these connections to the B+ terminal of the accessory socket. I then connected the Y terminal of the S-meter circuit to this point and its X terminal to the i.f. transformer terminal. I also bypassed the transformer terminal to chassis with an additional .005-μf. capacitor.

To adjust the meter, short the receiver antenna terminal to ground, advance the sensitivity control to maximum, and turn the BFO off. Adjust *R1* for zero meter reading. Unshort the antenna and adjust *R2* so that only the very strongest signals will "pin" the meter. *R2* may be omitted if desired. Opening *S1* removes the meter from the circuit.

News and Views

Bob Mindell, WV6DIQ, 11235 Covello St., Sun Valley, Calif., excites a "Demi-Quad" antenna (described in POPULAR ELECTRONICS, January, 1958) on 15 meters with a WRL Globe Chief transmitter, and he receives with a Hallicrafters SX-99. He has worked 18 states; Massachusetts is his best DX. Bob offers to help prospective amateurs get their licenses. . . . . In five weeks, **Bob Myers, KN3HWL,** Meadville, Pa., has made 150 contacts in 15 states on 80 and 40 meters. He uses a Heathkit DX-20 transmitter to feed an all-band "trap" antenna about 30' high. He receives with a Hallicrafters SX-99, to which he has added a Q-Multiplier for additional selectivity. KN3HWL would like to arrange a contact with a member of the Rag Chewer's Club, so that he can earn an RCC certificate for himself. . . . . **James Crouse, K4SET,** 10 East Parrish, Statesboro, Ga., now has his General Class license. His WRL Globe Chief 90A transmitter and his Hallicrafters S-53A have accounted for some good DX recently, too, including England, Yugoslavia, Germany, Japan, and Scotland. Jim operates some on 20 meters, but 40 meters is still his favorite band.

Don Maase, KN5SUO, 9433 Parsifal Place N.E., Albuquerque, N. M., has made three contacts a day spread over nine states in his 21 days on the air. He uses a Heathkit DX-20 transmitter to feed a Mosley 40-through-10-meter vertical antenna mounted on the house roof. Don is proud of his home-built receiver. His pet peeve is hams who neglect to put any spacing between letters and words in their sending. He requests a little help with General Class theory. . . . . **Tommy Murphy, KN5UKH,** Route 1, Kosciusko, Miss., has worked 22 states on 40 meters in his first two weeks on the air. He feeds a dipole antenna about 35' high with a 50-watt transmitter of his own design, and receives with a SX-99. See Tom if you need a Mississippi card. . . . . **Benny "Chip" Thomas, KN4ZEP,** 313 North Sterling St., Morganton,

HELP US OBTAIN OUR HAM LICENSES

K1/W1 CALL AREA

Dave Waycie, 57 Newington Rd., Elmwood 10, Conn. Phone: AD 3-1670. (Code, theory and regulations)

Philip Brady, Jr., 60 Park Ave., Needham Heights 94, Mass. (Code, theory and regulations)

Lorraine Chaulk, 617 E. 7th St., South Boston, Mass. (Code and theory)

K2/W2 CALL AREA

Jim McLellan, 20 Ridgewood Pkwy. W., Denville, N. J. Phone: OA 7-7132. (Code and theory)

Erwin P. Cohen, 3962 Walkow Ave., Seaford, N. Y. Phone: SU 5-9231. (Code)

Thomas Doolittle, Sharon Springs, N. Y. (Code and theory)

Robert W. Myers, 25 Harding St., Copiague, N. Y. Phone: AM 4-5622. (Code and theory)

Ronald J. Kuhl, 121 Kramer Dr., Lindenhurst, N. Y. Phone: TU 8-9274. (Code and theory)

James White, 2375 First Ave., New York 35, N. Y. (Code and theory)

Kenneth Fee (13), 848 Elizabeth Ave., Elizabeth 4, N. J. Phone: EL 3-0702. (Code, theory and regulations)

Richard C. Factor, 115 Central Park West, New York 23, N. Y. Phone: SC 4-5673. (Code)

Thomas A. Gundlach, 2 Hopes Ave., Holtsville, N. Y. (Code, theory and selection of equipment)

Jim Tweedle, 501 Oxford St., Vineland, N. J. Phone: OX 1-4571. (Code)

Paul Adler, 2232 Brigham St., Brooklyn 29, N. Y. Phone: NI 6-1101. (Code)

Richard W. Reynolds, 14 Longview Rd., Livingston, N. J. (Code, theory and selection of equipment)

K3/W3 CALL AREA

Carl Sacherich, Jr. (16), 418 Seddon Ave., N. Braddock, Pa. Phone: BR 1-7330. (Code and selection of equipment)

Joseph Zelezniak (15), 1034 Sixth St., N. Braddock, Pa. Phone: BR 1-2087. (Code and selection of equipment)

Mickey Kirkell, 181 N. Spring St., Blairsville, Pa. (Code and theory)

K4/W4 CALL AREA

L. L. Womack, Jr., 39 Park Ave., Brevard, N. C. (Code and theory)

Moran Graham, Tilford, Ky. (General Class theory)

Philip Walker, 1501 Waverly Ave., Charlotte 3, N. C. (Code, theory and regulations)

Horace Monroe, 400 N. 33rd St., Richmond 22, Va. (Code and theory)

