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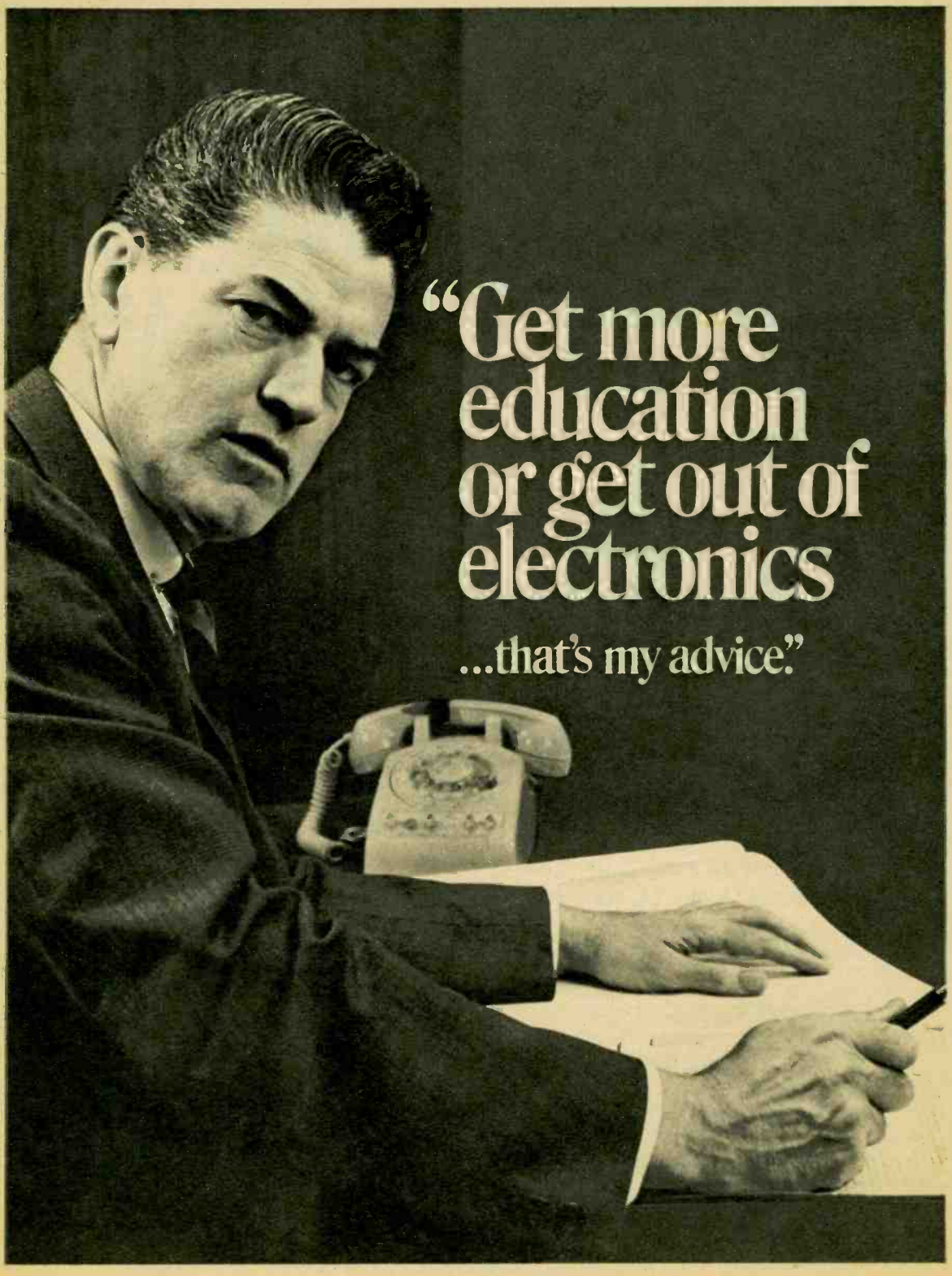

