Service Series: What Puts Color in Color TV?

ELECTRONICS ILLUSTRATED®

By the Publishers of MECHANIX ILLUSTRATED SEPTEMBER 1969 50¢

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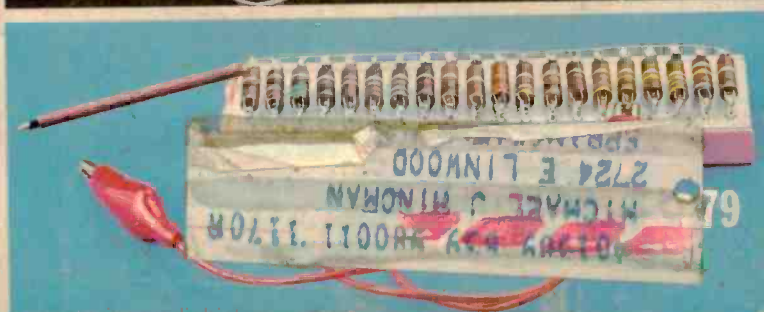

79

our money from NRI

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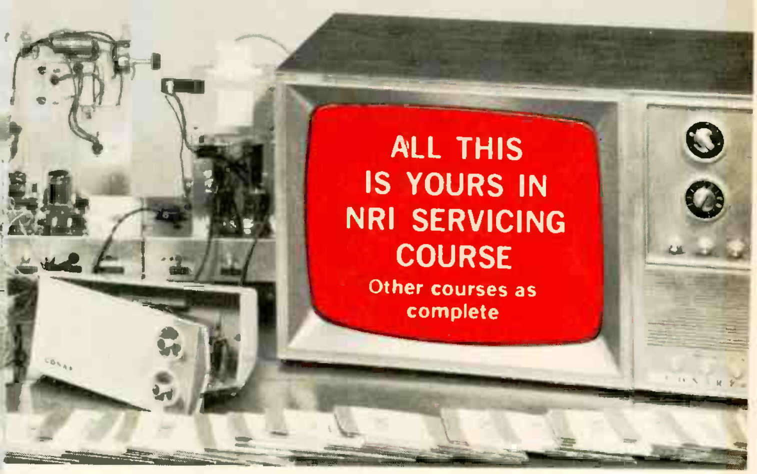

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RANDY ACERMAN, Camden, N.J., has his own TV service business. He is the official TV repair center for the Radio Shack store and Goodyear Tire Co. in his area. He says, "I have seen other schools' texts and most can't hold a candle to NRI lessons."

BERNARD SMOLKOVICH, Ft. Knox, Kentucky, is a Staff Sgt. with the U.S.A. Armor & Engineering Board. "Thanks largely to the NRI diploma I hold, I am a very successful and upcoming Communications Technician. My thanks to your fine staff for their unfailing assistance during my course."

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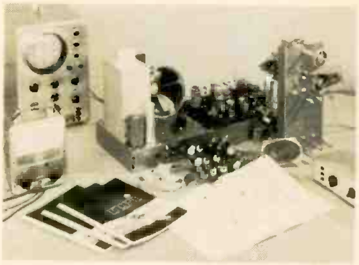

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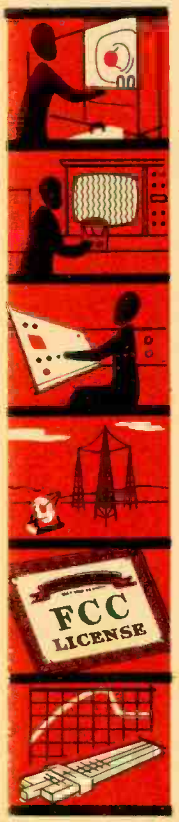

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A Fawcett Publication

September 1969 Vol. 12 No. 5

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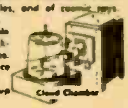

ATOMIC CLOUD CHAMBER WITH PROJECTOR ILLUMINATOR. See the vapor trails of alpha and beta particles, and of cosmic rays. **SPINTHARISCOPE.** Shows exploding atoms. **ELECTROSCOPE** — metal housed with **Scale** and **Magnifying Viewer.** Measures background radiation and tests sample sources. **SAFE RADIOACTIVE MATERIALS. Alpha Source** in handy container and Uranium Ore. **Full instructions and explanations open up the fascinating field of nuclear physics.**

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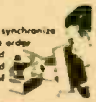

A **Neon Lamp** that flashes at intervals you can synchronize with the speed of rotating or vibrating objects in order to "freeze" their motion to permit close study and checking frequencies and RPM. Flashes are timed by a variable frequency oscillator with a range of 20 to 600 cycles per second.

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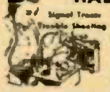

SIGNAL TRACER. A valuable trouble shooting tool which permits you to "listen in" as you probe through a faulty circuit until you find the trouble spot. **CONTINUITY TESTER.** Pin-points open circuits and test voltages. The use of both pieces fully described in accompanying manual, **"Simplified Radio and TV Servicing."**

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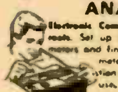
ANALOG COMPUTER


Electronic Computer multiplies, divides, calculates powers, roots. Set up the problem on the scales of two potentiometers and find the answer on the scale of third potentiometer as indicated by a sensitive meter. Instruction Manual covers computer theory and practical use. Over 150 sample problems and answers demonstrate use with fractions, trigonometry, logarithms, physics formulas, ballistics, etc.

MICROCRAFT LAB


Microprojector shows microscopic subjects enlarged with brilliant detail on wall or screen. Has sturdy Steel Cabinet, large Condensing Lenses for extra brightness, and a GE Projection Lamp. **Microscope** features Ramsden Eye piece for wide field viewing, Substage Light and Polarizing Filters. Magnifies up to 200X. Includes Slides, Cover Glasses and **Microscopy Manual.**

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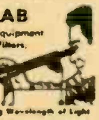
A practical **Transit. 6X erect image telescope with Range Finder Reticle for measuring remote distances and heights.** Vernier reading for both horizontal and vertical scales. Leveling Head with Thumb Screw Adjustment and Spirit Level. Clamps under head hold wooden legs of Tripod. (Legs not included.) **Instructions cover elementary surveying, range-finding.**

LIGHT AND OPTICS LAB


Exciting optical projects for the study of light. Equipment includes **five Precision Lenses, Prism, Polarizing Filters, Diffraction Grating, Mirror, Telescoping Tubing, Lens Mounts, Tube Holders and Brackets.** All the parts and instructions to build a Camera Obscura, Camera Lucida, Polariscope, and many other optical devices.

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30X erect image. Extends to 30" length. Five ground and polished **Lenses. Ramsden Eyepiece. Sturdy Equatorial Mount** makes it easy to follow the movement of heavenly bodies. Mount has fittings for wooden legs that complete the tripod (legs are regular 1x2 lumber not included).

PHOTOGRAPHY LAB


A PRECISION 35MM ENLARGER . . . horizontal type with twin condensing lenses and 3" F/L projection lens. Produces quality enlargements up to 8"x10". Contact Print Frame takes negatives up 3½"x4¼". 3 **Plastic Developing Trays, Neon Safelight, Tray Thermometer, Film Clips, Developing Chemicals, Printing and Enlarging Paper and Darkroom Handbook.** Make quality enlargements for 6¢. Make prints for only 3¢. Full instructions.

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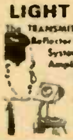

The **TRANSMITTER** consists of a **Light Source,** a **Modulating Reflector Diaphragm** and an Optical Projection System. The **RECEIVER** is a **Two-Stage Audio Amplifier,** controlled by a Photo-electric Cell that catches the projected light beam and causes the original sound waves to be reproduced in the headphone.

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Q. May members choose the order in which they receive their kits?

A. Yes. With the first kit members receive a list of the equipment and projects contained in each of the remaining eight kits. With this information they are able to choose the kit sequence that best suits their particular interest.

Q. Can members get their kits all at once instead of one-a-month?

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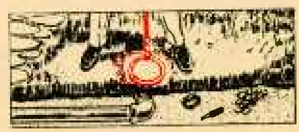

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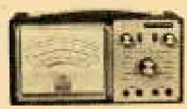
For all 6V/12V systems; 4, 6, 8-cyl. engines.



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CIRCLE NUMBER 6 ON PAGE 15

Feedback from Our Readers

Write to: Letters Editor, Electronics Illustrated, 67 West 44th St., New York, N.Y. 10036

● WATCH YOUR CRISIS!

I cannot help but comment on your May 1969 issue (RADIO'S CRISIS OF IDENTITY), as I take issue with some of your remarks. You say an FCC Commissioner is like a Justice of the Supreme Court, in that they never seem to leave office. Wrong. An FCC commissioner is appointed for seven years.

Also, you say that New York City has no fewer than 62 AM and FM stations. This statement is incorrect. There are exactly 35 AM and FM stations in New York, according to the FCC. You cannot consider surburban (or receivable) stations as being in New York City. These are licensed elsewhere. Actually, I can receive a total of 180 AM and FM stations in this area with my present equipment. This is three times your number!

Finally, you say: ". . . KADS (Los Angeles) recently has made itself the first radio station in the nation devoted exclusively to classified advertising." Your statement is quite out of date, as KADS gave up its classified ad format more than six months ago, changed its call to KOST-FM and went back to music programming.

Thomas R. Haskett
New York, N.Y.

● SQUAWK BOX

Happy days are here! At last I can get my pet parrakeet on the air with your Legal Broadcast Station (July '69 EI) and let my neighborhood hear some real talent. But what should I do if other parrakeet owners decide to get their own rigs and compete against me?

Charley Seebrook
Daytona Beach, Fla.

Start an underground network.

● FLIP, FLOP—YOU'RE DEAD

I have been a member of Community Radio Watch (July '69 EI) for some time and have been waiting for my moment of service. Last week not only did I contact the police but I captured a notorious bank robber as well.

Al Venturi
Lakeville, Conn.

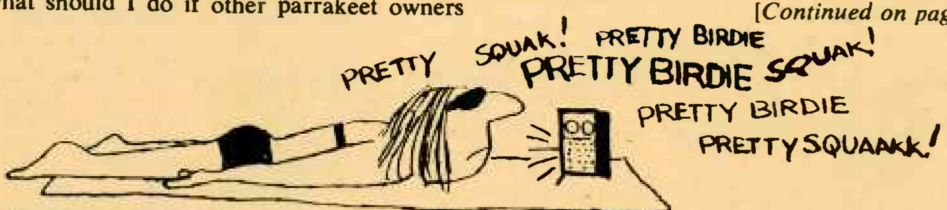
Was that a pepperoni, by any chance, Al?

● FIRST ON THE AIR

I am enclosing a letter from station CFCF in Montreal concerning the date they first went on the air. Also, you will find an answer to a letter I wrote station KDKA in Pittsburgh when I made an attempt to discover which was the first BC station on the air in North America. I think the correspondence speaks for itself so I would appreciate your publishing the letters.

Michael Hewton
Lafléche, Que.

[*Continued on page* 8]



Pat Powers, Computer Technology

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Please send free booklets and information about careers in electronics. I am interested in the following fields (check one or more).

- ☐ Nuclear Instrumentation Testing
- ☐ Automation
- ☐ Broadcasting/telecasting
- ☐ Radar
- ☐ TV-radio service

Name ____________________ Age ______

Address ____________________ Apt. ______

City ________ State ________ County ________ Zip Code ________

☐ Veterans: Check here. If you were discharged after Jan. 31, 1955, the "G. I. Bill" may cover the entire cost of your tuition. 118

Why don't you?

Accredited Member, National Home Study Council

DE VRY INSTITUTE OF TECHNOLOGY
4141 BELMONT AVENUE. CHICAGO. ILLINOIS 60641

ONE OF THE
BELL & HOWELL SCHOOLS

Feedback from Our Readers

Continued from page 6

In reply to your recent correspondence, enquiring about the date CFCF Radio station first went on the air, please be advised that our first transmission was in November 1919, and the call letters were XWA at that time.

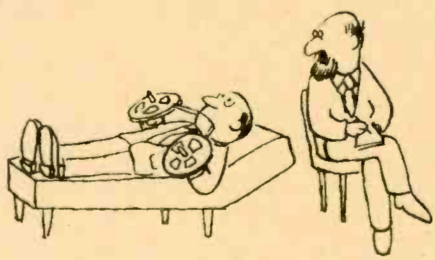
Prior to a regular program, we did experiments as early as 1918, but it was from a purely engineering and technical point of view.

Sam Pitt
Program Manager
Radio Station CFCF
Montreal, Que.

. . . KDKA was actually the first licensed broadcast station to operate in the United States. The first program was the results of the Harding-Cox presidential election of Nov. 2, 1920. This equipment had been operated by Dr. Conrad and the Westinghouse Electric Company as an amateur station, starting in 1916 with the call letters 8XK. . . .

T. C. Kenney
Chief Engineer
Radio Station KDKA
Pittsburgh, Pa.

FAST REWIND

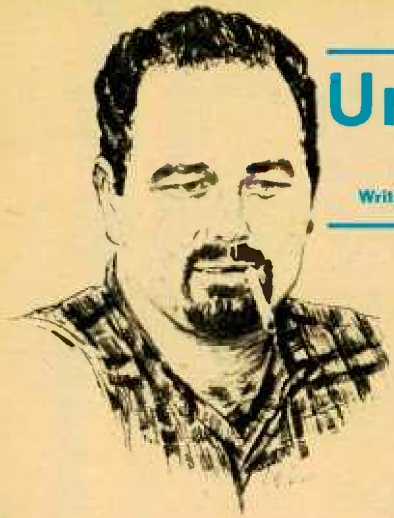


You will understand that the contents of this letter are confidential. One of my patients is convinced he is a tape recorder. I wonder if your Tape-Head Analyst (July '69 EI) could help him on the road to recovery? I've tried hypnosis and my head is still spinning.

Prof. Dr. H. Albrecht
Cincinnati, Ohio

When do you get out, Doc?

CIRCLE NUMBER 8 ON PAGE 15



Uncle Tom's Corner

By Tom Kneitel, K2AES/KQD4552

Uncle Tom answers his most interesting letters in this column. Write him at Electronics Illustrated, 67 West 44th St., New York, N.Y. 10036.

★ *During weather emergencies, how do the various offices of the U.S. Weather Bureau keep in contact with each other? Certainly they can't rely on telephones or regular teletype service. I've heard of a special radio network but nobody seems to have anything definite on it. Can you find out about this? I'd like to listen in when the hurricanes start whizzing by.*

Ted Osterman
Plantation Key, Fla.

The U.S. Weather Bureau operates 36 emergency radio communications installations which can be heard using SSB on the following channels (kc): 2776, 3363, 5925, 4977.5, 14792.

★ *Recently the Portland Police and Fire Departments added new UHF channels at about 400 mc. Can you find what they are and also let me know whether there are any directories which show police and fire department call signs and frequencies around the country?*

Robert Marton
Portland, Ore.

Portland's brand-new UHF PD channels are 460.05, 460.10, 460.20 and 460.25 mc, while the UHF channels are 453.80, 460.525, 460.55, 460.575, 460.60 mc. These are in addition to the nine other PD and FD channels which are in the VHF band. Police and fire station directories are published by the Communications Research Bureau, Box 56, Commack, N.Y. 11725. They offer a catalog if you send a 6¢ stamp.

★ *Here's a fine kettle of fish. I spent five hard-earned bucks at a ham-radio auction for a carton of 30 assorted radio tubes. They all turned out to be Western Electric special industrial types. They're new and mostly 350As and 403As. That, in itself, wouldn't be so bad except that I can't find these listed anywhere and Western Electric people can't (or won't) tell me what they're used for. I had hoped to start building a ham station from the contents. Want a box of assorted tubes, cheap?*

Alfred Margolis, Jr.
Rockaway Park, N.Y.

Hey, don't throw those fish back in the kettle. You made a good buy! The 350A can be used in any transmitter circuit which calls for the popular 807—and they are worth almost \$4 each in anybody's book. It's a direct replacement. The 403A is a 6AK5 in an industrial-sounding disguise. A 6AK5 is 90¢ worth of the hottest front-end tube you can design into a high-frequency receiver.

Some folks tell us that Western Electric uses these offbeat names for their tubes to discourage pilferage by employees, which probably is the route your box of goodies took to the auction block.

★ *Recently I picked up a Voice of America broadcast on about 7600 kc. This wouldn't have been odd except that it was an SSB transmission consisting of a news program. It wasn't a taped rebroadcast but a live transmission with the latest news and even correct time announcements. What gives? Is the VOA going SSB along with the hams?*

Rudy Zalesak, Jr. WA5REI
LaMarque, Tex.

While many musical and other VOA programs can be taped and mailed from Washington to relay stations overseas, news and other current-events programs are written just before they are broadcast. The relay stations must try to receive them from a standard VOA transmitter and simultaneously rebroadcast them. If a relay station can't get broadcast-quality reception the VOA sends the news program out via point-to-point SSB circuits. What you heard wasn't an actual broadcast, but a private transmission.

You can pay $600 and still not get professionally approved TV training.

Get it now for $99.

Before you put out money for a home study course in TV Servicing and Repair, take a look at what's new.

National Electronic Associations did. They checked out the new TV training package being offered by ICS. Inspected the six self-teaching texts. Followed the step-by-step diagrams and instructions. Evaluated the material's practicality, its fitness for learning modern troubleshooting (including UHF and Color).

Then they approved the new course for use in their own national apprenticeship program.

They went even further and endorsed this new training as an important step for anyone working toward recognition as a Certified Electronic Technician (CET).

This is the first time a self-taught training program has been approved by NEA.

The surprising thing is that this is not a course that costs hundreds of dollars and takes several years to complete. It includes no kits or gimmicks. Requires no experience, no elaborate shop setup.

All you need is normal intelligence and a willingness to learn. Plus an old TV set to work on and some tools and equipment (you'll find helpful what-to-buy and where-to-buy-it information in the texts).

Learning by doing, you should be able to complete your basic training in six months. You then take a final examination to win your ICS diploma and membership in the ICS TV Servicing Academy.

Actually, when you complete the first two texts, you'll be able to locate and repair 70% of common TV troubles. You can begin taking servicing jobs for money or start working in any of a number of electronic service businesses as a sought-after apprentice technician.

Which leads to the fact that this new course is far below the cost you would expect to pay for a complete training course. Comparable courses with their Color TV kits cost as much as six times more than the $99 you'll pay for this one.

But don't stop here. Compare its up-to-dateness and thoroughness. Find out about the bonus features—a dictionary of TV terms and a portfolio of 24 late-model schematics.

Get all the facts. Free. Fast. Mail the reply card or coupon below.

ICS® Dept. M5697G
Scranton, Penna. 18515

Yes, I'd like all the details about your new TV Servicing/Repair basic training package. I understand there's no obligation. (Canadian residents, send coupon to Scranton, Pa. Further service handled by ICS Canadian, Ltd.)

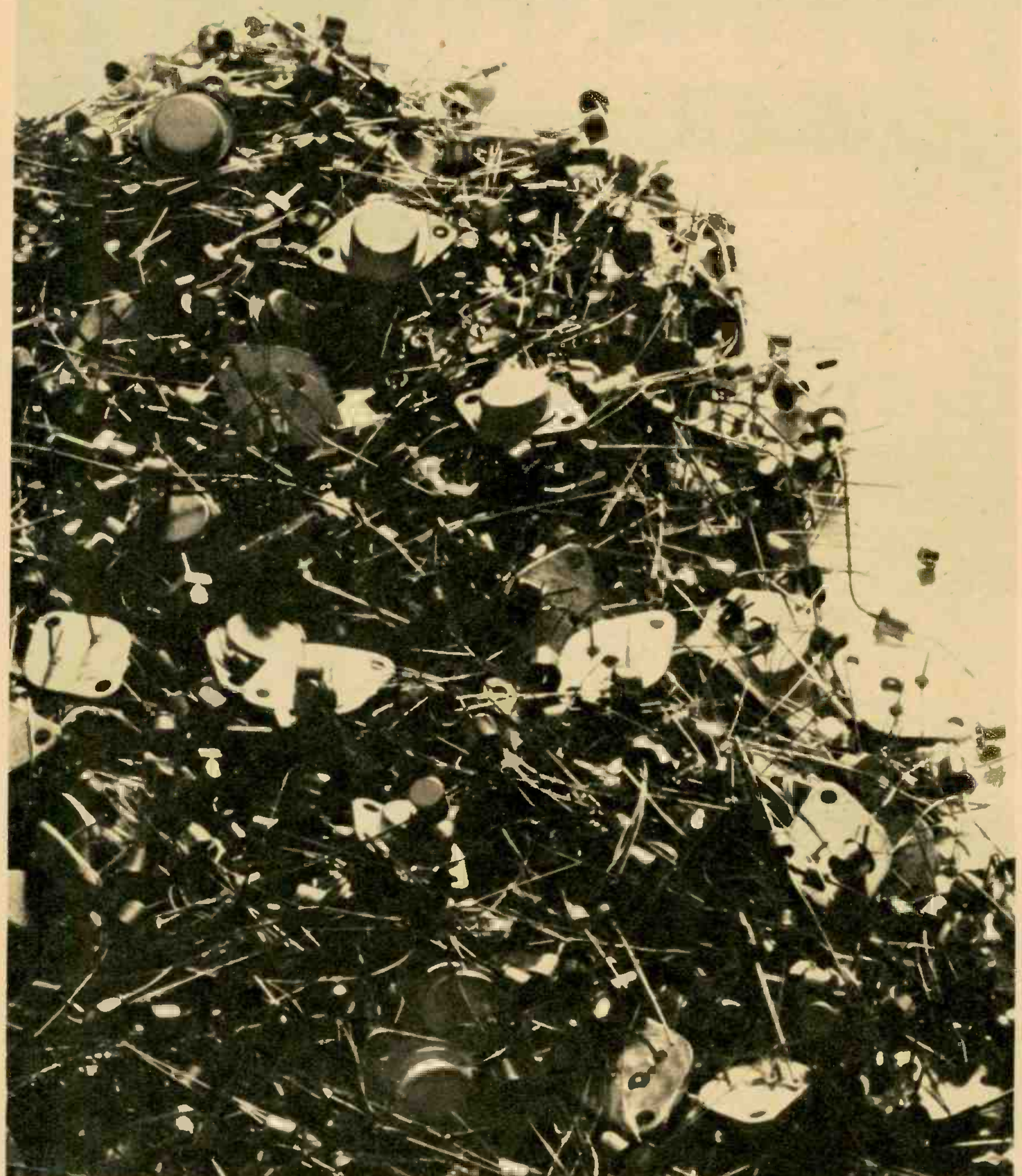
Name ______________________________

Street ______________________________

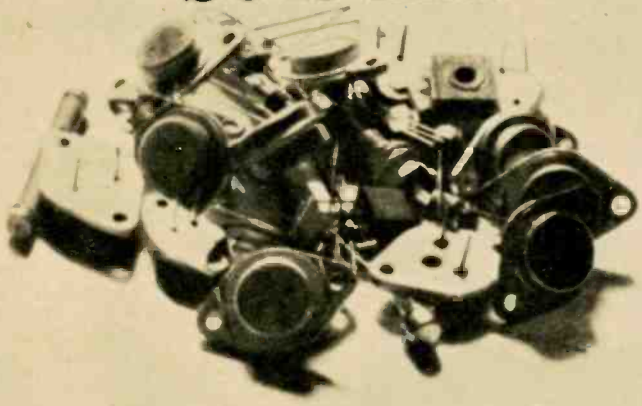
City ____________________ State ____________ Zip ________

Prices slightly higher outside U. S. and Canada.

This is 30,000 solid state replacement parts.



So is this.



It used to be if you wanted to satisfy everyone, you had to stock over 30,000 different solid state replacement parts.

Well, everyone realized that was ridiculous. So some enterprising people came up with a bunch of universal replacements.

Then you only had to stock about eleven or twelve hundred.

That was a lot better, but we still thought it was a little ridiculous.

So two years ago (when we went into this business), we figured out how to replace all 30,000 with only 60.

Now all you have to do is stock 60 of our diodes, transistors, integrated circuits, etc., and you can replace any of the 30,000 parts now in use. Including all JEDEC types, manufacturers' part numbers, and foreign designs.

That means you invest less money.

You don't tie up valuable space.

You do away with complicated inventory control.

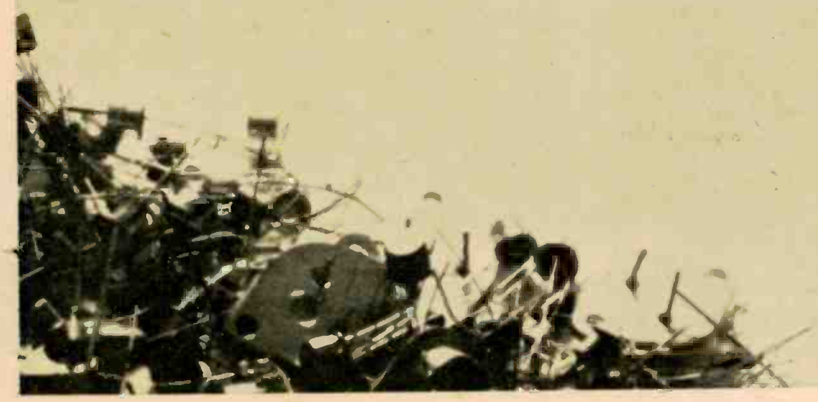
And you operate more efficiently.

To make life even easier, we've got a new book that gives you all the cross references you need to figure out which part replaces which.

It's available from your Sylvania distributor.

If the whole thing sounds rather incredible, you're right. But why not give your distributor a call and let him narrow the incredibility gap.

SYLVANIA
GENERAL TELEPHONE & ELECTRONICS



Broadsides

Pamphlets, booklets, flyers, application notes and bulletins available free or at low cost.

IF YOU dig musical instruments, especially **electronic organs,** you'll want a free copy of Conn's How to Choose an Organ. This 28-page pocket-size booklet provides a check list of what to look for when you're planning to invest in a high-quality instrument. Technical problems are discussed and listening tests are recommended. Conn Organ Corp., 1101 East Beardsley, Elkhart, Ind. 46514.

Motorola now offers a Selector Guide for their line of **field-effect transistors.** It runs to six pages, with more than 100 JFET and MOSFET types being categorized by application. Nearest Motorola equivalents are given for 300 FET industry devices and a list of application notes describes FETs and their uses. Selector Guide SG-15 may be had from Motorola Semiconductor Products, Inc., Box 20924, Phoenix, Ariz. 85036, by writing on official letterhead.

Operational amplifiers are the subject of a 19-page application bulletin offered free by Fairchild Controls, 423 National Ave., A Mountain View, Calif. 94040. With the title of A Review of Operational Amplifier Principles, this technical brochure defines basic terms and presents fundamental gain equations for technicians who want an understanding of op-amps without too much detail.

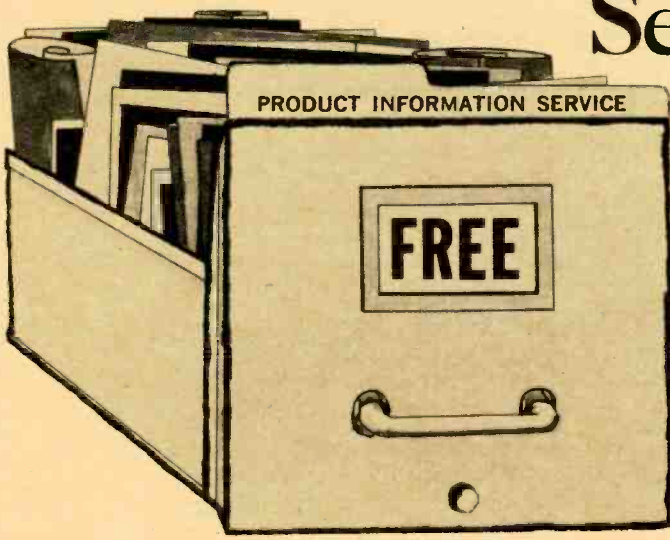
Anyone planning to work with **master antenna TV systems** will want a copy of Finco's MATV Planning Manual. This design aid runs to 30 pages and includes discussions of what MATV is, antenna and distribution systems and design factors. Numerous charts, diagrams and a glossary of terms help make ideas clear. Available for $1 from the Finney Co., 34 West Interstate St., Bedford, Ohio 44146.

Also from Finney comes a small, colorful brochure which describes their line of frequency-dependent **color TV antennas.** Models come in all price ranges and are designed for weak, moderate and strong signal areas. A technical discussion of frequency-dependent antennas is included. For free copy of this Finco Color Spectrum Catalog write to Finney address above.

Instrument mechanisms are the topic of conversation in a 42-page technical bulletin called The Instrument Sketch Book. This seventh edition is the most comprehensive ever. Performance curves, detailed drawings and charts serve to illustrate such subjects as electrostatic and PM moving-coil mechanisms, transducers and digital vs analog meter presentations. The Weston Instruments Div. of Weston Instruments, 614 Frelinghuysen Ave., Newark, N.J. 07114, will let you have this item for $1.25.

ELECTRONICS ILLUSTRATED

Product Information Service



If you want more information about one or more of the products advertised in ELECTRONICS ILLUSTRATED, this service is for your convenience. The product information you request will be sent to you promptly free of charge.

Just complete the name and address portion of the handy coupon below and circle the PRODUCT INFORMATION SERVICE number or numbers you find beneath the advertisements in this issue.

Mail the completed coupon to ELECTRONICS ILLUSTRATED at the address shown—We'll take care of the rest.

ELECTRONICS ILLUSTRATED   This coupon will not be processed if received after October 15, 1969
P.O. BOX 7474, PHILADELPHIA, PENNSYLVANIA 19101

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45	46	47	48	49	50					

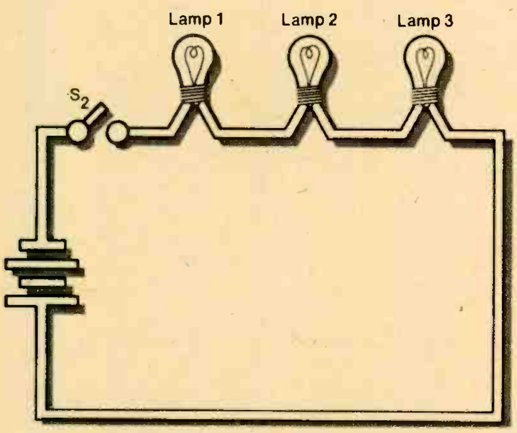
NAME (PLEASE PRINT) ______________________________

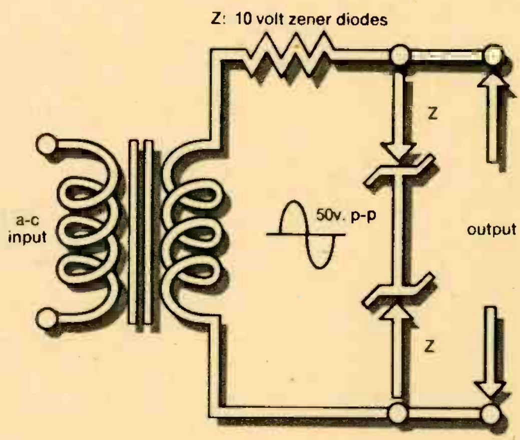
ADDRESS ______________________________

CITY ______________ STATE ______________ ZIP ________

9/69

Can you solve these two basic problems in electronics?





This one is relatively simple:

When Switch S_2 is closed, which lamp bulbs light up?

Note: If you had completed only the first lesson of any of the RCA Institutes Home Study programs, you could have solved this problem.

This one's a little more difficult:

What is the output voltage (p–p)?

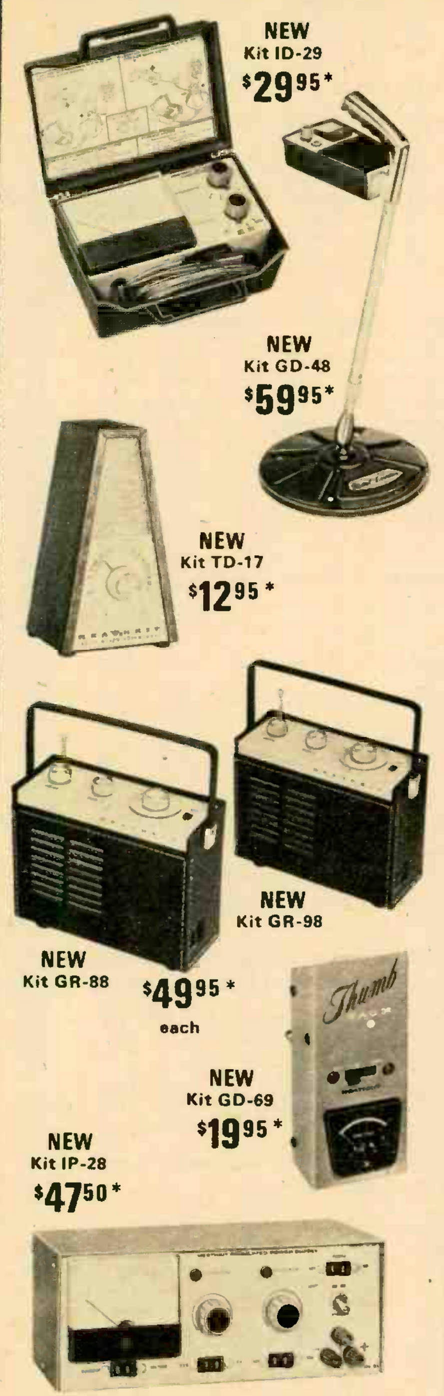
Note: If you had completed the first lesson in the new courses in Solid State Electronics, you could have easily solved this problem.

These new courses include the latest findings and techniques in this field. *Information you must have if you are to service today's expanding multitude of solid state instruments and devices used in Television, Digital, and Communications Equipment.*

If you had completed an entire RCA Institutes Home Study Course in Semiconductor Electronics, Digital Electronics, or Solid State Electronics, you should now be qualified for a good paying position in the field you choose. Send for complete information. Take that first essential step now by mailing the attached card.

ANSWERS: Problem 1—they all light up
Problem 2—20 Volts (p-p)

10 Exciting New Kits



NEW Heathkit Solid-State Auto Tune-Up Meter . . . Measures Dwell, RPM And DC Voltage

The new Heathkit ID-29 is most versatile . . . really three automotive test instruments in one . . . and its low price makes it even a better value. Measures Dwell on all 4-cycle 3, 4, 6, or 8 cylinder engines . . . measures RPM in two ranges 0-1500 and 0-4500 . . . measures DC voltage from 0 to 15 volts. And no batteries are needed . . . running engine provides both signal and power. Easy to use . . . on both 6 and 12 volt system without changing leads. It's lightweight, easy to carry . . . comes equipped with black polypropylene case that has a built-in lead storage compartment and is resistant to virtually everything. Fast, simple assembly . . . takes just one evening. The perfect accessory for the handyman who wants to do his own car tune-up, emergency road service personnel, or shop mechanics . . . order your ID-29 now. 4 lbs.

NEW Heathkit GD-48 Solid-State Metal Locator

A low cost, versatile, professional metal detector at one-third the cost of comparable detectors. Packed with features for long life, rugged reliability, and dozens of uses. Completely portable, battery operated and weighs only 3 lbs. The GD-48 is highly sensitive, probes to 7 feet, and has an adjustable sensitivity control. Its built-in speaker signals presence of metal; front panel meter gives visual indication. Other features include built-in headphone jack, telescoping shaft for height adjustment, smartly styled and smartly designed for easy in-hand use and easy assembly. Whether you're an amateur weekend hobbyist or a professional treasure hunter the GD-48 is for you . . . also a great help to contractors, surveyors, Gas, Electric, Telephone and other public Utility Companies. 4 lbs., GDA-48-1, 9 Volt Battery $1.30*; GD-396, Headphones, 2000 ohm (Superex) $3.50*

NEW Heathkit Electronic Metronome

The new Heathkit TD-17 is a low cost, precise performing electronic Metronome . . . a handy helper for any music student. Battery operated . . . no springs to wind . . . accurate, steady calibration is always maintained . . . from 40 to 210 beats per minute. Instruction label on bottom gives conversion from time signature and tempo to beats per minute. Stylish fruit wood finished cabinet. Easy solid state circuit board construction . . . assembles and calibrates in only 2-3 hours. The new Heathkit TD-17 Electronic Metronome is so low in cost every music student can afford one . . . order yours now. 1 lb.

NEW Heathkit GR-88 Solid-State Portable VHF-FM Monitor Receiver

Tunes both narrow and wide band signals between 154-174 MHz . . . for police, fire, most any emergency service. Exceptional sensitivity and selectivity, will outperform other portable receivers. Features smart compact styling . . . with durable brown leatherette case, fixed station capability with accessory AC power supply, variable tuning or single channel crystal control, collapsible whip antenna, adjustable squelch control and easy circuit board construction. The new GR-88 receiver is an added safety precaution every family should have . . . order yours today. 5 lbs.

NEW Heathkit GR-98 Solid-State Portable Aircraft Monitor Receiver

Tunes 108 through 136 MHz for monitoring commercial and private aircraft broadcasts, airport control towers, and many other aircraft related signals. Has all the same exceptional, high performance features as the GR-88 above. The perfect receiver for aviation enthusiast . . . or anyone who wants to hear the whole exciting panorama of America in flight. 5 lbs. GRA-88-1, AC Power Supply $7.95

NEW Heathkit GD-69 "Thumb Tach" . . . An Accurate, Low Cost Tachometer To Measure RPM's On Any Model Engine

The new Heathkit GD-69 "Thumb Tach" Tachometer is an accessory every R/C modeler should have. An accurate, inexpensive and easy way to make sure your model engine is giving maximum performance (also suitable for measuring RPM's of any rotating shaft). Features all solid-state design and battery operation for long life reliability. Simple to use . . . set the slide switch to the meter scale you want to use, aim the lens at the propeller or flywheel. The meter reads directly in RPM from reflected light for precise, accurate measurements . . . doesn't load engine. Easy 2 or 3 hour assembly. Raise your engine performance standards now . . . with the new Heathkit GD-69. 1 lb.

NEW Heathkit 1-30 VDC Solid-State Regulated Power Supply

The new modestly priced IP-28 is an excellent power supply for anyone working with transistors whether it be in a laboratory or in a home workshop . . . and its low price makes it the ideal power supply for classroom use. Compact brown and beige, Heathkit instrument styling with large easy-to-read meter . . . with two voltage ranges 10 v. and 30 v. . . . and two current ranges 100 mA, 1 A. External sensing permits regulation of load voltage rather than terminal voltage. Adjustable current limiting prevents supply overloads and excessive load current. Convenient standby switch. Fast, easy assembly with one circuit board and wiring harness. Order yours today. 9 lbs.