Sam S. Wright, 514 N. Monroe St., Arlington 1, Va. (Code, theory, regulations and selection of equipment)

David H. Butler, Rippon Lodge, Woodbridge, Va. Phone: GY 4-4004. (Code, theory and selection of equipment)

Kenneth Helton, Route #1, Vinemont, Ala. (Code, theory, regulations and selection of equipment)

Andre Hansen, 1504 Peachtree Circle, Jacksonville 7, Fla. (Code and theory)

Craig Littlejohn, 4564 Rosewood Ave., Jacksonville 7, Fla. (Code and theory)

K5/W5 CALL AREA

Lynn Dale Brooks, 2500 37th St., Snyder, Tex. (Code, theory and selection of equipment)

David F. Tyndell, 513 E. Layton St., Kilgore, Tex. (Code, regulations and selection of equipment)

Clarence Perry, Route #2, Madill, Okla. (Code, theory and regulations)

John W. Daut, Route #2, Box 1061, Humble, Tex. (Code and regulations)

Alex Galbraith, 1710 McCall Rd., Austin 3, Tex. (Code, theory and selection of equipment)

K6/W6 CALL AREA

Joseph Yelda, 2257 Holly Dr., Hollywood 28, Calif. Phone: HO 9-4233. (Code)

Michael J. P. Dooley, 454 65th St., Oakland 9, Calif. (Code, theory, regulations and selection of equipment)

Michael Flynn, 2830 Harmony Place, La Crescenta, Calif. Phone: CH 8-2549. (Code and theory)

Dan Scanlan (16), 4579 W. 171st St., Lawndale, Calif. (Code, theory and selection of equipment)

K7/W7 CALL AREA

Pete Almada, 1328 E. 13th, Tucson, Ariz. Phone: MA 2-2496. (Code and theory)

Eric Lundberg (14), 2316 E. 110th St., Seattle 55, Wash. (Code and selection of equipment)

K8/W8 CALL AREA

Robert Morgan (14), 6317 Stratford Dr., Parma Heights 30, Ohio. (Theory and selection of equipment)

Ken Kozel (16), 13466 Eureka, Detroit 12, Mich. Phone: TW 2-5662. (Code and selection of equipment)

Mike Bockoff, 666 W. Maplehurst, Ferndale 20, Mich. Phone: LI 2-6307. (General code, theory, regulations, and selection of equipment)

K9/W9 CALL AREA

John Walasewich, 4029 W. Warwick Ave., Chicago 41, Ill. (Code, theory, regulations and selection of equipment)

Jerry Kelley (16), R. R. 3, Box 103-B Applegate Lane, Jeffersonville, Ind. Phone: BU 2-3137. (Code)

Tom Lanham, 765 Indiana St., Gary, Ind. (Code, theory and selection of equipment)

KØ/WØ CALL AREA

James Crooks, 6606 Hoffman, St. Louis 39, Mo. (Theory and selection of equipment)

Robert J. Nobis, Jr. (16), 1316 13½ St. N., Moorhead, Minn. Phone: CE 3-5548. (Code and theory)

VE AND OTHERS

Melville C. Coffin, P. O. Box 882, Mission City, B. C., Canada. (Code, theory and regulations)

Dennis Madokoro, 209 10th Ave., No. Port Alberni, B. C., Canada. (Code, theory and selection of equipment)

Louis Bouvier, Cote Noir Rd., St. Hubert, Quebec, Canada. Phone: CR 6-2482. (Code and theory)

Donald Druick (13), 261 Sheraton Dr., Montreal 28, Quebec, Canada. (Theory, regulations and selection of equipment)

Ian Hodgson, 64 Malcolm Circle, Dorval, Quebec, Canada. (Code, theory, regulations and selection of equipment)

N. C., has made 20 watts input to his Heathkit AT-1 "antenna heater" and a single 40-meter crystal sufficient for over 100 contacts. His receiver is a National NC-183D, which works excellently except that the BFO jumps around a bit at times; he will welcome any suggestions on how to find the trouble.

Mike Eilers, KN8OOK, 2533 Leahy St., Muskegon Heights, Mich., worked three Generals for his first three contacts. Now, after a week on the air, he has become a DX-chaser. Mike runs 40 watts to a home-built transmitter and listens with a Hallicrafters receiver, model not specified. He does both with the aid of a 40-meter dipole antenna. . . . . From the rare state of Delaware, **Tom H. Weslager, KN3GKD,** 601 South Maryland Ave., Wilmington, offers to schedule anyone needing his card for WAS (worked all states). Tom operates on 7199.5 kc., using a Heathkit DX-20 transmitter to feed a 40-meter dipole through a pair of balun coils. He receives with a Hallicrafters S-53A. In seven months on the air, Tom has worked 37 states, all confirmed, and three WP4's (Puerto Rico). . . . . **Bruno "Butch" Wizolek, KN9QPA,** 3404 N. Keeler Ave., Chicago 41, Ill., runs 75 watts to a WRL Globe Chief 90 transmitter. He has two antennas, a WRL 12AV vertical and a 40-meter dipole. In a month on the air, Butch has worked Australia, England, Switzerland, and Poland, plus many U.S. stations. He is also an avid SWL'er, having heard both Sputnik I and the U.S. Army's "Moon-Bounce" signals.