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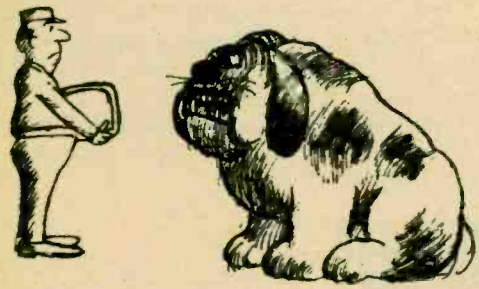


I am a TV roadman and I must say that I greatly enjoyed the Art Margolis article ON OPENING YOUR OWN TV SERVICE SHOP (May '71 EI). He covered most of the important items, but neglected to give any advice on how to handle the surly customers in the home, especially when they have fierce-looking dogs. Any suggestions?

Hank Merrit
Yonkers, N.Y.

Many servicemen partition their caddies and carry dog treats, lollipops and Bibles to deal with dogs, kids and housewives.

● THE VOICE SPEAKS

The March 1971 issue of Electronics Illustrated carries a column, The Listener, in which C. M. Stanbury II claims that the Voice of America reduced its broadcast schedule at the time of the accident to Apollo 13 last spring in an attempt to "protect the nation's image." Nothing could be further from the truth.

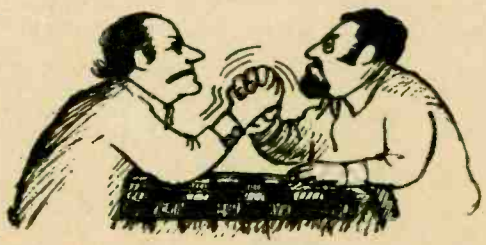
When the news of the mishap in space came, VOA, which had returned, as planned and pre-announced, to normal broadcasting hours following the launch, revamped its schedules immediately to provide round-the-clock coverage in English to all areas of the world and special facilities to provide service in the Spanish, Portuguese, Arabic, Chinese, Vietnamese and Russian languages. Because atmospheric conditions for short-wave reception were not of the best, the Voice even set up satellite feeds to the Philippines so that coverage in English and Chinese could be heard better in the Far East. Additional reporters were sent to the Manned Spacecraft Center in Houston and to the recovery area near Pago Pago, Western Samoa.

I don't know what Mr. Stanbury was listening to, but it quite obviously was not the Voice of America.

Kenneth R. Giddens
Washington, D.C.

The writer is the Assistant Director of Broadcasting for the U.S. Information Agency.

● STILL FRIENDS



Your debate on the hobby band (A CODE FREE HOBBY BAND? May '71 EI) is the first good article that I have seen on the subject. Everybody is choosing sides in this argument and it's refreshing to see a magazine present both sides of an issue. After all was said and done, I wonder if Tom and Wayne are still friends.

Randolph Martin
Phoenix, Ariz.

Who said they ever were? Now that we've dispelled that rumor, on to the hobby band.

Broadsides

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

A BURGLAR has broken into your house. The police arrive and say, "Sorry, we can't do anything without a description." Smiling, you walk to an out-of-the-way closet, push a button and TV sets come alive showing every move the burglar made, including beautiful close-ups of his face. "Why that's Louie the Looter," says the flatfoot and the case is solved. If you want to use television for this or any other purpose, consult the free catalog of Denson Electronics, Box 85, Rockville, Conn. 06066. They claim to have the world's largest selection **of TV equipment.**

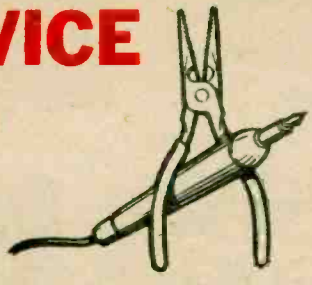
Comparison shopping for your electronic needs can save money. If you're looking for alternatives to the biggies, look to Workman Electronic Products. Their catalog is packed with **radio and TV replacement parts** and goodies for the experimenter. Request Catalog No. 100 from Workman, Box 3828, Sarasota, Fla. 33578.

Are you the John Paul Jones of the neighborhood boat basin? Even if you're not, you'll want to keep your boat in good shape. What with changes in the marine radio frequency assignments, this should be the time to get that new VHF-FM rig or perhaps install radar or a depth sounder. Raytheon has taken 31 **electronic aids to navigation, communications and safety** and put them in a free color brochure. Write: Raytheon Co., Marine Electronics, 676 Island Pond Road, Manchester, N.H. 03103.