CIRCLE NUMBER 3 ON PAGE 15

From The Leader HEATHKIT®

NEW Heathkit Ultra-Deluxe "681" Color TV With AFT . . . Power Channel Selection & Built-In Cable-Type Remote Control

The new Heathkit GR-681 is the world's most advanced Color TV with more built-in features than any other set on the market. Automatic Fine Tuning on all 83 channels . . . eliminates touchy fine tuning forever, power push button VHF channel selection, built-in cable-type remote control . . . or you can add the optional GRA-681-6 Wireless Remote Control any time you wish . . . plus the built-in self-servicing aids that are standard on all Heathkit color TV's but can't be bought on any other set at any price. Other features include a bridge-type low voltage power supply for superior regulation; high & low AC taps to insure that the picture transmitted exactly fits the "681" screen. Automatic degaussing, 2-speed transistor UHF tuner, hi-fi sound output, two VHF antenna inputs, top quality American brand color tube with 2-year warranty.

GRA-295-4, Mediterranean Cabinet shown **$119.50***

Heathkit "295" Color TV

Big, Bold, Beautiful . . . with the same high performance features and built-in servicing facilities as the GR-681 above . . . but less the Automatic Fine Tuning, push button VHF power tuning and built-in cable-type remote control. You can add the optional GRA-295-6 Wireless Remote Control at any time.

GRA-295-1, Contemporary Walnut Cabinet shown **$62.95***

Both the GR-681 and GR-295 fit into the same Heath factory assembled cabinets; not shown, Early American style at $99.95.*

NEW Deluxe Heathkit "581" Color TV With AFT

The new Heathkit GR-581 will add a new dimension to your TV viewing. Brings you color pictures so beautiful, so natural, so real . . . puts professional motion picture quality right into your living room. Has the same high performance features and exclusive self-servicing facilities as the GR-681, except with 227 sq. inch viewing area, and without power VHF tuning or built-in cable-type remote control. The optional GRA-227-6 Wireless Remote Control can be added any time you wish. And like all Heathkit Color TV's you have a choice of different installations . . . mount it in a wall, your own custom cabinet, your favorite B&W TV cabinet, or any one of the Heath factory assembled cabinets.

GRA-227-2, Mediterranean Oak Cabinet shown **$99.50***

Heathkit "227" Color TV

Same as the GR-581 above, but without Automatic Fine Tuning . . . same superlative performance, same remarkable color picture quality, same built-in servicing aids. Like all Heathkit Color TV's you can add optional Wireless Remote Control at any time (GRA-227-6). And the new Table Model TV Cabinet and roll around Cart is an economical way to house your "227" . . . just roll it anywhere, its rich appearance will enhance any room decor.

GRS-227-6, New Cart and Cabinet combo shown **$49.95***

Both the GR-581 and GR-227 fit into the same Heath factory assembled cabinets; not shown, Contemporary cabinet $59.95.*

NEW Heathkit Deluxe "481" Color TV With AFT

The new Heathkit GR-481 has all the same high performance features and exclusive self-servicing aids as the new GR-581, but with a smaller tube size . . . 180 sq. inches. And like all Heathkit Color TV's it's easy to assemble . . . no experience needed. The famous Heathkit Color TV Manual guides you every step of the way with simple to understand instructions, giant fold-out pictorials . . . even lets you do your own servicing for savings of over $200 throughout the life of your set. If you want a deluxe color TV at a budget price the new Heathkit GR-481 is for you.

GRA-180-1, Contemporary Walnut Cabinet shown **$49.95***

Heathkit "180" Color TV

Feature for feature the Heathkit "180" is your best buy in color TV viewing . . . has all the superlative performance characteristics of the GR-481, but less Automatic Fine Tuning. For extra savings, extra beauty and convenience, add the table model cabinet and mobile cart. Get the value-packed GR-180 today.

GRS-180-5, Table Model Cabinet & Cart combo **$39.95***

Both the GR-481 and GR-180 fit the same Heath factory assembled cabinets; GRA-180-2, Early American Cabinet $75.00.*

Add the Comfort And Convenience Of Full Color Wireless Remote Control To Any Rectangular Tube Heathkit Color TV . . . New Or Old!

Kit GRA-681-6, for Heathkit GR-681 Color TV's **$59.95***
Kit GRA-295-6, for Heathkit GR-295 & GR-25 TV's **$69.95***
Kit GRA-227-6, for Heathkit GR-581; GR-481 & GR-180 Color TV's **$69.95***

Now There Are 6 Heathkit® Color TV's To Choose From

2 Models In 295 Sq. Inch Size

NEW
Kit GR-681
With AFT
$499^95*
(less cabinet)

Kit GR-295
$449^95*
(less cabinet)

2 Models In 227 Sq. Inch Size

NEW
Kit GR-581
with AFT
$419^95*
(less cabinet)

Kit GR-227
NOW ONLY
$379^95*
(less cabinet & cart)

2 Models In 180 Sq. Inch Size

NEW
Kit GR-481
with AFT
$359^95* (less cabinet)

Kit GR-180
NOW ONLY
$329^95*
(less cabinet & cart)

HEATHKIT

NEW FREE 1969 CATALOG!

Now with more kits, more color. Fully describes these along with over 300 kits for stereo/hi-fi, color TV, electronic organs, electric guitar & amplifier, amateur radio, marine, educational, CB, home & hobby. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022.

HEATH COMPANY, Dept. 39-9
Benton Harbor, Michigan 49022
a Schlumberger company

☐ Enclosed is $________________, plus shipping.

Please send model (s)________________________________
☐ Please send FREE Heathkit Catalog. ☐ Please send Credit Application.

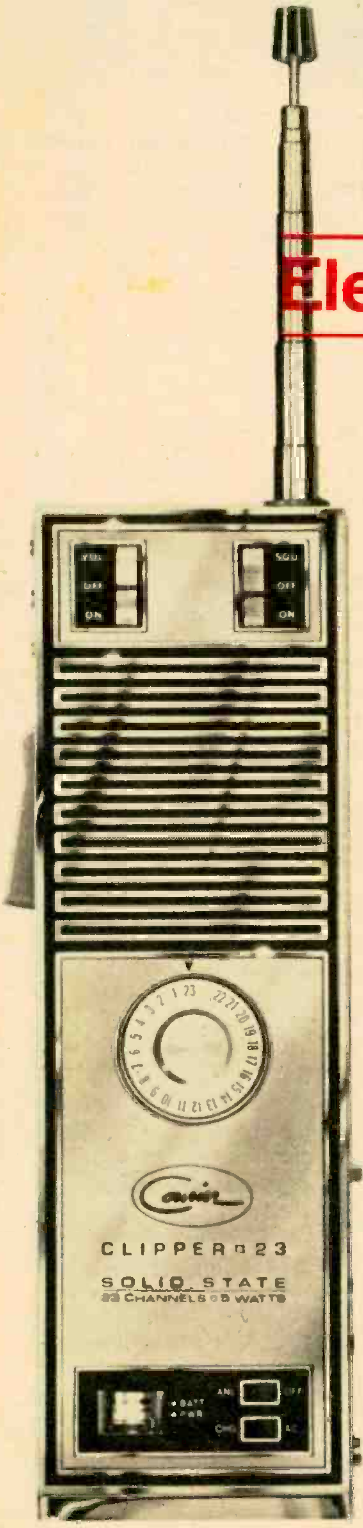
Name________________________________

Address________________________________

City________________ State________________ Zip________

*Mail order prices; F.O.B. factory. Prices & specifications subject to change without notice. CL-358

CIRCLE NUMBER 3 ON PAGE 15



ALL CHANNELS. Clipper 23 CB transceiver is said to be first walkie-talkie capable of transmitting and receiving on all 23 channels. Weighing less than 5 lbs., its solid-state circuitry features variable squelch, built-in range expander and an automatic noise limiter. Receiver offers 0.25 microvolt sensitivity while transmitter provides 5-watt input at 100 per cent modulation. Effective inland range is 10 mi. The unit is supplied with all crystals for 23-channel operation. $159.95. Courier Communications Inc., Newark, N.J. 07114.

Electronic Marketplace

Variety Package. Model KR-100 AM/FM stereo receiver claims amplifier output of 140 watts music power (IHF) into 4 ohms and 110 watts into 8 ohms, with overall distortion less than 0.5 per cent. Frequency response is 13 to 70,000 cps, according to the manufacturer. The FM receiver features two FETs and four ICs for a front-end sensitivity of 1.8 microvolts. Inputs are provided for two turntables and tape head. $229.95, including cabinet. Kenwood, Los Angeles, Calif. 90007.

Gold Platter. Thorens TD-125 transcription turntable features three speeds, synchronous 16-pole motor with belt drive and replaceable mounting board to accommodate any high-quality tonearm (not included). Turntable speeds of 16⅔, 33⅓ and 45 rpm are electronically controlled by solid-state circuits. Specifications: weight of platter, 8 lbs.; wow & flutter, 0.08 per cent; rumble, -48db (unweighted), -68db (weighted). Power requirements: 110-130 VAC or 200-240 VAC, 50/60 cps. $185 ($200 mounted in base). Elpa Marketing Industries, New Hyde Park, N.Y. 11040.

Our competitors hate our guts.

Boy, do they. Stuff like HetroSync® Circuitry that substantially reduces spurious frequencies.

A Pearce-Simpson exclusive.

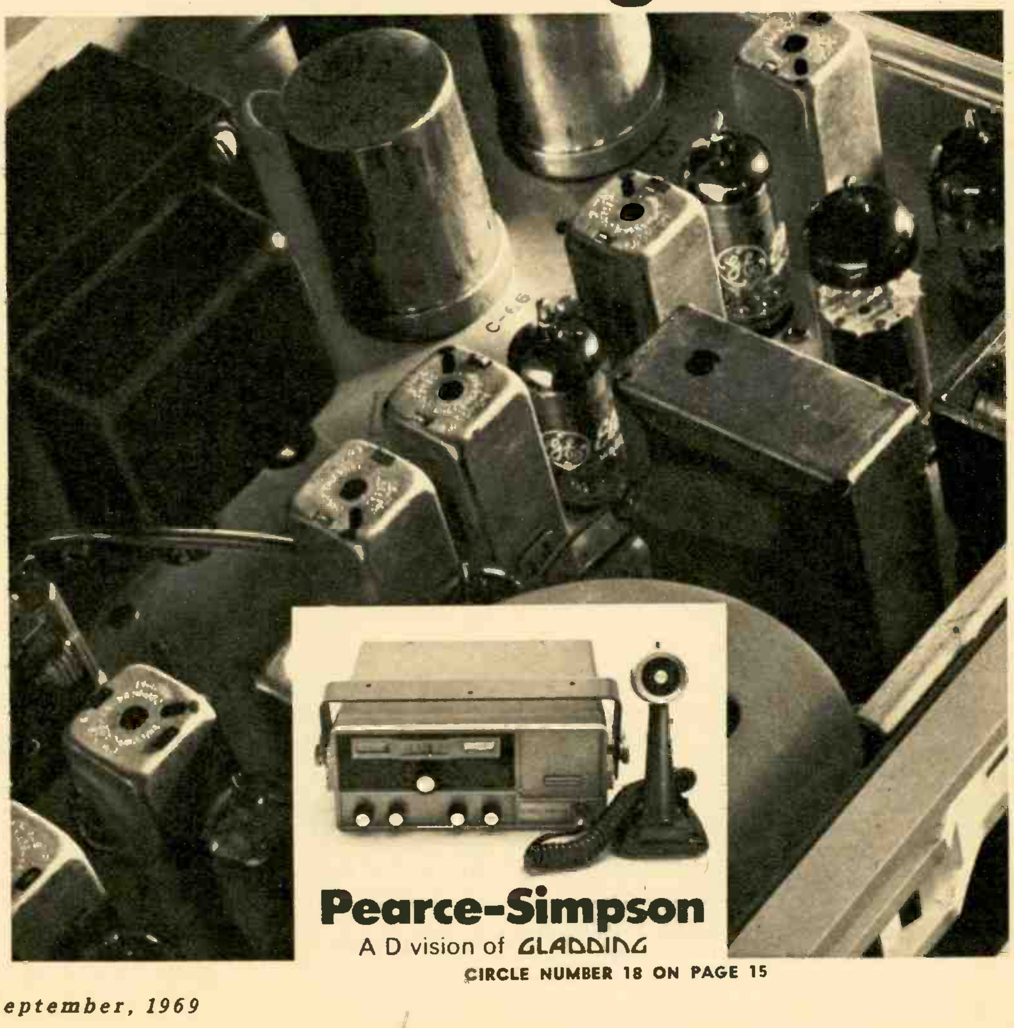
Our dual conversion superhet receiver that pulls in signals where others fade. Nuvistor front end that gives you a very fine signal to noise ratio. The result: the biggest ears in the industry.

Automatic speech clipping by high level saturation limiting. Big, easy to read dual function S Meter and RF Output Meter. Illuminated channel selector. Modulation indicator. Transistorized AC/DC power supply. Not to mention complete hand wired circuitry.

But what really frosts them is how we put all of these goodies into a compact, 23-channel beauty like the Guardian—include crystals, microphone, power cords and mounting cradle—and beat the daylights out of their prices.

Guardian 23 (which is both a mobile and base unit) with palm microphone, $269.90. Guardian 23B (base station with built-in preamp), $264.90. With Super Mod ceramic desk microphone, $279.90.

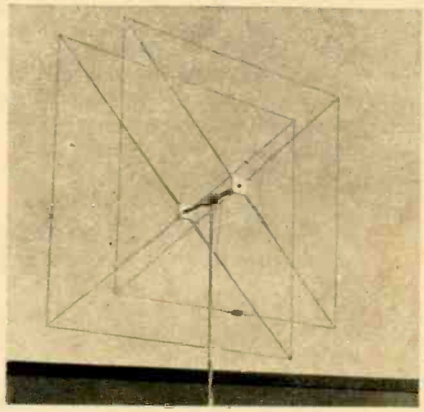
Write us and we'll send you a spec sheet on the whole line. Pearce-Simpson Inc., P.O. Box 800, Biscayne Annex, Miami, Fla. 33152. Dept. EI-969



CIRCLE NUMBER 18 ON PAGE 15

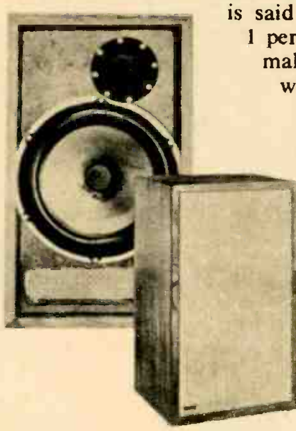
Electronic Marketplace

Square Rigger. Model M-195 quad antenna weighs 15 lb., is rated for 1,000 watts. Antenna is for communications on Citizens Band. It can withstand winds up to 100 mph. Forward gain



is said to be 7.5db, VSWR is 1.3:1 or better. Matching system requires no stubs or ferrites for elements and results in a 30db front-to-back ratio. $49.95. Antenna Specialists Co., 12435 Euclid Ave., Cleveland, Ohio 44106.

No Resonance? Aperiodic (non-resonant) speaker system, Model KA-25, uses 10-in. extended-excursion woofer and dome tweeter to cover audio spectrum. The KA-25 is said to have less than 1 per cent THD at normal listening levels, with no more than 3 per cent THD above 50 cps for 25-watt input. Impedance is nominally 8 ohms; power rating: 60 watts per channel; cross-over frequency is 1500 cps (using non-inductive network); a five-position level control is provided. Unlike acoustic-suspension and bass-reflex speaker systems, resonance is not used to sustain low-frequency response. An acoustic impedance design provides variable-volume action supposed to offer a more constant impedance so that amplifier distortion is lower at low frequencies. $79.95. Dynaco, Inc., 3060 Jefferson St., Philadelphia, Pa. 19121.



CIRCLE NUMBER 18 ON PAGE 15

Electronic Marketplace

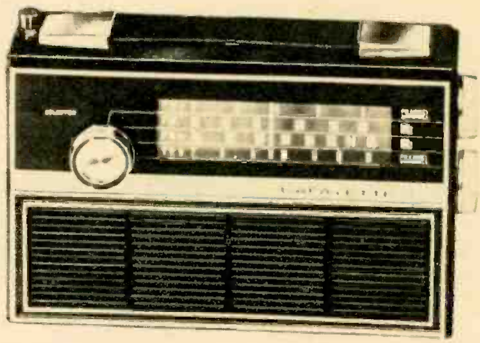
Rugged Mariner. Simpson has anticipated the move to VHF-FM on the marine bands by introducing three new radiotelephones. Solid-state, modular construction is featured throughout,

which allows a boating enthusiast to move up to greater power when he needs it. Power modules (10 or 25 watts) can be plugged into the low-powered (3-watt) unit at any time. Models FM-3, FM-10 and FM-25 offer optional remote control, dual front-end, squelch and a narrowband reception mode. Units are supplied with crystals for two channels, antenna and mount. Models range from $330 to $500. Simpson Electronics, Miami, Fla. 33125.

Cassette au Go Go. Model 2560 compact Casseiver system combines an AM/FM stereo receiver and stereo cassette recorder with a matched pair of air-suspension speakers. Besides listening to prerecorded cassettes, the audiophile

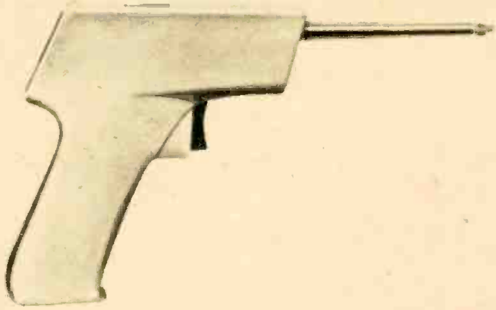
can record onto cassettes from records, stereo mikes, tape recorder, or directly from the built-in stereo tuner. The cassette mechanism features a synchronous motor, while tuner offers usual FET/IC circuitry. Includes dual mike inputs and dual recording level meters. $399.95. H. H. Scott, Inc. Maynard, Mass. 07154.

Television Sound. All-transistor, four-band portable radio features reception of sound portion of TV broadcasts. You can hear TV even if you can't see it. This unusual radio (Model 99-3536L) is designed for battery operation, but can be used with optional AC adaptor; it tunes channels 2 through 13 on two bands, standard



FM broadcasts at 88-108 mc, public service frequencies from 146 to 175 mc and U.S. weather broadcasts on 162.55 or 163.275 mc. Circuitry employs 14 transistors, three diodes and one thermistor. It comes with whip antenna, built-in speaker, four C batteries and an earphone. $39.95. Lafayette Radio Electronics, Syosset, N.Y. 11791.

Power Heat. Tempmatic temperature-controlled soldering tool is said to combine all the advantages of a lightweight pencil iron and a fast heating soldering gun, and at the same time be capable of both light- and heavy-duty soldering.



The tool weighs 7 oz. and has a trigger switch. Two Powerheads (containing the temperature control system) are available: a 700° F. head with a 3/16 in. chisel point and an optional 600° F. head with a ⅛ in. conical point. Other Powerheads will soon be available, according to the manufacturer. Ejector button for quick head changing is provided. $12.95. Weller Electric Corp., Easton, Pa.

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Famous Quick Grip® mount — clamps on trunk lip . . . no holes to drill . . . no soldering . . . cable completely hidden!

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the antenna specialists co.

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CIRCLE NUMBER 21 ON PAGE 15

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CIRCLE NUMBER 15 ON PAGE 15

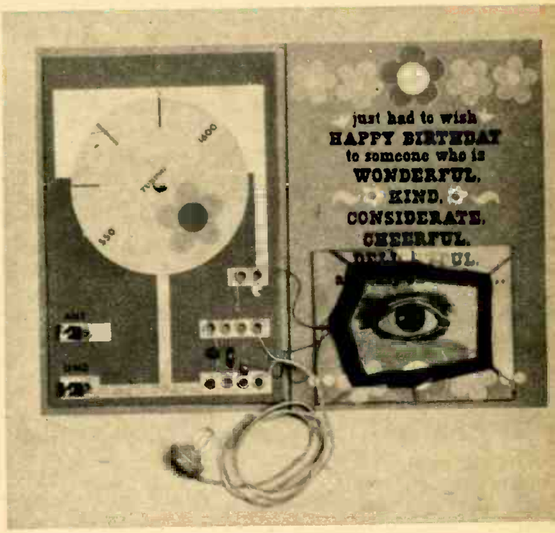
Pinchpenny Project

$1.97 Greeting-Card Radio

By CHARLES GREEN, W6FFQ

THEY all laughed when Edison invented the talking box known today as the phonograph. Now through the trials, tribulations and tinkering of the pioneers of radio we have—would you believe?—a talking greeting card. Besides being a most unusual surprise when it arrives in the mail, our greeting-card radio is a low-cost fun project and an offbeat gift, too.

The radio is a crystal set enclosed in an ordinary greeting card. It uses aluminum foil, which is cemented on a cardboard base, for wiring and for circuit elements. It is tuned by an unusual cardboard/foil variable capacitor. The antenna coil is wound on a piece of cardboard so as to take up a minimum amount of space. A crystal earphone is permanently connected to the radio. Only an external antenna and ground are required for reception of local broadcast stations.



Construction

First thing to do is select a greeting card whose dimensions are at least 6 x 9 in. One side of our greeting card was made with two pages fastened together. We used this side to hold coil L1 whose leads came through a slit at the inside edge of the page-fold.

In the radio shown in the photo on the first page of this article, the coil is wound on a 1/16-in.-thick piece of Plexiglass. And we left the coil sitting on top of the right side of the card so it can be seen. Since the right side of our card is a double page, the coil can be slipped between the pages and kept out of view. If your card does not have a double page, cement an additional sheet behind the back page to hold the form for L1.

The radio is built in two sections; the foil circuit board (Fig. 3) and the coil-form board (Fig. 1). Both boards are made of 1/16-in.-thick (approximately) corrugated cardboard, although the thickness is not critical. For best appearance, use cardboard with a white surface on one side.

Start construction by cutting on 8 x 5¼-in. piece of cardboard and cover the top surface completely with rubber cement. Coat a piece of household aluminum foil with rubber cement and then press foil on the cement-coated cardboard surface. Cut away the excess foil around the edges of the board and press out any bubbles or wrinkles in the foil with a piece of cloth. The foil should have a smooth surface.

Make a full-size template of the foil circuits in Fig. 3 and tape the tracing on the top of the foil-covered cardboard. Carefully transfer the foil outline from the template to the foil with a ball-point pen. Do not cut deeply into the cardboard; just go deep enough to score the surface. Mark the circuit-hole centers with an ice pick or large needle. Remove the template and cut the foil on the lines with a single-edge razor blade. Carefully peel off the remaining aluminum foil, leaving just the foil circuits cemented to the board.

The components are connected to the foil with unpainted aluminum eyelets, which are available in the notion department of variety stores. Before inserting the eyelets in the

Greeting-Card Radio

board, use diagonals to make cuts in the eyelet shank. This will cause the eyelets to open up more easily and evenly when installed.

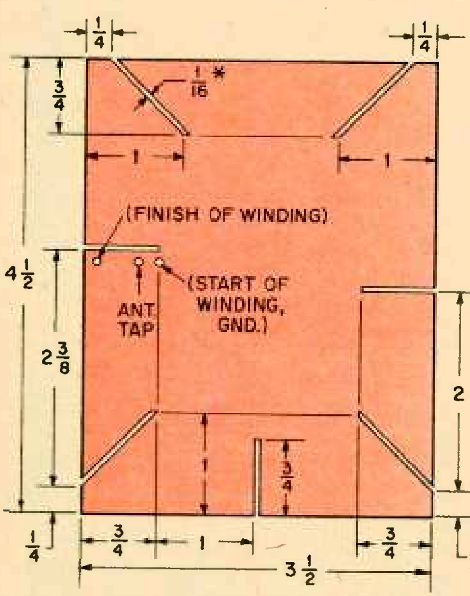
Wrap one of R1's leads around an eyelet shank just below the head and insert the eyelet in the circuit-board hole where shown in Fig. 3. If you have an eyelet tool use it now. If you don't, turn the board over, place the eyelet head on a rounded metal surface (such as the shank end of a large drill held in a vise) and use a punch and hammer to spread the serrated end of the eyelet over the board. Just spread the eyelet enough to hold it firmly to the board; do not hit it too hard or you'll break the cardboard. Repeat this procedure for R1's other lead and the remaining board components. Also, install an eyelet in the rotor ground foil (center of circle outline in Fig. 3). Make sure that you position the solder lugs as shown before securing them to the board.

Cut a section of cardboard and make the rotor for C1 as shown in Fig. 2. After cementing on the aluminum foil and cutting to size, install an eyelet in the center so that it makes a good contact with the foil. Cut the ½-in.-dia. finger hole in the rotor and letter the rotor.

Cut a 5¼ x 5-in. piece of thin acetate (the type used for notebook sheet protectors) and staple it to the top of the circuit board. Punch a hole in the acetate directly over the ground-circuit eyelet and place C1's rotor eyelet directly over this hole. Fasten the rotor firmly to the board with a brass paper fastener through both eyelets. Use a small brass washer between the fastener's head and the rotor prevent the fastener from cutting into the cardboard. Using a VOM, check for continuity of the rotor circut between the rotor foil and the J2 ground clip. Make sure there's no continuity between the rotor and stator.

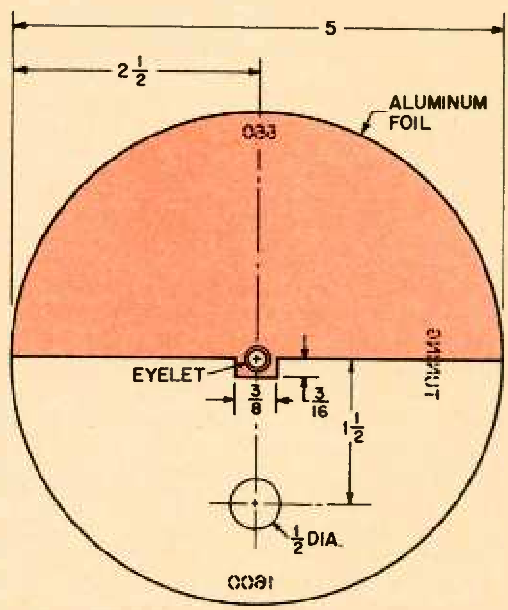
Cut a section of cardboard as shown in Fig. 1 and wind on the form 10 turns of No. 28 enameled wire. Make a tap at the 10th turn and continue to wind 25 turns. Leave about 6-in. of wire for the coil leads.

Temporarily position the circuit board and L1 on the card as shown in the photo on



NOTES:
1. ALL DIMENSIONS IN INCHES
2. MATERIAL: CARDBOARD OR PLASTIC 1/8 INCH THICK
*3. ALL CUTS ARE 1/16 WIDE

Fig. 1—Coil form. Pull 8-in. length of wire through hole marked start, wind 10 turns and pull out 8-in. loop for tap. Then wind 25 more turns.



C1 ROTOR
(BOTTOM VIEW)

NOTES:
1. ALL DIMENSIONS IN INCHES
2. MATERIAL: 1/8-IN. THICK CORRUGATED CARDBOARD

Fig. 2—C1's rotor. Coat 5-in.-dia. cardboard and foil with rubber cement. Place foil on cardboard, smooth it out then remove the foil from white area.

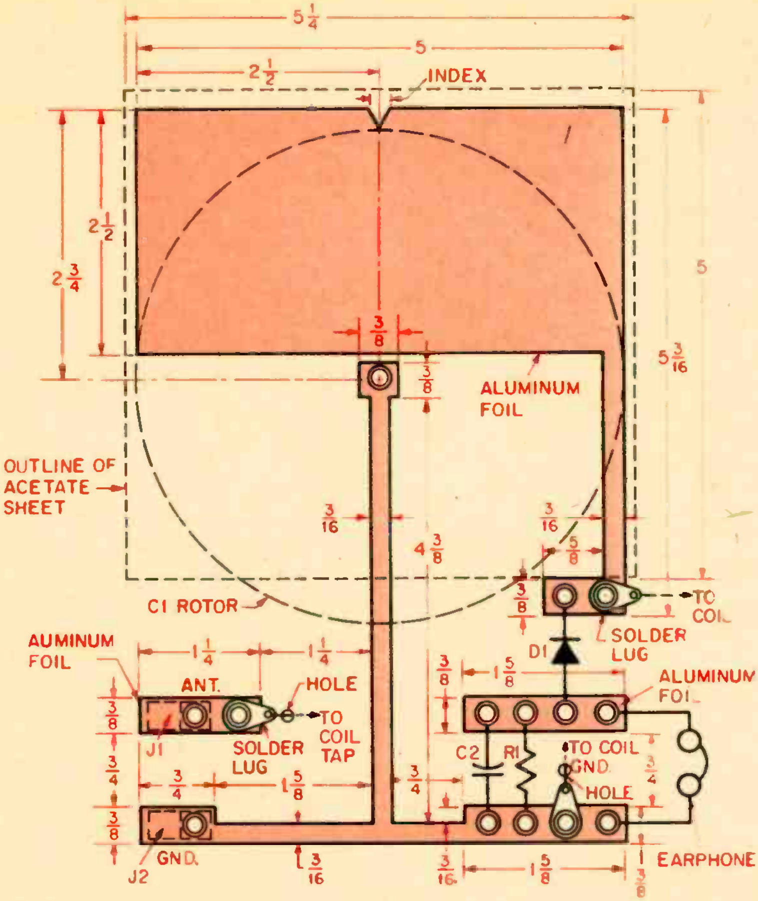
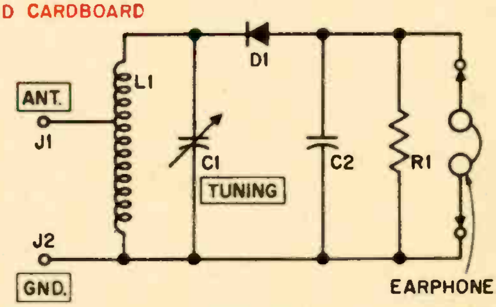


Fig. 3—Main circuit board is built on 8 x 5¼-in. piece of cardboard. Put rubber cement on board and foil then put foil on board and smooth out. Using full-size template (or freehand) remove foil from white areas. Lay a 5¼ x 5-in. piece of acetate sheet over area indicated with broken lines and staple to cardboard at top edges. The acetate sheet acts as the C1 dielectric. Punch holes for the eyelets, install clips, solder lugs and other parts where shown. Mount rotor (Fig. 2) over stator with paper fastener.

NOTES
1. ◎ - INDICATES EYELET
2. FOIL CIRCUIT ON 8 X 5 1/4 X 1/16-IN. CORRUGATED CARDBOARD
3. ALL DIMENSIONS IN INCHES

Fig. 4—Radio's circuit below. Signals are picked up by antenna and tuned by C1. D1 is detector diode, C2 bypasses RF to ground. R1 is load. Phone must be high-impedance crystal.



the first page of this article and cut L1's leads to size. Run the leads under the board, through the holes and solder them to the solder lugs. Cement the board to the greeting card and cement L1's form inside of the double-page, if your card has one. Slit the page so that the coil leads will emerge to the circuit board.

Operation

The greeting-card radio requires a good outdoor antenna and ground. An inside antenna may work for local high-power stations. To tune the radio slowly turn C1 with your finger in the finger hole, keeping your hand away from the board-foil rotor circuit.

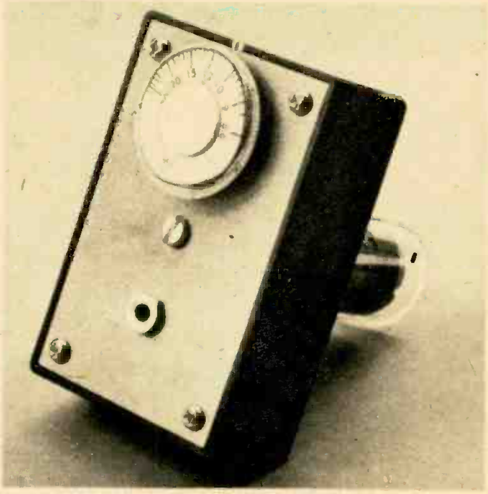
In a receiver of this type, antenna loading may affect the tuning range of C1/L1 over the broadcast band. Try increasing or decreasing the number of turns on L1 to get best tuning range and reception.

PARTS LIST

C1—Tuning capacitor (aluminum foil and cardboard, see text)	$ .00
C2—.001 μf ceramic disc capacitor	.15
Card—(at least 6 x 9 in.)	.35
Crystal earphone—(Lafayette 99 T 2515)	1.09
D1—Germanium diode (1N34 or equiv., Lafayette 19 T 1505)	.08
Eyelets and paper fastener	.05
J1, J2—Fahnestock clips (Lafayette 33 T 7102)	.04
L1—Coil wound with No. 28 enameled wire; approx. 50 ft.	.09
R1—180,000 ohm, ½ watt, 10% resistor	.12
	$1.97

Pinchpenny Project

$3.13 Wavemeter for Hams and CBers



By CLARE GREEN, W6FFS

ARE YOU sure that your ham or CB transmitter isn't putting out spurious out-of-the-band signals? The quickest and cheapest way to find out is with a wavemeter. When held near your transmitter's final, this accessory will let you know via a VOM or an earphone whether you're radiating harmonics and how clean your modulation is. SWLs can use the wavemeter to troubleshoot the front-end oscillator of their receiver.

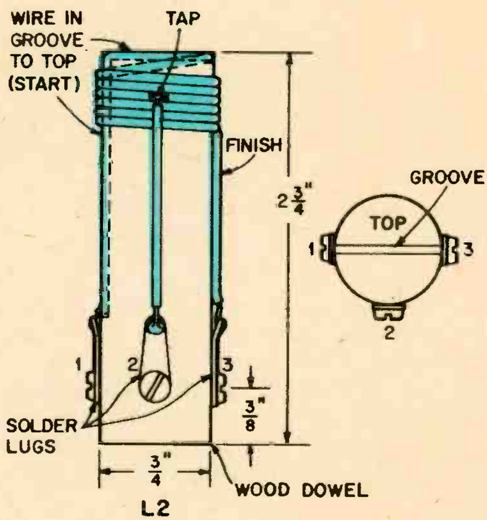
Our wavemeters, which consist of a tunable resonant circuit and detector, cover 3.2 to 10 mc and 8.6 to 35 mc. The units are built in 3¼ x 2⅛ x 1⅛-in. Bakelite utility cases and do not require a source of operating power.

Construction. Except for the coils, which cover different ranges, the wavemeters are alike. Most of the components are mounted on the 3⅛ x 2-in. metal panel. A 7-dram plastic pill bottle is mounted on the bottom of the case to cover the coils.

First, cut two 2¾-in. lengths of ¾-in. wood dowel and cut grooves in the tops of them as shown. Then mount three solder lugs and wind the coils with No. 22 plastic-covered solid hookup wire. Use tape to hold the last turns of the coils in place. Lay out and mount the components on each panel as shown. Because of the high-frequency at which the circuits operate, parts placement is critical. Mount C1 so that the dial edge is close to the top edge of the metal panel. Mount the coils on each panel with a sheet-metal or wood screw in the center of the dowel. Mount phone jack J1 so its connecting lugs do not short to the coil lugs. Cut off the unused lug on J1.

Cut a hole in the bottom at each box and cement the pill bottle in place. Make sure that the bottle is large enough to fit over the coil. (There may be a variation in the size of pill bottles.)

Calibration. The wavemeters can be cali-



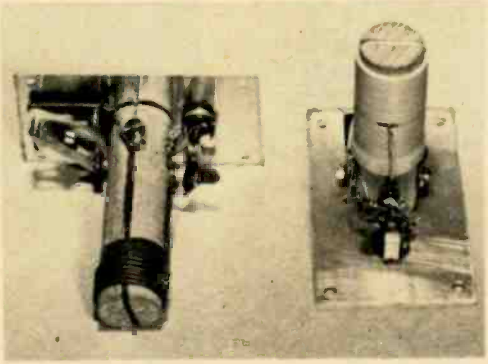
NOTES:

L1-(3.2-10MC) 28 TURNS, CENTER TAPPED NO.22 PLASTIC-INSULATED SOLID HOOK-UP WIRE.

L2-(8.6-35MC) 6 TURNS, CENTER TAPPED (SAME WIRE)

BOTH COILS START APPROX. 1/8 IN. FROM TOP OF DOWEL

Coil-winding details. Diagram is of high-frequency coil L2. Except for the number of turns, coil L1 is the same. Both coils are tapped at center.



Wavemeter for 8.6-35 mc is at left. At right is low-frequency (3.2-10 mc) wavemeter. Dowel is held to plate with wood or sheet-metal screw.

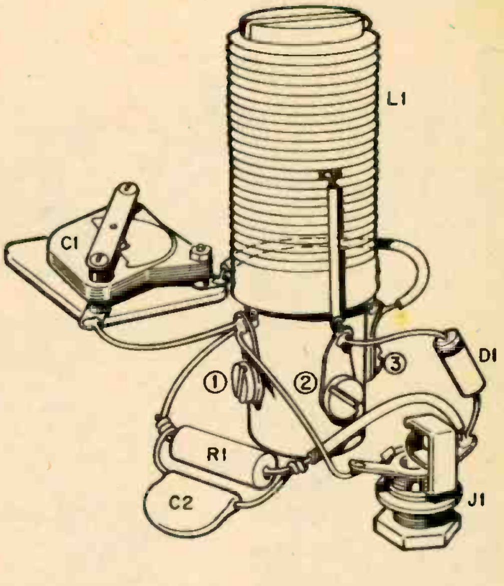
brated with either a modulated signal generator or a grid-dip meter, and a crystal or high-impedance magnetic earphone plugged in J1. They can also be calibrated with an unmodulated signal generator or grid-dip meter, and a VOM (set it to lowest DC-current range) plugged in J1. (Diode D1 is connected to give a negative DC output.)

If a signal generator is used, connect a loop of wire to its output terminals or output cable and position the wavemeter coil close to the generator's coil to obtain a VOM (or earphone) output indication. When using a grid-dip meter, either phones, VOM, or the grid-dip meter can be used for the indication.

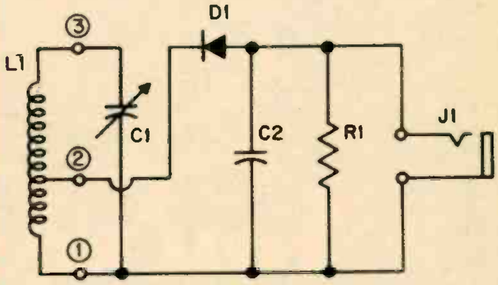
Calibrate the dials starting at the lowest frequency (C1 fully closed). We calibrated our units as follows: low-frequency unit—3.2 to 4 mc in 100-kc points, 4 to 6 mc in 200-kc points and 6 to 10 mc in 500-kc points. High-frequency unit—8.6 to 10 mc in 200-kc points and 20 to 30 mc in 2-mc points and a 35 mc point.

Operation. To check the front-end oscillator circuit of a tube or transistor shortwave receiver use the wavemeter to test for RF output of the oscillator as well as the approximate operating frequency; just hold the wavemeter near the oscillator coil to detect RF.