Marilyn J. Baer, KN4FLW, P.O. Box 553, Andrews, N. C., had had her license for exactly three weeks when she wrote us. In that time, she had made 48 contacts in 30 states, 13 states already confirmed! In setting this record, Marilyn called only two CQ's! She says, "I have a lot of patience, and I do a lot of listening." Marilyn operates on 40 meters only, running 65 watts to a WRL Globe Scout transmitter, which feeds a Windom antenna. She listens on a Hammarlund HQ-160 receiver. Incidentally, her husband is K4YBQ. . . . . **Nasir, 9K2AN,** Kuwait, Arabia, mentioned earlier, has worked 33 states and 88 countries on c.w. and 66 countries on phone in 15 months on the air. During 1958 he used a Heathkit DX-35 transmitter running 50 watts and an AR-3 receiver. In January he switched to a Harvey-Wells T-90 transmitter at 90 watts input and a Hallicrafters SX-101 receiver. He uses dipole antennas.

Mark, WV2CYZ, 53-31 Marathon Parkway, Little Neck 62, N. Y., calls his antenna a "76-foot mess," which may explain why he has worked only three states in a month on 40 meters. . . . . **R. M. Saltzman, WV2BWC/WA2BWC,** 1 Vista Drive, Great Neck, N. Y., claims that it is grammatically correct for him to say, "*We* at WV2BWC use a National NC-109 receiver and a WRL Globe Scout transmitter at 65 watts feeding a long-wire antenna or a 15-meter dipole," because his brother Rick (11) passed his Novice exam 55 days ago. Bob's record is 40 states and 20 countries confirmed.

Until next month, when I hope to hear from you, 73,

Herb, W9EGQ

Short-Wave Report

(*Continued from page 99*)

The following is a resume of the current reports. All times are Eastern Standard. Stations may change frequency and/or schedule with little or no advance notice; however, all reports given here are correct at the time of compilation.

Please remember to send all your reports to P.O. Box 254, Haddonfield, N. J., from now on.

Andorra—*R. Andorra* has definitely moved from 5979 kc. to 5991 kc. and is noted at 1640 with classical music and Spanish. The ID is *Aqui Radio Andorra*. (*WPE3NF*)

A new outlet, known as *Andorradio*, was noted on 6306 kc., close/down at 1700 with French and Spanish ID. Another report lists this station as being noted from 0500 to 0700. However, according to *World Radio Handbook*, it operates only on 3145 kc. (*WPE3NF, WPE4FB, WRH*)

Angola—According to a verification, the correct call for the *Emisora Oficial* outlet on 17,795 kc. is CR6RZ, not CR6SF. This Luanda xmtr operates with 10-kw. power to a rhombic antenna. (*URDXC*)

Argentina—LRA33, *R. Nacional*, Buenos Aires, carries Eng. to Europe at 1800-1900 on 15,345 kc. Portuguese begins at 1900. (*WPE4EB, WPE8FV, WPEØJJ*)

The *R. Nacional* Mendoza outlet on 6180 kc., LRA34, 10 kw., is scheduled from 0700 to 2300. (*WRH*)

Australia—Changes have been made recently in the *R. Australia* xmsns to S. Asia and N. E. Asia. Broadcasts now go to S., S. E., & S. W. Asia at 1714-1830 on 15,210 kc., 1714-0415 on 21,540 kc., 1815-0230 on 17,840 kc., 0129-0445 and 1915-1930 on 15,160 kc., 0459-1230 on 9580 kc., 0800-0830 and 0930-1230 on 7220 kc., 0800-1230 on 11,710 kc., and 0930-1000 on 11,740 kc.; to N. E. Asia and N. Pacific Islands at 1559-1800 on 15,240 kc., 0244-0700 on 11,740 kc., 0459-0900 on 15,160 kc. All of these xmsns are in English. (*WPE9DN, HB*)

VLX15, Perth, 15,425 kc. (new frequency), is heard weakly at 2228 with dance music. (*WPE3NF*)

Brazil—*R. Marajoara*, Belem, 15,245 kc., is a new station that has been testing around 1600. PRG9, *R. Nacional de Sao Paulo*, Sao Paulo, has moved from 6125 kc. to 6115 kc. and is heard well at 1930-2030. (*WPE4FI, WPE9KM*)

PRG3, *R. Tupi*, Rio de Janeiro, 15,370 kc., will make special tests in Spanish, French, and Eng. with 100-kw. power. (*AR*)

The call-signs for the *R. Rural Brasileira*

MONITOR CERTIFICATES

Applications for Short-Wave Monitor registration certificates and call letters are pouring in thick and fast. If you haven't written for yours yet, you'll find an official application form on page 129, this issue. Make sure you include a dime. This project will be of most value to SWL's when everyone is registered.

outlets are ZYZ31 (6062 kc.) and ZYZ32 (15,105 kc.). *R. Progresso*, Sao Paulo, 4775 kc. (reported on 4755 kc.), is now ZYR81. There are two stations reportedly operating as *R. Guaruja:* one on 5975 kc., Florianopolis; the other on 5985 kc. giving the ID *R. Guaruja Paulista*. The former is ZYJ7, and the latter is ZYT7. (*WRH*)

Cameroon—*R. Douala*, formerly on 6115 kc., has moved to 6184 kc. and is tuned at 0100 with French and a very poor signal. (*WPE3NF*)