The 1970 lines of color TV sets have been cooking away in some homes for as long as a year. Fewer and fewer sets are packed with schematics and the like, so that if servicing becomes necessary you'll be up Lake Winnepesaukee without an outboard motor. Howard Sams rides to the rescue with its Annual Photofact Index which guides you to the correct Photofact **schematic for every radio and TV set** made since 1946. The index costs 50¢ and is available at distributors and Howard W. Sams & Co., 4300 W. 62nd St., Indianapolis, Ind. 46268.

What do you do when stuck in bumper-to-bumper traffic? Turn on the stereo. What's that you say, no stereo in your car? Priority reading matter for you is the Audiotex car stereo bulletin from GC Electronics. Included are **cartridge tuners, auto stereo speakers, control panels and burglar alarms** to protect your rig. Another section describes a line of power supplies that allow use of 12-V equipment in the home. You can get this free bulletin by dashing off a note to GC Electronics, 400 S. Wyman St., Rockford, Ill. 61101.

SERVICE TIPS



By
ART MARGOLIS

BE SURE to replace all strain-relief gadgets like grommets and clamps in the high-voltage section of TVs. Not only do they remove undue pressure on solder connections, but they also have high insulating qualities. They position wires carrying high voltage away from areas where the voltage has a tendency to arc.

—

Should a lead come loose on a PC board that for some reason has an inaccessible foil side, try the trick shown at left before going through disassembly. Grasp the lead and hold it firmly so it is snugly touching the foil side of the board. Then touch a medium-wattage iron to the lead. The heat should flow through the lead, melt the solder on the other side of the board and restore the connection.

Designers do their best to hide assembly screws and bolts in appliances. On occasion it's harder to take apart and put together equipment than it is to perform the actual repair. If you can't find some of the screws, look under metal trim and plastic nameplates that have been pasted on to the chassis.

—

Motorboating in a radio used to suggest open filter capacitors. This assumption may still be valid, but battery-operated sets may exhibit this symptom for another reason. A weak battery. As you try to get more and more volume as the battery goes, you finally set a stage into oscillation and get the motorboating noise.

—

If you are trying to get rid of ignition noise in your car radio you might try installing a resistor of about 10,000 ohms in series with the ignition coil. You can buy these suppressors in any auto-supply house. Before you start the job, wipe the dirt off the distributor wire. If it says *radio*, the car's wires have this suppressing resistance accounted for internally. Something else is necessary to remove this noise.

—

If the circuit breaker in a portable TV keeps kicking out and nothing else appears to be wrong, the trouble could be the breaker itself rather than a short. The first thing to do is to look on the breaker for a little set screw. Adjustment of the screw can give the breaker a higher current threshold. If it's the kind that doesn't have a screw, install a new breaker that has about a 4-A rating.

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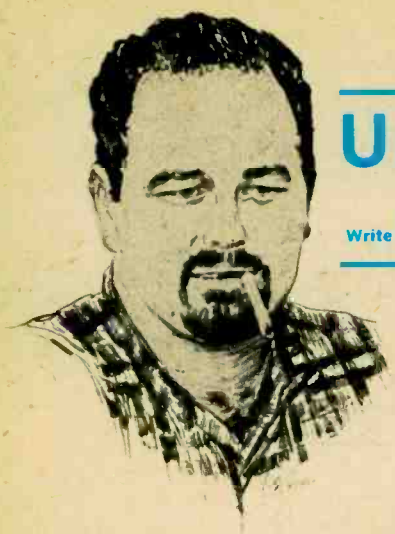

Uncle Tom's Corner

By Tom Kneitel, K2AES/KBG4303

Uncle Tom answers his most interesting letters in this column. Write him at Electronics Illustrated, One Astor Plaza, New York, N.Y. 10036.

★ *Can you tell me anything about an electronic device that could be used to aid the circulation of the blood, get the heart to beat faster and generally speed up my system?*

Walter Herrmann
Riveredge, N.J.