To check for spurious RF output of a transmitter, hold the wavemeter near the RF circuits (with a VOM set to a low-current range and plugged in J1) and tune C1 for an indication. Then note any out-of-band indications. To test modulation quality, have someone speak into the mike while you listen with an earphone. Do not hold the wavemeter too close to high-power RF circuits.



Low-frequency wavemeter. Except for L1 (which has fewer turns) high-frequency wavemeter is same. Parts are shown spread apart for clarity.



Pick-up coil L1 is tuned by C1. Signal is detected by D1, and C2 filters RF. Negative DC output at J1 feeds VOM or a crystal earphone.

PARTS LIST

C1—10-365 μμf miniature variable capacitor with dial (Lafayette 99 T 6217)	$.59
C2—.001 μf ceramic disc capacitor	.15
D1—Germanium diode (1N34, 1N34A, 1N60 or equiv. Radio Shack 276-821)	.10
J1—Subminiature phone jack (Lafayette 99 T 6211)	.18
L1,L2—Coils wound of No. 22 plastic-covered solid hookup wire on ¾-in. dia. wood dowel (see text)	.11
R1—180,000 ohm, ½ watt, 10% resistor	.12
Misc.—3¼ x 2⅛ x 1⅛-in. Bakelite utility case with aluminum panel (Radio Shack 270-230)	.79
Crystal earphone (Lafayette 99 T 2515)	1.09
Plastic pill bottle, screws, solder lugs	.00
	$3.13

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This is the new Allied model 2660 portable 6-band radio. It's $69.95.

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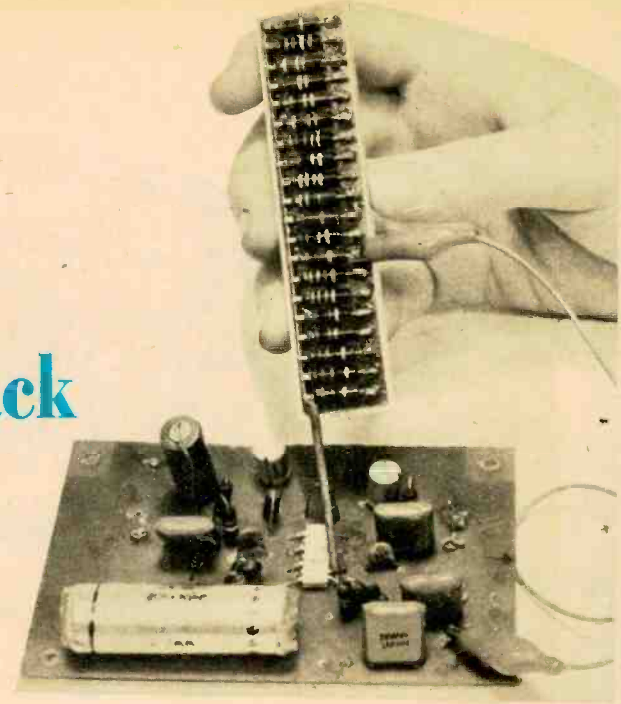
CIRCLE NUMBER 23 ON PAGE 15

Pinchpenny Project

$2.79 Mini Resistor Rack



TROUBLESHOOTING goes so much faster when you can make quick resistance substitutions with a probe that contains the most-popular-value resistors. Such a probe is our Mini Resistance Rack. It consists of a string of 20 resistors soldered to push-in terminals (Vector T28) which are mounted on a ⅞ x 3⅞-in. piece of perforated board (3/16-in. hole centers).

The ends of all the resistors at one edge of the board are connected together with a bus wire. At the end of the bus there's a pointed probe which you touch to parts in the circuit being checked. To the other end of the chosen resistor you connect a small clip lead and clip it to the circuit under test.

Short jumper leads can be used to parallel-connect one or more resistors to obtain values not provided for in the probe. We used the following ½-watt, 10 per cent resistors in our probe: 15; 27; 56; 100 (2); 220; 560; 1,000 (2); 1,200; 3,300; 4,700; 10,000; 22,000; 47,000; 100,000; 220,000; 470,000; 820,000; 1 megohm.

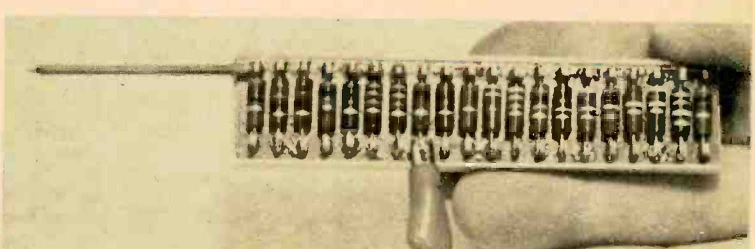
To make sure you don't touch the terminals, cement the board in the plastic holder supplied with a children's-size Pepsodent toothbrush; it's the exact size required.

Construction of the probe is a simple job but takes care. The thing that requires time is the installation of the push-in terminals. You'll find the job goes much easier if you support the board from the back around each hole. This will prevent the board from bending (and possible cracking) when you push in a terminal; they require a fair amount of pressure. Apply the force directly down on the terminal or it will bend over. If a terminal folds, discard it; it can't be straightened and used again. After the 40 push-in terminals are installed slip the resistors in place, solder them to the terminals and clip off the leads.

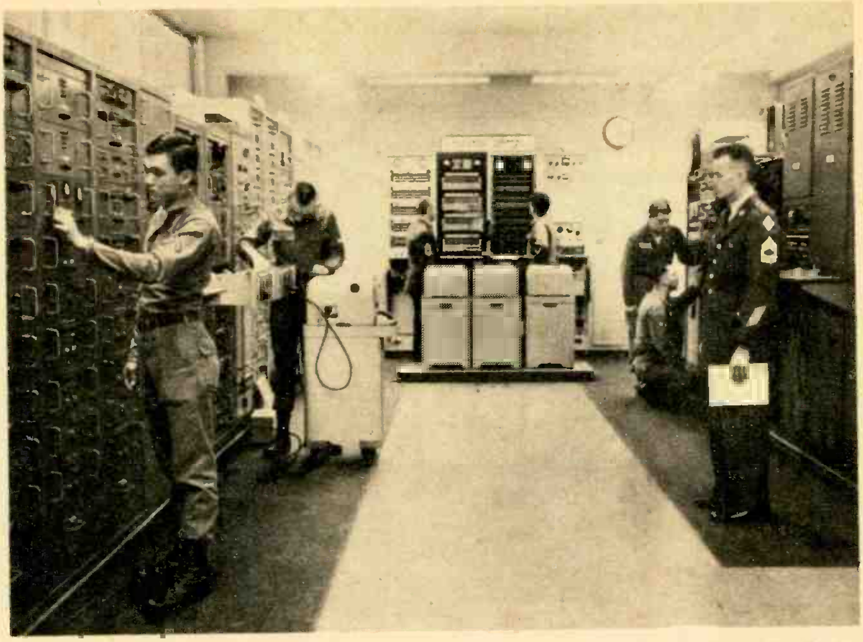
The probe tip is a short length of No. 16 solid wire whose tip should be filed to a sharp point. Slip a length of sleeving on all but the tip of the probe. —*Leslie Powell*

PARTS LIST

Clip lead (Lafayette 99 T 6235)	$.10
Perforated board (⅞ x 3⅞ in.)	.07
Plastic toothbrush holder	.00
Push-in terminals: 40 @ $.0155	.62
Resistors; ½ watt, 10%: 20 @ $.10	2.00
	$2.79



In our model, tops of all resistors are connected by a bus wire; probe at left is soldered to bus. A clip lead connects to the bottom of the resistors. Using another clip lead you can parallel resistors; omit bus and you can connect the resistors in series.



U.S. Army Photos

By FOREST H. BELT

The real true facts about military electronics training and subsequent civilian employment

could be illustrated by the case of a young airman who spent 25 weeks of his four-year enlistment in various Air Force electronic schools. He became a really good repairman on fire-control radar equipment. Coming out a few months ago, he applied for an electronics job at several different companies. No luck. His training had been too specialized, they told him.

A young Army specialist spent 18 months of his two-year hitch in Germany where he was responsible for maintaining human-hunting radar equipment. Shortly after leaving the service he was hired by the service organization of a large manufacturer. Today he is a successful color-TV service technician.

Why the difference? Why do some military-trained electronic specialists make the grade in private industry while others don't? There's a lot more to it than mere personalities. And the value of military electronics training depends on many factors.

[Continued overleaf]

Here, an advanced class in radar is given by the Signal Corps for specialists. Career military men who have specialized in electronics usually have easiest time finding positions in private industry or government. Classified work can sometimes prove a stumbling block, however.

MILITARY ELECTRONICS

There's no doubt about it, military electronic training generally is the best available. Yet while many young men join the Armed Forces every year in search of a *Glamorous Career in Space-Age Electronics,* they find that military electronics isn't quite the same as consumer items like television, hi-fi, two-way radio and CB. But that's where the civilian jobs are, so a successful transition between the two fields is a must.

Electronics is the skill most in demand by all the services and this field takes up a substantial portion of the $5 billion spent for training every year by the Department of Defense. The training is excellent for the purpose at hand. However, the main drawback found everywhere is overspecialization. The Air Force technician's training, for example, was specifically military, and a Marine specialist may be taught to repair or operate only *one* electronics system or a single piece of equipment. The reasons are not hard to understand.

A draftee is available to the Army for only two years. Even if he joins voluntarily his hitch may run only three years. Marine Corps enlistment is for two years, while Air Force and Navy enlistments run four years. Little wonder that the services try to get a man trained as quickly as possible. Training usually is limited to bare fundamentals and a single specialty. The recruit never gains the broad experience which helps him adapt to civilian gear.

Another reason for short training periods and specialized instruction in the Army and Air Force is that electronics maintenance in both services amounts to black-box changing. Instead of repairing electronic equipment in the field, you exchange a faulty module for a good one and ship the bad one to a repair depot or the manufacturer.

In the Navy, however, you repair everything possible on the spot. A unit that goes bad at sea can't be sent back to the manufacturer. So Navy technicians need more training and must be familiar with a wider range of equipment. This broader training pays off in civilian life.

People who find jobs for military-trained specialists say its easier to place graduates from certain schools. Those we talked with consider the Navy to have the broadest training programs in electronics. The Army's Fixed Communications School at Fort Monmouth, N.J. rates high in turning out communications experts, while the Air Force school for aviation electronics at Chanute AFB near Rantoul, Ill. is also high on the list. For computer training no one denies that the best school is at Keesler AFB near Biloxi, Miss.

Code class is one of the first hurdles a specialist in Army communications must overcome. Communications equipment does offer excellent background in general electronics, a factor to be considered if you're looking for a springboard into a career in consumer or industrial electronics.

When you evaluate electronics training in the military consider both the quality and the length of training available. An Army draftee usually gets little more than 15 weeks while a Navy enlisted man, under certain circumstances, may get as much as a year of advanced electronics; also, this experience is likely to cover a variety of equipment ranging from TV sets to computers.

If you're a student facing a hitch in the service it's smart to do some planning ahead. One of the most basic requirements is a high-school diploma, but a little college won't hurt. All special training in the military is based on aptitude tests. If you want some schooling in electronics you must pass these tests. Best way is to get all the electronics you can beforehand—in your school's vocational-technical program or from a correspondence school while you attend high school.

While you can try to obtain a commitment for the training you want, only the Army guarantees your training before you sign up; even then, you must first pass a battery of aptitude tests. In other branches of the Armed Forces the needs of the service come first and your wishes second. If you score high on the AQT (applicants' qualifying test) and show promise, you can probably get some kind of electronics training since the need is so great. However, you have little choice as to what kind or how much.

Adapting your military training to a civilian career is easy in some specialities. Computer technology is an example. Companies are always looking for console operators, programmers, systems analysts and computer repairmen. Computers used in the Armed Forces are the same as those used by corporations all over the country, so anyone who qualifies for computer training can transfer to a lucrative civilian career. Some other specialities serve as springboards, too. Examples are closed-circuit TV systems, military radio and TV equipment, and most communication systems.

Some military equipment is very unlike civilian gear. However, once you understand the basic principles of electronics you are half-way along the path to a civilian job. Fire-control radar is an example. Being a pulsed radar, its principles of operation are much the same as for most weather radars. Any Doppler radar is based on the same principles as speed-control radars and some burglar alarms. Certain military IFF (identification—friend or foe) equipment operates on principles used for navigation transponders in commercial and business aircraft.

Two important ways to assure a successful transition from a military specialty to consumer electronics are: One, recognize that fundamental principles apply to both and get all the schooling you can in basic electronics; and two, study civilian electronics on the side through correspondence courses available

MILITARY ELECTRONICS

from the Armed Forces Institute (most are free). If you fail to qualify for them, you can still take other courses on your own.

If you cannot obtain an electronics assignment, there is still a way you can get some electronics training from the military. A new program called *Project Transition* is now being offered to members of the Armed Forces who have six months or less left to serve. Previous electronics education or experience is not required. You only need take a screening test to show that you have aptitude.

Project Transition was instituted by former Secretary of Defense Robert McNamara during the summer of 1967 to help prepare short-timers for civilian jobs. One skill being taught is electronics repair. The Department of Defense furnishes classrooms and provides counseling and testing for servicemen wishing to participate in this free vocational training. For the field of electronics, the Electronic Industries Association worked out a curriculum aimed at turning out TV repairmen in a 90-day period. Member companies of EIA furnish test equipment, TV sets for the classes and instructors. Their aim is to answer the television industry's need for service technicians and at the same time give discharged servicemen a valuable skill.

The first electronics class began at Great Lakes Naval Training Center in March 1968, drawing 20 short-timers from nearby Fort Sheridan. A placement program is also a part of Project Transition; and there is a follow-up system to see if trainees prove permanently employable. Any man about to be discharged can ask his commanding officer if Project Transition training is available near his base. Not all bases have such facilities yet, but more and more are becoming available throughout our country—particularly at mustering-out points.

Career military men (20 years plus) whose assignments have been in electronics are top candidates for civilian jobs. Yet, odd problems crop up here, too. For example, one lieutenant colonel retired last fall after 27 years experience in the Signal Corps. In the five years before his retirement he had acquired valuable experience with missile systems and was eminently qualified to serve a

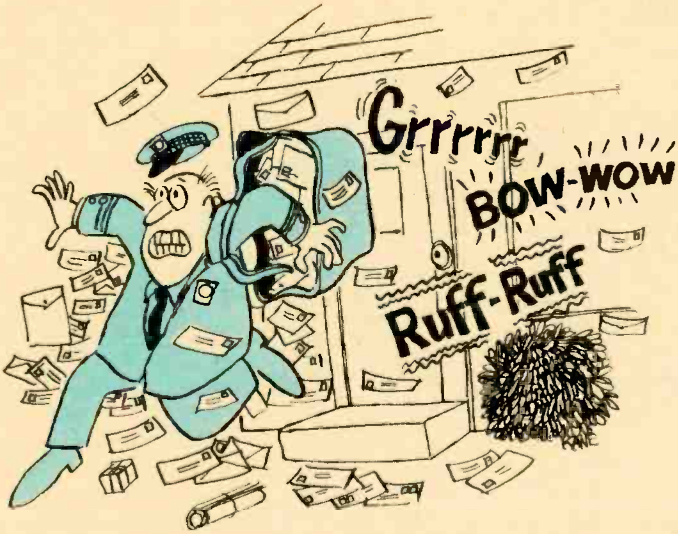
No matter how specialized the military equipment you work on, if you have a thorough understanding of basic electronics and fundamental circuitry, you can apply what you know to consumer products.

certain defense contractor in a top-paying job. But his work has been classified, so he couldn't even describe his experience to this prospective employer.

A placement counselor for NCO Availability, Inc., an employment service for departing military men, describes this problem as common. "Our toughest placements are people who have been on secret projects. They can't talk and neither can the companies who are interested in them." This dilemma is usually solved by giving a general idea of the applicant's training and convincing a company he is worth taking a chance on. (Another solution is for the job candidate to apply to the company that makes the secret equipment. Trying a company that supplies, designs or builds a familiar piece of electronic gear is a good angle for any military-trained technician.)

Within the past three years several employment agencies have sprung up which cater to the needs of the retiring military expert. NCO Availability, Inc. of Arlington, Va. was formed by noncommissioned officers from various services. This agency specializes in the problems of the long-time NCO. Another such agency is Lendman & Associates of Norfolk, Va. Its operator, Ernie Lendman,

[*Continued on page* 111]



The Canned Hound Dog

By LESLIE POWELL

FEW things offer better home protection than 90 lbs. of snarling police dog. The sound (and sight) of bared fangs will scare off even the bravest of intruders.

But suppose you don't want to add another mouth to the weekly food budget. You don't have to. With EI's Canned Hound Dog, you can have the protection of a dog without having to feed it. By means of a tape recording of a growling dog, our project produces the realistic sound of a vicious canine when someone presses your doorbell button.

The circuit activates a solid-state (instant play) tape recorder which continues running for approximately 20 seconds—or for whatever time you design the unit for. Even if the doorbell button is released instantly the tape will play for the full time. To avoid having the dog growls sound recorded, additional activation of the doorbell has no effect until the play cycle is completed; the effect is natural.

Construction. Our model is built in the U-section of a 7 x 5 x 3-in. Minibox. Note that there is no connection between the cabinet and the circuit ground (binding post BP2 is insulated from the cabinet). One side of J1 is connected to the cabinet. If you use the project to control an AC or line-operated recorder make certain that J1 is completely insulated from the cabinet.

To facilitate servicing, we show the normal collector voltages in the schematic. The voltages in circles are the *off* voltages (RY1's contacts open). The voltages in squares are the *on* voltages (RY1's contacts closed).

Except for transformer T1, mount all components on a 4 x 4¼-in. piece of perforated board. Keystone type 1499FT or Vector T28 terminals are used for tie points.

The layout is not critical, but use the transistor leads full length; the diode leads should be no shorter than ½ in, to avoid soldering-heat damage. Also, use a heat sink on each transistor and diode lead when soldering. Do not substitute for the specified diode and transistors.

The Canned Hound Dog

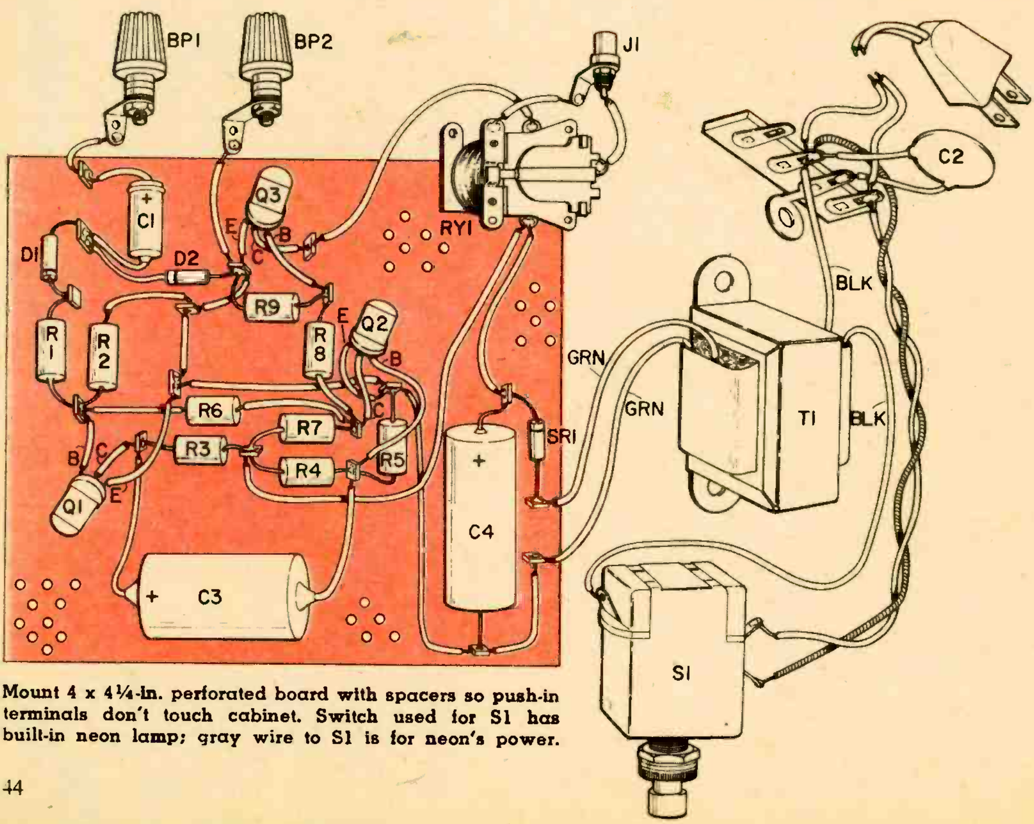
Power switch S1 can be a SPST type shown in the schematic. However, our model used the type shown in the pictorial which is a combination SPST pushbutton switch and neon pilot lamp. Wire this switch as shown in the pictorial or according to the instructions supplied with it.

Checkout. Apply power—RY1 should not close. If it does, check for a wiring error, particularly a poor ground at Q3's emitter or the bottom of R9. Next, touch BP1; RY1 should close and remain closed for about 20 seconds (if you used the specified C3). If the relay closes and then opens quickly, C3 is the wrong value or is leaky.

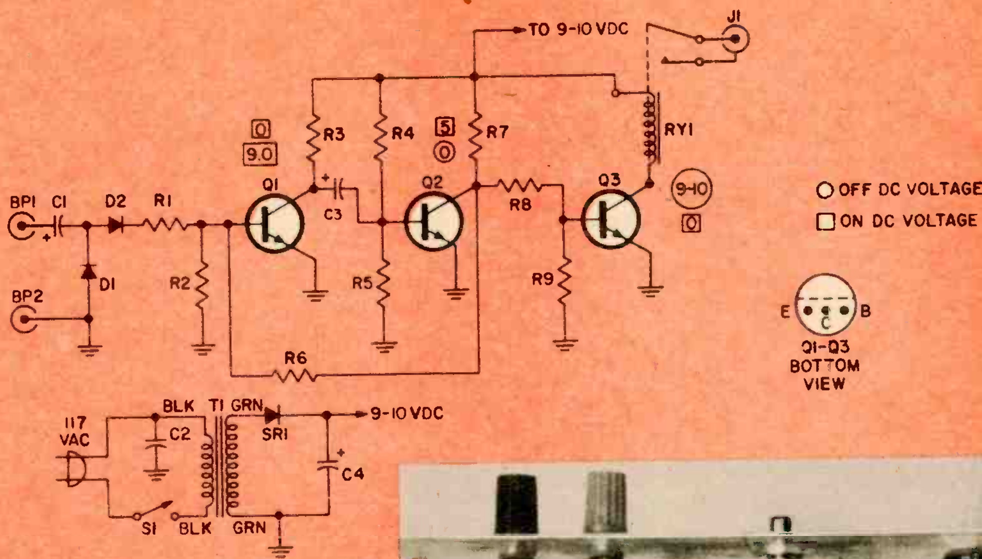
Getting the bow-wow or a grrr-rr-r. A well-stocked record store should have a sound-effects record of a growling dog. Be sure to check the record before paying for it. Some records are of puppies or a friendly mutt. Remember, you want the sound of an angry hound. If you can't purchase such a record, record a neighbor's watchdog. Either record the sounds on a tape loop, or dub and redub the sounds on a full reel of tape running at the slowest possible speed. You might

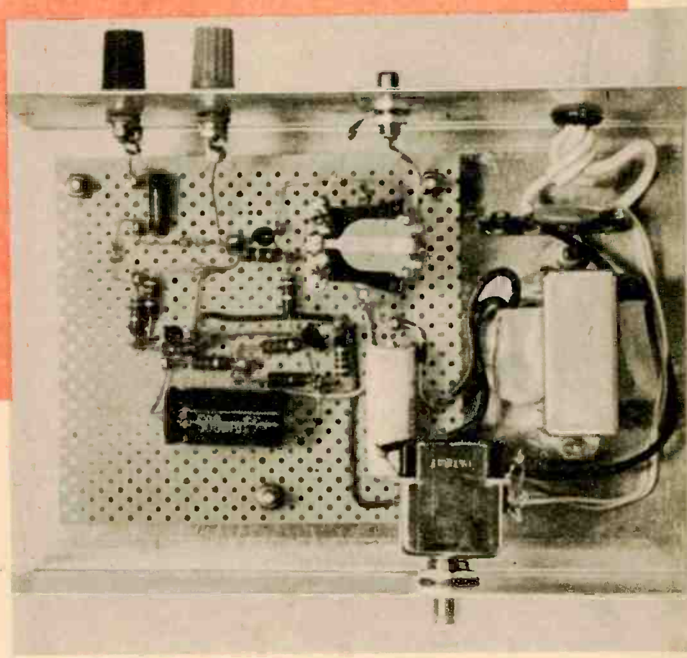
PARTS LIST

BP1,BP2—Insulated binding posts
C1—1 µf, 15 V electrolytic capacitor
C2—.01 µf, 500 V disc capacitor
C3—500 µf, 12 V electrolytic capacitor (see text)
C4—500 µf, 15 V electrolytic capacitor
D1,D2—1N60 diode or equivalent
J1—Phono jack
Q1,Q2—2N3393 transistor (GE)
Q3—2N3415 transistor (GE)
Resistors: ½ watt, 10%
R1—3,300 ohms
R2,R5—4,700 ohms
R3,R7—2,200 ohms
R4—15,000 ohms
R6—22,000 ohms
R8—3,900 ohms
R9—10,000 ohms
RY1—SPDT relay; coil: 6 VDC, 335 ohms (Potter & Brumfield RS5D-6VDC, Lafayette 30 T 8598)
S1—SPST switch (with neon indicator lamp Lafayette 99 T 6192 or equiv., see text)
SR1—Silicon rectifier; minimum ratings: 100 ma, 25 PIV
T1—Filament transformer; secondary: 6.3 V @ 1 A
Misc.—7 x 5 x 3-in. Minibox, perforated board



Mount 4 x 4¼-in. perforated board with spacers so push-in terminals don't touch cabinet. Switch used for S1 has built-in neon lamp; gray wire to S1 is for neon's power.





In AC bell circuit, connect BP1, BP2 to either line. In DC circuit, connect BP1 to positive line. Signal to input from doorbell causes RY1 to close and start recorder. RY1 stays closed until C3 discharges. Increase the size of C3 to lengthen the time recorder plays and vice versa. View of inside of cabinet is at the right. Don't use this project with bell circuits in which voltage is over 18V.

be able to squeeze an hour or so of sounds on an extended-play tape: this is enough sound for a couple of weeks or even months because you use up tape for only 20 seconds at a time.

Connect J1 to the remote-control jack of a solid-state tape recorder (the $20 or $30 kind). When RY1's contacts close, the recorder will start instantly and play the tape of a growling dog. Once the cycle is started, further doorbell pushing has no effect until the play cycle is complete.

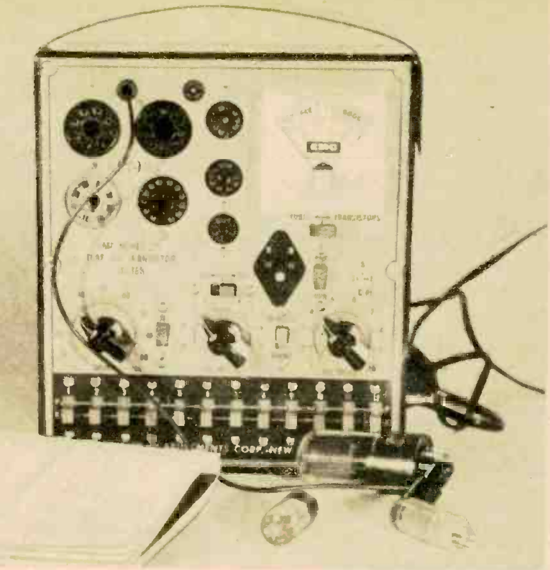
How it Works. Transistors Q1 and Q2 constitute a one-shot multivibrator. Normally Q1 is off (no collector current) and Q2 is on (maximum collector current). Because Q2 is conducting the voltage at its collector is zero. Since Q2's collector voltage is also Q3's base bias, Q3 does not conduct and relay RY1's contacts stay open as shown. When voltage is applied to BP1, Q1 conducts.

The voltage at Q1's collector then falls but C3 maintains the voltage on Q2's base until C3 discharges. The discharge current of C3 opposes Q2's normal-on bias provided by R4 and R5. Eventually C3 discharges and Q2 is cut off. When Q2's collector current drops, the collector voltage rises and Q3 is turned on. The current through Q3 causes RY1 to close and remain closed until C3 discharges. When C3 is discharged the circuit flips back to its normal state with RY1 open. Increasing the capacitance of C3 will increase the closed time and vice versa.

EI Kit Report

Tube/Transistor Tester

EMC 215



A TRIP to the drug store to check a set of tubes can be a drag when you're anxious to get the TV going again. Therefore, in terms of both the time and patience it can save you, having EMC's (Electronic Measurements Corp., 625 Broadway, N.Y., N.Y. 10012) Model 215 tube and transistor tester handy makes good sense. It's priced at $27.95 ($42.95 wired). On the transistor side it shows quickly whether a high- or low-power transistor is usable.

The 215 has eight tube sockets: loctal, octal, 10-pin, 9-pin, 7-pin, Nuvistor, 12-pin compactron and 9-pin novar. In addition there are two sockets for wire-lead and TO-3 type transistors. Measuring 8½ x 7¼ x 4-in., the 215 takes up little space on a bench or in a tool bag.

The kit went together routinely in seven hours. However, one socket wouldn't fit in its panel hole and another was a 9-pin instead of a 10-pin socket. A call to EMC got us the correct sockets. Also, at one point in the instructions we were not told to solder a wire to a lug on a ninth slide switch, yet we had a strong feeling it had to be connected there. A check with the schematic and pictorial confirmed our suspicion. . . So we made the connection. And in one or two other places the instructions did not tell us to solder after all connections had been made to a lug. (After each connection you are told to solder with an *S* or not to solder with an *NS*.)

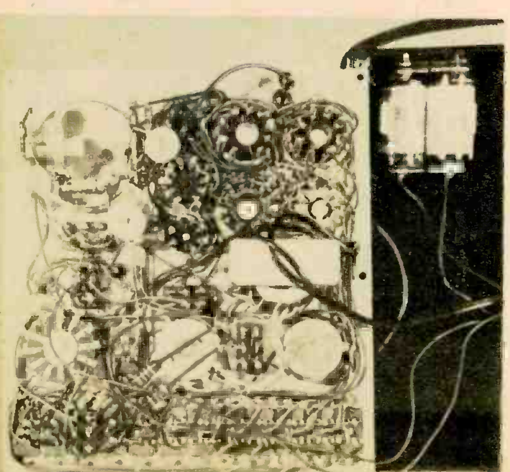
Aside from those things, construction was straightforward. The wiring is tight and layered; most of the connections are made between like-numbered pins on each socket. That is, pin 1 to pin 1, etc.

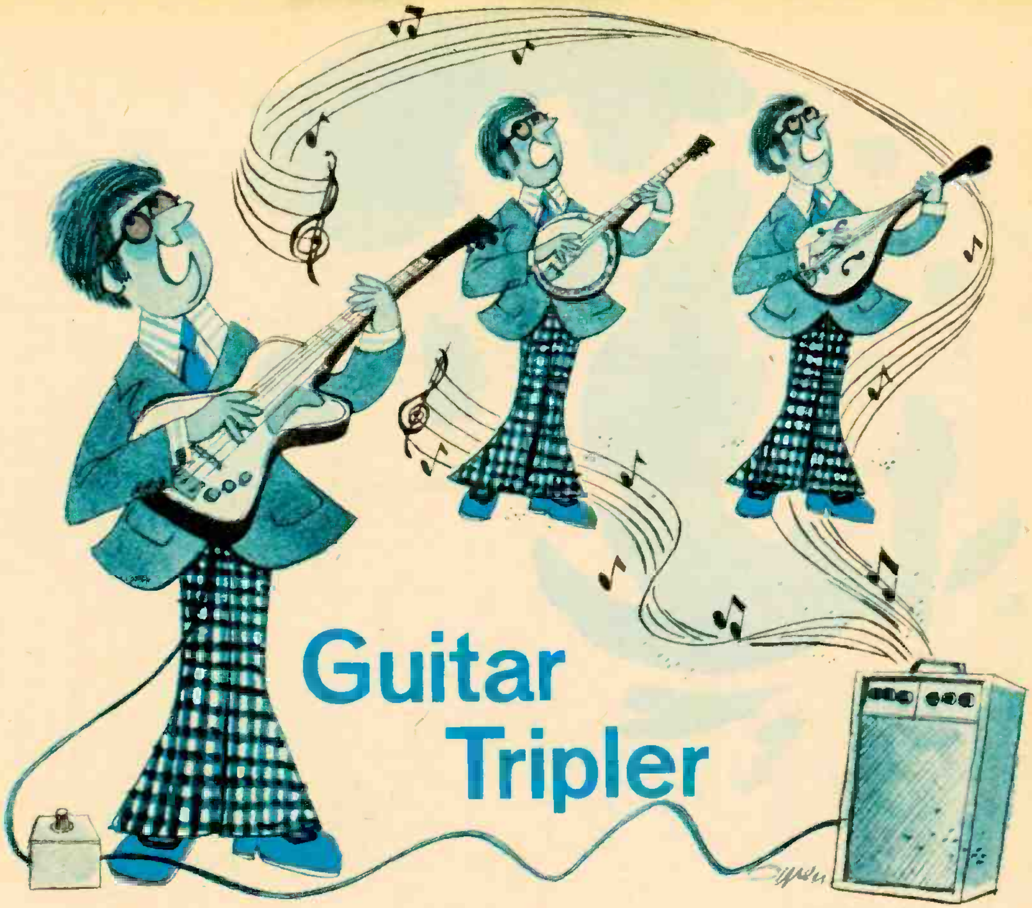
The tester checks tubes for emission, interelectrode shorts, leakage and intermittents. The filament transformer is a small one but it does the job. When checking a tube whose filament pulled 3 A, the voltage fell about 40 per cent.

The transistor test circuit is independent (with the exception of the meter) of the tube-tester circuitry. As a matter of fact, you can check transistors without plugging the unit into a 117-VAC outlet. When a transistor is plugged in it becomes part of an oscillator circuit that operates at about 30 kc. Such a test is satisfactory for audio and DC applications and will turn up a shorted or an open transistor. Absolute measurement of gain is not made—it is simply a good-bad check.

The 215 will earn its keep in short time. And you can say goodbye to those lines in front of the supermarket tube tester.

Wiring is packed in around sockets in upper right corner. Batteries in case supply power for oscillator circuit in which transistors are tested.





Guitar Tripler

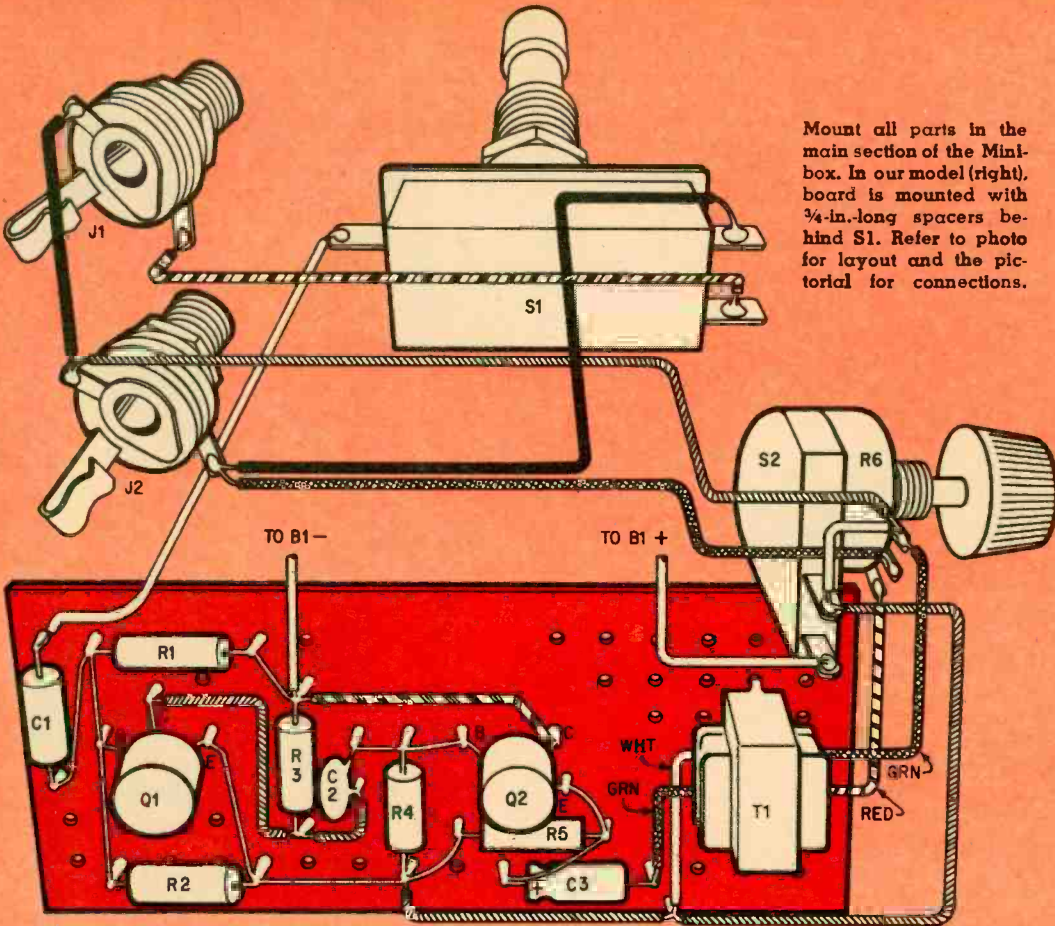
Like you feed your guitar through this box and out come the sounds of a banjo and mandolin.

By **STEVE DANIELS** T-W-A-A-N-N-G. . .! It's the sound of an electric guitar and it never fails to stir excitement, rhythm and action. In a rock band it's *the* instrument that makes the group swing. Those combos that are lucky enough to have more than one guitar come on just that much stronger. Like so many other things, if one guitar is good, you can be sure more are better.

Let's say your band is small and could use a few more string instruments to get it up in the big leagues. Answer is to hire a few more players and purchase another guitar or electronic bass. But this takes bread and there may not be too much available.

Don't give up. We have a low-cost solution to the problem. It's a handful of parts worth about $10 that can give your guitar the added sounds of a banjo or even a mandolin. At least that's what our guitar sounded like when played through the Guitar Tripler. The sounds may strike you differently but without doubt you'll think there are two new men up there next to you doing their thing. Suddenly your band has three string instruments.