Canada—CKFX, Vancouver, 6080 kc., listed as 10 watts, is a real challenge for DX'ers. Try for it around 0300 with news, 0305 with pop records, 0320 with CKWX Headlines. (*DXRA*)

CFVP, *Voice of the Prairies*, Calgary, 6030 kc., is another rarely reported station. It carries Eng. to the N. W. Territory from 0830 to 1200. (*DG*)

Radio Canada offers a program guide monthly. Send your request to the International Service, P. O. Box 6000, Montreal, Canada. (*DH*)

Ceylon—The Commercial Service of *R. Ceylon*, 15,265 kc., continues to be well reported in its S. Asian "Early-Morning" show at 2030. Catch the tuning signal from 2025 and "Strike Up The Band" at 2030. (*GK*)

Radio Ceylon relays the *VOA* on 6075 kc. at 0700-1300. (*DW*)

China—Chinghail, 9457 kc., is heard in native language at 0700-0900. Other Peking stations have been noted on 11,820, 11,975, and 9064 kc. at the same time, and on 9620 kc. at 0905. (*WPE6AA*)

SHORT-WAVE ABBREVIATIONS

BBC—British Broadcasting Corp.
B/C—Broadcasting
Eng.—English
ID—Identification
kc.—Kilocycles
kw.—Kilowatts
R.—Radio
s/off—Sign-off
s/on—Sign-on
VOA—Voice of America
xmsn—Transmission from station
xmtr—Transmitter used by station

Congo Republic—*R. Brazzaville*, 21,500 kc. (new), is noted at 0830-1015, dual to 17,720 kc. English news is given at 0930. (*WPE4FI, WPE6AA*)

The 11,725-kc. outlet can be heard in Eng. at 1730-1755 for Africa and Asia and at 2015-2100 for N. & S. America, dual to 11,970 kc. They are reportedly doing their verifying with new cards. (*PB*)

Costa Rica—TIDCR (reported also as TIRICA), San Jose, 9620 kc., is using two slogans: *La Voz de la Victor* and *R. Internacional de Costa Rica*. It was checked around 2110. (*WPE4EB, WPE9KM*)

TIQ, *R. Casino*, Puerto Limon, 5960 kc., is noted with Latin and American music at 0030-0102. (*WPEØJJ*)

Cuba—COBZ, *R. Salas*, Havana, has been varying from 9025 kc. to 9030 kc. and as high as 9068 kc. It is audible from 1830 to 0000 with good signals. Programs are mostly music,

commercials, and announcements in Spanish. The medium-wave outlet on 830 kc. is often heard during the evenings in northern states. (*WPE9DK, WPEØAE*)

COCY, *R. Rebelde*, Havana, has moved from 11,750 kc. to 6450 kc. and is heard at 1900-0000. (*WPE4FI*)

Dominican Republic—HI8Z, *R. Santiago*, Santiago de los Caballeros, has moved from 6140 to 6075 kc. and is noted around 2000 with music and commercials. (*WPEØJJ*)

Ecuador—*Ondas del Volante*, Azogues, 6140 kc., has been monitored at 2200-2230 with nonstop Latin and old American jazz, and to 2259 with Andean music. Two ascending chimes were noted at 2259 followed by a brief vocal selection. The s/off was at 2302. (*DXRA*)

Germany—*Deutsche Welle*, Cologne, 11,795 and 9640 kc., has Eng. at 2130-2150 daily. English/German lessons begin at 2140. (*WPE2AIQ*)

Write Us Again!

Your Editor would like to get in touch with the following readers but return addresses were not included with their letters:

Jack Carr	Ray Myers
Gordon Levine	Curtis Schild
Lawrence Luser	Tom Watson
Fritz Markworth	

India—Madras is operating on 15,365 kc. (new) at 1845-1915 with programs in Tamil. (*WPE4FI*)

Israel—Israel B/C Service, Jerusalem, has been testing on 11,845 kc. at 1600 and urgently requests reports. (*WPE8GB, WPE9KM*)

Ivory Coast—Abidjan has been found on 7215 kc., dual to 4940 kc., at 1730 with final ID in French. This one is only 1 kw. but the signal is good. The schedule has apparently been extended. (*WPE3NF*)

Malaya—BBC Far East Station, Singapore, 9690 kc., is tuned from 1115 to 1147 s/off with program details, commentary, and forum. (*WPEØAE*)

Netherlands—*R. Nederland*, Hilversum, operates in Eng. to N. A. at 1615-1655 (except Sundays) on 17,775, 15,220, and 11,730 kc., and at 2130-2210 (except Sundays when "Happy Station Program" is broadcast) on 11,730, 9590, 6025 kc. (*WPE2AIQ, WPE9DN, WPE9LF, WP*)

New Zealand—ZL2, Wellington, 9540 kc., is heard well at 0100-0300 with music and news in English. (*WPE5CN*)

Panama—HP5J, *La Voz de Panama*, Panama City, 9606 kc., has returned to the air after a long absence. It was noted at 0700 and from 2000 to 2205/close. Announcements are all Spanish. (*WPE3HP, WPE4EB, WPE4FI*)

HOLA, Colon, 9505 kc., can be tuned at 2115-2215 with music programs and many commercials. (*MS*)

Peru—OAX4T, *R. Nacional del Peru*, Lima, has moved from 15,130 to 15,152 kc. and is noted at 1600-0000. (*WPE4FI*)