Try watching a few minutes of the evening news on TV.

★ *Can you identify a station on about 1710 kc which sends out a continuous CW transmission of the letters MDE. How can I get a QSL from this station?*

Stephen Martin
Upper Marlboro, Md.

MDE is one of the many radio beasons which are often reported by folks tuning around the band edges of a table radio. This particular beacon is in Medellin, Colombia, and operates continuously on 1690 kc. They run about 4 kw and have been known to QSL if you send a prepared reply card along with your report. The station is operated by Aerovias Nacionales de Colombia, Bogota. Keep tuning around for more of these stations. There are about 300 of them in 20 countries.

★ *Can you give me some information on a device that can be used to measure brainwaves?*

PFC Robert H. Sipes
APO San Francisco

An electroencephalograph (EEG) measures the strength and duration of brainwaves, but if you're talking about the actual wavelength or frequency. I don't believe that such a device has been developed yet. My feeling is that these frequencies are the basis of ESP and other parapsychological phenomena.

★ *What else have you learned from the Ouija board (THE LONG NIGHT OF UNCLE TOM, November '70 EI)? I tried it once but never got any results, although I've read some of the material on Patience Worth who was the spirit author of several books written via Ouija and found it all amazing. Let's hear some more about this when you get the chance.*

Chuck Feld
San Bruno, Calif.

I found your Ouija story very interesting. Do you plan to continue telling your experiences?

Bill McMillin
Simi Valley, Calif.

Perhaps someday I'll get around to doing a follow-up story. There have been several developments since the days of the early messages which were described in the story EI ran last November. There seems to be quite a bit of real evidence relating to this stuff (look it up in the encyclopedia).

★ *I'm interested in getting the best results from my TV set. I'm in a low-level area on the fringe of Albany TV stations. I put up a 25-ft. tower and a double-driven 12-element antenna. The run from my antenna to the set is 140 ft. I also installed RG59/U coaxial cable and a booster, but I still am getting plenty of TVI and ignition noise. Any further moves I can make?*

George W. Rudolph
Freehold, N.Y.

While 25 mi. shouldn't be too long a haul under normal conditions, it looks as though you live on the wrong side of the Catskills to get good reception without some extra effort. The ignition noise may also be getting

in via the long run of cable (which also is sapping the signal). Get a deep fringe (225-mi. range) antenna with a built-in preamp, then get it up at least 50 ft. Use RG11U low-loss cable, and you should find the investment worthwhile.

★ *I came across an old superregenerative receiver which belonged to my grandfather. He tells me that the set sold for over $75 when it was new 40 years ago, but doesn't work as well as a modern $10 table radio. What was it about these sets that made them cost $65 more than they were worth?*

Al Corman
N. Kansas City, Mo.

H. V. Kaltenborn, Amos & Andy, Jack Benny, The War of the Worlds and all that stuff.

★ *There are many CB stations using SSB; however, I notice that a great many of these stations are organized into large rag-chewing networks in which the stations use weird call-signs such as Kilowatt 12, Unit 205, Sideband 007, ect. What's this all about?*

Milton Feldman
Chicago, Ill.

Just one more illegal aspect of CB. It would be a shame if the FCC let the great potential of SSB on CB be run into the ground by these crackpot SSB networks.

★ *A friend of mine says that there is a coding device in all telephone dials that tells the phone company if there is a bootleg extension on your line (if the extension is from a different area code). Ever hear of this one?*

Bob Rucinski
Detroit, Mich.

No, but I understand that they can tell about those illegal telies by checking how much current is required to ring the bell. The extra current gives 'em away every time.

★ *Can you let me know the frequency of the Minnesota Highway Patrol?*

William DuLong
Chishold, Minn.

The action takes place on 42.82 mc, Bill.