On the other hand you may be just a beginner with a small amplifier that doesn't have features like built-in distortion, fuzz or selective frequency

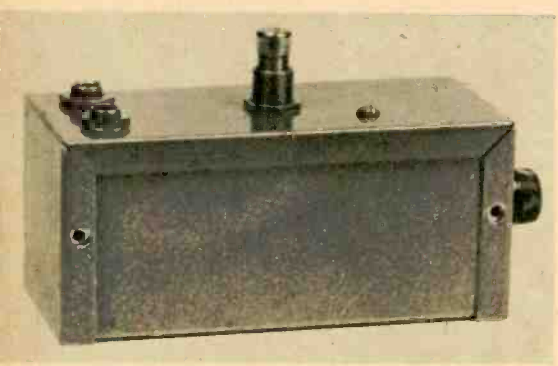


Mount all parts in the main section of the Minibox. In our model (right), board is mounted with ¾-in.-long spacers behind S1. Refer to photo for layout and the pictorial for connections.

Guitar Tripler

boost. Again, the Tripler is what you need.

The Tripler is a filter that emphasizes the high-frequency harmonics generated by the guitar. It makes possible a variety of offbeat sounds and original effects.



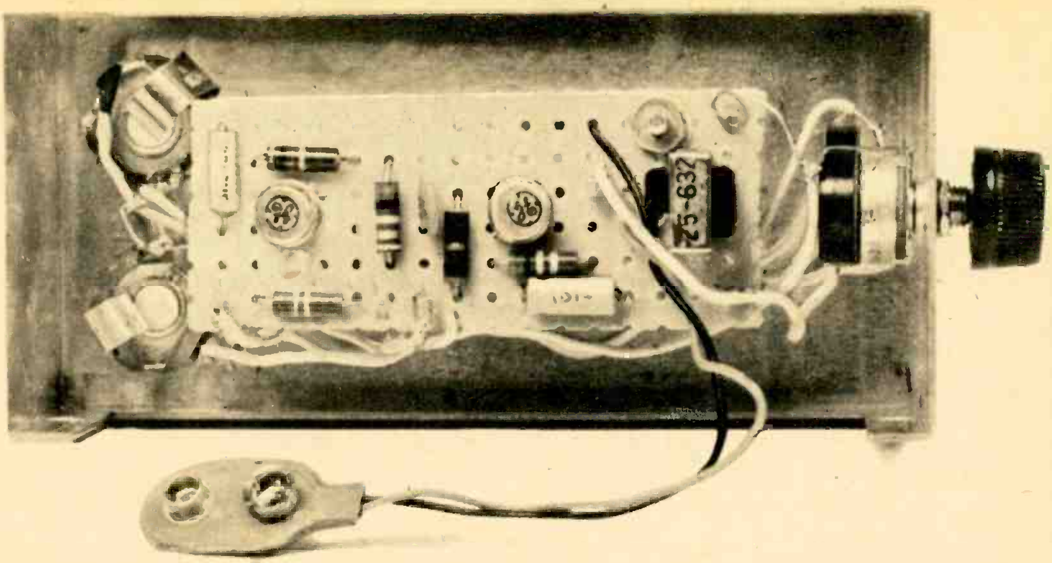
Input, output jacks are at left, level control is at right. Step on switch (top) to turn on.

What makes the Tripler different from an ordinary tone control? Most low-cost amplifiers use a tone control circuit that shunts a certain amount of treble to ground depending on the controls' setting. The Tripler does the opposite. A glance at the schematic shows that capacitors C1 and C2 at the input and output of Q1 will block low frequencies because their capacitance is small. The second stage, consisting of emitter follower Q2 and transformer T1, takes care of impedance matching.

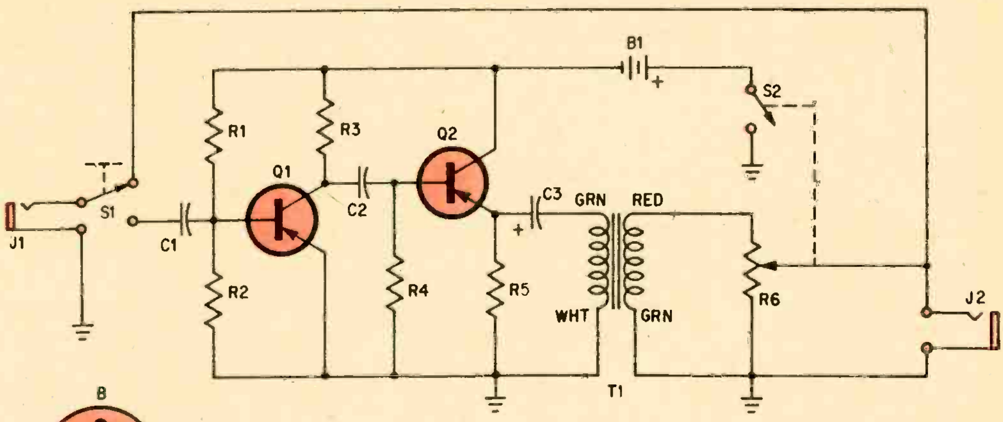
Construction

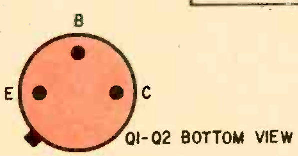
Construction isn't particularly critical but a metal box will help keep noise out of the system. Regardless of the enclosure, just wire the board using good wiring practice as you would for any amplifier. Use flea-clip terminations for the pot, input, output, ground and the switch on R6.

The switch specified for S1 may look like a conventional SPDT pushbutton job, but it isn't. Unlike an ordinary pushbutton switch that returns to its original state after being



Push-button switch is behind circuit board. Transformer (right) is held to board by soldering its mounting tabs to flea clips. Battery can be attached to U-section of Minibox with tape or standard holder. Schematic is below. Potentiometer R1 is used to set output level of Tripler relative to guitar's output. With S1 in position shown, signal from guitar is fed unaltered to output jack. Be sure to connect T1 as shown.





released, this switch stays in one position or the other until it is pushed a second time.

Operation

Connect the Tripler between the guitar and amplifier as you would any outboard accessory. Turn your amplifier on and set its volume control to a low level and set the tone control to mid-range. Turn the Tripler on and turn pot R6 to about three-quarters full clockwise. Depending on the position of S1 you should get either straight sound or emphasized treble sound. Step on the switch and start experimenting with the controls.

PARTS LIST

B1—9 V battery
C1,C2—.001 µf, 25 V or higher ceramic disc capacitor
C3—2 µf, 15 V electrolytic capacitor
J1, J2—Phone jack
Q1,Q2—2N1414 transistor (GE, Motorola)
R1,R4—1 megohm, ½ watt, 10% resistor
R2—22,000 ohm, ½ watt, 10% resistor
R3,R5—10,000 ohm, ½ watt, 10% resistor
R6—500,000 ohm, linear-taper potentiometer with SPST switch
S1—SPDT push-push switch (Carling 112 or equiv.)
S2—SPST switch on R6
T1—Transistor audio transformer; primary impedance: 200,000 ohms, secondary impedance: 1,000 ohms (Lafayette 99 T 6034)
Misc.—5¼ x 3 x 2⅛-in. Minibox, perforated circuit board
The Carling 112 switch is available for $2.50 postpaid from Tridac Electronics Corp., P.O. Box 313, Aldon Manor Br., Elmont, N.Y. 11003. No foreign orders

Radio Libertad – a REAL Mystery Station

REMEMBER Radio Swan and Radio Americas? Then there was also the Blue Eagle incident! All had something in common. They were radio stations operating with an aura of mystery. Trouble is, these mysteries were more imagined than real. Both R. Americas and R. Swan said they were on Swan Island—it was just that nobody believed them.

Now we *do* have a mystery station. Called Radio Libertad, La Voz Anti-Communista de America, this station is a rarity because no one in the DX community knows much about it. Who operates it, who supports it, where the transmitter is located and what the purpose of the station is—all this is unknown.

Radio Libertad first appeared on the shortwave scene in October 1961, shortly after the Bay of Pigs fiasco, and almost at the same time that R. Swan was transformed into R. Americas. Initially two frequencies were used by Libertad—7318 and 6999 kc, the latter having been used by R. Escambre Libre, a one-shot transmission aired by the CIA at the end of the Cuban invasion. R. Libertad added a third outlet on 15050 kc in December of 1961 and by mid-December of 1962—after the worst of the Cuban missile crisis had past—they were working a full schedule on five frequencies (15050, 7318, 5067, 4005, with MW broadcasts on 1556—later replaced by 1404).

During this period R. Libertad's anti-Communist propaganda operation was in full swing. Since then, however, it has been a downhill affair. By March 1967 the outlets were reduced to two SW transmitters, and presently Libertad can be heard only on 15050 kc. As opposed to R. Americas (which had a 50-kw station) R. Libertad's signals have always been of low power. Best guess would place transmitter strength at 5 to 15 kw, if that. Signal quality has deteriorated during the last two years and now the 15050-kc outlet is scarcely recognizable. Obviously, this is not a station out to make headlines.

On the Track of RL. That R. Libertad is a mystery is an understatement. Your reporters have been unable to meet anyone who could provide even the slightest wisp of first or secondhand information about its operations. In the Miami area alone, where over 100,000 Cuban refugees now make their home, a number of attempts were made (by the distribution of printed material and through private sources) to contact someone having any kind of information about the station. No luck. Not one person came forward.

In June 1962, the station announced that it was broadcasting from the studios of a Eugenio Fernandez Ortega. However, no location was given. The station first gave a mailing address in November 1962. This was Box 135, Miami, Fla. Shortly afterwards this was changed to 2113 Ocean View Drive, Miami Beach. A check of the latter address revealed that there is no such street. There is an Ocean Drive but it ends in the 1400 block. Other addresses were given: Box 2113. Ocean View Branch, Miami Beach; and as of December 1964, Box 5650 (sometimes 5650E), Caracas, Venezuela. By April 1966 the Caracas address was given along with a new address (Box 2214) in Miami.

As far as we know, no one ever received a QSL card or letter from any of these addresses, though one DXer is reported to have received a QSL from RL in Caracas. However, QSL cards have been received from NTS, a *Free Russia* underground station which is anti-Communist and operates (using low-powered, mobile equipment) somewhere in Europe. The illustration of its QSL card shows the transmission to have been sent via R. Libertad. It is reported that NTS is the only non-Spanish speaking rebel group using R. Libertad's facilities, but just what the relationship is between the two stations, nobody knows.

Programs have been broadcast in Spanish, English, German and even Russian (for the benefit of Cuban-based Russian missile technicians). They always have had a hard-line anti-Communist subject matter and have been, in fact, much stronger than the CIA inspired programs broadcast by Radio Americas. No holds are barred when it comes to talking about the dangers of Communism.

Where and Who? Just where is R. Libertad located and who is behind it? Theories fly as thick as gnats, but names and locations are meaningless when you have no data to back them up. The easiest and quickest solution has been to blame the CIA or even the DIA (Defense Intelligence Agency, a separate entity from the CIA and more hush-hush). One cannot be 100 per cent sure, but we feel this is too easy a way out—even though respected names in the DX community are willing to stake their rigs on the theory of CIA support.

The fact that R. Escambre Libre used 6999 kc before Libertad appeared on that frequency means little. In fact, this could have been a clever way to put the CIA on the spot. The major evidence against direct CIA participation is that one of your reporters managed to get a look at a CIA short-wave monitoring report (marked confidential!) which guessed that the station was located in Venezuela and being operated by a group calling itself *the Eleven*. This is inconclusive, but it is doubtful that such a report would be distributed to government agencies if the CIA were actually behind the station. (However. this could make sense if some other agency—DIA, NSA, etc.—were involved.)

Direction finding has been undertaken by individual DXers, DX clubs and some of our sources who have access to government-owned DF equipment. These studies tend to place R. Libertad in the Caribbean, near the

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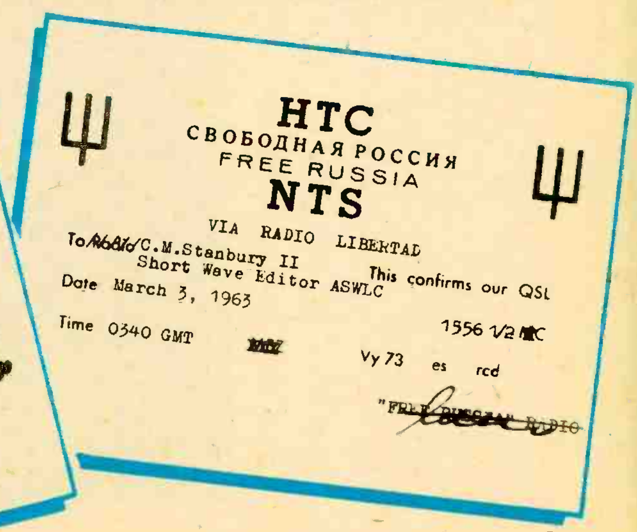

QSL card from NTS for their transmission over R. Libertad. NTS is a Russian underground operation devoted to anti-Communism. They broadcast from Europe with mobile rigs.

Ask any man who really knows the electronics industry.

Opportunities are few for men without advanced technical education. If you stay on that level, you'll never make much money. And you'll be among the first to go in a layoff.

But, if you supplement your experience with more education in electronics, you can become a specialist. You'll enjoy good income and excellent security. You won't have to worry about automation or advances in technology putting you out of a job.

How can you get the additional education you must have to protect your future—and the future of those who depend on you? Going back to school isn't easy for a man with a job and family obligations.

CREI Home Study Programs offer you a practical way to get more education without going back to school. You study at home, at your own pace, on your own schedule. And you study with the assurance that what you learn can be applied on the job immediately to make you worth more money to your employer.

You're eligible for a CREI Program if you work in electronics and have a high school education. Our FREE book gives complete information. Mail postpaid card for your copy. If card is detached, use coupon below or write: CREI, Dept. 1709H, 3224 Sixteenth Street, N.W., Washington, D.C. 20010.

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Please send me FREE book describing CREI Programs. I am employed in electronics and have a high school education.

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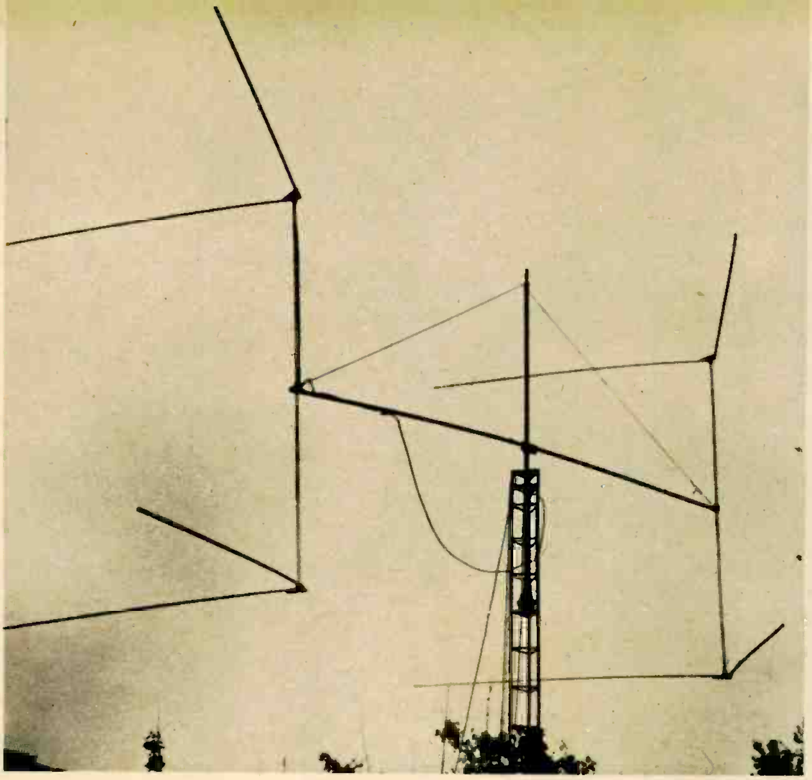
APPROVED FOR TRAINING UNDER NEW G.I. BILL

Vee-Quad Antenna for CBers and Hams

By RONALD LUMACHI
WB2CQM



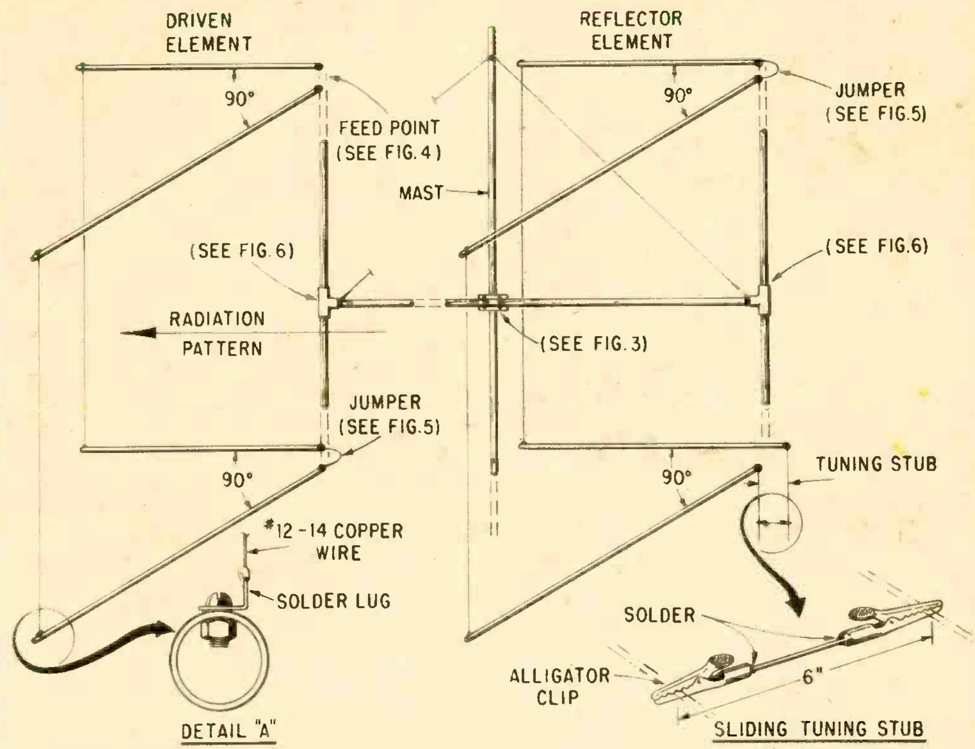
WHEN experimenting with new antennas, CBers and amateurs frequently are faced with the problem of getting maximum gain while keeping design simple and cost low. Our two-element Vee-Quad beam has features which offer some solutions to the problem. By incorporating the best characteristics of several designs, the antenna maximizes gain, minimizes cost and reduces the effect of rear pickup or radiation.

The antenna basically is a quad configuration with front and rear elements folded 90° at the center. The signal the antenna intercepts when receiving is greater than that of (for example) a Yagi array of comparable size.

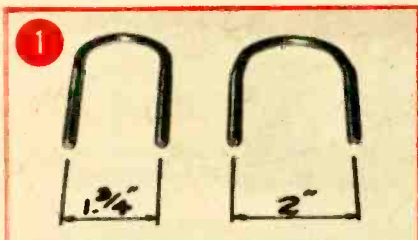
On the third page of this article we list the dimensions of the antenna elements so you can build one for the band of your choice. Lengths are given for operation on 20, 15 and 10 meters as well as the Citizens Band. It is impractical to build the antenna for 40 and 80 meters because it would be too large and unwieldy.

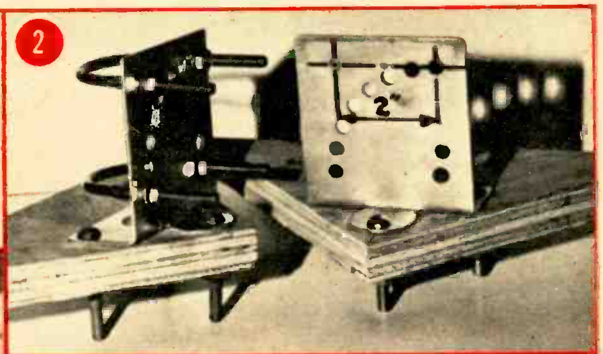
Let's Build It.

First take a look at the photo above of the antenna and the diagram of it at the top of the next page. It consists of four horizontal V elements—two in the front and two in the back. The front (driven) elements are supported by a vertical mast, as are the rear (reflector) elements. The masts to which the elements are attached are supported by a horizontal boom. The wires that you see going from the front ends of the top elements to the front ends of the bottom elements are not visible



Overall construction. Dimensions are in table on next page. Figs. Nos. refer to photos of the details.





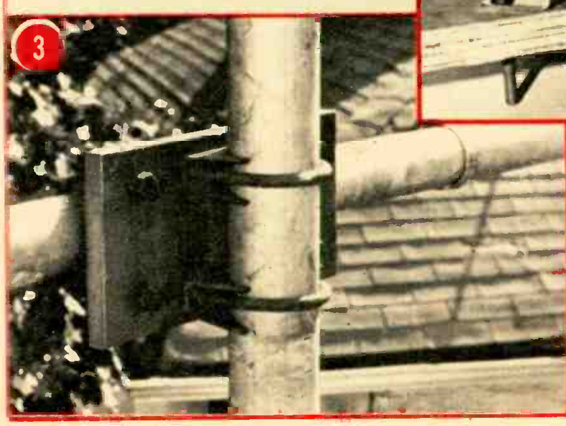


Fig. 1—In upper-left-corner photo, left U bolt is unmodified. Open it out to 2 in.

Fig. 2—All-angle mount (above). Add hole in upper left corner where indicated.

Fig. 3—Photo at left shows method of attaching horizontal and vertical parts.

Vee-Quad Antenna

in the photo on the first page of this article because they are too fine.

Thick-wall aluminum tubing is satisfactory for the boom; it can be purchased from metal-supply dealers. The boom should be supported from the main mast (center) at each end to prevent sag. Figure 6 shows one method of providing support with a turnbuckle and nylon rope. Don't use wire because it will interfere with the electrical characteristics of the antenna.

The two vertical wooden poles that support the V elements' triangular platforms are 1⅝-in. dia. A system of U-shape clamps and a steel plate can be used to attach the driven and reflector-element vertical supports to the boom and to attach the boom to the mast.

The four supporting platforms for the top and bottom driven elements and the top and bottom reflector elements are made of ¾-in. exterior-grade plywood. Saw two 8 x 8-in. pieces of wood diagonally to form the triangle-shaped platforms.

The all-angle mounts we used to connect each platform to the vertical support poles are available from Lafayette and other distributors. Use U clamps. The mounting clamp included with the mounts is not suitable for this application. Modify the clamps to the dimensions shown in Fig. 1 to accommodate the poles. The all-angle mount, although not specifically designed for this application, works well with only one minor modification: 2 in. to the left of the upper hole (on the arc of holes) drill a ¼-in.-dia. hole to accommodate the top U clamp (Fig. 2).

Attach the mount to the platform at three points with ¼-20 x 1½-in. stove bolts, nuts and washers. The antenna elements are ⅞-in.-dia. lengths of aluminum tubing (0.049-0.058-in. wall thickness). They are mounted on the platform (Figs. 3 and 4) at 90° angles with ¼-20 x 2½-in. bolts, nuts and lock-washers. To prevent the end of the tubing from collapsing, slip 4-in. lengths of wood dowel into the tubing ends before drilling for the mounting bolts. All elements are constructed exactly in the same manner.

The lower driven and the upper reflector elements require a jumper wire to close the loop formed by the V (Fig. 5). Figure 4 shows the upper driven element feedpoint. At this point, care should be exercised not to allow the tubing to touch the angle support

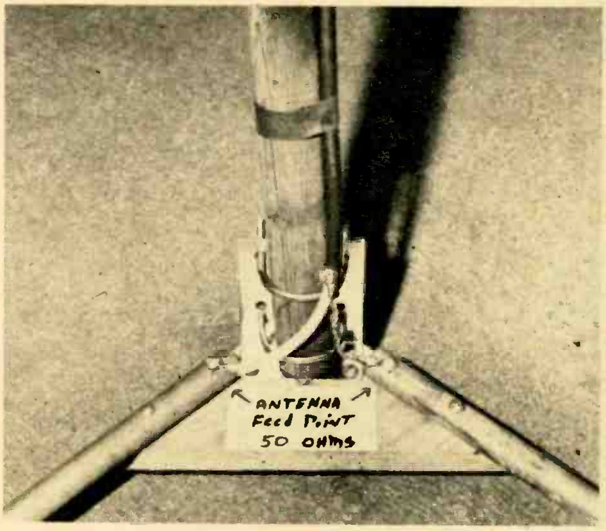
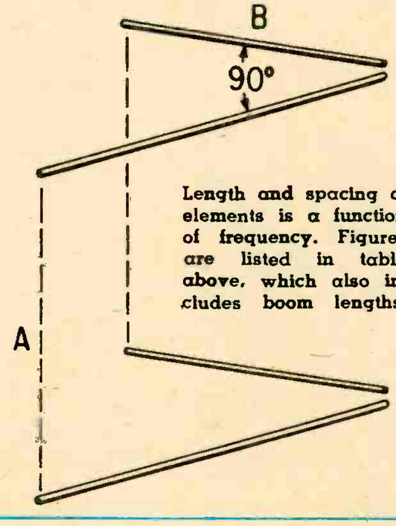


Fig. 4—Note how elements are attached to wooden platforms. This is where the antenna connects.

since it will short the system.

The input impedance at the feed point is about 50 ohms, however, it will vary some-

Band	ANTENNA DIMENSIONS Element Length A	B	Stub Length	Boom Length
20 meters	13′	12′	3′ 8″	16-20′
15 meters	9′	8′	2′ 6″	12′
10 meters	6′ 7″	6′	1′ 9″	10′
CB	6′ 10″	6′ 3″	1′ 10″	8-10′



Length and spacing of elements is a function of frequency. Figures are listed in table above, which also includes boom lengths.

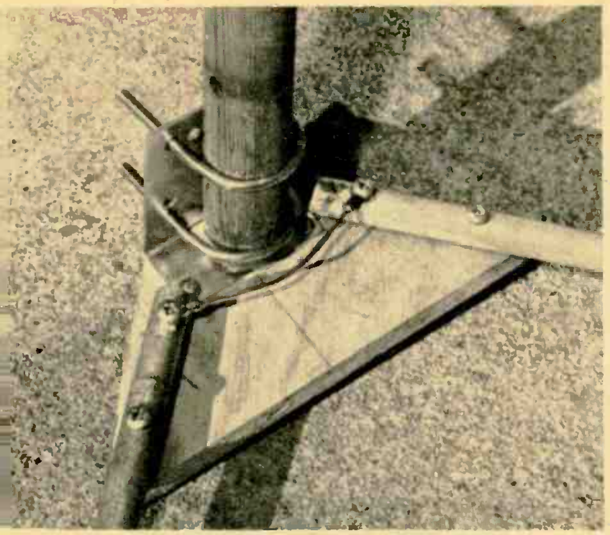


Fig. 5—These elements are connected with jumper. Wood screw goes up through platform into pole.

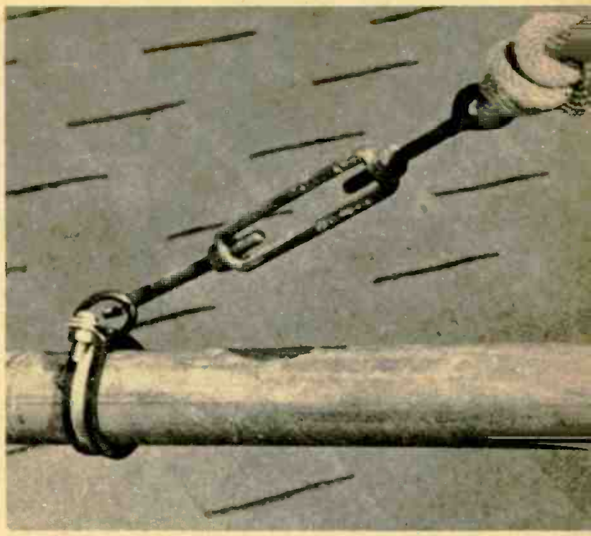


Fig. 6—View of end of boom shows how nylon support rope is attached with turnbuckle and clamp.

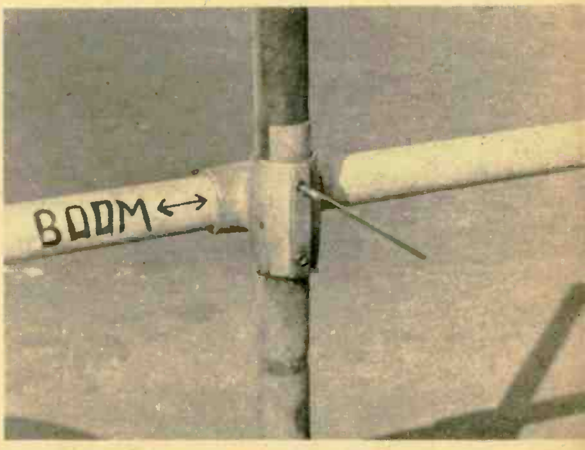
what depending on the antenna's height above ground. To attach the transmitter to your antenna, simply connect the center conductor of the coax under one element mounting nut and connect the copper braid to the other. The lower reflector element requires a tuning stub extending from the elements' end. (Inset on top diagram on second page of this article.) The proper length of the stub will maximize the front-to-back ratio.

The ends of the driven and reflector elements are connected with No. 12 or 14 copper wire. Drill a small hole in the ends of the elements and connect the wires with a small nut and bolts and a heavy-duty solder lug. To insure horizontal rigidity install a 3-in. No. 8 wood screw through each platform base into the vertical support pole. Coat all bare wood, metal and bolts with spray painting to protect from weathering.

Dress the antenna feed line from the upper driven element feed point down the pole and along the boom. Strap the coax with tape.

Materials

Description	Quantity
Alligator clips	2
All-angle mount (Lafayette 18 T 0199)	4
Boom, 1¼-in.-dia. (or larger) thick-wall aluminum tubing	1
Dowel, ¾-in. dia., 3-ft. long	1
Plywood, exterior grade, ¾-in. thick, 8 x 16 in.	1
Pole, wood, 1⅝-in. dia., 13-ft. long	2
Screws, wood, No. 8 x 3-in. long	4
Solder lugs, heavy duty	4
Tubing, aluminum ⅞-in. dia. (0.049-0.058-in. wall thickness). See table for lengths	8
Turnbuckle, 6-in.	2
U-bolts (Lafayette 18 T 0202)	7 prs.
Wire, copper No. 12 or 14	30 ft.
Misc: ¼-20 x 1¼ in. screws and bolts	12
¼-20 x 2½-in. screws and bolts	16



You also can couple vertical and horizontal elements with No. 10 Nu-Rail fitting available from Whitehead Metal Prod., Milik St., Cartaret, N.J.

EI Kit Report

Economy Treasure Locator

Caringella TRL-1

Birch handle, left, is about 3 ft. long and folds in half for storage. Center photo shows electronics. Outputs of two FET oscillators go to mixer which is followed by two audio stages. Search head, right, is glass-epoxy board that is used without cover. A coil is etched on top side, a shield is etched on other.

SOME people work for their bread. Others wait for an inheritance. A few think money grows on trees. Some hopefuls even dream of finding money in the streets. Then there's a growing fraternity of people who seek riches from buried treasure. The standard tool of their trade is a metal locator such as this $29.95 model sold by Caringella Electronics, Inc., Box 327, Upland, Calif. 91786.

An easy one-evening project (our construction time was about two hours), the TRL-1 works on the beat-frequency oscillator principle. That is, the circuit consists of two oscillators, one of which operates at a fixed frequency (around 1 mc). You adjust the frequency of the other until you don't hear a tone in the headphone. When the search head passes over metal or mineral objects, the frequency of the tunable oscillator changes and you hear a tone.

Construction presented no problems. The tuning capacitor, volume control and power switch as well as phone jacks, mount in one half of a U-shape metal cabinet. All other parts mount on a small printed-circuit board. Tune up consists of adjusting one coil slug.

One thing worried us. The glass-epoxy search head is not enclosed in anything. We have an uncomfortable feeling that someday it might hit a rock and break. Since the search coil and shield are etched on the board, there could be trouble. Also, our first search head did not work; a replacement did.

Have we found any treasure yet? Nope. We tried to find a hammer head but there was a tone when the search head got close to wet grass. This prevented our getting a fix on the head some 2 in. below on the ground.

The locator was a great aid in finding buried 20-penny nails used as markers on a dry clay tennis court. The nails were spotted at ½ to 1 in. On a wooden floor the locator detected a quarter at 1½ in.

They're Taking the Guesswork out of Scatter Communications

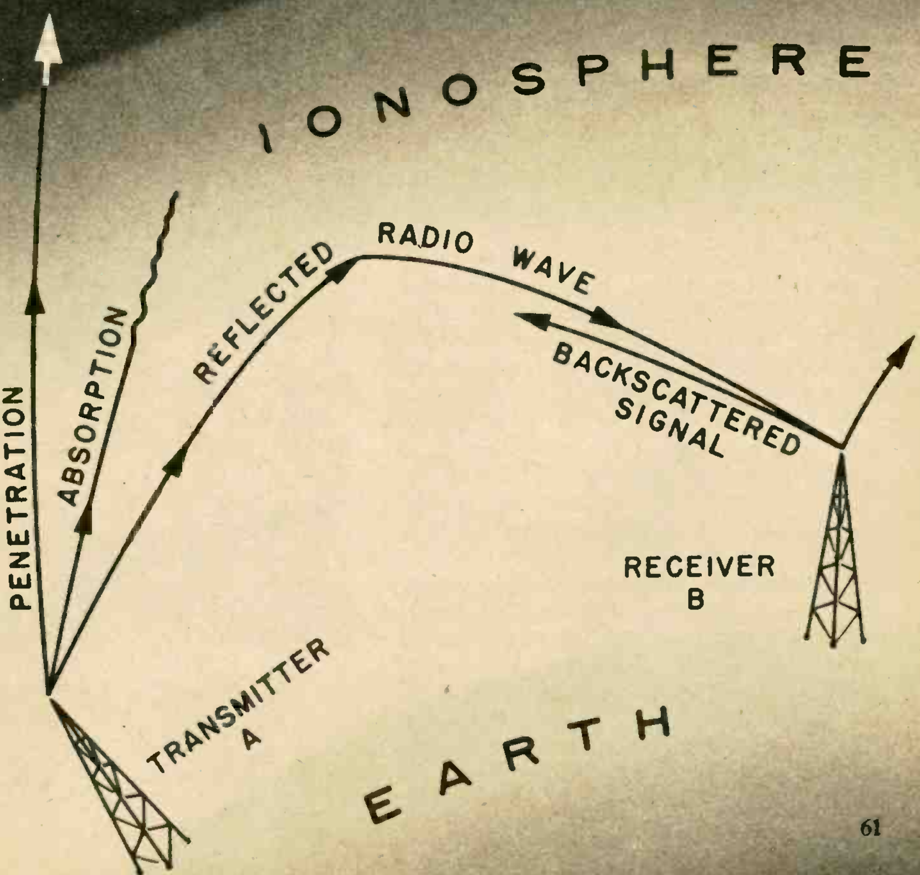
To get a good signal into a target area international short-wave broadcasters now are probing the ionosphere.

By STANLEY LEINWOLL

INTERNATIONAL BROADCASTERS located in the United States are developing a system based on the principles of radar that will boost the signals aimed into target areas without requiring increased power or antenna gain. The system, called *backscatter sounding*, is expected to be operational within a year. If successful it could revolutionize broadcasting techniques on both short-wave and amateur bands.

How it Works. Radio waves striking objects on or above the earth are reflected and scattered in all directions. A small portion of this reflected energy always returns to its source. By measuring the time between the transmission of the energy and its return to the point of origin, accurate determinations of the reflecting object's distance from the transmitter can be made.

We know radio waves travel at the speed of light—186,000 mi. per sec-



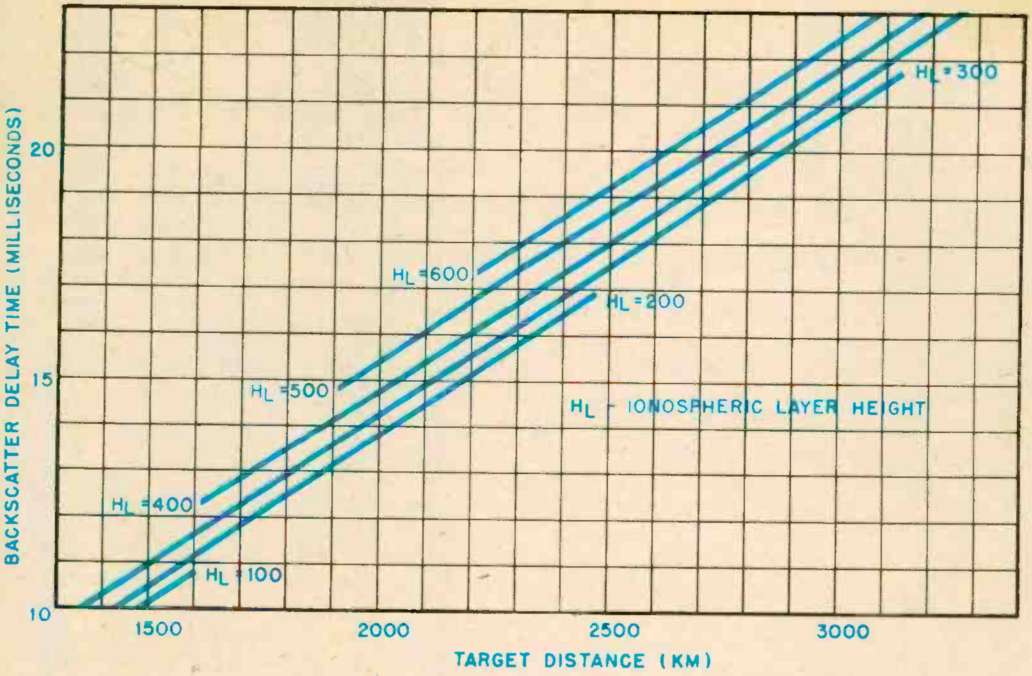


Fig. 1. Nomograph shows relationship of backscatter time to target distance. Height of ionosphere (up to 300 mi.) depends on amount of solar activity.

Scatter Communications

ond. A delay of a microsecond between the time a radio wave is transmitted and the time it's received back at the transmitter corresponds to a round trip (984 ft.) over a path 492 ft. long. All radar measurements are based on this principle. Most radar devices, however, operate at frequencies of 1,000 mc or more because short wavelengths give a more accurate determination of the size and shape of physical objects.

Shortly after World War II it was discovered that short radio waves (between 3 and 30 mc) display radar-like characteristics. These properties help to reveal information about a signal as well as valuable information about the ionosphere.