Portugal—*R. Lisboa*, Lisbon, 17,895 kc., has Eng. news at 1248-1255; music follows to 1300/close in English. (*DXRA*)

Portuguese Guinea—CQM, Bissau, has been noted on 7948 kc. with male and female vocals at 1751-1759. The ID followed and the anthem was presented from 1800 to 1802 s/off. The 3974-kc. channel is inactive. Present schedule: 1600-1800 daily; 0800-0900 Sundays only. (*WPE1BM*)

Solomon Islands—VQO2, Honiara, Vavaya Ridge, 5960 kc., is being heard well from 0259 s/on to 0535 s/off; children's show at 0300, request records at 0330, BBC news at 0415, local news at 0430. (*WPE7AT, WPEØJJ, MK*)

Tibet—According to information from two broadcasting operators living in Northern India, no regular broadcasting service exists in Tibet. Only a Chinese Army xmtr is active from time to time near Lhasa, and that station varies between 9210 and 9245 kc. (*WRH*)

Tunisia—Tunis is not currently operating on the short waves. An Arabic station noted on 7110 kc. at 0145-0300 may be Rabat, Morocco, 7111 kc., actually scheduled to operate to 0400. Another Arabic station noted on 4810 kc. is the fifth harmonic of Tunis on 962 kc. (*URDXC*)

USA—The Dept. of Commerce, National Bureau of Standards, is conducting a survey of users of the technical radio broadcast services of WWV and WWVH. For a questionnaire, write to F. W. Brown, Director of Boulder Laboratories, Boulder, Colorado. (*DH*)

SHORT-WAVE CONTRIBUTORS

Jerry Berg (*WPE1BM*), W. Hartford, Conn.
Daniel Mersel(*WPE2AIQ*), Frenchtown, N. J.
Richard Morcroft (*WPE3HP*), Pittsburgh, Pa.
George Cox (*WPE3NF*), New Castle, Del.
Royston Lawson (*WPE4EB*), Murfreesboro, Tenn.
Maxey Irwin (*WPE4FB*), Sparta, Tenn.
Roger Legge (*WPE4FI*), McLean, Va.
Arno Feltner (*WPE5CN*), New Braunfels, Texas
Stewart MacKenzie, Jr. (*WPEoAA*), Long Beach, Calif.
Don Beebe (*WPE7AT*), Seattle, Wash.
Richard England (*WPE8FV*), Columbus, Ohio
Ken Boord (*WPE8GB*), Morgantown, W. Va.
Chris Pinn (*WPE9DK*), Lockport, Ill.
J. P. Arendt (*WPE9DN*), Aurora, Ill.
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Martin Schneider (*MS*), Watertown, N. Y.
Dan Wilt (*DW*), Barberton, Ohio
DX Radio Association (*DXRA*)
Universal Radio DX Club (*URDXC*)
World Radio Handbook (*WRH*)

Vatican City—*Vatican Radio* can be heard on 15,120 kc. from 1315 s/on to 1330 s/off, dual to 9646 and 11,685 kc. (*WPEØAE*)

Venezuela—YVKX, *La Voz de la Patria*, Caracas, is heard well in English on 3305 kc. at 2130-2230 with "Night Beat." The news is read at 2200. Jim Davission, announcer, requests that reports be sent to Apt. 2797, Caracas. (*AR*)

Utility—Standard frequency station BPV is presumed to be located in China, in or near Shanghai. Although it has been heard on 5000, 10,000, and 15,000 kc. for over a year, few details are actually known about this particular station. (*WRH*) —30—

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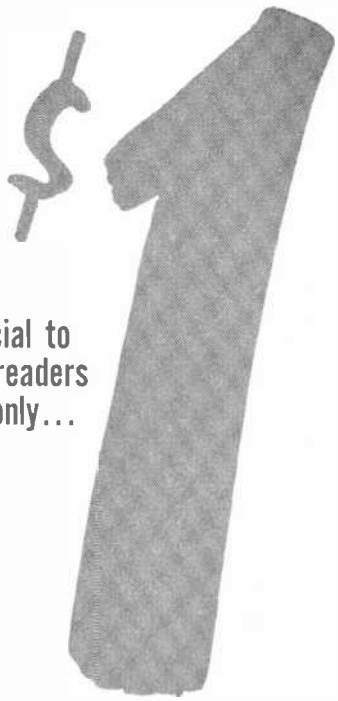

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Part 12, Section 12.231(a) of the FCC Rules is being amended as follows:

(a) The following tabulation indicates the frequencies and frequency bands, within the regularly allocated amateur frequency bands, which are available for use by stations in the Radio Amateur Civil Emergency Service. These frequencies and frequency bands may be used, on a non-exclusive basis (stations authorized in the Amateur Radio Service may also, pursuant to the provisions of Section 12.111, use these frequencies or frequency bands until such time as national conditions require discontinuance of regular amateur operations), by the classes of radio amateur civil emergency stations or units of such stations indicated, and only with the types of emission shown in the right-hand column.