Long-distance short-wave communication is possible because there exists in the atmosphere a series of electrified layers collectively referred to as the ionosphere. The ionosphere is capable of reflecting radio waves in the high-frequency (3-30 mc) portion of the RF spectrum. However, the ionized gases making up the ionosphere change from day

Engineer for Radio Free Europe compiles detailed charts as he listens to international short-wave band. Effort is made to improve RFE's signal.
UPI Photo

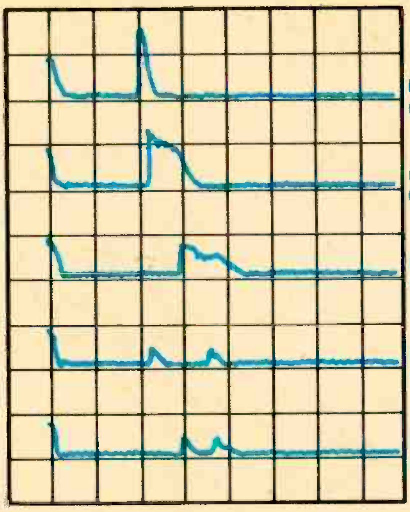


Fig. 2. RFE backscatter depends on finding best angle for propagation of signal at a given frequency. Distance increases as angle decreases.

to night, from season to season and over an 11-year cycle dependent on the number of sunspots.

A high-frquency radio wave entering the ionosphere will either be absorbed, be reflected back to earth or be lost in outer space. Reflection back to earth depends on the amount of ionization in the layers, the frequency of the radio signal and the angle at which the wave strikes a particular layer. Most radio energy returning to earth is reflected by the earth back to the ionosphere, where it is again reflected to a distant point. These *sky waves* make communication over great distances possible.

Backscatter Technique. Because of irregularities on the surface of the earth, a small portion of the energy striking it at some point will be scattered in all directions and even scattered back toward the transmitter. (Hence, the term backscatter.) By setting up a directional antenna and a receiver that feeds its output into an oscilloscope the backscattered signal can be monitored and analyzed right in the vicinity of the transmitter.

If the transmitter should send a series of pulses at different frequencies, say beginning at 3 mc and sweeping up at predetermined intervals to 30 mc, a receiver monitoring these pulses will show just what frequencies are being backscattered. Some of the signals will be absorbed by the ionosphere, some will penetrate it and some will be *propagated.* Backscatter sounding tells the broadcaster which frequencies are being propagated by the ionosphere and consequently which frequencies can be used for communication to a specific area of the world.

In addition, when the pulses are viewed on a scope, the time delay can be calculated. The time delay between the transmitted pulse and received echo gives the approximate location of the point of reception. This is illustrated in Fig 1. If a scope shows a delay time of 20 milliseconds at a particular frequency, we can arrive at our target's distance by estimating the height of the ionosphere (HL). In general, 300 kilometers is a reasonable assumption and the chart gives us a target distance of about 2,900 kilometers. Since no energy has been returned from a closer location it follows that the target distance was about 2,900 kilometers (or 1828 miles).

Radio Free Europe. The backscatter sounding system currently under test by Radio Free Europe is more sophisticated than the technique described above. It consists of a high-gain curtain antenna for transmitting and a frequency-shift pulse keyer at the input. This device shifts the carrier frequency of a transmitter for short periods of time while pulses of energy are sent out. A receiver and antenna system are tuned in step with the shifted carrier. The antenna consists of nine vertically-stacked cubicle-quad elements mounted on a 108-meter tower. It operates in the 11.8-, 15.3-, and 17.8-mc international short-wave bands and can be ad-

[*Continued on page* 103]

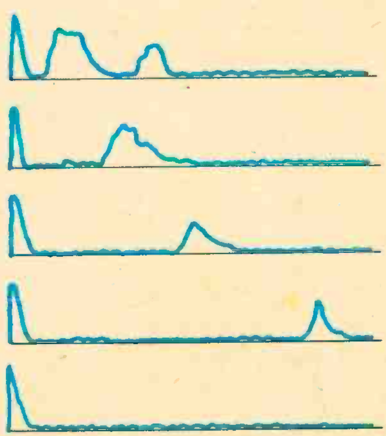
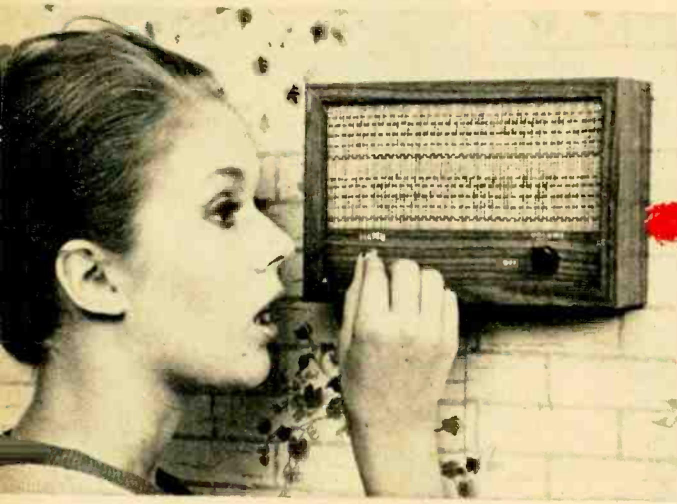


Fig. 3. Backscatter display for amateur bands. First pulse is from transmitter; echoes indicate distance of transmission (greater with higher frequency).



Tight-Budget

By VICTOR KELL

REMEMBER those old intercoms? They used several tubes and if left on for long periods of time got as hot as fire. Yet updated intercoms using transistors gave you two limited choices: an expensive multitransistor system or a cheap outfit with enough distortion to garble every message. By using an integrated-circuit amplifier in an intercom you can get high-quality, low-distortion sound at rock-bottom prices.

The schematic of our Tight-Budget Intercom shows how it's done. Transistor Q1 is a high-gain amplifier that boosts the output voltage from the speaker/mike to approximately 0.5 V to drive amplifier IC1 to almost 1-watt output. That's the whole bit, Q1 and IC1. Everything else in the circuit constitutes the power supply and the necessary speaker switching.

The IC amplifier, A GE PA234, is the heart of the unit. It consists of seven transistors, three diodes and three resistors in a package about 1 in. long by ¼ in. wide. Transistor Q1 is used to increase sensitivity so that the intercom can be used as a babysitter or as a listening post. The intercom can pick up footsteps at 20 ft.

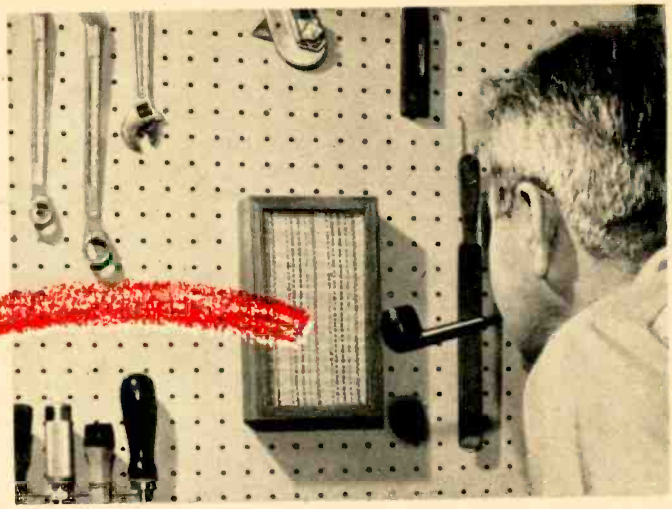
The model shown provides single *master* performance. That is, the master station, which houses the amplifier and talk/listen switching always monitors the remote station, which consists only of a speaker in an enclosure. Only the master has privacy; that is, the remote cannot listen to the master until *talk/listen* switch S2 is pressed.

Current drain in the standby mode is exceptionally low—less than 10 ma—and the unit can be left on continuously for pennies a year. At full output (1 watt) the intercom draws 100 ma; therefore, T1 must be rated for the 100-ma load. However, if you don't intend to use the intercom at loud volume levels you could get by with a 35- to 50-ma. power transformer, though the distortion on voice peaks will be considerably higher than the rated 1 to 3 per cent total harmonic distortion.

As long as you wire the perforated-board amplifier exactly as shown you can use any mounting arrangement for the speaker, switch S2, and volume control R7. The reason the amplifier must be built as shown is because the IC is a wideband amplifier and is extremely sensitive to ground loops. Couple this with the very high gain of Q1 and a single difference in the circuit grounding from that shown will produce total instability—continuous howling.

Also, the speaker load must be a minimum of 16 ohms. We suggest using a 32- to 45-ohm intercom speaker because it is specifically designed to avoid the heavy, boomy sound produced by standard speakers when used as mikes. Our intercom's sound quality is very crisp. If the speaker impedance is less than 16 ohms the IC amplifier will break into oscillation at low to moderate output-power levels. If, to keep costs down, you want to use an 8-ohm speaker, connect a 10-ohm resistor between C6 and S2. Although the amplifier will work it will not have high sensitivity and the sound will be somewhat distorted. Best thing to do, therefore, is use a high-impedance speaker.

Intercom



Construction

Start by completely wiring the perforated-board amplifier using Vector T28 terminals or flea clips for tie points. You will find that IC1 can be easily mounted if you use a piece of perforated board (2¼ x 4½ in.) with 3/16-in. hole centers; the holes will line up with IC1's wiring tabs. Note in the pictorial and photograph that only the terminals on the IC which are used are soldered to tie points—this is adequate for support.

Since IC1's terminals are not numbered make certain you orient it correctly or you will be wiring to the wrong terminals. Looking at the end of IC1 you will note the terminals are not centered exactly; they are closer to one side than the other. Mount IC1 so that the distance from the terminals to the board is less than from the terminals to the top of the IC. If you bend the IC terminals 90° they will drop right into the tie points.

First wiring step is to solder a 1-in.-square heat sink to the tab that sticks out the end of the IC. The heat sink can be cut from a tin can—not aluminum as it won't take solder.

Except for C3, C6 and R7, all part values are critical and should not be changed. Similarly, the power supply output voltage must be 20 to 22 VDC. The use of ¼-watt resistors is suggested as it avoids crowding, though ½-watt resistors can be substituted. A heat sink is not required when soldering IC1's terminals, but the soldering iron should be less than 50 watts and have a pencil tip. Use a heat sink on Q1's leads and keep them full length.

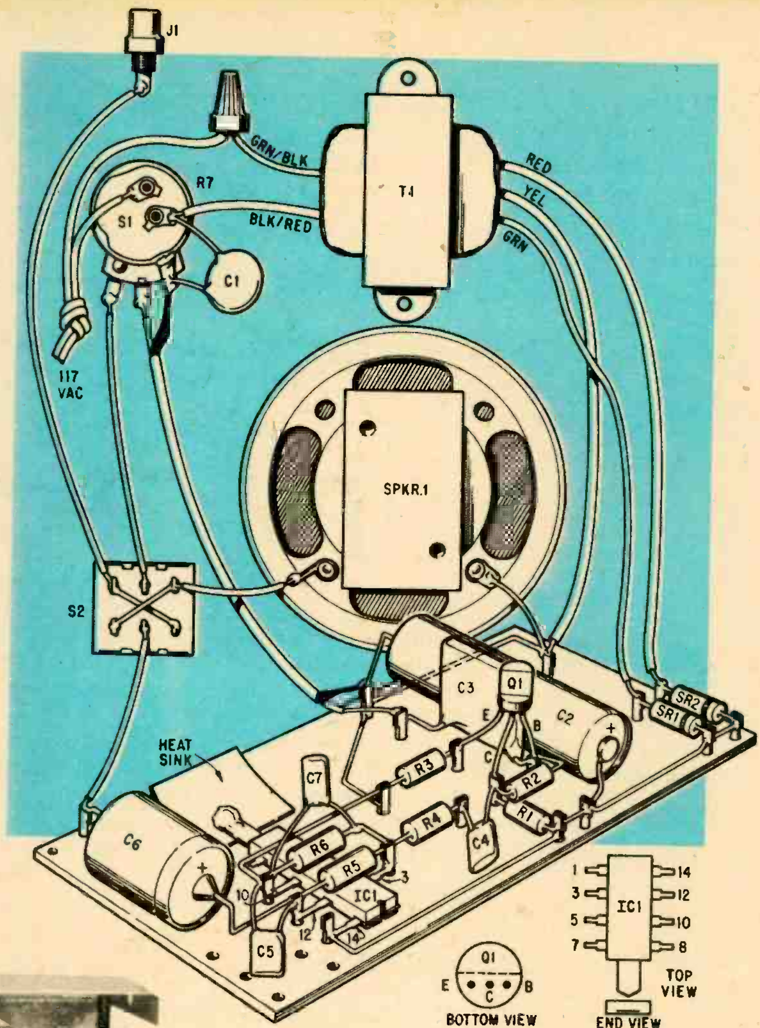
Double check the polarity of C2, C6, SR1 and SR2 before applying power as a reversal can cause permanent damage, especially to IC1.

After the amplifier is completed, set it aside temporarily and mount the cabinet components. The speaker specified is round and has no mounting holes. It is mounted on the panel with four small cable clamps, as shown in the photograph. Do not overtighten the clamps' mounting screws as too much pressure might distort the speaker frame. If you can obtain a 32- or 45-ohm intercom speaker that has mounting holes by all means use it.

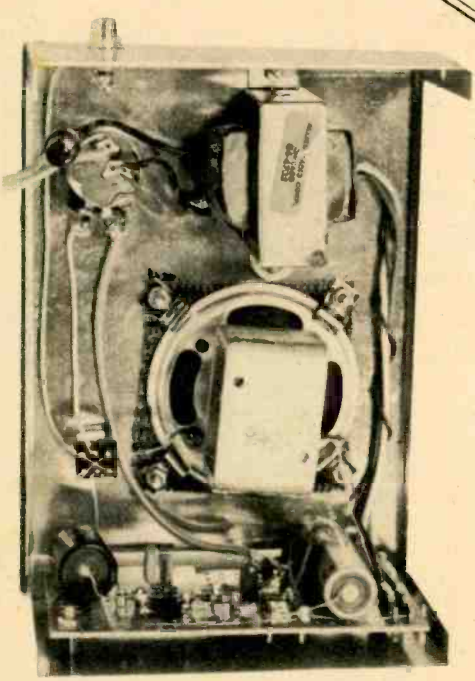
Switch S2, the *talk/listen* switch, can be any DPDT type—either slide, toggle or rotary. It is best to use a spring-return type so that the master station is automatically returned to listen mode when the switch is released. *Volume* control R7 can be any potentiometer rated from 1,000 to 50,000 ohms, either audio or linear taper—use whatever you have.

After the cabinet components are in place, install the amplifier as shown making certain there is sufficient clearance to allow the cabinet cover to be slipped into place. Complete the intercom wiring taking care to install the ground connections exactly as shown. The board assembly is grounded through the input cable's shield to R7's case. The speaker ground is returned to a ground point on the board—*do not ground the speaker to the cabinet*. Incorrect grounding will produce continuous howling or a tendency of the amplifier to break into oscillation.

Tight-Budget Intercom



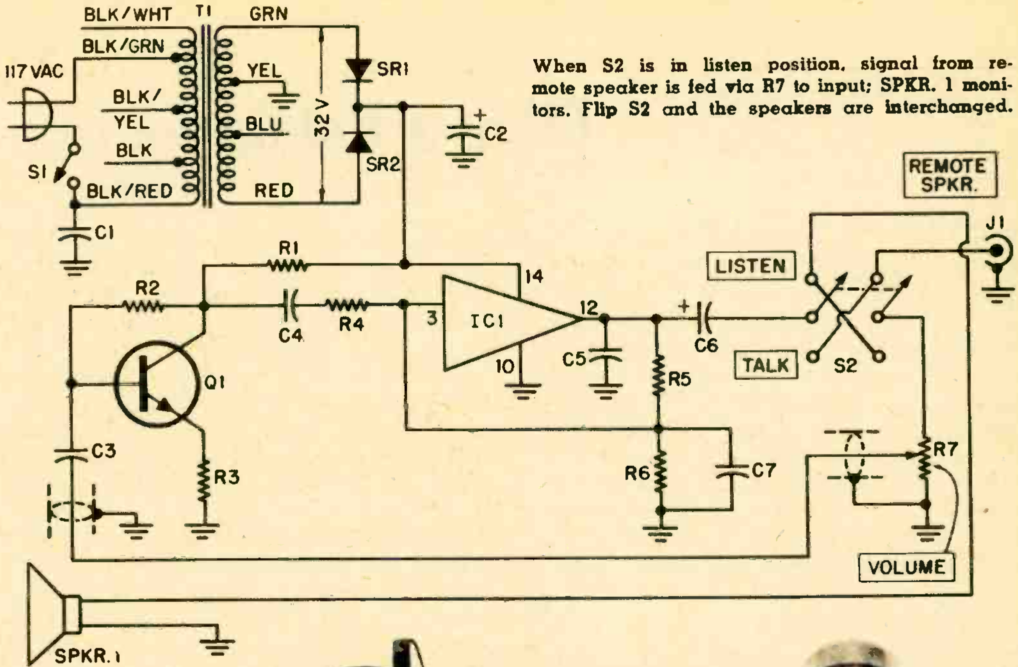
Although units shown on the first pages of this article were built in wooden cabinets, our prototype was built in 7 x 5 x 3-in. Minibox. Note that C1 and shield on wire from R7 to board are soldered to R7's right lug which is also soldered to R7's case. ⅜-in. spacers are used between board and case as shown in photograph at bottom. Heat sink tab coming out of end of IC1 should be nearest to the circuit board.



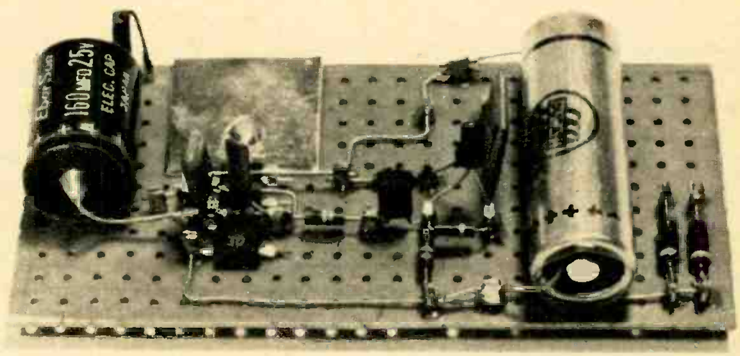
The remote speaker assembly is simply a speaker in an enclosure. The Radio Shack 3¾ x 6⅛ x 2-in. Perfbox makes an ideal enclosure as it is drilled with speaker holes and a ¼-in. hole for the connecting wire or a ¼-in. phono jack. The speaker can be mounted in the box with epoxy cement.

Checkout

Connect the negative lead of a DC voltmeter to the chassis and the positive lead to the junction of SR1 and SR2. Apply power by turning S1 on and note the meter's indication. If the meter indicates more than 25 V quickly shut off the power and check the color codes on T1's primary wires as you most likely have used the wrong leads. The correct primary leads are green with black tracer and red with black tracer. If the meter indicates less than 20 V, check T1's sec-



When S2 is in listen position, signal from remote speaker is fed via R7 to input; SPKR. 1 monitors. Flip S2 and the speakers are interchanged.



Board in our model is 2¼ x 4½ in. Only place things get tight is around IC. Heat sink for IC (shiny object at top, left) is 1-in. square piece of tin cut from a can. Silicon rectifiers SR1 and SR2 are at right of the board.

PARTS LIST

Capacitors: 25 VDC or higher
C1—.01 µf, 500 V disc
C2—500 µf electrolytic
C3—.2, .22 or .25 µf
C4—.01 µf
C5—.05 µf
C6—160, 200 or 250 µf electrolytic
C7—.001 µf
J1—Phono jack
IC1—PA234 integrated circuit (GE)
Q1—2N3391 transistor (GE)
Resistors: ¼ or ½ watt, 10%
R1—22,000 ohms
R2—2.2 megohms
R3—10 ohms
R4,R6—100,000 ohms
R5—1 megohm
R7—5,000-ohm potentiometer with SPST switch
S1—SPST switch on R7
S2—DPDT switch (see text)
SPKR-1—32 or 45-ohm intercom speaker
SR1,SR2—Silicon rectifier: 50 PIV, 100 ma
T1—Low-voltage rectifier transformer; secondary: 10-20 V center tapped, 40 V center tapped @ 100 ma (Allied 54 C 4732)
Misc.—7 x 5 x 3-in. Minibox, perforated board, ⅜-in.-long spacers

A KIT of two intercom speakers and IC1 is available for $6.65 plus 80¢ postage and handling from Custom Components, Box 352 Alden Manor, Elmont, N.Y. 11003. N.Y. State residents add sales tax. Canadians add $1. No foreign orders.

ondary leads and SR1 and SR2. The correct secondary leads are green and red to the diodes and yellow to ground. If the meter indicates the correct B+, generally between 20 and 22 VDC, move the positive meter lead to Q1's collector where the voltage should be about half the B+, though the normal collector voltage range is from 8 to 14V. If you don't obtain this voltage and the unit is inoperative check to see if Q1 is defective or change R2's value.

Operation

Connect the remote speaker to J1 and apply power. Set R7 to about its mid-rotation position. You should be able to continuously monitor the remote station. To talk to the remote, simply flip S2. *Volume* control R7 adjusts the speaker volume of both the master and remote speakers.

CB Corner

By Len Buckwalter, KQA5012

CB as a Public Service

HEARING about CB exploits may be somewhat like reading wanted posters in the post office: lots of exciting action and much of it beyond the pale of the law. But there is a glimmer of change. What's happening in Oconomowoc, Wis., is proving that a band of civic-minded CBers cannot only put the radio rascals to rout but also score remarkable success in public service.

It all started when Ed Beyler, an employee of the Wisconsin State Highway Patrol, wondered whether CBers could help solve the state's persistent problem of motorists in distress. Though troopers patrol a stretch of Interstate 94, they are spread out thinly over miles of expressway. A stranded driver may have to wait 45 minutes before encountering a passing trooper—perhaps longer if a bad accident snarls the schedule. Beyler described this problem to a CB dealer in Milwaukee, who steered him to the Waukesha County CB club.

Anyone familiar with the fickle relations existing between CBers and public-safety officials might raise an eyebrow at this point. It's just like a confrontation between Chairman Mao and Premier Kosygin. Their goals are similar but the approach differs. Historically, police, fire, Civil Defense and other officials often have considered CBers as welcome as gnats on a whipped-cream pie. But that's not what happened in Wisconsin.

The project got off to an auspicious start, thanks to Charles Case, captain of the club's disaster unit. He quickly recognized Ed Beyler's request as a golden opportunity for the CB club to prove its worth. Case dug into his own pocket and circulated a no-nonsense letter to Waukesha County club members describing a detailed plan: A CB rig would be installed (at Case's expense) in the communications room of state police headquarters and be tuned to channel 9, the standard emergency frequency. The unit would be monitored by officers on a 24-hour basis. Any mobile CBer encountering a distress situation (stalled car, accident, bad road conditions, etc.) could radio the communication room.

Dreaming up the plan was easy. But what about the horrendous possibility of some CBer calling in and asking a state trooper for a QSL card, or comparing signal strengths, or asking, "What kind of rig ya got?" Thinking ahead, Case implored everyone to keep the channel clean or risk blowing the project.

The impact of his plan soon was apparent. "Channel 9 has undergone tremendous improvements," says Case. When an unknowing

[*Continued on page* 108]

Ed Beyler of Wisconsin State Highway Patrol was on the scene to get this photo of Capt. Kenneley, District II State Highway Patrol Commander (left), talking with Charles Case, Disaster Service Captain of Waukesha County CB Club, who's on the right. Both men were instrumental in starting channel 9 operation to aid stranded motorists.

The ABCs of Color Television Servicing

By Forest H. Belt

Part II: Color Servicing Fundamentals

IN THE FIRST installment you reviewed the stages of a color receiver and learned about the four basic steps of troubleshooting. Also, you examined the block diagram of a set in ways that make it easier to troubleshoot. Now turn to page 46 and take the short quiz on Part I. This should help to refresh your memory.

The Power Supply. Before becoming better acquainted with the chroma section of a color receiver—the circuits that put color in a color TV and differentiate color from b&w—it will help if we check out the power supply. Just about every stage in the set depends on the low-voltage power supply. It furnishes the life blood of any receiver—its proper DC voltages. (You will learn later on how to check these DC voltages for component failure.) The power section is made up of rectifier tubes (or semiconductor rectifiers), a transformer, electrolytic capacitors, some resistors and a circuit breaker or fuse.

When a power supply goes dead so does the rest of the receiver. So if nothing is getting power, first check the line cord. If the heaters glow you know the line cord is okay. Check the fuse or circuit breaker next. Occasionally the breaker opens due to a surge in the power line feeding the house. The first test is to hold the circuit breaker button in for a second or two and then try turning on the set. If you hear a thump and the button jumps back out something inside the set is overloading the power supply. Reset the breaker and try the set again. If the breaker keeps opening try to locate the short.

If the set has a fuse *don't* bridge it; try another fuse. If that one blows, assume there's a short to find. If the circuit breaker or fuse turns the set off instantly or within a couple of seconds, the overload may be in a rectifier. Even if the breaker and fuse are working a dead set may be caused by rectifier tubes that have burned out. However, don't think the problem always can be solved by simply replacing a rectifier tube. Rectifier tubes can die a natural death or can be destroyed by shorted filter capacitors in the power-supply circuit. The way to determine whether it's the tube or something else is to replace the tube, turn the set on and alternately look at the CRT and the rectifier. If you get a normal picture you're in business. If you notice that the plates inside the rectifier are beginning to glow red, or there is a bit of blue glow, and maybe even some tiny sparks, turn the set off fast and plan on doing some underchassis troubleshooting of filter capacitors. Sometimes even the low-voltage supply may seem okay and

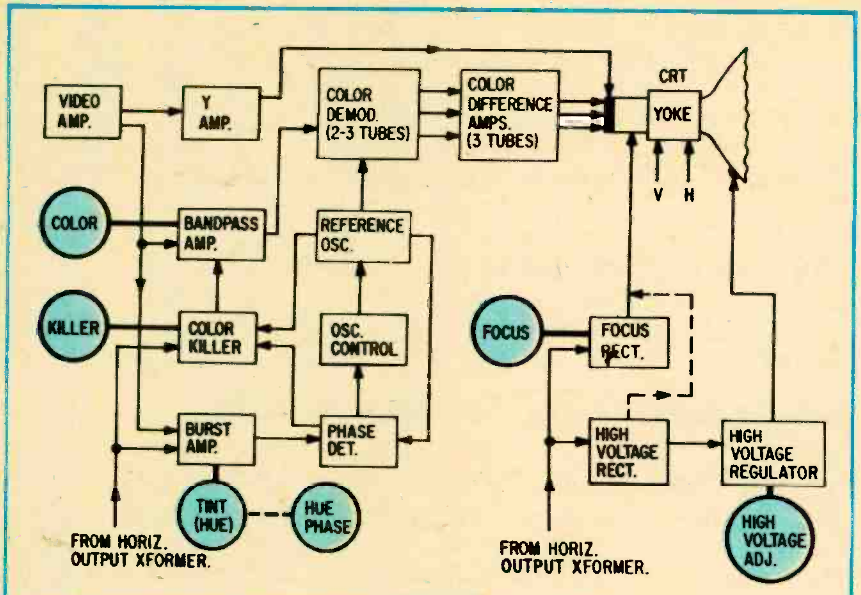


FIG. II-1

still be weak. A typical symptom is a raster that has shrunk at the top and sides and has become fuzzy and out-of-focus. The most common culprit here is a rectifier. Simply replace it.

The Chroma Section. Fig. 2-1 shows the main stages in the chroma section and includes the high-voltage and focus stages which differ slightly from their monochrome counterparts. The chroma signal comes through at least one stage of video amplification after the video detector. It's then fed to the bandpass amplifier stage which can amplify all the different parts of a color signal equally. The video signal goes separately to the Y (luminance) amplifier where it's boosted enough to control the beams in the CRT.

Just as the sweep signals in the receiver have to be synchronized with pulses from the transmitter, so does the color information. The station's color signal contains a small burst of reference signal just before each raster line starts. This burst actually rides on the horizontal blanking signal alongside the horizontal sync. Once the color-sync burst and the horizontal sync are recovered and amplified by the receiver's video stages they are fed to a burst amplifier. This stage recovers the color-sync signal and does away with everything else. The burst amplifier gives color sync a boost and sends it to the phase detector which matches up the color burst with a signal coming from the color oscillator (also called a reference oscillator). The phase detector compares the two signals and generates a correction voltage so that a control stage can keep the set's reference oscillator precisely in phase with the color-sync signal from the station.

The primary output of the reference oscillator goes to the color demodulator, where it is used as a reference for the chroma signals. The demodulator sorts out the signals and comes up with the original parts of the color scene. Its output contains the exact amount of R, G and B signal to recreate the original color image. All three signals are fed to the CRT and mixed there with the Y (luminance) signal. All this activity occurs bit-by-bit and line-by-line just as in black-and-white reception. It is synchronized with the start of each raster line by pulses coming from the horizontal-output transformer.

The control (controls are enclosed in circles) labeled *color* in Fig. 2-1 permits the viewer to vary the strength of chroma signal fed to the demodulator circuit. Turning the control up makes colors stronger (they can be too harsh, however). The hue or tint control adjusts the phase of color signals in the chroma section with reference to the chroma signal originating at the transmitter. Advancing or retarding the phase (timing) of the color-sync signal in the burst amplifier, the tint control brings the colors into a true color relationship. The tint control is best set for accurate flesh tones in the face of a performer. At one end of its rotation it makes faces green; at the other, purple.

The color-killer stage, with its adjustment, disables the chroma section when there is no color program. The killer circuit senses from the output of the phase detector whether or not there is a color burst. If this is absent the killer turns off the bandpass amplifier. Otherwise noise from the amplifier would show up as color confetti (something like colored snow) on the screen. The killer control is adjusted without any station signal—there is only snow from the tuner. Turn the control to the point that leaves confetti. Then turn the control back slowly until the colors disappear from the snow.

The high-voltage rectifier functions as in monochrome receivers and develops the same symptoms if it's defective: a black screen or poor focus. Test it by replacing it, but be sure you turn the set *off* first. Also, never use the arc-drawing method of testing the color high-voltage rectifier. It's output voltage—nearly 25 kv of DC after rectification—can do a lot of damage. The high-voltage regulator keeps the voltage constant no matter what the video load on the CRT beam. Without it, the voltage would go way down whenever part of a scene is very bright because the beam then draws a lot of current. The focus voltage for the picture tube is sometimes taken from the high-voltage section, as suggested by the dashed line in Fig. 2-1. Otherwise, it's taken from the horizontal-output transformer and rectified by its own tube or semiconductor diode. This voltage is pretty high, too—about 5 kv in most receivers.

Obviously, there are certain precautions to take with color sets to protect yourself and viewers from possible X-rays. Normal high voltages can generate tiny amounts of soft X-ray energy in the picture tube, the high-voltage rectifier and the regulator. If you keep the high-voltage cage closed except when the set is off that protects you. When you make adjustments always follow the manufacturer's directions carefully. Too great a high voltage can develop overdoses of X-rays; the service instructions for the receiver tell you how to adjust high voltage properly. If you're careful there's no reason for any set you service to expose you to radiation.

Curing Chroma Troubles. An easy symptom to spot is *no color.* You see color programs in black-and-white. However, the very fact that there is a black-and-white picture (video) means certain circuits in the color section are okay. Surprised? Then consider these points. If the color demodulator doesn't work, one color can dominate the others. For instance, a supposedly white raster can turn a wild shade of chartreuse or some other weird color. Thus, the demodulator stages are working if you see a normal b&w picture (one having proper values). Now the color-difference amplifiers control the electron guns of the tricolor picture tube. If one color-difference amp goes bad it affects that particular gun and overbalances the colors. Conclusion: if the picture is okay in black-and-white, the color difference amps are probably okay, too. About all that's left is the bandpass amplifier (called color amplifier or color IF in some sets). It must be dead, or else the color killer is working overtime and won't let it operate. If you can't get color check both the color killer and the band-pass amp!

There's another problem that can spoil color viewing. The symptom is characterized by colors *running* all over the screen. The colors may be strong but they won't stay still; it will look as if only the color has fallen out of horizontal sync while the video remains normal. This loss of color sync lies in one of the stages that carry color synchronization to the reference oscillator. The most likely candidates are the burst amplifier (sometimes called burst keyer), the phase detector and oscillator-control tube (or reactance tube in some sets). Sometimes the tint control will not bring out correct hues—i.e., you can't get a flesh tone. Color alignment may correct the problem (you'll learn about that later) but first try replacing the burst-amplifier, phase-detector, oscillator-control or oscillator tubes.

These are color troubles you can do something about now. In a lesson that follows you will learn how to troubleshoot the chroma section more thoroughly. A standard procedure will lead you quickly to most any fault—you'll soon discover that color sets are almost as easy to service as black-and-white jobs once you've mastered technique.

Troubleshooting Technique. This is a good time to look at our troubleshooting method with the entire color receiver in mind. From here on in keep the whole set in mind as you concentrate on sections, stages, circuits and individual components. Then shortcuts won't lead you astray as you work toward the defective part.

Remember that the four basic steps are *analyze, inspect, isolate* and *pinpoint*. Steps one and two begin as you mentally divide the set into sections (as in Fig. 2-2). You analyze the symptoms and inspect various stages: picture, sound, how well the operating and servicing controls do their jobs, how the parts on and under the chassis look and how each section of the receiver appears to be working. After you diagnose the ailment, deciding from all your clues just which section of the receiver is at fault, you isolate the stage that is defective. While doing this you may be compelled to use instruments. Finally, you should replace the faulty component.

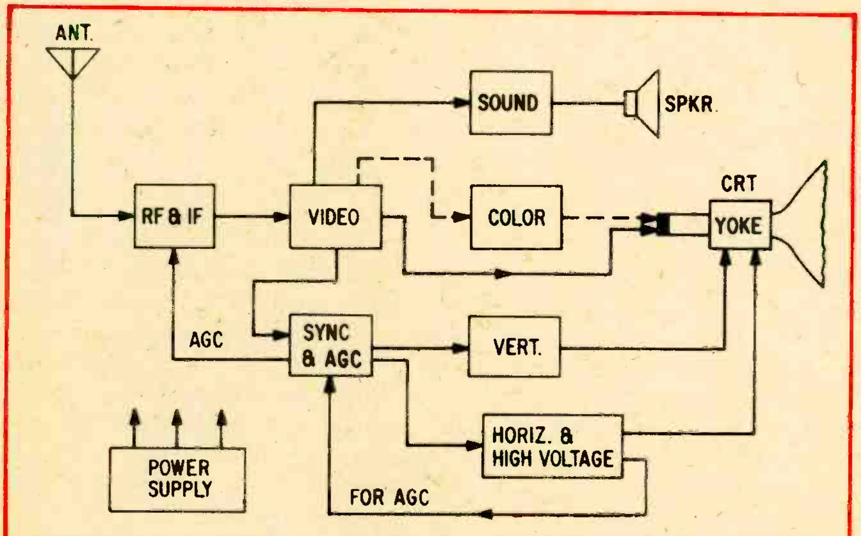


FIG. II-2

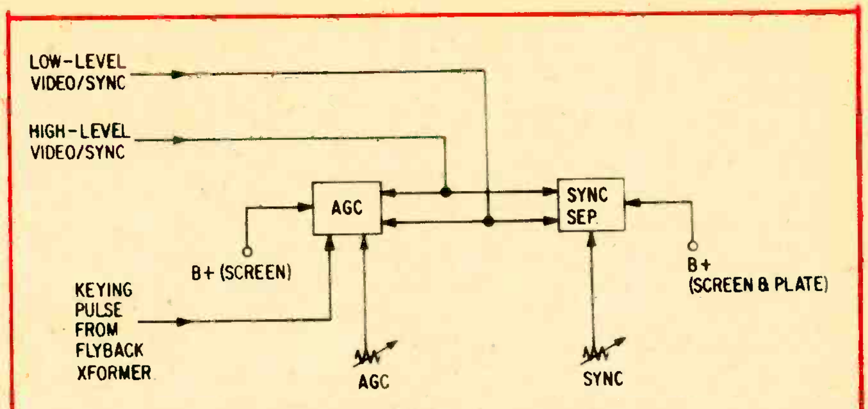


FIG. II-3

An example may help clarify this. Consider the sync and AGC block in Fig. 2-2. Numerous lines run to and from the section since its operation is dependent on other stages. Keep that in mind as you divide up the section as shown in Fig. 2-3. Examine each stage separately without ignoring its relationship to other stages in the set. Forget that relationship and you may waste a lot of time troubleshooting the wrong stage or even the wrong section. If a stage is inoperative it could be that there's trouble within or that signal voltages aren't reaching it from outside. When you've isolated the inoperative stage your next task is to pinpoint the defective part. You usually do this by king DC or signal checks—first to pin down which circuit in the stage is at fault, and then to determine exactly which component is defective. A detailed view at this stage of the game would look something like Fig. 2-4. Here you come down to the brass tacks of troubleshooting a specific circuit.

The logical way to start hunting for a fault in this stage is to make signal tests.

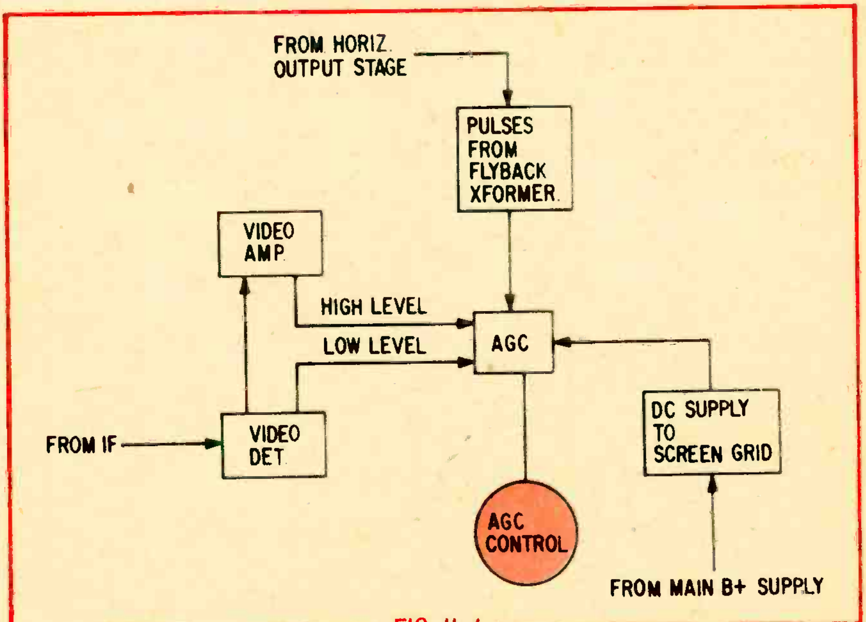


FIG. II-4

There are three signal inputs and you can use your oscilloscope to identify and measure each of them. Set the scope so it displays two or three horizontal lines of video; then check first at the output of the video detector. You should see well defined sync and video signals. Next probe the input to the AGC tube to be sure the sync/video signal is there.

The video signal also goes through a stage of video amplification. The output of that stage should be inverted (sync pointed upward) and the signal should be 15 or 20 times as large as the output of the video detector. Make sure this signal reaches the AGC tube. Finally, check for the keying pulse from the flyback transformer. If all signals are present, use your voltmeter to check out the DC supply at the screen grid.