(1) For use only by authorized stations or units of such stations which are operated under the direct supervision of duly designated and responsible officials of the civil defense organization:

Frequency band	*Authorized emission*
1800-1825 kc. (Note 1)	0.1A1, 1.1F1, 6A3
1975-2000 kc. (Note 1)	0.1A1, 1.1F1, 6A3
3500-3510 kc.	0.1A1, 1.1F1
3990-4000 kc.	0.1A1, 1.1F1, 6A3, 6F3

NOTE 1. Use of frequencies in the band 1800-2000 kc. is subject to the priority of the Loran system of radionavigation in this band and to the geographical, frequency, emission, and power limitations contained in Section 12.111 of the rules governing amateur radio stations and operators (Subpart A of this part). The use of these frequencies by stations authorized to be operated in the Radio Amateur Civil Emergency Service shall not be a bar to expansion of the radionavigation (Loran) service, and such use shall be considered temporary in the sense that it shall remain subject to cancellation or to revision, in whole or in part, without hearing, whenever the Commission shall deem such cancellation or revision to be necessary or desirable in the light of the priority within this band of the Loran system of radionavigation.

(2) For use by all authorized stations in the continental United States only: (Not available in Alaska, Hawaii, the territories or possessions of the United States.)

Frequency band	*Authorized emission*
3510-3516 kc.	0.1A1, 1.1F1
3516-3550 kc. (Note 2)	0.1A1, 1.1F1
3984-3990 kc.	0.1A1, 1.1F1, 6A3, 6F3
7097-7103 kc.	0.1A1, 1.1F1
7103-7125 kc. (Note 2)	0.1A1, 1.1F1
7245-7255 kc. (Note 2)	0.1A1, 1.1F1, 6A3, 6F3
14,047-14,053 kc.	0.1A1, 1.1F1
14,220-14,230 kc. (Note 2)	0.1A1, 1.1F1, 6A3, 6F3
21,047-21,053 kc.	0.1A1, 1.1F1

NOTE 2. The availability of the frequency bands 3516-3550 kc., 7103-7125 kc., 7245-7247 kc., 7253-7255 kc., 14,220-14,222 kc. and 14,228-14,230 kc. for use during periods of actual civil defense emergency is limited to the initial 30 days of such emergency unless otherwise ordered.

(3) For use by all authorized stations:

Frequency or frequency bands	*Authorized emission*
3997 kc. (Note 3)	0.1A1, 6A3
28.55-28.75 mc.	0.1A1, 6A3, 6F3, 6A4
29.45-29.65 mc.	0.1A1, 1.1F1, 6A3, 6A4, 40F3
50.35-50.75 mc.	0.1A1, 6A2, 6F2, 6A3, 6F3, 6A4
53.30 mc. (Note 3)	40F3
53.35-53.75 mc.	0.1A1, 1.1F1, 6A2, 6F2, 6A3, 6A4, 40F3
145.17-145.71 mc.	0.1A1, 1.1F1, 6A2, 6F2, 6A3, 6A4, 40F3
146.79-147.33 mc.	0.1A1, 1.1F1, 6A2, 6F2, 6A3, 6A4, 40F3
220-225 mc.	0.1A1, 1.1F1, 6A2, 6F2, 6A3, 6A4, 40F3

NOTE 3. For use in emergency areas when required to make initial contact with military units; also, for communication with military stations on matters requiring coordination.

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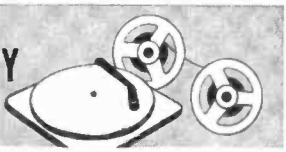

RECORDERS, Hi Fi. Free Wholesale Catalogue. Carston, 125-P East 88, N.Y.C. 28.

DISGUSTED with "HI" Hi-Fi Prices? Unusual discounts on your High Fidelity Requirements. Write Key Electronics, 120 Liberty St., New York 6, N. Y. EVergreen 4-6071.

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HIGHEST Trade-In Allowances Toward Ampex, Concertone, Crown, Ferrograph, Presto, Pentron, Components. Accessories. Catalog. Boynton Studio, 10-PE Pennsylvania, Tuckahoe, N. Y.

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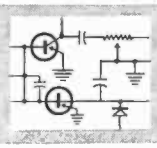

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SPECIAL offer, complete correspondence course in Radio, Electronics and Television. All new material. Only $49.50. Formerly sold for over $300.00. 44 books, over 2000 pages. Limited supply. For details write Dept. PE, Electronics Training, P. O. Box 764, Pittsburgh 30, Pennsylvania.

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SAVE High Fees. Apply for your patent yourself. New Kit now makes it easy. Free "Registration Form." Miss Clare Ardun, 806 Wm. Penn Annex, Philadelphia 5, Penna.

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INVENTIONS wanted. Patented: unpatented. Global Marketing Service, 2420 77th, Oakland 5, Calif.

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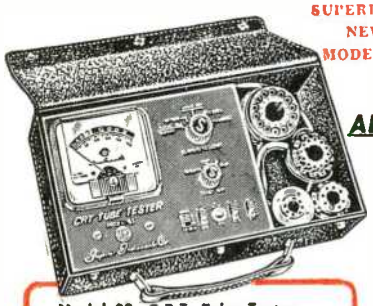
SUPERIOR'S NEW MODEL 83

C.R.T. TESTER

Tests and Rejuvenates ALL PICTURE TUBES



Model 83—C.R.T. Tube Tester
Total Price $38.50
Terms: $8.50 after 10 day trial, then $6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

ALL BLACK AND WHITE TUBES

From 50 degree to 110 degree types —from 8" to 30" types.