There are always shortcuts to finding a defective part: alignment procedures, service bulletins, experience. But the sure-fire way is to go through this procedure. After you're convinced a part is faulty, verify this by either testing or replacing it. Keep in mind throughout how the stages depend on each other for signals and power. The schematic diagram will show how and where they are coupled. These relationships are important because circuits sometimes have very complex interdependencies.

In the next installment you'll learn how to set up color sets. We will discuss some of the equipment you'll need, such as a degaussing coil, VOM, VTVM, color-bar generator and service data. Also discussed will be such procedures as degaussing, getting color purity of each of the rasters, checking the horizontal and high voltages, gray-scale adjustment, pincushion correction, static convergence and dynamic convergence. What you've studied so far has been quite general. However, it's paving the way for troubleshooting and adjustment procedures you'll learn about in the final three parts of this course

Examination on Part I

1. Basic troubleshooting involves what four steps?

2. What three signals modulate the chroma subcarrier at the color television transmitter to make up the chroma signal?

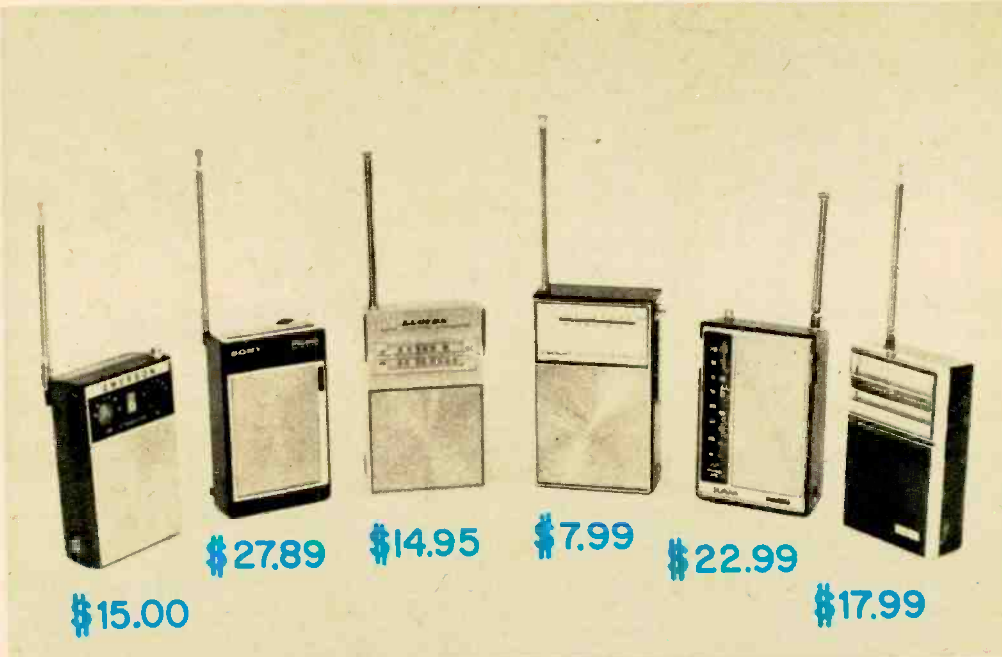
3. If you see video on the CRT what stages can you assume are working correctly, or nearly so?

4. Incorrect gray-scale in a color receiver is noticeable only during a color program. True or false?

[Turn to page 103 for correct answers]

Next Issue: ***Adjusting Color Sets***

Plus Examination on Part II



Do Dollars Buy Quality in AM-FM Pocket Radios?

EI runs field checks on a few sets in this highly-popular category ... and then comes to some surprising conclusions.

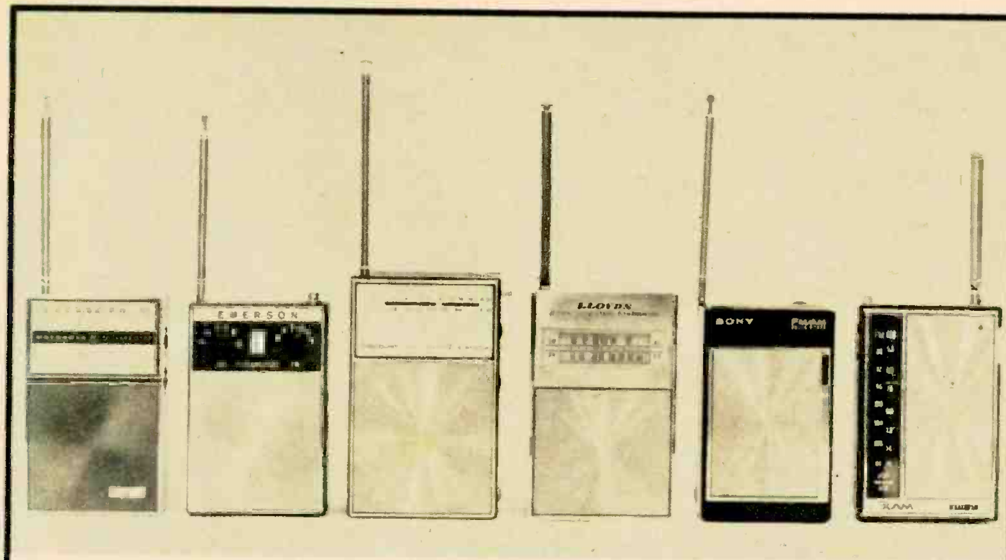
By E. L. GREGORY

SEVERAL times a year discount (and other) stores run what are called loss-leader sales on pocket radios just to get you in the store. In the old days it was an AM radio for perhaps $2.95. Now stores try to lure customers in with pocket AM/FM radios at absurdly low prices.

Can you really expect the FM performance of an AM/FM pocket radio priced under $10 to be any good at all, or as good as one priced at $20 or $25? Will you hear anything other than local FM stations on a cheap set? Will selectivity be so poor that you get two or more stations at the same time?

To find out we purchased several off-the-shelf models priced from less than $10 to almost $30. We tested them in terms of relative sensitivity, selectivity, ease of tuning, output sound level and distortion. Based simply on the number of transistors and the number of IF amplifiers (some sets have two, some three) you might think it would be logical to assume there is a major performance difference between models. As we'll show, there isn't much.

After testing and listening to six typical pocket AM/FM receivers (see photos), it immediately became clear that it is impossible to rate one over



Typical pocket AM/FM receivers we tested included such brand names as (going from left to right) Motorola, Emerson, Viscount, Lloyd's, Sony and XAM. Results showed that performance was essentially the same for all models regardless of price. Major differences included easier dial tuning, better telescoping antennas, slightly better components and more spacious battery compartments.

AM-FM Pocket Radios

another. We don't mention model numbers in our identifications because these sets have such a short life. In fact, several of the radios we evaluated may no longer be on the market in that exact form. Quite frequently a specific model is a one-shot or one-shipment item—once it's gone, it's gone forever. First thing to face up to is that regardless of the brand name on the case—be it Sony, Panasonic, Motorola, GE, Emerson, Lloyd's or Uncle Tom's White Lightning Special—chances are it was made in the Orient.

Our first test was made five blocks from a 20-kw (effective radiated power) FM station. The next was an evaluation some 20 mi. from New York City. Sensitivity, selectivity and distortion were essentially the same in all the models tested. Believe us, we tried (and failed) to get the goods on at least one model. No luck. Regardless of price, overall performance from one set to the next did not vary enough to raise an eyebrow. We did find that sliderule dials are easier to tune than round ones and that a telescoping antenna which swivels can affect performance (by reducing multipath distortion), if that makes you feel any better. All were tuned to around 100 mc (the most crowded part of the band in New York) and all exhibited the same amount of jamming. There was some strong-signal overload on a few models—not necessarily reflected in the price. However, overload on any set could be eliminated by shortening the telescoping antenna.

Why the big price spread? Generally, it appeared due to the case and the quality of the components. The more expensive radios look better—perhaps they're easier to tune—but little else stands out. On some of the cheaper models the battery compartment is so cramped you can expect the connecting leads to break unless you are extremely careful when replacing batteries. Of course, there are minor differences in circuitry, just as there are slight differences in performance.

These differences in sensitivity, selectivity and distortion will show up on the meters of test instruments, but not when you're simply at the beach or at home! Anyway, the fact is, you still can enjoy it . . . whether it's to keep informed or be entertained while you're on the move, to record AM and FM programs on a cassette recorder or to attach a power-amplifier module and a better speaker.

Just remember that your pocket blaster is not meant to be a long term investment and that $8 will buy as much as $30.

Solid-State VOM

Delta 3000

EVERY day, it seems, a new solid-state VOM comes on the market. One of the latest to make the scene is made by Delta Products, Inc., Box 1147, Grand Junction, Colo. 81501. Tagged the Model 3000, the kit's price is $59.95; it's $74.95 assembled.

Similar in its capabilities to a VTVM, the 3000 has two switch controls; the function switch selects the operating mode: +DC, —DC, AC, ohms and current (it's also the power switch). The other switch determines the 3000's range. As on a VTVM there are zero- and ohms-adjust controls.

A field-effect transistor in the 3000's input circuit gives the instrument an input impedance of 10 megohms. Although this impedance is common to service-grade VTVM's, the fact that the 3000 can also measure current (which a VTVM cannot) gives it an important edge over a VTVM.

The 3000 is powered by eight penlite cells. Current drain in the resistance mode is about 35 ma. In all other modes it is about 2 ma. You can check the batteries under load by touching a probe to a screw in one of the mounting feet.

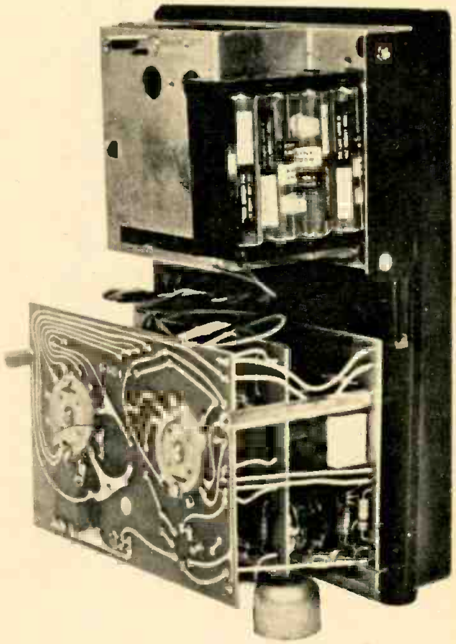
The full-scale AC and DC ranges go from 0.3 V to 1,000 V with 1:3:10 decading (1 V, 3 V, 10 V, etc.). The voltage scales are linear, hence, the same scale is used for both AC and DC measurements. Resistance ranges are from R×1 to R×1 megohm, with 10 ohms at center scale. Full-scale current ranges are from 0.03 μa to 300 ma in ×10 steps.

There is a pair of diode-connected transistors ahead of the input FET. Their purpose is to prevent damage to the FET should the meter be connected to high voltage when the range switch is set to low voltage. The diodes have no effect on normal operation because they conduct—thereby limiting input voltage to the FET—only when the input voltage exceeds a safe value.

The ohmmeter circuit is somewhat unusual in that it works from a constant-voltage source of 0.3 V with a nominal test current of less than 10 ma. While at first this might seem to be ideal for testing solid-state devices, the ohmmeter cannot be used for such tests since 0.3 V is not quite enough to exceed the barrier potential of a semiconductor's junction. Result is that the 3000 will indicate infinite impedance for both polarity connections.

To measure current, the meter measures the voltage drop across an internal voltage divider. In this mode there is a 0.3 V drop across the 3000's input terminals, a value so low as to be of no significance.

[*Continued on page* 110]



Meter, shield and battery holder (top) come installed. You wire the three circuit boards and solder lugs on switches to the foil on the boards.

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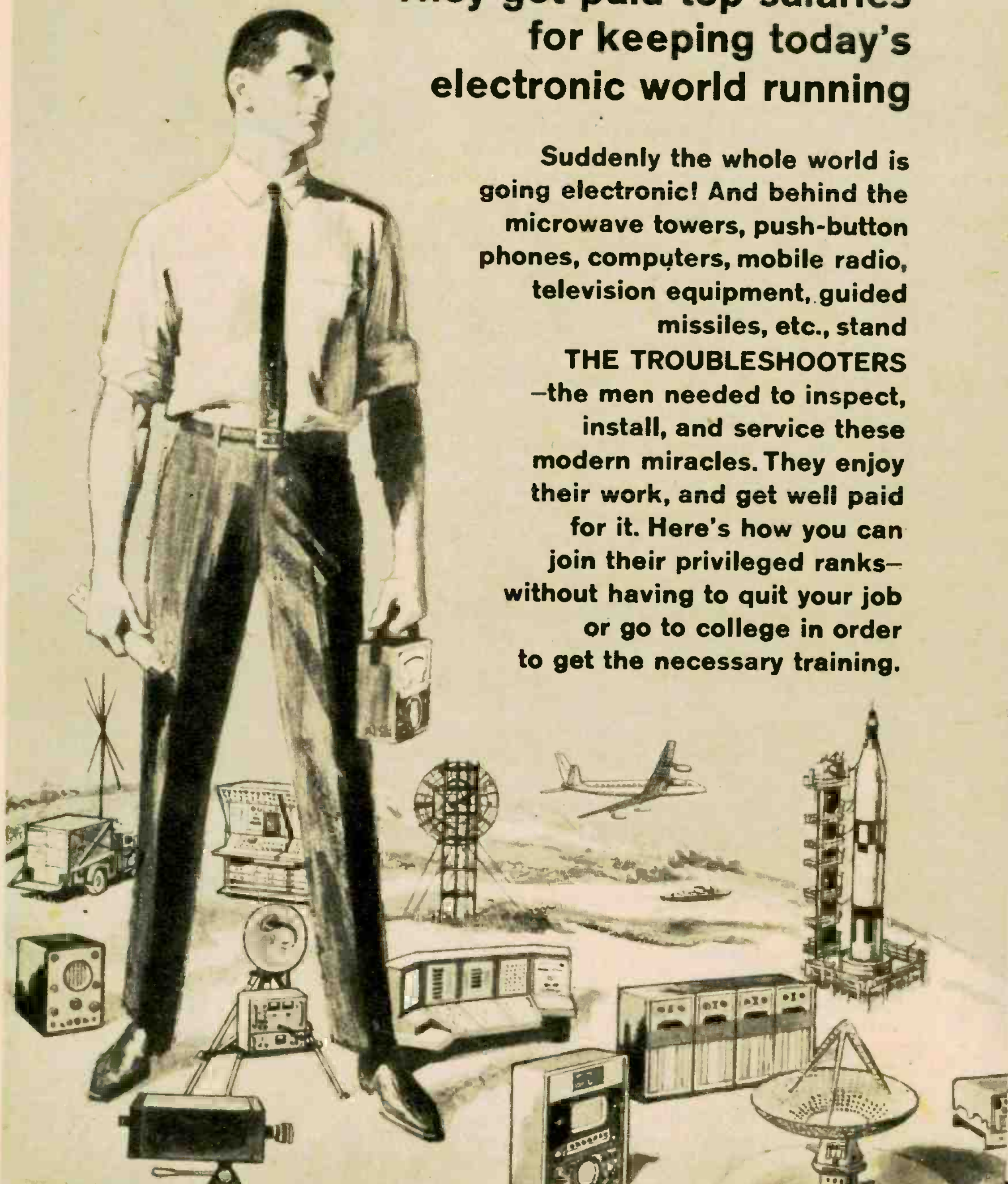

JUST THINK how much in demand you would be if you could prevent a TV station from going off the air by repairing a transmitter...keep a whole assembly line moving by fixing automated production controls...prevent a bank, an airline, or your government from making serious mistakes by servicing a computer.

Today, whole industries depend on Electronics. When breakdowns or emergencies occur, someone has got to move in, take over, and keep things running. That calls for one of a new breed of technicians—The Troubleshooters.

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The Ham Shack

By Wayne Green
W2NSD/1

IN THE OPENING paragraph of the FCC amateur regulations several good reasons are listed as to why the amateur service should exist. The most important reason of all, in my mind, is not mentioned. Sure, we amateurs provide emergency communications. We provide a pool of trained engineers and technicians as well as radio operators during times of war. We even do a lot more than is generally recognized. All this comes under the concept of service.

But amateur radio, thank heavens, is far more than a service. This aspect is more of a by-product, really. Basically amateur radio is fun. It is not an easy hobby; you have to work to get your license in order to have this fun. And once you have the license you face all sorts of frustrations and problems. This makes amateur radio all the more exciting once you surmount the difficulties.

It is fun to talk with amateurs in Afghanistan. It's fun to get up on a hilltop when you're broadcasting on 2 meters and work stations 150 mi. away with a propped-up beam. It's fun to work the South Pole while driving along in your car. It's fun to make like a miniature Western Union and send, receive and pass along messages in a traffic-handling system that reaches into every state. It's fun to construct your own rig and make it work, to collect QSL cards from all over the world or from as many states or countries as you can, or to organize and participate in emergency networks. And it's fun to get together at radio club meetings and swap lies and exaggerations. Sometimes, if you've worked hard and done something unusual, it is even fun to tell the truth.

Because ham radio is so much fun it in turn provides the services outlined by the FCC. And more important, it is providing a valuable service to our country (and to the world, for that matter) by getting youngsters interested in a scientific hobby. Amateur radio has been the gateway into electronics and communications for hundreds of thousands of our engineers and technicians. Most of them got caught up in the hobby while in high school. The fun involved in ham radio not only gave them some drive and purpose during those important formative years, but it also kept them out of the trouble that kids fall into when they have no time-consuming interests.

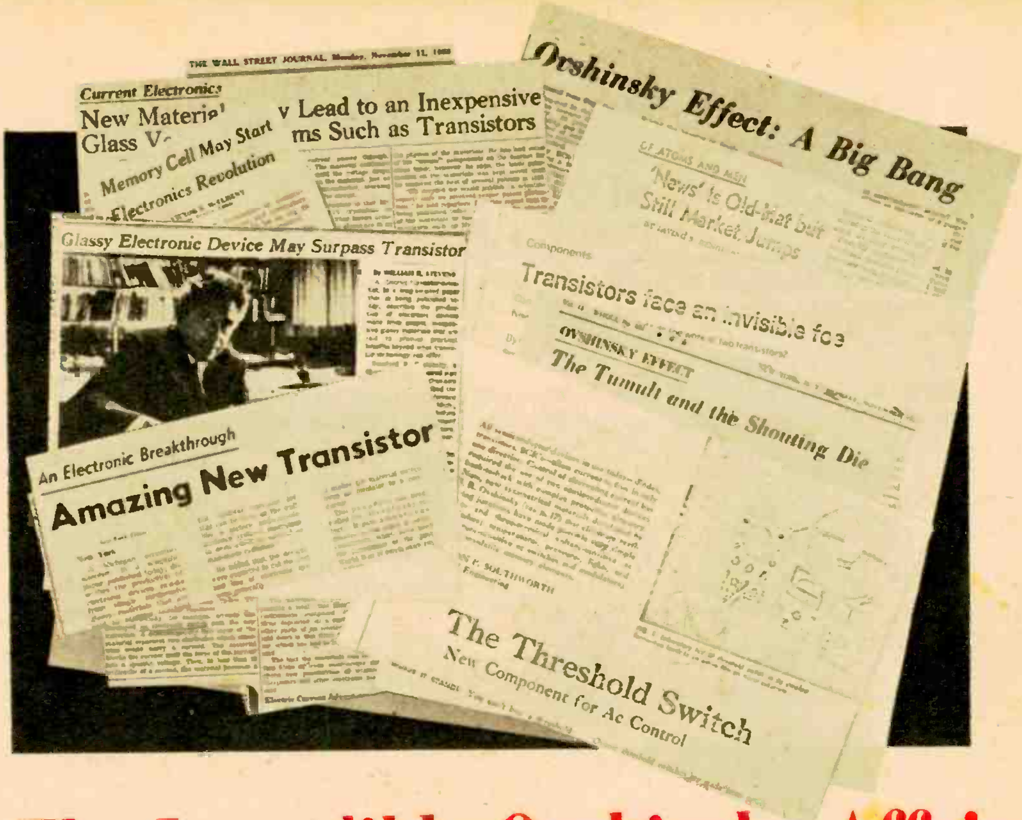
It is estimated that about 80 per cent of all amateurs who start the hobby while in their teens decide to pursue electronics as their life's work. It happened to me, just as it has to thousands of others. I was hamming away in high school, building 2-meter transceivers, all-band receivers, 160-meter rigs and having a ball. Then, as graduation neared, my school did a disastrous thing. They had all seniors take a series of aptitude tests. I had been planning on going to Dartmouth and eventually going into law but the vocational adviser, noting my great interest in hamming, strongly suggested that I go to an engineering college instead. Not knowing any better, I did just that.

Perhaps it worked out for me, who knows? I might have liked law. But my engineering background got me into electronics during the war and kept me in associated fields in business—hi-fi manufacturing, television engineering and direction, radio engineering, etc. Eventually I found that writing and editing were more fun and I've stuck with them.

To appreciate the importance of amateur radio and how it channels 200,000 people or so into the electronics industry, try to picture the industry's situation if we suddenly took all this ham talent out. There wouldn't be an electronics industry, practically speaking. It is more than a coincidence that those countries which have encouraged amateur radio are now the leaders in the world in electronics and communications. Without amateur radio how are you going to interest youngsters in going into electronics in the first place?

We all got quite a start a few years back when we discovered that Russia had lofted a satellite first. Then we read that the Russians were ahead of us in attracting students into the sciences. Many government officials wrung their hands in public over the situation until everything settled back as before. If we still consider it in our country's interest that our teenagers become interested in science, we could do a lot worse than expose them to amateur radio. Anyone interested in

[*Continued on page* 111]



The Incredible Ovshinsky Affair

Wave the magic wand of electronics and Wall Street comes running

By JAMES LYDON

IF YOU'VE got it, flaunt it. So say the ads. Stanford R. Ovshinsky isn't the most humble person around in the scientific community today, but why should he be? He may have one of the best things going in semiconductor electronics. Then again, he may not. Even the professionals are undecided at this moment.

Mr. Ovshinsky is the author of several papers on glassy semiconductors—also called Ovonic devices—that exhibit what he has termed the Ovshinsky Effect. The big guns in the semiconductor industry (Bell Labs, RCA, Texas Instruments, etc.) have been working on glass devices off and on since the early sixties but Ovshinsky seems to be the first to have made a full-time thing of it. Now that he has announced the Ovshinsky Effect and its future applications, many people in the scientific and technical-press communities are mad at him for *not* telling it like they think it really is.

Glass semiconductors differ from the silicon and germanium materials you are familiar with. Silicon and germanium are crystalline substances which provide an abundance or lack of electrons at positive-negative junctions. Current flows according to the bias placed on the junction. Glass semiconductors, however, are *amorphous* (disordered) materials. They exhibit a high resistance to

Ovshinsky Affair

applied signals until a critical voltage (dependent on the design) appears at the two terminals of the glass layer; at this point resistance practically disappears. Thus, an Ovonic device acts like a semiconductor switch. You turn it on or off by applying the correct voltage. Also, the devices are said to be unaffected by radiation—a possible point of interest for the military.

Problem is, glass semiconductors work according to little known principles so the whole thing is highly theoretical. The technology of amorphous materials is not fully understood (crystal growers, take note!) and it is impossible to reproduce stable devices with any uniformity. This puts the Ovshinsky Effect back in time to when the transistor was still suffering growing pains. At the moment many experts are disenchanted with Ovonics. Its sudden presentation to the press on Friday, Nov. 8, 1968, had a lot to do with this state of affairs.

Presentation is the key word. These days, how you sell an item is just as important as the worth of your product. Part of this hectic scene is the press kit. Between pieces of glossy cardboard bearing a company's name, reams of data sheets, photographs and other miscellaneous and sundry items are stuffed until the folder will hold no more.

Such was the package that greeted a few technically unprepared reporters at the November 8 press conference sponsored by Energy Conversion Devices, Inc., the company headed by Mr. Ovshinsky. Since only 11 of 25 reporters invited from the consumer press showed up, remaining press kits were mailed to publications selected with great care.

When scientists at Bell Telephone Labs picked up a copy of the *New York Times* on the following Monday (Veteran's Day), they were probably mesmerized by a three-column headline on the front page which heralded a new era in physics.

According to the *Times* story, the phenomenon whereby glass becomes a semiconductor was called the Ovshinsky Effect; and it had thus far yielded switches, computer memories and thin-film semiconductors, the latter having been heretofore considered impossible in the industry. These Ovonic devices were termed a breakthrough in a new branch of physics that would make possible a whole new line of ultra-miniature gizmos—desk top computers, flat TV sets you can hang on your wall, ultra-fast switches, everything for a better world.

Shades of Shockley! The Bell scientists probably recalled that the announcement of their transistor some 20 years ago got a mere four in. of space on the inside pages of the *Times*. And the transistor effect was hot news at the time.

In Washington, one could imagine Russian diplomats scanning the front page of the *Washington Post* for news of the Paris peace talks. You guessed it! They read still another angle on the same story—a glass mini-switch had been announced at a press conference in Troy, Michigan. This story implied that the new device was a forerunner of a revolution in electronics similar to that started by the transistor. It probably appeared to the Russians and some other foreign diplomats that the Americans had again widened the technology gap.

On Wall Street the quiet of the holiday was shattered by a banner headline in the esteemed *Wall Street Journal* which pulled readers into a story announcing cheap, easy-to-make glass versions of transistors. Investment brokers, mutual fund managers, bank clerks and elevator operators underlined the name of Energy Conversion Devices and started a telephone marathon that would last well into the week. Indeed, the one-two punch of the *Times* and *WSJ* stories was enough to drop the stock values of virtually every major semiconductor manufacturer when the exchanges opened the following day.

Throughout the country the story of the new science was told by the 11 odd reporters who had been among the select group at the Troy press parley. The *Boston Globe*, aiming for the egghead community of MIT and Harvard, proclaimed that Ovshinsky had made a discovery "missed by the world's great industrial laboratories and university physicists." Filled with pride, the *Detroit News* sounded off with "Troy Ovonics Inventor Eyed for Nobel Prize." Finally, Sub urban America was filled in by the Associated Press which put the story on its wire.

Only a monetary crisis in France could knock the story off the front pages of the Paris *Herald*; yet it had no trouble biting a good swatch of newsprint inside. The *Herald* picked up the *Times* story and ran it whole—the Ovshinsky effect had become a snowball effect, adhering to a little known law of

Headed for a Nobel Prize? Stanford Ovshinsky was so photographed on Nov. 11, 1968 after his company, Energy Conversion Devices (located at Troy, Mich.), held a press conference to announce the development of Ovonic devices. After initial fever hit Wall Street and certain members of the press, Ovonics soon cooled down to a point where a deep freeze finally set in. Just what the outcome will be is anyone's guess.

UPI Photo

Newton that publicity begets more publicity unless acted upon by an external fact. Feedback from the tidal wave was not long in coming.

Phones rang all day at Energy Conversion Devices in Troy. Ovshinsky—overwhelmed by sudden fame—had a tough time handling the calls. A Milan magazine called about an interview, an Australian News service asked for a taped report, radio reporters from CBS sought material, and invitations to speak at universities poured in. Was impresario Sol Hurok waiting in the wings?

The Dow Jones News Service (in a frenzy of activity after the *Times* and *WSJ* stories) began to record the scramble for Energy Conversion stock that occurred when the Street opened for business Tuesday. Traded over-the-counter ECD shares opened at 105 from a low of 58 on the previous Friday. The asking price soared to 150 before trading ended; small fortunes were won and lost almost instantaneously before some Tuesday afternoon quarterbacking knocked the price of ECD down to 75—still much higher than the pre-press conference price.

The first of the more cautious quarterbacks was Bache & Co., which issued a caveat to its investors on the basis of a dubious attitude that its investigators found among experts in the electronics industry.

Meanwhile, financial reporters for the *Times* (who not too willingly inherited the follow-up assignments from the Science desk) started a probe but were unable to come up with much support for the enthusiasm of the Monday story. Ovonic devices, they found, were apparently not up to snuff, and a licensing agreement between ECD and ITT (cited in the initial story) had gone a little sour. If there were red faces around the Science desk they were to get redder still.

The *Wall Street Journal*, homing in on fiscal aspects, reported in its follow-up that Energy Conversion was up tight, having sustained sizable losses during the last two years. Most of the firm's income, the *Journal* said, was derived from private investors and contracts. The company had only one profitable year in its eight years of operation, the *WSJ* noted dryly.

As the Times and WSJ continued to examine and meditate upon the Ovonic Wonder, *Newsweek* magazine, with more lead time, checked with its own inputs and discovered that the technical press had not been invited to the Troy press conference. For some reason, a subject as abstruse as amorphous semiconductors was restricted to the lay press. It was almost like inviting *Better Homes and Gardens* to speed trials at Indy.

Why trade and technical reporters were snubbed was soon to emerge much to the discomfort of the national press. For what had been brought back from Troy as hot copy had actually been circulating for years in the staid pages of trade magazines. Over the past five years Ovshinsky had been plying trade journals with reports of his efforts in glassy materials, explaining their potential use as semiconductors. He had examined hundreds of compositions and had worked relentlessly to build practical devices since founding the company in 1960.

An in-depth piece on the Ovonic switch ran four years ago in *Control Engineering Magazine*. About this time, Ovshinsky began an advertising campaign in several trade journals wherein he described his devices and invited readers to send for a brochure on basic Ovonic principles. To reach a broader audience, the advertisement also ran in *Scientific American* in December 1964.

Ovshinsky Affair

Two years later, *Electronics*, another industry magazine, carried a detailed feature on Ovshinsky's new science and its alleged promise. The term Ovshinsky Effect was used here for the first time. The article emphasized the fact that Ovshinsky was far from alone in the field and that research at Bell Labs had created a rather volatile patent situation.

Despite this publicity, much of which he generated himself at seminars and meetings of professional societies, Ovshinsky was unable to get a rise out of the electronics industry. There was no backlog of orders at Troy. No one was knocking down his doors.

Confident, and still trying to get Energy Conversion into the black, the 46-year old, self-educated inventor renewed his advertising campaign in the fall of 1967 by running three full-page display ads in *Electronics*, *Control Engineering* and *Scientific American*. The copy this time stated the speeds of his switches and proclaimed the new field of Ovonic physics and technology. A photo of the switch in the advertisement was later handed out at the press conference—a cardinal sin in any press agent's book.

It is not an unfair assumption that if trade and technical reporters had been present at the Troy briefing they would have tempered much of the hysteria that appeared in Monday's newspapers. Indeed, the more journalists studied the circumstances of the press conference, the more it took on the guise of a vacuum. To begin with, it had been held on the eve of a three-day holiday weekend; there was no opportunity for the reporters to check out the claims with leading industrial organizations. Since only 11 reporters had the story none of them could afford to sit on it without risk of being scooped. It was a case of mass psychology, par excellence.

Ovshinsky claims to have had a good reason for choosing Friday. On the following Monday the details of his Ovonic theory (explaining the materials he was working with and had recently patented) were to appear in the *Physical Review Letters*, a highly respected organ of the American Physical Society. Being published in the *Letters*, for a non-physicist, was no mean accomplishment and Ovshinsky felt some chest-pounding was justified.

The only snag was that while a copy of the *PRL* paper was in the press kit, its jargon was beyond the grasp of the reporters. Anticipating this, a ten-page explanation of the treatise was also in the kit and in plainer language it unfolded the story of Ovonics, much of which was by now old hat. Probably an all-time record for length, it was lifted almost bodily into newspaper stories. No one took the time to examine the copy.

If Ovshinsky had anything going for him that Friday, it was undoubtedly the all-star cast of physicists, including a Nobel laureate, which endorsed his work. Three of them briefed reporters at the conference and it appeared to bother no one that one was an officer of the company and the others, consultants to ECD (one a shareholder).

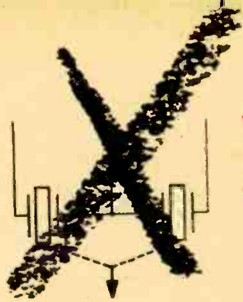
Though Ovshinsky was stunned by the magnitude of the press coverage—"I had expected a blurb in the Sunday papers," he said afterward—he did not help his cause any by refusing to say who was buying his Ovonic devices, reportedly being turned out at the rate of 150,000 a day at Troy. This prompted *Newsweek* to ask in its weekend story, "Did Ovshinsky have anything or didn't he?"

Top brass at some of our country's leading daily papers, a trifle anxious over the stock market reaction, undoubtedly put the same question to their science editors.

The *New York Times* Science desk, however, stuck to its guns. "In my opinion, the Ovshinsky story merited page one on the basis of his paper in the *Physical Review letters*, said Henry Lieberman, chief of the *Times* science desk. "My reporter tried to check it out at Bell Labs but they gave him a lot of double talk. I called them myself and they were afraid to say anything for publication." Mr. Lieberman added that the *Times* "was only interested in the scientific aspects of Ovshinsky's work and not the technology, and if 20 physicists think it's great stuff, that's good enough for me."

George Trigg, senior editor at *Physical Review Letters*, noted that when the Ovshinsky manuscript was submitted it was assumed the work had no previous history, at least not on the scale that was later discovered. "If we had known that some of it had appeared in advertisements we would have turned it down," said Trigg. Apparently the referees at *PRL* were caught napping.

In any event, there emerged out of it all an exuberant inventor—a high school dropout—whose name and company were catapulted around the world in no more time than it takes to write a headline.



For Better Stereo, Change to a Magnetic Cartridge

By JOSEPH RITCHIE

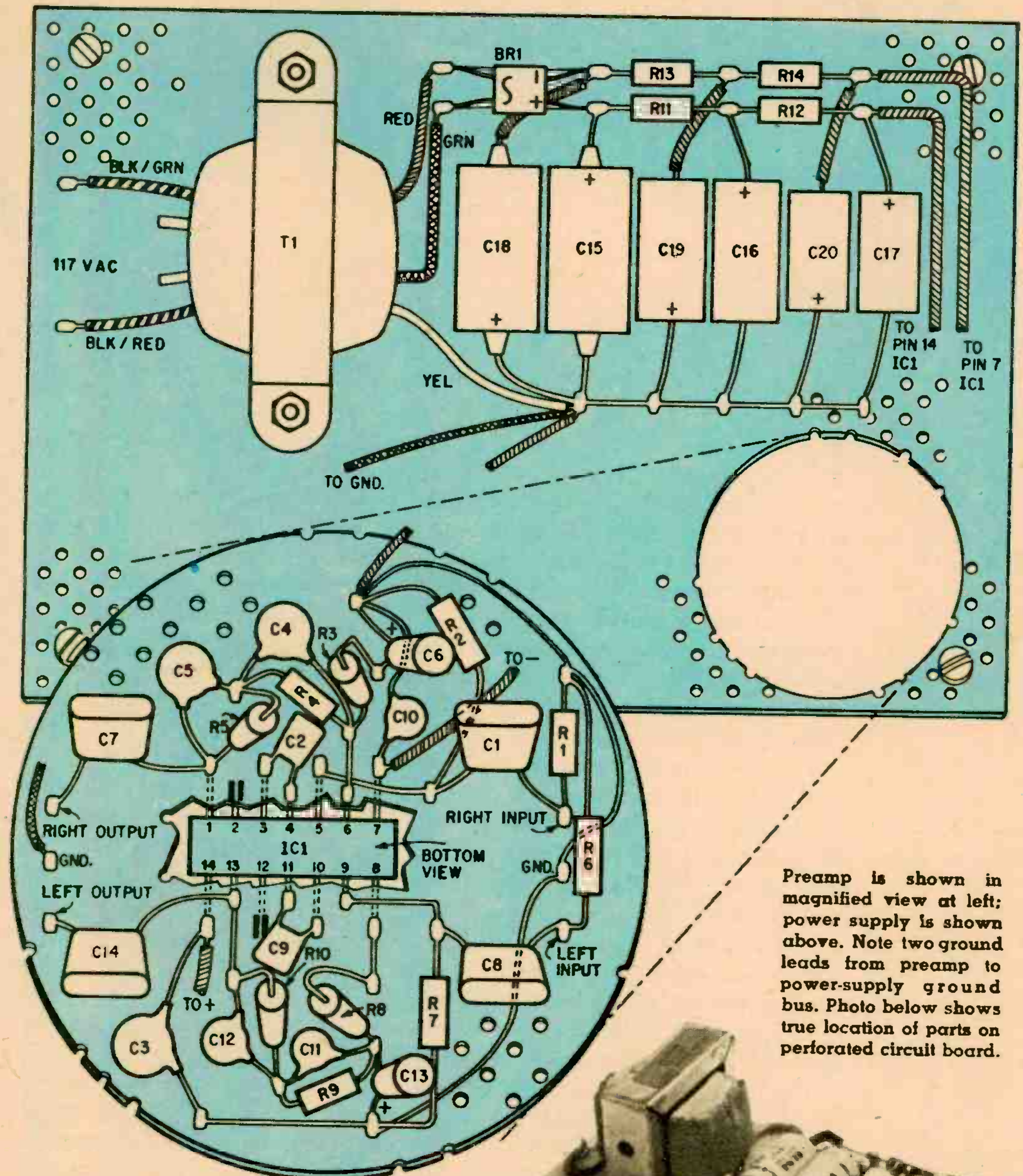
UNLESS you have a component stereo system or a portable record player of component quality, a good part of what's on a recording never gets to your ears. Reason for this is that the manufacturing shortcuts that lower the price of the portable player also cut out much of the sound. First, you've got small speakers working against you. Generally speaking, amplifiers do a good job because their being solid-state makes it somewhat difficult to design a terribly bad one. Then there's the cartridge, and that's where most of the sound dies (or is never born). It takes a magnetic cartridge to do justice to a good recording. The ceramic cartridge supplied with most portable stereo record players simply can't do the job. You can easily upgrade your player by installing a magnetic cartridge.

A magnetic cartridge means you'll need our IC preamp to equalize (RIAA) and amplify the cartridge's output voltage so the record player's amplifier can be driven to full output. Our preamp is self powered and it can be used with just about any stereo player. A single IC, a Motorola MC1303L, provides the amplification and equalization for left and right channels; separation is about 60db. Used with a typical magnetic cartridge the preamp's output is slightly greater than 0.3 V (rms). This will be just right for some players, a little too much for others, and just a little under the level needed by some players. If you get too much volume, the preamp's output can easily be padded down. If the volume is not enough, the slight sacrifice will be more than offset by the improvement in sound quality.