● Model 83 is not simply a rehashed black and white C.R.T. Tester with a color adapter added. Model 83 employs a new improved circuit designed specifically to test the older type black and white tubes, the newer type black and white tubes and all color picture tubes. ● Model 83 provides separate filament operating voltages for the older 6.3 types and the newer 8.4 types. ● Model 83 employs a 4" air-damped meter with quality and calibrated scales. ● Model 83 properly tests the red, green and blue sections of color tubes individually—for each section of a color tube contains its own filament, plate, grid and cathode. ● Model 83 will detect tubes which are apparently good but require rejuvenation. Such tubes will provide a picture seemingly good but lacking in proper definition, contrast and focus. To test for such malfunction, you simply press the rej. switch of Model 83. If the tube is weakening, the meter reading will indicate the condition. ● Rejuvenation of picture tubes is not simply a matter of applying a high voltage to the filament. Such voltages improperly applied can strip the cathode of the oxide coating essential for proper emission. The Model 83 applies a selective low voltage uniformly to assure increased life with no danger of cathode damage.

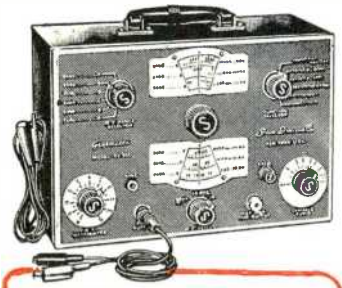
ALL COLOR TUBES

Test ALL picture tubes—in the carton—out of the carton—in the set!

Housed in handsome portable Saddle Stitched Texon case—complete with sockets for all black and white tubes and all color tubes. Only $38.50

Superior's New Model TV-50A GENOMETER

7 Signal Generators in One!



Model TV-50A GENOMETER . . .
Total Price $47.50
Terms: $11.50 after 10 day trial, then $6.00 monthly for 6 months if satisfactory. Otherwise return, no explanation necessary.

√ R.F. Signal Generator for A.M. *√ Bar Generator*
√ R.F. Signal Generator for F.M. *√ Cross Hatch Generator*
√ Audio Frequency Generator *√ Color Dot Pattern Generator*
√ Marker Generator

This versatile All-Inclusive GENERATOR Provides ALL the Outputs for Servicing:

A.M. Radio • F.M. Radio • Amplifiers • Black and White TV • Color TV

R. F. SIGNAL GENERATOR: The Model TV-50A Genometer provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilacycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: In addition to a fixed 400 cycle sine-wave audio, the Madel TV-50A Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

BAR GENERATOR: The Model TV-50A projects an actual Bar Pattern on any TV Receiver Screen. Patterns will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars.

CROSS HATCH GENERATOR: The Model TV-50A Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting, horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

DOT PATTERN GENERATOR (FOR COLOR TV) Although you will be able to use most of your regular standard equipment for servicing Color TV, the one addition which is a "must" is a Dot Pattern Generator. The Dot Pattern projected on any color TV Receiver tube by the Model TV-50A will enable you to adjust for proper color convergence.

MARKER GENERATOR: The Model TV-50A includes all the most frequently needed marker points. The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency).

The Model TV-50A comes absolutely complete with shielded leads and operating instructions. Only $47.50

USE APPROVAL FORM ON NEXT PAGE ▶

We invite you to try before you buy any of the models described on this and the following pages. if after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

NO INTEREST OR FINANCE CHARGES ADDED!

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

MOSS ELECTRONIC, INC. **Dept. D-655 3849 Tenth Avenue, New York 34, N. Y.**

TRY FOR 10 DAYS

before **you buy!**

then **if satisfactory pay in easy, interest free, monthly payments. See coupon below.**

Model 82A—Tube Tester
Total Price $36.50
Terms: $6.50 after 10 day trial, then $6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

Superior's New Model 82A

A truly do-it-yourself type

TUBE TESTER

TEST ANY TUBE IN 10 SECONDS FLAT!

(1) Turn the filament selector switch to position specified.

(2) Insert it into a numbered socket as designated on our chart (over 600 types included).

(3) Press down the quality button—

THAT'S ALL! *Read emission quality direct on bad-good meter scale.*

FEATURES:

• Tests over 600 tube types. • Tests OZ4 and other gas-filled tubes. • Employs new 4" meter with sealed air-damping chamber resulting in accurate vibrationless readings. • Use of 22 sockets permits testing all popular tube types and prevents possible obsolescence. • Dual Scale meter permits testing of low current tubes. • 7 and 9 pin straighteners mounted on panel. • All sections of multi-element tubes tested simultaneously. • Ultra-sensitive leakage test circuit will indicate leakage up to 5 megohms.

Production of this Model was delayed a full year pending careful study by Superior's engineering staff of this new method of testing tubes. Don't let the low price mislead you! We claim Model 82A will outperform similar looking units which sell for much more—and as proof, we offer to ship it on our examine before you buy policy.

Model 82A comes housed in handsome, portable, Saddle-Stitched Texon case. Only.... **$36.50 Net**

Model TW-11—Tube Tester
Total Price $47.50
Terms: $11.50 after 10 day trial, then $6.00 monthly for 6 months if satisfactory. Otherwise return, no explanation necessary.

Superior's New Model TW-11

STANDARD PROFESSIONAL

TUBE TESTER

• Tests all tubes, including 4, 5, 6, 7, Octal, Lockin, Hearing Aid, Thyratron, Miniatures, Sub-miniatures, Novals, Subminars, Proximity Fuse Types, etc.