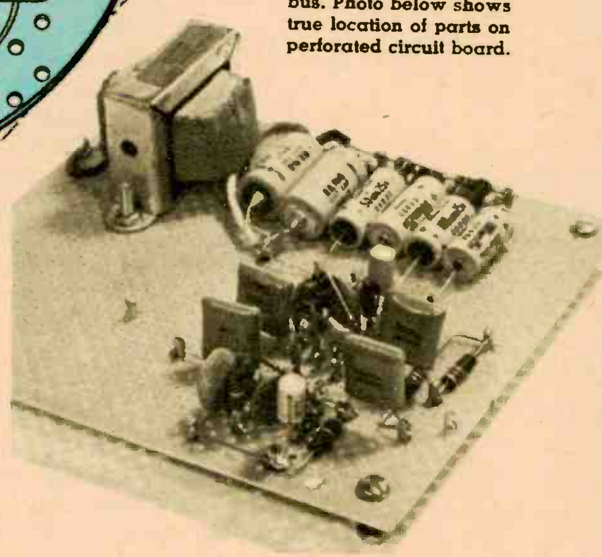
The preamp is built on a 5 x 5½ piece of Keystone G-pattern perforated-board. (A cabinet is not needed as the board can be installed in the player near the amplifier). G-pattern board, rather than standard board must be used as the holes have the same spacing as the IC's terminals. Standard perf-board holes will make it difficult to mount the IC. A 14-pin in-line IC socket could be used, except it is difficult to obtain.

All IC connections are made to push-in terminals and every single connection must be made to a tie point. There must be no floating connections as they can cause amplifier instability. Another cause of instability is not duplicating the parts layout exactly and not using the parts specified. A change of capacitor value can cause the amplifier to break into oscillation.

Construction. First, complete the power supply as you must be certain its output voltages are correct before connecting the preamps. Note that the power supply is bi-polar, that is, it has outputs that are +13 and −13 V with respect to ground. You cannot connect a single-ended power supply to the IC by connecting the B− to pin 7 and the B+ to pin 14. Pin 14 must



Preamp is shown in magnified view at left; power supply is shown above. Note two ground leads from preamp to power-supply ground bus. Photo below shows true location of parts on perforated circuit board.

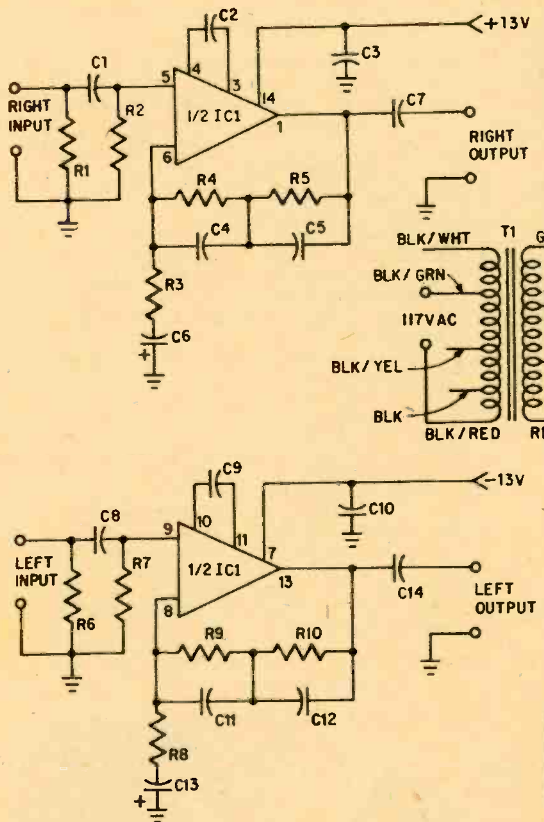


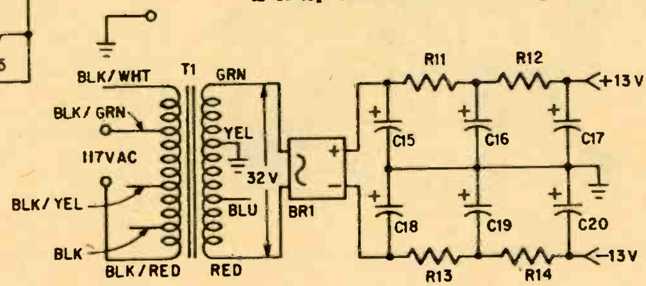
Change to a Magnetic Cartridge

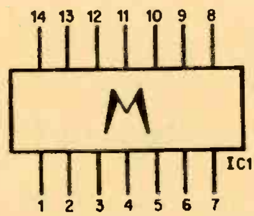
connect to +13 V and pin 7 to −13 V. (There is no direct connection between any pin on the IC and ground.)

Rectifier BR1 is a molded diode bridge. The transformer secondary leads connect to the two terminals opposite the ~ symbol molded in the case. The terminal marked + is the positive output and the terminal marked − provides the negative voltage.

Schematic. Preamps are shown one above the other at the left and the power supply is shown below. Power supply has two 13-V outputs with respect to ground. +13 V goes to pin 14 on IC; −13 V output goes to pin 7. Pin numbering of IC is in sketch below power supply. View is of top of IC with Motorola symbol as shown.

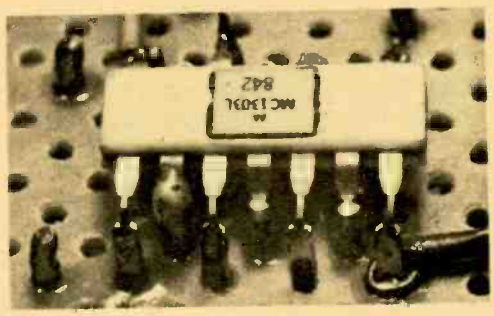






Both the positive and negative filter circuits are identical, and the filter capacitors must connect to ground as shown; do not connect the capacitors from the +13 to −13 V outputs.

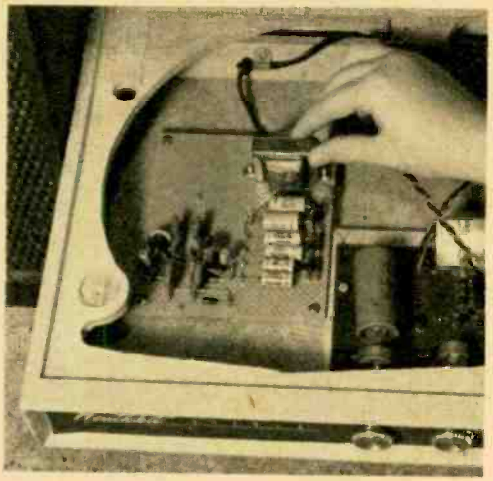
When the power supply is completed check it out in the following manner: Connect a 2,200-ohm resistor across the output terminals (+13 V to −13 V) and measure the voltage across the resistor. If it is not between 22 and 26 V you have made a wiring error or used the wrong primary taps on the power transformer. Next, with the 2,200-ohm resistor connected, measure the voltage from each side of the power supply to ground. Each side must measure exactly half the total voltage. That is, if the total voltage is 26 V, each side should measure 13 V to ground. If the positive side measures more than the negative side, or if you got a total voltage considerably less than 22 V check that the polarity of C16, C17 and C18 is correct. In no event must the total voltage (with the 2,200-ohm resistor connected) measure greater than 26 V. If it is greater it may be because your line voltage is high.



IC is mounted by fanning out every other lead and then dropping into four rows of push-in terminals. Hole pattern of board matches pin spacing.

in which case connect the AC line to T1's *blk/wht* and *blk/red* wires. When the power supply checks out, remove the resistor and complete the amplifier.

If you use an IC socket cut a hole in the board and cement the socket in place so that the terminals are on the *top* of the board—the IC will mount on the underside of the board. If you don't use a socket, use push-in terminals to mount the IC, which goes on the underside of the board. Using long-nose pliers, fan-out the IC's 1, 3, 5, 7, 8, 10, 12 and 14 terminals. From the *top* of the board install a row of four push-in terminals. Then put push-in terminals in the three ad-



Install preamp as close as possible to player's amplifier. Make sure there is clearance for all changer parts before mounting preamp in place.

Change to a Magnetic Cartridge

jacent holes. Do the same on the other side of the IC.

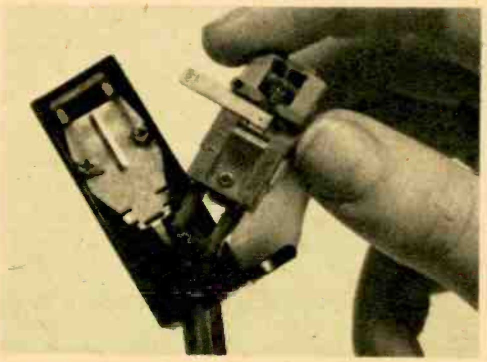
From the underside of the board, slip the IC's pins into the four rows of terminals. Gently push the pins in as far as possible and then tack-solder with a fine-tip iron rated no higher than 40 watts. To protect the IC avoid excess heat or solder. Only the IC, ground-bus and power-supply connections are on the underside of the board; all other components and wires are on the top.

To conserve space and avoid a parts jam all capacitors should be the printed-circuit type with both leads sticking out the same end. Resistors R3, R4, R5, R8, R9 and R10 should be mounted on end. Mount the remaining resistors flat on the board. Make certain the polarity C6 and C13 is correct. Turn the board over and check that a solder blob didn't run down a terminal and short two IC terminals.

Amplifier Installation. Carefully remove the changer from your player and unplug or unsolder all wires from the changer to the amplifier. Mount the preamp near the player's amplifier so that the IC's input terminals are as far as possible from the AC line cord going to the amplifier or changer. Locate the AC line cord going to the changer's motor and splice T1's primary wires to it. Since the record changer's AC supply is disconnected after the last record is played, the preamp will be turned off automatically.

PARTS LIST

BR1—Full-wave bridge rectifier; 50 PIV, 1 A (Motorola HEP-175)
Capacitors: 25 V unless otherwise indicated
C1,C7,C8,C14—.25 µf
C2,C9—.005 µf
C3,C10—.1 µf
C4,C11—6,800 µµf ceramic disc
C5, C12—1,500 µµf ceramic disc
C6,C13—10 µf, 6 V electrolytic
C15,C18—100 µf electrolytic
C16,C19—50 µf electrolytic
C17,C20—100 µf, 15 V electrolytic
IC1—MC1303L stereo preamplifier integrated circuit (Motorola)
Resistors: ½ watt, 10% unless otherwise indicated
R1,R6—47,000 ohms
R2,R7—820,000 ohms
R3,R8—1,000 ohms
R4,R9—750,000 ohms, 5%
R5,R10—51,000 ohms, 5%
R11,R12,R13,R14—560 ohms
T1—Low-voltage rectifier transformer; secondaries: 10,20,40 V center tapped @ 35 ma. Allied 54 C 4731
Misc.—Perforated board, push-in terminals
The Motorola MC1303L is available for $5.40 plus 75¢ postage and handling from Custom Components, Box 352 Alden Manor, Elmont, N.Y. 11003. Canadians add $1. N.Y. State residents add sales tax. No foreign orders.



If you can't find mounting screws for ceramic cartridge, removing the cartridge from spring retaining clip will expose them on mounting plate.

Unsolder the leads from the player's amplifier input and connect them to the preamp's input (C1 and C8). Connect the lead's shield to the ground terminal between the IC inputs. It doesn't matter whether there are two pickup leads or a two-wire shielded cable; all shields go to the single ground terminal. Using shielded wire connect the preamp's outputs (C7 and C14) to the player amplifier's inputs. Connect the shields to the player amplifier's ground point.

If the preamp's output is too much for the [*Continued on page* 111]

Good Reading

By Tim Cartwright

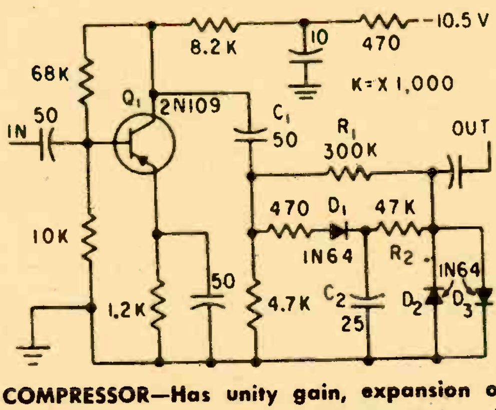
SOURCEBOOK OF ELECTRONIC CIRCUITS. By John Markus. McGraw-Hill, New York. 888 pages. $18.50

These 888 pages are not only the large economy size, but also chock full of more information on electronic circuits than I have ever seen in any one source. The publisher calls it a "virtual desk-top retrieval center" for anyone working in electronics, and so it is. Just about everything is here (specifically, more than 3,000 circuits from work done over the past ten years, one of which is reproduced at the bottom of this page), and it's organized well for super-fast looking and leisurely leafing. Definitely *something else* if you can afford it. An excellent purchase for anyone seriously involved in electronics.

THE WHOLE EARTH CATALOG. Published by the Portola Institute, 558 Santa Cruz Ave., Menlo Park, Calif. $5 ($8 with quarterly supplements)

This, too, is a retrieval center, but of a very different, distinctive and fascinating kind. Its purpose is to tell you how and where to get various things worth getting—from a book of Buckminster Fuller's to an electronic kit or a game—and to supply these items directly if you can't find them in the usual place.

According to the publishers, a product is listed in the catalog if it's (1) useful as a tool, (2) relevant to independent education, (3) of high quality or low in cost, (4) not already common knowledge and (5) easily available by mail. The whole project is obviously produced (on an IBM Selectric Composer and a Polaroid MP-3 industrial camera) by people you would like to know. The basic catalog is added to quarterly with a Difficult But Possible supplement. Wonderful, really wonderful.



COMPRESSOR—Has unity gain, expansion of 3 db, and compression of 12 db. Gain adjustments are automatic. Used to maintain even recording level during tape-recorded interviews.—E. C. Miller, Audio Volume Compressor, *Electronics*, 33:2, p 62.

UNDERSTANDING ELECTRONIC TEST EQUIPMENT. By Joseph A. Risse. Howard W. Sams, New York & Indianapolis. 192 pages. $4.25

Books like this one all tend to look alike and that makes the occasionally good one (like this) harder to find in your store's book rack. This is a well organized and cleverly illustrated little book on test gear, and definitely could be useful to all sorts of beginning hobbyists in electronics. I suggest you look into it either for yourself or someone you know.

SERVICING TRANSISTOR EQUIPMENT. By Gordon J. King. Hart Publishing Co., New York. 151 pages. $7.95

Although the publisher doesn't really come out and say it, this is a translation (!) of a British text so several of the circuits illustrated are types not generally available in this country. Still, the book is worth noting because of its easy and sensible approach to the subject and its nice production. I can't really predict how applicable you will find it, so have a look for yourself.

And Make Note Of. . . .

FEEDBACK AMPLIFIERS AND OSCILLATORS. By Robert E. Sentz and Robert A. Bartkowiak. Holt, Rinehart & Winston. New York. 218 pages. $3.95

HOW TO USE GRID-DIP OSCILLATORS. By Rufus P. Turner. Hayden Pub. Co., New York. 128 pages. $2.95

THE RADIO AMATEUR'S HANDBOOK. 46th Edition. Published by the American Radio Relay League, Newington, Conn. 710 pages. $4 in the U.S.A.

United Nations Photo

Headquarters for the International Telecommunication Union (ITU) is now located in Geneva, Switzerland.

The Grim Facts on Short-Wave Broadcasting

Watch it—Your short-wave receiver may soon be gathering dust!

By STANLEY LEINWOLL

TALK TO A ham licensee and the first thing he'll complain about is the decreasing space available on the ham bands. He has lost quite a bit of the spectrum over the last few years and he's anxious about the future.

Most short-wave listeners, however, seem to live in a land of milk and honey. As they tune in stations all over the globe they seldom question what the future will bring. Local conditions are blamed for interference and, of course, increased transmitter power would take care of a lot of things. Or would it?

Truth is, time is running out for short-wave broadcasting. Unless something is done pronto by the powers that be, your SW receiver soon may sound like a voice scrambler in Operations at the Pentagon. A traffic jam is building up all over the spectrum that will soon make your Sunday afternoon drive look like a breeze.

Unfortunately, unlike cars, most radio waves don't travel in the nice, neat patterns found on the highway charts of a city planner.

Directional antennas are a help but radio propagation dictates that a good deal of energy will always spread to areas where it isn't wanted. And the more transmitters in a given area, the more likely that interference will be severe.

Geneva. Of course, this problem isn't new. September marks the tenth anniversary of the Geneva Radio Conference where representatives from almost 100 countries made the first attempt to bring law and order to the *management* of international high-frequency broadcasting.

Up until this conference very little had been done to plan the flow of radio transmissions throughout the world. At Geneva, a revolutionary new procedure—described in Article X of the Geneva Radio Regulations of 1959—was drafted which brought some stability to international broadcasting at a time when it appeared headed towards complete turmoil.

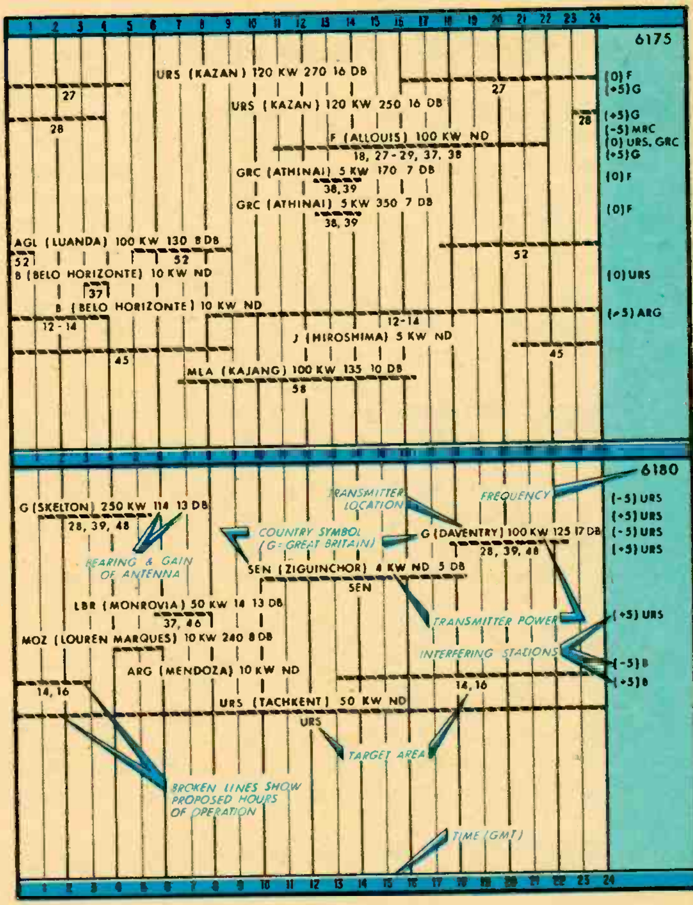


Fig. 1—A page from March 1969 tentative schedule published by the International Frequency Registration Board (IFRB) in Geneva, Switzerland. Here you can see broadcasting plans of various countries for two frequencies, 6175 and 6180 kc. Information is identified in color.

However, the conditions which led to the enactment of Article X have continued to worsen. The number of transmitters operating in the high-frequency bands has increased to the point where congestion is extreme. During certain hours some bands are overloaded by a factor of three. Thus, interference is at an unprecedented level. To make matters worse, these man-made problems will intensify since the number of frequencies available for shortwave broadcasting will soon decrease due to lower sunspot numbers. As a result, the international bands are going to become progressively less useful as a medium for communication.

Under the terms of Article X the year is divided into four seasons that are determined by propagation conditions (November to February is the winter season. March and April are spring, May to August is summer, and September and October are the fall). All member countries of the International Telecommunication Union (ITU) are required to submit their program schedules for each season six months in advance. The International Frequency Registration Board (IFRB), a division of the ITU, is responsible for publishing these schedules two months before they are implemented. Fig. 1 shows a page from the schedule for March 1969.

The whole schedule consists of 206 pages, covering all SW bands from 6 to 26 mc. Besides publishing schedules, the IFRB undertakes a technical examination of them and recommends changes that will eliminate or reduce harmful interference. The schedules are also examined by the management experts of countries engaged in international broadcasting. These people attempt to find solutions for potential interference problems.

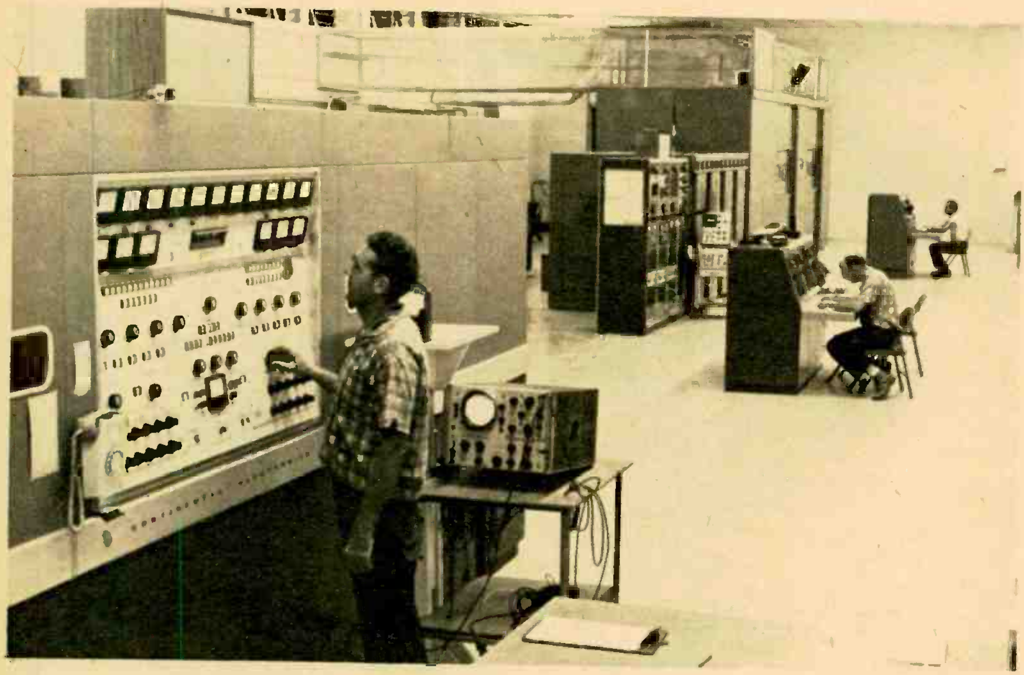
The Article X procedure brought order to short-wave broadcasting because it provided an advance look at schedules so that changes could be made. But this has its limitations. In Fig. 1, Angola (AGL) is shown operating on 6175 kc. The station has never appeared on this frequency, though it has been listed on numerous schedules. Unfortunately, since some nations are under the erroneous impression that the IFRB schedule can serve as a framework for their future plans they pad their schedules. A second problem is that some countries do not even notify the IFRB about their plans. The schedule often does not show a country occupying a frequency that it is actually using. Consequently, the IFRB schedules contain errors which are unnecessary.

Recent Developments. During the years following the Geneva Conference the number of hours of daily broadcasting increased from 9500 in 1959 to 17,000 in 1969. Many channels are now occupied by two or more broadcasters, with sometimes as many as four countries broadcasting simultaneously. This is serious and yet the trend continues. Broadcasters are using not only more transmitters, but greater power as well. It's been estimated that at the present rate of expansion there will be a 20 per cent increase in the broadcasters now operating when the next minimum in the sunspot cycle is reached.

As sunspot activity passes from maximum to minimum the amount of useful spectrum space decreases by as much as 50 per cent. Since the maximum of the current sunspot cycle was reached several months ago spectrum space will be on the downswing in the months (and years) to come, forcing more and more broadcasters to crowd into the bands that remain. You can bet your last dollar that the combination of increased broadcasting and worsening propagation conditions will produce a situation bordering on chaos.

Look at the Future. Though the outlook appears bleak there are a number of steps which can be taken to improve conditions:

• At the present time representatives of the VOA, the BBC, RFE, Radio Liberty, Radio Netherland, Radio Germany, Radio Canada and the FCC (which represents private U.S. stations such as Radio New York Worldwide) meet six times a year to coordinate their



Relays such as one previously operated by Trans World Radio (above) on Bonaire for RN add to interference. This type of interference could be reduced if other communication services were used instead.

Radio Service	Total Bandwidth Allocated Exclusively (kc)	Total Bandwidth Allocated on a Shared Basis (kc)
1. Fixed	10 173	6147
2. Maritime Mobile	3850	
3. Aeronautical Mobile (R)	1105	150
4. Aeronautical Mobile (OR)	695	150
5. Land Mobile		1985
6a. Mobile except aeronautical mobile)		2907
6b. Mobile (including aeronautical mobile)		800
7. Broadcasting	2150	
8. Tropical Broadcasting		500
9. Amateur	2800	500
10. Standard Frequency	50	30
11. Meteorological Aids		500
12. Space and Earth-Space		30

Fig. 2—Allocations for the high-frequency spectrum as set forth by radio regulations of Geneva Conference in 1959. These allocations are for Region 2 (Western Hemisphere); allocations for Regions 1 and 3 (Russia, Asia and South Pacific) are similar.

schedules before they are submitted to the IFRB for publication. These conferences are an informal extension of the Article X agreement and offer no long-term solution. However, they do assist these broadcasters in working out some of the conflicts that arise in their schedules. For instance, representatives have learned that sharing frequencies (which at first may have looked technically impossible) will work under certain conditions. Also, changing the characteristics of an assignment (such as target area, hours of operation, transmitter power, etc.) can make conflicting assignments more compatible.

By extending such conferences to other regions broadcasters in other parts of the world could work out similar arrangements among themselves. This would not solve the problem of overcrowding on an international level, but it might result in an improvement in conditions at the grass roots.

• Several broadcasters make considerable use of the short-wave bands to send programs to bases closer to target areas. The relays then transmit the programs to the intended audience. Crowding often results from the use of these *feeder* frequencies for transmissions to distant relay stations. If relay operations were transferred to other services such as cable, satellite or commercial high-frequency channels a significant step toward alleviating congestion will have been taken.

• Approximately 50 per cent of short-wave broadcasts are intended for domestic consumption. Extensive short-wave home service networks exist in the Soviet Union and in many Latin American countries. A panel of communication experts which met in Geneva some years back, reported that crowding in the high-frequency bands would be reduced if the domestic services were transferred either to MW or FM. There has been some improvement as several countries have begun a move toward domestic VHF networks, but it has been too slow a process to produce meaningful results. Acceleration of this program, perhaps with financial assistance from the ITU, would benefit everyone.

• Presently Communist countries attempt to prevent reception of Western broadcasts by jamming some programs. To combat the effects of jamming, the West uses multiple frequencies to carry the same program material in the hope that at least one channel will get through. This puts added strain on spectrum space. So an end to any form of jamming would free many of these frequencies.

• In the final analysis, the future effectiveness of short-wave broadcasting depends on making more frequencies available. This appears to be the only practical long-range solution. Of the 27,000 kc available, only 2150 kc are allocated to international broadcasting (see Fig. 2). This amounts to 8 per cent of the high-frequency spectrum.

During the past ten years communication satellites have become a reality, cable facilities have expanded and the use of ionospheric and tropospheric scatter circuits has increased significantly. Since these sophisticated methods of transmitting information will continue to replace HF services, the concept of making more spectrum space available to SW broadcasting is now more feasible.

At the Geneva Radio Conference of 1959 there was considerable pressure from smaller countries to expand the broadcast bands. The Article X agreement was a compromise arrived at after strong opposition to expansion was voiced by the major broadcasting powers. It appears that Article X must be modified.

There is no radio conference scheduled in the immediate future. A space conference and maritime conference will be held in Geneva in 1971 and 1973, respectively. The earliest possible date for a radio conference appears to be 1975, and the earliest date for possible expansion, to be late 1976 or 1977. The question is, will it be in time to save international broadcasting?

Notes from EI's DX Club

CLUB member Donald Rubin, WA3JRA (Maryland), has worked and QSLed a rare Eurpoean DX outpost—IS1LJO on the Mediterranean island of Sardinia. His QSO was on 10 meters around 1230 EST.

From George Earle, VE1ZS/VE3ESL (Northwest Territories), comes a note regarding DXING THE TOP OF THE WORLD (Jan. '69 EI). CHAK (860 kc), he says is now located at the model town of Inuvik, about 40 mi. from the old site of Aklavik, while KFRB (at Fairbanks) is on 900 kc. As soon as fall sets in, West Coast BCB DXers should start looking for these rare Arctic targets.

EIDXCer Lou Geis, WB2CDZ, has worked a rare Asian country on 15 meters (at least it's rare on the ham bands)—it's YA5RG in Afghanistan, around 1230 EST.

Morey Goldstein (New York City) has pulled off a real QSL coupe. He has got short-wave broadcaster R. Moscow to verify his reception of the Moscow telephone station. Another New York Stater, Utility DXer Alex Kosinski, has bagged a rare Guatemalan radio beacon—PO at Poptun on 1740 kc. This one is on the air irregularly.

Gerry Dexter (Wisconsin) has logged an Ecuadorian short-wave station which uses the amateur call HC4RS and announces its location as Portoveijo; it is received around midnight EST on 4817 kc.

The Latin American station which appeared in February around R. Americas' old BCB spot is not RA, nor has Columbia suddenly switched to CST as suggested by the National Radio Club. The station (on 1155 kc) is YSCF at San Miguel, El Salvador. Barring another frequency switch, this is one medium-wave DX target that should be logged occasionally—even through summer static.

Kol Israel has been airing a series of English-language test transmissions to North America at 2300 EST (2000 PST) on 9009 kc. Reception has been generally good.

A hot DX prospect is R. Nepal whose comparatively new 100-kw transmitter is being reported widely on 11970 kc at 2120 EST sign-on. It's certainly nice to encounter a rare Asian target that you don't have to log in the wee hours.

A newcomer to the short-wave broadcast wars is Radiodiffusora Nacional de Nicaragua, which has been reported by Mike Macken (Massachusetts) and others to have test transmissions on 5935 and 11875 kc. Of course, this one has been a regular for some years on 615 kc (BCB), where the call is YNM.

A semi-rare African catch is R. Uganda on 5026 kc. Gerry Dexter reports reception just after 2300 EST. At this same time, R. Tanzania can be heard occasionally on 5050 kc. Both use English during this period.

A new and apparently potent frequency for R. Hanoi is 7290 kc, where Bill Migley (Ohio) reports reception through ham QRM around 0700 EST. At this time they have a special propaganda broadcast for U.S. troops stationed in Vietnam.

Propagation: During daylight hours the 11- and 13-meter bands still will be relatively ineffective for DX. Short-skip propagation both in these bands and the amateur 10-meter band will be quite frequent during the hours from 1000 to 1500 local time due to sporadic E-layer propagation in the ionosphere. Occasional TV and FM DX also will be possible because of the same phenomenon. It is caused by the formation of dense clouds of ions in the lower levels of the ionosphere (in the vicinity of the E layer). These clouds are able to reflect frequencies back to earth that are much higher than usual. Ionospheric propagation usually cuts off around 30 mc.

Short-wave DX will be best during daylight hours in the 16- and 19-meter bands. At night, all bands from 49 to 19 meters should be good to excellent for DX. But high noise levels, typical of the summer months, will once again inhibit good medium-wave DX reception.

Pin-Money Power Sensor for CB

Less than $4 worth of parts plus your VOM or VTVM are all you need to make a check of the output power of your CB transceiver.

By JOHN S. RICHARDS

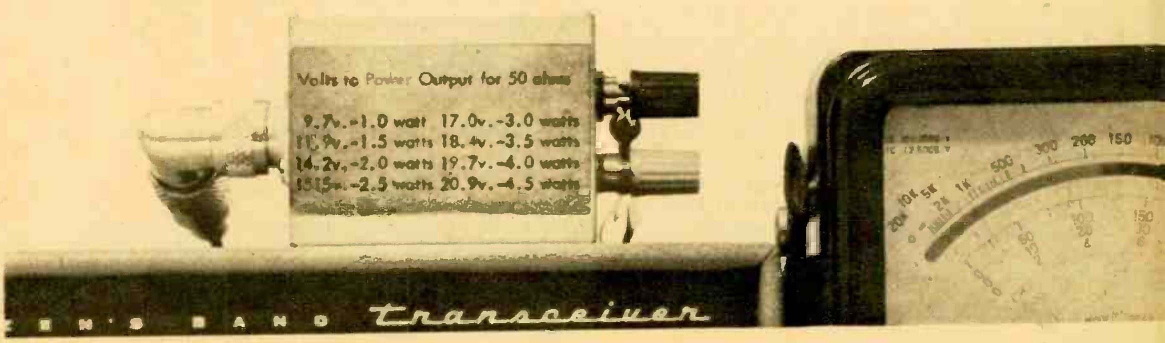
BEEN getting reports from down the block that you sound as though you were 10 mi. away? Reason might be that your CB rig just isn't putting out enough power. Your antenna system could be the source of trouble but it's always a good idea to check output power first.

Cheapest way to do this is with our Pin-Money Power Sensor. Its cost is low because most of its parts probably are in your junk box. Another reason for the low cost is that you already own the most expensive part—the calibrated meter, which is your VOM (its sensitivity must be at least 20,000 ohms-per-volt) or VTVM. Simply connect the meter to the sensor's output and it will indicate the transceiver's power, in terms of a DC voltage. Check the power opposite voltages in the chart or calculate power from a formula, and you have your transceiver's output power. For example, suppose the VOM indicates 18.4 VDC. From the chart you see that 18.4 VDC means 3.5 watts RF output power. If the meter indicated 15.5 VDC the output power would be 2.5 watts.

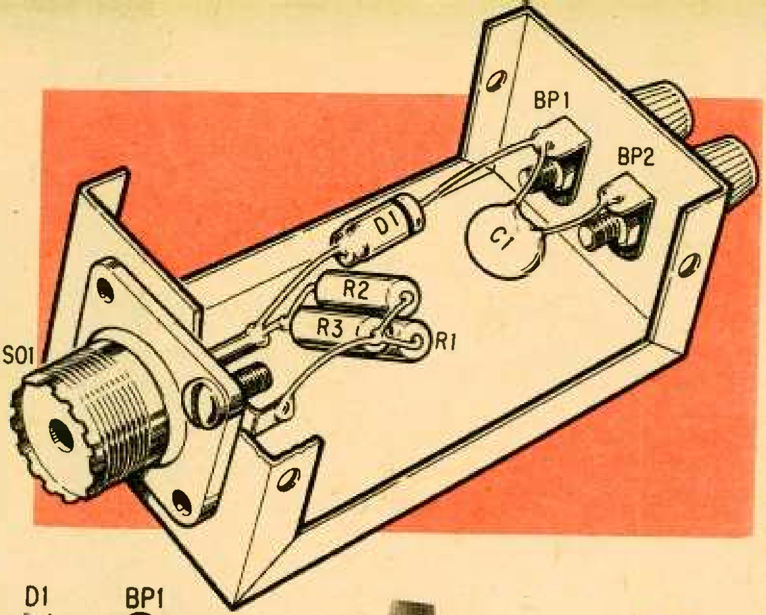
The sensor is a small metal box containing a 50-ohm dummy load and a diode detector. The output voltage of the detector, which is indicated by your meter, can be converted to power by the formula (specifically and only this circuit): $\text{W. (power)}=[E+0.3) \times 0.707]^{2}/R$. This formula is the $W=E^2/R$ power formula with a few extras. Don't let the 0.3 and 0.707 throw you; we'll explain.

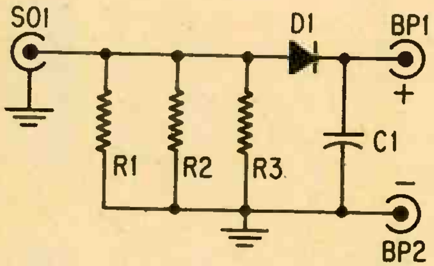
In the formula *E* is rms voltage. But the sensor's detector output is *peak* voltage and must be converted to rms by being multiplied by 0.707. What about 0.3? It's the voltage drop across the germanium diode—nominally 0.3 V. *R* equals the resistance of the 50-ohm dummy load.

Now look into the circuit's output as though you were a VOM. The DC voltage at the binding posts is the peak (not peak-to-peak) RF voltage across the



We built our model in a 2¾ x 2⅛ x 1⅝-in. Minibox, however, any size will do so long as the box is metal. Resistors are connected to ground lug installed under one of SO1's two mounting screws.



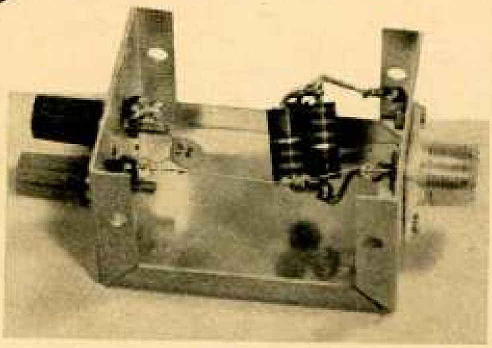


Power Sensor for CB

Meter Voltage	Power (watts)
9.7	1.0
11.9	1.5
14.2	2.0
15.5	2.5
17.0	3.0
18.4	3.5
19.7	4.0
20.9	4.5

dummy load minus the 0.3 V drop across diode D1. Therefore you must add 0.3 V in the formula to allow for the drop across the diode. For example, if the meter indicates 15.5 VDC across the binding posts the peak RF voltage is 15.5 + 0.3 or 15.8 V. Convert 15.8 to rms by multiplying by 0.707 and you get 11.2 V. Substitute 11.2 V in the formula and you get 2.5 watts.

Construction. The sensor can be built in any small metal cabinet. Coax connector SO1 should match your existing transmission-line connector. Binding posts BP1 and BP2 can be the five-way type, or any connector you want, such as a phone jack. Only BP1, the



In schematic at left, resistors are load, diode is detector, C1 is RF bypass. Note open layout in photo at right. If available, use smaller box.

positive binding post, need be insulated from the cabinet. Diode D1 is a germanium type such as 1N60. Do not use a silicon diode as it has a higher voltage drop.

The dummy load, consisting of R1, R2 and R3, is three parallel-connected 150-ohm, 2-watt resistors which provide a 50-ohm 6-watt load. Any number of resistors can be used as long as the net resistance is 50-ohms with a power rating of at least a 6-watts.

PARTS LIST

BP1, BP2—Binding post
C1—.05 μf, 50 V or higher disc capacitor
D1—1N60 germanium diode
R1, R2, R3—150 ohm, 2 watt, 5% resistor (carbon)
SO1—SO-239 coax connector
Misc.—2¾ x 2⅛ x 1⅝-in. Minibox

Hi-Fi Today * The Future of HI-FI

By John Milder

EVERY so often when hard news is a bit skimpy I start out to do a column on the future of hi-fi. But then something usually comes along so I put aside all thoughts of getting involved with prophesy and philosophizing. Not so this time.

At any given point there is good cause to ask whether hi-fi does have a future. The notion of component high fidelity as we have known it for the last 20 years (almost) came about because the manufacturers of mass-market radio-phonographs weren't really making anything that someone with a decent ear could accept as being the whole—or even part—of the truth. The hi-fi industry as such was created by the consumer who kept putting his own audio system together out of available public-address equipment until some manufacturers got the idea (finally) that there might be some money in making special gear for this man to plug together.

But now that specialty industry has grown and consolidated to the point where major component manufacturers offer many complete products; they are of high quality, to be sure, but not componenty in the revered sense of the term. At the same time, new kinds of equipment (like the tape cassette) push things even further in the direction of complete, ready-to-play products.

Even after all this progress, I still give hi-fi a future, both in terms of separate components and ready-to-play sets. But I don't see this future as a series of miraculous developments which finally contrive to wedge the concert hall into your living room. Today's equipment, if used properly, is close enough to the real thing to satisfy practically anyone who listens carefully.

What I do see coming is better source material (better initial recordings, better processing and perhaps new forms), much improvement in wide-range broadcasting and receiving methods and less garbage (noises and distortion) in all stages of the audio system. But perhaps more important, I see the extension of the whole notion of hi-fi into the realm of video.

The video experience right now is where recorded music was 20 years ago—trapped inside a box. Color television was and is an enormous improvement, but the scale of the experience is still all wrong. It should be bigger, and as it becomes so—which it will—the content as well as the form should improve.

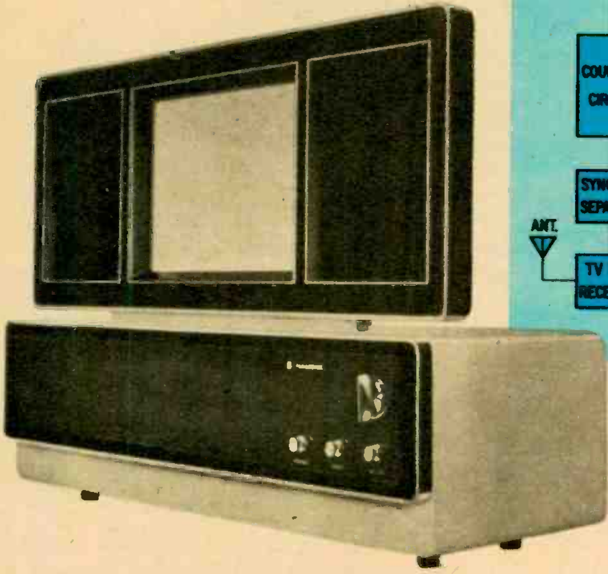
At this point there are many television systems that at last threaten to break out of the box. Certain systems will come soon, some not for a while, and others aren't meant to be more than the dream cars that never make it to market. But one product that's already catching on is the CBS EVR (Electronic Video Recording) system that will allow you, probably in a year, to buy an attachment for any kind of TV set so you can play pre-recorded video material through the set.

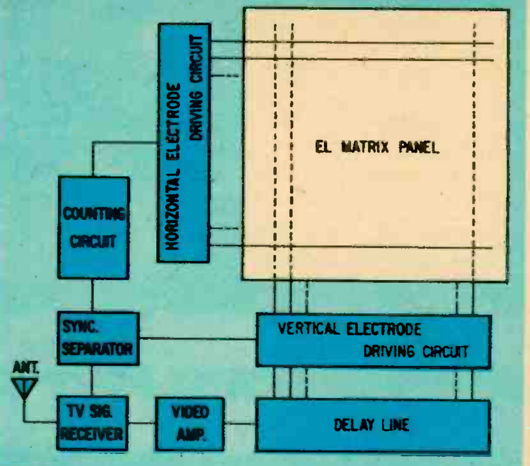
I won't describe the EVR system here, except to say that it is a playback medium and not a video tape recording system (the EVR prints are duplicated optically rather than rerecorded in the manner of audio and video tapes), and that it is already in use in educational television.

To my mind, it doesn't matter if the EVR system is successful or not. The point is that we are going to get before long, in one way or another, the video equivalent of the LP

[Continued on page 111]

EVR system developed by CBS permits you to program your TV—it'll be here in 1970.

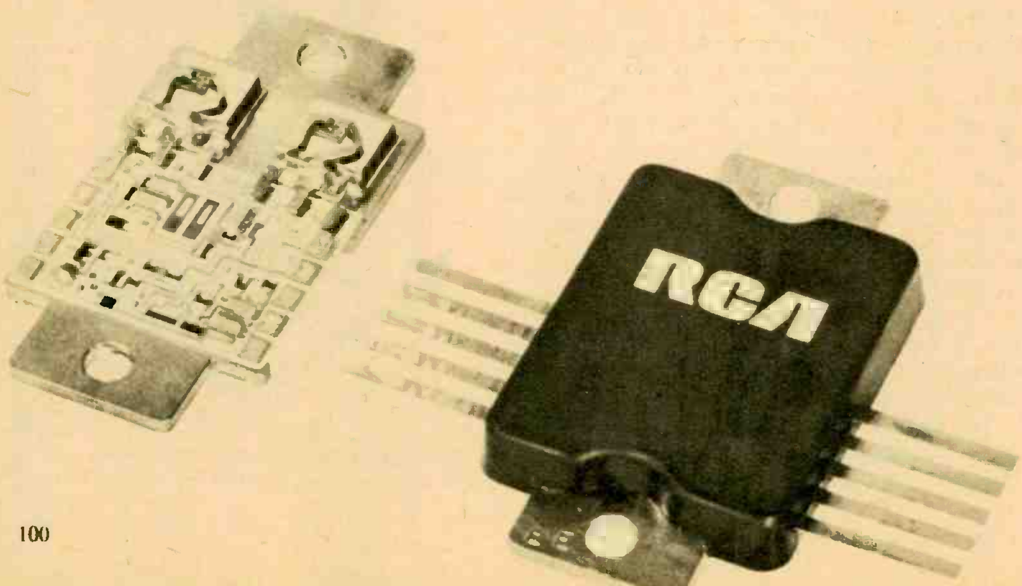




Electronics in the News

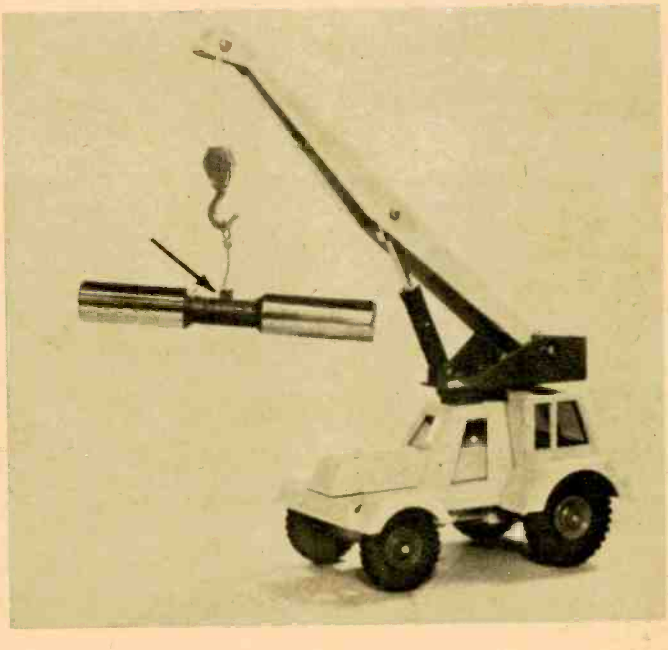
WAFER TV! . . . Panasonic (Matsushita Electric Corp.) has unveiled a prototype electroluminiscent TV screen which may prove marketable in about five years. The system (upper right) features solid-state circuitry, low-voltage operation and low power consumption. Inputs can be either closed-circuit and broadcast TV signals or video tape recorder. The matrix display surface measures 8 x 10.7 in., contains 52,900 picture elements and is scanned at a rate of 60 cps. The picture elements are scanned sequentially line by line (interlace method is not used) and blanking pulses applied to unscanned lines prevent any cross-effect on the panel. The image must be viewed in a dark room because contrast and brightness are still poor.

An IC with Zip . . . Time was when thin films wouldn't thicken. But it looks as if those days are gone forever now that RCA has developed a hybrid integrated-circuit power amplifier which has power to spare. This module uses 11 transistors, eight diodes, 23 thick-film resistors and seven chip capacitors to belt out 100 watts at 7 A peak load current. And it requires a mini-input of ½ V (at 20,000 ohms). When the TA7625 comes on the market, watch out, loudspeakers!



Single-Gun CRT . . . In a major effort to simplify convergence adjustments and reduce the size of the color CRT, Sony Corp. has announced an improved version of its Trinitron Color TV System. Heart of the matter is the Trinitron electron gun (at right) which uses only one gun for the three beams as opposed to the three-gun system standard in the U.S. It can be used with all color defining techniques—shadow mask, aperture grill, etc.

Super Magnet . . . A scientist working for the Raytheon Co., Dr. Dilip K. Das, has developed what may be the strongest-ever permanent magnet. Made from rare-earth samarium and cobalt, the magnet is four times as strong as alnicos. A speck of it is shown (arrow) in the photo holding up a small bar while suspended from a toy crane. Raytheon did not explain what the toy demonstration proved, but magnet will eventually find its way into microwave tubes.



The Listener

By C. M. Stanbury II

The Voice of the Purple Pumpkin

MYSTERY broadcasters exert a magic effect on the DX community. Add wings and you've got a wild semi-finale to the Blue Eagle story (see THE FANTASTIC FLIGHT OF THE BLUE EAGLE, May '66 EI).

Of the three Blue Eagle manifestations we have pinpointed—first, three aircraft installations tested by the U.S. Navy from June to September 1965; then powerful BCB signals (including off-the-air relays) in Baltimore during mid-September 1965; and, finally, a mystery signal which appeared on October 8, 1966, on 11620 kc with off-the-air relays from station WCUB at Manitowoc, Wis.—the last two had remained unaccounted for and the U.S. Navy denied any involvement. Now, however, we may have some answers to at least one, the Blue Eagle trick in Baltimore.

During 1967 we first received a QSL card and then a letter from someone calling himself the Voice of the Purple Pumpkin. This fellow claimed to operate a bootleg transmitter under the pirated call WJMS. We since have concluded that he did operate such a station even though many of his statements were pure DX fiction. Apparently a licensed amateur, Purple Pumpkin's QSL was mailed before the date of his alleged broadcast and a subsequent letter claimed, "We have received reports of reception from as far as California, Ontario, Miami, to name just a few of the over 100 we have on record." In point of fact, a Purple Pumpkin reception was never reported in any DX publication.

Now hear this. Remember that the Baltimore Blue Eagle incident received national publicity mostly because of the efforts of a single DXer? This fellow (now a ham) got together a collection of all the Baltimore press reports on Blue Eagle transmissions and acted as a sort of self-appointed press officer for the whole operation. Well, the Purple Pumpkin letter was written on the same typewriter used by this Baltimore DXer in his correspondence with me. Both Purple Pumpkin and our Baltimore press officer misspelled our name in the same way!

Further, in September 1965, Purple Pumpkin knew that he could go on the air as Blue Eagle, using as much power as his equipment would produce, and without the slightest danger of being apprehended by the FCC. In June 1965 he logged a Blue Eagle transmission around 20 mc. He then queried the FCC and their reply, in part, read as follows: "The station which you intercepted was unlicensed. Engineers from field offices of our Field Engineering Bureau located the station and while not actually observing the station in operation, contacted the suspected operator and warned him of the possible results and penalties of such unlicensed operation."

Subsequent evidence indicates that the FCC spokesman had not been fully informed that this 20-mc Blue Eagle operation was a legitimate U.S. Navy broadcast from the vicinity of Andrews AFB. However, Purple Pumpkin knew that he could *now* go on the air as Blue Eagle and that someone else would be blamed for it—he was one of the few radiomen outside the government in possession of such information.

In the light of these developments, it seems most likely that the BCB operation in Baltimore was a hoax perpetrated by our friend, the Purple Pumpkin.

Dry Tortugas. . . Three weeks after the start of the Cuban missile crisis two new Voice of America BCB stations appeared. One station on 1180 kc announced its location as Marathon, Fla., and the other (on 1040 kc) kept its location a secret for a couple of months and then gave Sugar Loaf (between Marathon and Key West) as home base. However, it became clear that the original VOA1040 was located elsewhere (though the move was accomplished without the DX community's noticing it). To get a good signal on the air that fast must have required a portable unit, but Sugar Loaf wasn't decked out with anything portable. Station VOA1040 received its programming off the air (a procedure which automatically reduces modulation quality), and this would have been unnecessary at Sugar Loaf.

[*Continued on page* 109]

The ABCs of Color Television Servicing

Answers to Examination on Part I:

Continued from page 74

1. First analyze the symptoms; second, inspect the equipment; third, isolate the trouble spot by eliminating operating stages from suspicion; fourth, pinpoint the faulty part by substitution or testing.
2. The R, G and B signals.
3. The unshaded stages in Fig. 1-4.
4. False. It refers to all ranges of gray occurring between black and white during a monochrome transmission.

Scatter Communications

Continued from page 63

justed so that the vertical-radiation angle changes to receive maximum energy at different angles (from 3.5 to 22.5 degrees).

Changing the optimum receiving angle is important because it helps determine which receiving mode is producing the strongest signal at a given frequency. International broadcasters such as Radio Free Europe operate on a *fixed* frequency schedule and cannot utilize backscatter equipment to determine which band is propagating best in order to make an assignment in that band. Instead, they have to determine which *angle* is producing the strongest signal on a particular frequency and then adjust the transmitting antenna to fire at that angle; this way a better signal is propagated into the target area.

The technique of adjusting your radiation angle is called *slewing*. RFE has a number of vertically-slewable antennas and is planning to construct others to take maximum advantage of its backscatter equipment. Fig. 2 shows what a typical display looks like. Mode 1 corresponds to the lowest transmitting angle and Modes 2 to 5 refer to increasing vertical angles. As expected, Fig. 2 shows that as the transmitting angle is decreased, the backscattering distance increases. Modes 1 and 2 show energy returning from two distinct zones; this is probably caused by reflection of the signal from different layers of the ionosphere. This situation frequently occurs during daylight hours.

Amateur Applications. Backscatter sounding promises to lend itself even more to amateur radio than to international broadcasting because the amateur is not limited to a fixed frequency schedule. To understand the great potential for an amateur backscatter network consider the display shown in Fig. 3. Instead of making soundings at different radiation angles on a single frequency, we switch to soundings for the different ham bands (i.e., 40, 20, 15, 10 and 6 meters).

The first pulse is the one received directly from the transmitter. The 40-meter trace shows two other pulses, one relatively close to the transmitter, the second about twice as far away. This is probably due to a *second-hop* transmission. Because of signal strength, the signal has returned to the ionosphere a second time, been reflected by the earth a second time, and both backscattered signals have been picked up at the receiver.

Succeeding traces show that as frequency is increased, the skip also increases—until at 6 meters we find there is no trace at all. This means that at 6 meters the ionosphere was not propagating and the radio energy was probably penetrating into outer space. Communication on all the other bands was possible, however.

Fig. 3 emphasizes the significance backscatter sounding has for the radio amateur. Here is a method by which instantaneous information on skip in various bands can be obtained. One might envision a network of backscatter sounding stations run by the ARRL and located at various points in the United States. Each such station would have a horizontally-rotatable backscatter array so that soundings could be made in all directions.

Periodic announcements could be made over offical ARRL station W1AW, as well as over regional stations, giving the best bands and the approximate skip distances on all bands. By listening to these stations hams would know which bands to operate in. Such forecasts would help CBers and SWLs too.

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CIRCLE NUMBER 17 ON PAGE 15

CB Corner

Continued from page 68

clod hamstrings the frequency, he's promptly shooed away by vigilant monitors—and now, word of the plan has been widely circulated through stories in newspapers and TV.

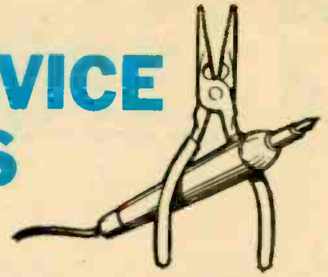
Call it the heavy hand of fate, but just after the system started it scored a startling success. The southeastern corner of Wisconsin was struck by a violent windstorm which tore away a microwave dish antenna and knocked out communications between some 60 state troopers and their base station. But the channel-9 receiver in the communications room was still alive and CBers were out on the highways. They bridged the broken link by reporting accidents and relaying urgent information directly to headquarters. CB saved the day.

It's in the daily drone of activity where this idea is proving its worth. Now the time required to discover a stranded motorist usually is slashed to minutes. Many observant CBers are on the highway, ready to grab a mike and report trouble. The number of CB-initiated calls climbed to about 30 per week within months after the plan started. And Beyler is impressed with the sharp operating style of many CBers. It's getting so that a CBer can inform the police operator whether an ambulance is needed on the scene, or a tow truck, or can supply some other advice that may save time. In some cases, the patroling trooper doesn't even have to appear on the scene.

Beyler says the system is not yet foolproof. There's the problem of skip bringing in objectionable traffic on the frequency. Often the rig springs a few surprises on the monitoring officer, like, "Honey, bring home a loaf of bread." And Case must check the trooper's rig about once a week to be sure someone hasn't turned up the squelch in order to silence the intruders (and lose emergency calls at the same time).

If the Waukesha County experiment succeeds it could reverberate throughout the state. Police officials are watching it closely as a pilot project. A positive outcome could spread similar CB operations to at least five other police districts in Wisconsin. After that, who knows? It just might catch on throughout the whole country. If that happens you may never hear another pickle recipe swapped on channel 9 again.

SERVICE TIPS



YOU can use your fingers (gently, though!) to find bad parts that are putting your TV on the fritz (see photo). Large-wattage resistors must run hot; otherwise, there is insufficient current flowing through them. Also, tubes and output transistors should run hot. If they don't they may be getting only heater voltage or aren't conducting. Flybacks, coils and yokes must run cool. (Turn off power before you touch these parts.) If you discover any hot spots the unit is defective.

Most electronic buffs know a heat sink is your best friend when you solder transistors. Few people know that a shock sink is needed when you snip the leads on a transistor. If you don't hold the lead between the snip point and the case, the vibration from the cut may damage the semiconductor material.

If you're tempted to adjust the sound-reject control on the circuit board of your color TV, don't! That control helps clear the 920-kc beat pattern which develops on the CRT screen when the audio beats with the color subcarrier. You can, however, try the fine-tuning adjustment.

Don't try to repair switches in three-way lamps. They usually act up because they are burned out due to too large a bulb. Purchase a new switch and install it. It's an easy job compared to most you're used to doing.

Is the arm of your record changer failing to land at the beginning of the record? Most arms have a screwdriver adjustment near the back which permits you to loosen the arm and swing it into the correct landing spot by trial and error. Correct starting points is about 1/16 in. from the edge of the record.

Safest way to check the presence of high-voltage AC in your TV is *not* to draw off an arc from the high-voltage rectifier tube or lead. Instead, use a neon bulb and place it near the cap of the horizontal-output tube. If the bulb glows brightly your high voltage is good. If it's dim—or absent—the voltage is low.

If you're having trouble getting excess solder off printed-circuit boards, do what the pros do. Place a soda straw in your mouth and position the other end near the tip of your iron. When the solder melts blow it away with short puffs. You'll soon be able to blow it off the chassis.

Radio Libertad

Continued from page 51

coast of South America; the best guesses being either the Venezuelan off-shore islands, Venezuela itself, or the Netherlands Antilles.

The Netherlands Antilles seem particularly attractive since our sources with the government-owned DF equipment have pinpointed Bonaire as being Libertad's home base.

Of course, there are differing views. Other reports have mentioned the Bahamas, the Virgin Islands, Puerto Rico and smaller islands such as Andros, S. Caicos and Vieques (which harbors a naval base). Also, much copy has flowed about the possible use of airborne relays and ships that move up and down the coasts of Central and South America. Inaccurate monitoring is probably at the root of the majority of these since no information corroborates any of them. The use of different frequencies at different locations is a possibility, however.

Independent Entity. Since R. Libertad's programming is basically anti-Communist and not simply anti-Castro we lean toward the opinion that we are dealing with a totally independent operation which is financed overseas and staffed by non-Cubans. This might explain the connection with NTS in Europe.

It is worth noting that it would be in the interest of wealthy people to help prevent the spread of Communism in Latin America. Many are fearful of the future. They are especially frightened by any kind of guerrilla activity inspired by Castro's Cuba. In the United States, an example would be the activities of H. L. Hunt, wildcat oilman and head of Hunt Foods & Industries, Inc., who uses a substantial portion of his fortune to subsidize radio programs that conform to his right-wing philosophy. (These programs are currently subscribed to by 331 radio stations in the U.S.)

It is interesting that while Fidel Castro has made a number of violent speeches against Radio Americas/Swan (including one in the United Nations), he has never taken on R. Libertad nor has he ever attempted to jam its broadcasts. Apparently he doesn't consider the station a threat.

Where does R. Libertad go from here? Who knows? The station may die a natural death before DXers find out what it is—or was—*A Special EI Report Compiled by C. M. Stanbury II, Tom Kneitel, K2AES/KS4CH, and Jim Phillips.*

The Listener

Continued from page 102

Finally, it would have been impossible to operate a 50-kw BCB station secretly on such a populated island.

However, the real significance of the mysterious VOA1040 was its off-the-air relays. For one of the transmitters which it relayed apparently belonged to Radio Americas and R. Americas was itself an off-the-air relay at that time. During these double-relay periods the setup would have gone like this: a signal was transmitted by a SW rig in the U.S. (or on Marathon), received by RA, then rebroadcast through heavy jamming to VOA 1040, which in turn rebroadcast it through heavy jamming to Cuba.

Two alternate theories about the relays have been fighting it out. The first had it that the original VOA1040 was airborne and R. Americas, for some reason, had been specially equipped to communicate with it. This solution seemed likely since the U.S. Navy admits equipping airborne broadcasters at that time—their success later inspired the Blue Eagle project. Second theory is that VOA1040 had been located on Dry Tortugas (about 75 mi. west of Key West) and had used a hitherto unknown portable transmitter.

Now, for the first time (at least that we can remember), an official of the U.S. government has come out and admitted that equipment was installed on Dry Tortugas in secret!

During the Johnson Administration the Voice of America always avoided giving out any information on the original 1040-kc station (which, like Blue Eagle, was operated by the USN). All questions were answered in ambiguous terms. Now, with a new administration in Washington, the VOA's policy seems to have changed drastically. Thus, a Voice of America official now states with reference to the missile crisis: "I understand that a transmitter located temporarily on Dry Tortugas in connection with the military buildup at that time did relay VOA programs for several weeks."

This makes Dry Tortugas one more chapter in the story of U.S. involvement in the fight against Cuba under Castro.

One might also wonder if there is another chapter to this story—namely, that RA could have been located much closer to Dry Tortugas at that time.

CB Transceiver Plus VHF

IN A CABINET about the size of the average solid-state mobile CB transceiver the Lafayette Telsat-150 combines a CB transceiver and a VHF police/fire/emergency-service receiver. REACT members and other CB emergency organizations may find the set particularly useful.

Sharing a common power supply and audio amplifier/modulator, the transceiver and receiver are otherwise independent of each other. The transceiver features 23-channel coverage, adjustable squelch, external-speaker jack and TVI filter. CB performance measurements were 0.6 μv, sensitivity; 41db adjacent-channel rejection; 3.5 watts RF output; average microphone sensitivity, effective 100 per cent modulation limiting and the best receive and transmit audio quality we've heard in a long time.

The VHF receiver has variable tuning from 150 to 174 mc or two crystal-controlled frequencies. As with the VHF front end, the VHF IF amplifier is independent of the CB section. VHF variable squelch also is independent of CB squelch. VHF sensitivity measured 1.0 μv. Selectivity—which could not be measured because of test-equipment limitations—was good enough for us to separate all the police and fire frequencies in the New York City area.

Frequency stability was excellent, almost making the VHF crystal positions unnecessary. The audio was exceptionally clean. The Telsat-150 is priced at $199.95; this includes 23 CB crystals, microphone, DC cable and mobile bracket. VHF crystals ($5.95 each) are optional, as are a 117 VAC power supply and a battery pack.

Solid-State VOM

Continued from page 77

An interesting and important feature is a low-pass filter in the DC-input circuit that attenuates AC pickup. The benefit of this is that the 0.3-V DC range is quite stable and there's no tendency to drift upscale when you touch the probes.

We assembled the meter in about four hours. The only problem we had was the breaking-off of a lug on the molded deck of the function switch. Rather than replace the deck or the complete switch (the lugs on the other two decks were already soldered to the boards) we gouged away the plastic around the lug until enough metal was available to solder a jumper wire to it.

Performance. The 3000 is rock-stable on almost all ranges. Once the zero-set is established the zero will hold for all +DC and −DC ranges, the current and almost all the resistance ranges. Only the lowest (R×1) resistance range drifts off zero when switching from another range, but the drift is so slight that it can be ignored. The AC zero set also is rock-steady for all ranges except we could not obtain perfect zero. At best, the pointer was about a half a scale division above zero at all times.

The resistance-range accuracy was excellent, decading accuracy superb. The DC accuracy was within the two per cent specification except at the full-scale deflection, where the accuracy ranged from 5 to 10 per cent in decading. This is unusual as maximum accuracy is generally at full scale.

While the AC accuracy was similar to that of DC, the slight zero drift increases the error of readings taken between ⅛ and ½ full scale. And the AC accuracy of 2 per cent (specified) is valid only between 20 and 1,000 cps. Above 1,000 cps accuracy falls (indications are high). The 3000, therefore, should not be used for audio checks made with frequencies greater than 1,000 cps. Current ranges checked out within rated accuracy.

The 3000 is particularly well made with quality printed circuit boards and switches whose lugs solder directly to foil on the boards. There are very few interconnecting wires between boards so you are not faced with a complex maze of wires. The calibration procedure is simple, involving only the adjustment of two internal potentiometers. The scale is mirrored to eliminate parallax error caused by looking at the pointer from the sides, rather than head-on.

Ham Shack

Continued from page 82

electronics and the future of his country should take it upon himself to interest young people in our wonderful hobby. The challenge of amateur radio is open to all, men and women alike, and any amateur operator or ham club will be only too glad to help initiate the beginner.

Military Electronics

Continued from page 42

specializes in finding jobs for junior officers.

Joseph D. Harrington, president of Harrington Associates, Inc. of Washington, D.C., works with both enlisted men and officers and has examined all aspects of the problem involved. "We start by sitting a man down, handing him a cup of coffee and asking him three important questions: what he wants to do, where he wants to do it, and how much salary he wants. We find hundreds who have no idea of any of the three.

"We help him decide what his training and experience best qualify him for. A good many have delusions of moving directly into a middle management post in private industry. They've usually been misled by conversations with other service people. We help them see what they can realistically expect in the civilian job market. If a man's military training does suit him for management, we help orient him to the difference between military and civilian life. Often we convince him to lower his sights a little."

Some of the best job opportunities for military men lie with government agencies which hire through the Civil Service Commission. For example, Federal Aviation Agency (FAA) spokesmen tells us that many of their best maintenance technicians have military backgrounds. The transition is remarkably simple because most of the equipment used by the FAA to control our airways is just like equipment used by the Armed Forces. And ex-military men have an advantage in CSC job competition since their service time counts in their favor.

Certain bits of advice apply to everyone in military electronics who wants a related civilian career. Some of the most appropriate bits of counsel come from Joe Harrington. He stresses his version of the three r's—realism, relocation and resume. Realism about experience, training, ability and salaries. Relocation to where the jobs are; and a professionally prepared resume to present the applicant's capabilities to best advantage.

For Better Stereo

Continued from page 90

player amplifier (requiring the volume control to be only cracked open for normal volume) install a resistor of more than 10,000 ohms between C7 (C14 also) and the hot lead to the player's amplifier input. You might have to experiment with other values to obtain the desired volume level.

Installing a Magnetic Cartridge. Remove the wires from the cartridge (usually soldered to small clips that pull off the cartridge's terminals) and install the clips on the magnetic cartridge. If the cartridge has three terminals and there are two independent shielded wires, connect both shields to the cartridge's ground terminal. Similarly, if there are four terminals on the cartridge (two for ground) and the connecting wire has two hot wires in a single shield, connect the shield to both ground terminals on the cartridge. Many cartridges are supplied with a ground jumper clip for this purpose.

Using a stylus pressure gauge, set the tone arm's stylus-pressure-adjustment screw for the tracking force recommended by the cartridge manufacturer. This is essential to prevent accelerated stylus wear.

Hi-Fi Today

Continued from page 99

record. And having this device around, having to think of what you do and don't want to buy and having to worry about what you got for your money once you get it home—all this is all going to change the pattern of mindless TV watching.

Just as the LP record was the final incentive which made people go out and get better sound equipment, EVR—or its equivalent—will help bring about a big change in video, this coming along with one (or many) of the big-screen TV systems now on the horizon. Then, the second hi-fi era will have begun. Once bigger screens are here and people are used to programming their own TV viewing, popular acceptance will emerge.

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YES, IT'S TRUE! You may have any 4 of the best-selling 8-track cartridges shown here—ALL 4 for only $5.95! That's the fabulous bargain the brand-new Columbia Stereo Tape Cartridge Service is offering new members who join and agree to purchase as few as five additional selections in the coming year.

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SHORT-WAVE LISTENING

BC-348-Q RECEIVER (200-500 kc, 1-5-18 mc). Will swap for best offer. Reb Burroughs, 1018 Hilltop Dr., Palestine, Tex. 75801.

SURPLUS BC-474A transceivers and BC-312 receiver. Want VHF/UHF gear. R. Kolakowski, WA1KAT, G-206, Norwich University, Northfield, Vt. 05663.

LAFAYETTE PF-175 receiver (25-50 and 150-175 mc), new. Will trade for sonar transceiver with original box and manual. Philip Clarke, 2723 Eighth St., Berkeley, Calif. 94710.

KNIGHT Span Master receiver. Want walkie-talkie, VHF receiver/convertor, or best offer. Gene Robbins, 517 Fairground Ave., Hillsboro, Ill. 62049.

HALLICRAFTERS SX-99 receiver and 35-W hi-fi amplifier. Want HW-12 or other transceiver. Owen Hayden, 225 S. Griffen, Bismark, N.D. 58501.

RANGER 111-C beacon receiver. Want general-coverage SW receiver. Richard D'Aquila, 73 Kilbourne Ave., New Britain, Conn. 06053.

HEATH GR-54 receiver. Will swap for CB base station or scope. E. A. Sjolander, Jr., 119 7th St., W., Ashland, Wis. 54806.

SURPLUS RAL-6 general-coverage receiver. Want inexpensive VHF ham, CB or test gear. David Carroll, 468 Genesee St., Trenton, N.J. 08611.

KNIGHT Star Roamer. Want Heath GR-64 or HR-10. Jim Brozivich, RR 2, Box 1, Toronto, Ohio 43964.

HALLICRAFTERS S-38 receiver, Hickok 470 VTVM, Heath VOM. Want communications receiver or best offer. Glenn Hansen, RR 2, Box 128-B, Burton, Wash. 98013.

HEATH GD-125 Q-multiplier. Will swap for best offer. Bill Kilgallon, 22347 Audrey, Warren, Mich. 48091.

RBS-1 SW receiver (2-20 mc). Want power supply for RBM-1 receiver (12v/205v). Donald E. Erickson, 6059 Essex St., Riverdale, Calif. 92504.

INTERNATIONAL 9-tube AM/FM/SW radio. Want oscilloscope. J. S. Wawzyniak, 1018 Douglass St., Reading, Pa. 19604.

GONSET G-33 receiver. Want Heath HR-10 and ham crystals or best offer. Mike Masheff, 15761 Riverdale Dr., Livonia, Mich. 48154.

HEATH GR-81, Philco 37-610 and Hallicrafters WR-600. Will swap for tape recorder or SW receiver. Ted R. Larson, WPEØFCO, 560 Central Ave., S., Milaca, Minn. 56353.

HALLICRAFTERS S-38D receiver plus 53 assorted tubes and AM radio. Want Regency PR-155B police monitor or Ameco R-5 receiver. David Rygwalski, 1506 Tropical Dr., Lake Worth, Fla. 33460.

LAFAYETTE HA-700 receiver with speaker. Will trade for Lafayette HB-23, similar two-way radio or best offer. Jerry Mraz, 179 Clinton Ave., Akron, Ohio 44301.

HEATH GR-64 receiver with Q-multiplier. Want good novice transmitter. Steve Lympany, WN3LLX, 9 Buena Vista Dr., Delmont, Pa. 15626.

HALLICRAFTERS S-38C receiver. Want Aiwa stereo cassette tape recorder. Richard Clark, 4302 Abispo Ave., Lakewood, Calif. 90712.

AMATEUR RADIO

AMPLIFIER, homebrew for hams, 80-10/200 watt. Want portable tape recorder. Virg Stucker, WA9EAN, 1407 N. Peach, Marshfield, Wis. 54449.

HOMEMADE dummy load (72-ohm, 250-watt). Want 15-meter beam antenna or best offer. Glen Jenkins, WN4KTF, 927 Cimmeron Dr., Tampa, Fla. 33603.

KNIGHT T-150 transmitter. Want general-purpose receiver. Craig Strickland, 930 LaSalle, Pontiac, Mich. 48053.

JOHNSON Viking II transmitter. Want Heath DX-60. David Wells, WN6EJX, 4145 Gregory St., Oakland, Calif. 94619.

[Continued on page 118]

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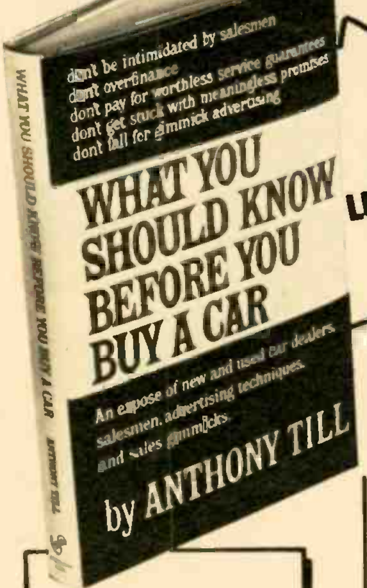

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ABOUT THE AUTHOR OF THIS BOOK

Anthony Till has been an auto-pro for over 25 years! He's been involved in every aspect of new and used car selling in the U.S.A., Canada and England. He's sold everything from Rolls Royce's to VW's in every kind of car agency that exists. In WHAT YOU SHOULD KNOW BEFORE YOU BUY A CAR he explodes myths that car-buyers harbor and dealers encourage, and exposes the dozens of unethical practices used every day, even in many of the "best" agencies, to con car buyers out of millions of dollars annually.

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Swap Shop

Continued from page 114

GLOBE (DSB-log) 50-W novice transmitter with 5 crystals for 80-, 40- and 15-meter bands. Swap for best offer. Joe Weatherly, WN8ARC, P.O. Box 455, Muskegon, Mich. 49443.

HAM GEAR in exchange for Heath HP-24 power supply. Roy E. Stuhr, 46 Edison, York, Neb. 68467.

HALLICRAFTERS SR-46 6-meter transceiver, Gonset squelch, Saturn 6 halo antenna. Will swap for quality 35-mm SLR camera. Foster Kawaler, 64 Lynwood Dr., Valley Stream, N.Y. 11580.

HEATH apache transmitter. Will swap for photographic or darkroom equipment. Gary Northup, 147 Wyngate Dr., Kettering, Ohio 45429.

AMATEUR RECEIVER (about $75) wanted in exchange for telescope. L. Hamilton, 19509 Flavian Ave., Torrance, Calif. 90503.

HALLICRAFTERS SX-110 receiver. Heath Q-Multiplier. Will swap for oscilloscope, test equipment, or best offer. Stephen Rollin, 7546 Brockton Rd., Phila, Pa. 19151.

NATIONAL NC-270 ham receiver. Will trade for Heathkit GR-64 receiver or best offer. David Hamilton, 3421 Fayette Ave., Louisville, Ky. 40213.

TRANSMITTER (BC-696, modified) with power supply, other gear. Will trade for HO train gear or best offer. Karl Geier, 145 Grandview Ave., Sierra Madre, Calif. 91024.

HEATHKIT DX-20. Want oscilloscope. Paul Adams, 1204 N. W. 97, Oklahoma City, Okla. 73114.

REGENCY ATC-1 convertor for best offer. H. Anderson, 639 No. Wahsatch, Colorado Springs, Colo. 80903.

GLOBE HG-303 transmitter. Want Hallicrafters SX-100 or similar receiver. Mark Dubay, WN6MMX/WPE6HHU, 500 S. Gilbert, Fullerton, Calif. 92633.

ANTIQUE ELECTRONICS

ATWATER KENT model 74 radio. Want CB transceiver and antenna. Charles E. Bell, KQV7328, 706 Spaulding St., Muskogee, Okla. 74401.

ANTIQUE TUBES, other items to swap. Want ham receiver, surplus gear, or best offer. T. Million, 4725 Miller St., Wheatridge, Colo. 80033.

HOWARD model 52909-6 (vintage 1921) with four extra UX-201A tubes. Want DX-60, 40-35 or -20 receiver. Terence O'Laughlin, 819 South 97 St., West Allis, Wis. 53214.

SPARTON 60 SW converter (circa 1932), tunes 1.5 to 25.5 mc. Will swap for Ameco R-5 or Heath Mohican receiver. J. A. Dixon, Wheatland, Manitoba, Canada.

250 QST MAGAZINES from 1921-1944. Will swap for 6-channel, 5-watt CB transceiver. Stephen L. Bird, Main Dalton Rd., Windsor, Mass. 01270.

ANTIQUE TUBES (10, 2A3's, 27's). Will trade for broadcast equipment. Gary Davis, 1116 Queen Anne Dr., San Jose, Calif. 95129.

GERNSBACK service manual, 1930 edition. Will swap for best offer. Herbert Rakes, RR 3, Bentonville, Ark. 72712.

OTHER EQUIPMENT

HEATH QM-1 Lab Q-meter. Will swap for model 19 or model 15 teletype. Joe Lewis, WA3LRS/WB6WLH, 12513 Summerwood Dr., Silver Spring, Md. 20904.

MAGNETIC REED SWITCHES. Want past issues of electronics magazines and annuals. Thomas King, 910 Harvey Rd., Pullman, Wash. 99163.

KODAK box camera. Want Lafayette Star Fire UI. Ed Mathes, 40 Huntleigh, Amherst, N.Y. 14226.

ALTO SAX. Will swap for SW receiver. Benny Garrett, Box 74b, RR 2, Lubbock, Tex.

FORD Model T spark coils. Will trade for best offer. Kirk Snyder, Box 131, Tonasket, Wash. 98855.

R/C SYSTEM for model airplanes, Rolli camera and strobe. Will swap for six-meter and/or two-meter transceiver. James Rocco, Jr., 4309 Ivy, East Chicago, Indiana.

ASSORTED TUBES, 10 coils, transformers. Will swap for all-band receiver, test equipment or best offer. Steve Shurtz, 1836 Webster, Topeka, Kan. 66604.

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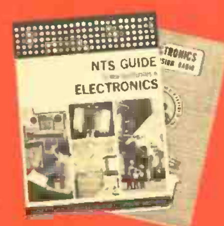

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