• Uses the new self-cleaning Lever Action Switches for individual element testing. All elements are numbered according to pin-number in the RMA base numbering system. Model TW-11 does not use combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.

• Free-moving built-in roll chart provides complete data for all tubes. Printed in large easy-to-read type.

NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier detects microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRAORDINARY FEATURE

SEPARATE SCALE FOR LOW-CURRENT TUBES Previously, on emission-type tube testers, it has been standard practice to use one scale for all tubes. As a result, the calibration for low-current types has been restricted to a small portion of the scale. The extra scale used here greatly simplifies testing of low-current types.

Housed in hand-rubbed oak cabinet **$47.50 Net**

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CUT OUT AND MAIL TODAY!

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☐ Model 83 Total Price $38.50 $8.50 within 10 days. Balance $6.00 monthly for 5 months.

☐ Model 82A.. Total Price $36.50 $6.50 within 10 days. Balance $6.00 monthly for 5 months.

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Model 77—VACUUM TUBE VOLTMETER. . .Total Price $42.50
Terms: $12.50 after 10 day trial, then $6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

Superior's New Model 77

VACUUM TUBE VOLTMETER

WITH NEW 6" FULL-VIEW METER

Compare it to any peak-to-peak V. T. V. M. made by any other manufacturer at any price

• Extra large meter scale enables us to print all calibrations in large easy-to-read type.

• Employs a 12AU7 as D. C. amplifier and two 9006's as peak-to-peak voltage rectifiers to assure maximum stability. • Meter is virtually burn-out proof. The sensitive 400 micro-ampere meter is isolated from the measuring circuit by a balanced push-pull amplifier. • Uses selected 1% zero temperature coefficient resistors as multipliers. This assures unchanging accurate readings on all ranges.

AS A DC VOLTMETER: The Model 77 is indispensable in Hi-Fi Amplifier servicing and a must for Black and White and color TV Receiver servicing where circuit loading cannot be tolerated.

AS AN ELECTRONIC OHMMETER: Because of its wide range of measurement leaky capacitors show up glaringly. Because of its sensitivity and low loading, Intermittents are easily found, isolated and repaired.

AS AN AC VOLTMETER: Measures RMS values if sine wave, and peak-to-peak value if complex wave. Pedestal voltages that determine the "black" level in TV receivers are easily read.

SPECIFICATIONS

• DC VOLTS—0 to 3/15/75/150/300/750/1,500 volts at 11 megohms input resistance. • AC VOLTS (RMS)—0 to 3/15/75/150/300/750/1,500 volts. • AC VOLTS (Peak to Peak)—0 to 8/40/200/400/800/2,000 volts. • ELECTRONIC OHMMETER—0 to 1,000 ohms/10,000 ohms/100,000 ohms/1 megohm/10 megohms/100 megohms/1,000 megohms. • DECIBELS: −10 db to + 18 db, + 10 db to + 38 db, + 30 db to + 58 db. All based on 0 db = .006 watts (6 mw) into a 500 ohm line (1.73v). • ZERO CENTER METER—For discriminator alignment with full scale range of 0 to 1.5/7.5/37.5/75/150/375/750 volts at 11 megohms input resistance.

Comes complete with operating instructions, probe leads, and streamlined carrying case. Operates on 110-120 volt 60 cycle. Only..... $42.50

Model 79—Super Meter
Total Price $38.50
Terms: $8.50 after 10 day trial, then $6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

SUPERIOR'S NEW MODEL 79

SUPER-METER

WITH NEW 6" FULL-VIEW METER

A Combination VOLT-OHM MILLIAMMETER Plus CAPACITY, REACTANCE, INDUCTANCE & DECIBEL MEASUREMENTS Also Tests SELENIUM & SILICON RECTIFIERS, SILICON & GERMANIUM DIODES

The model 79 represents 20 years of continuous experience in the design and production of SUPER-METERS, an exclusive SICO development. It includes not only every circuit improvement perfected in 20 years of specialization but, in addition includes those services which are "musts" for properly servicing the ever-increasing number of new components used in all phases of today's electronic production. For example with the Model 79 SUPER-METER you can measure the quality of selenium and silicon rectifiers and all types of diodes — components which have come into common use only within the past five years, and because this latest SUPER-METER necessarily required extra meter scale, SICO used its new full-view 6-inch meter.

SPECIFICATIONS:

● D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500. ● A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 ● D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes ● RESISTANCE: 0 to 1,000/100,000 Ohms, 0 to 10 Megohms. ● CAPACITY: .001 to 1 Mfd., 1 to 50 Mfd. ● REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms. ● INDUCTANCE: .15 to 7 Henries, 7 to 7,000 Henries. ● DECIBELS: —6 to +18, +14 to +38, +34 to +58. The following components are all tested for QUALITY at appropriate test potentials. Two separate BAD-GOOD scales on the meter are used for direct readings. All Electrolytic Condensers from 1 MFD to 1000 MFD. All Germanium Diodes. All Selenium Rectifiers. All Silicon Diodes. All Silicon Rectifiers.

Model 79 comes complete with operating instructions, test leads, and streamlined carrying case. Use it on the bench—use it on calls. Only $38.50

TRY FOR 10 DAYS

BEFORE you buy! ***THEN*** if satisfacto

pay in easy, interest free, monthly payments. See coupon inside.

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