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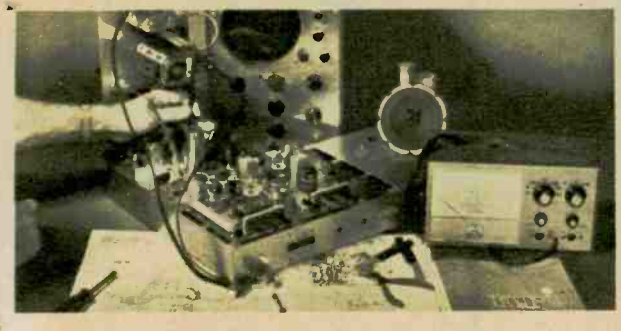

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Prepare quickly for a high pay career in COMPUTER ELECTRONICS

This may well be the most unique and exciting educational aid ever developed for home training—a digital computer *with memory* you build and use to learn organization, trouble shooting, operation and programming. It performs the same functions as commercial computers you encounter on the job. Lessons stress computer repair. You perform a hundred experiments, build hundreds of circuits. Your own solid-state voltohmmeter is included among the ten training kits you receive.

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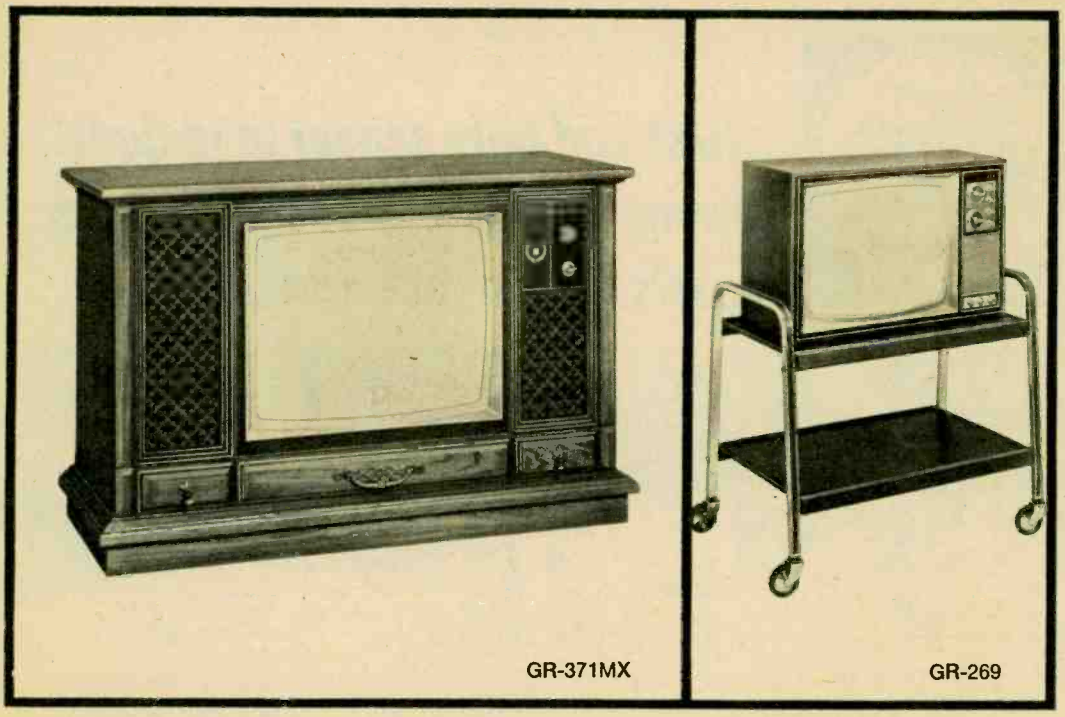

You may have spent your last nickel on color TV service calls!

Only Heathkit solid-state TVs can be completely serviced by the owner — and over the life of the set that can mean a savings of hundreds of dollars! The famous Heathkit manual, Volt-Ohm meter included with every kit, built-in dot generator and tilt-out convergence panel make maintenance easy — even if you're a novice. You perform all normal periodic servicing, such as dynamic convergence and purity adjustments. You can even do alignment and diagnose, locate and replace faulty components.

And Heathkit TV utilizes modular design, with plug-in glass epoxy circuit boards to make maintenance even easier. Should you detect a malfunction in any one board, simply return it to Heath Company for 48-hour expedited service. During the 90-day warranty period, circuit modules will be replaced at no charge! With this unique at-home service capability, Heathkit solid-state receivers are the best color TV investment you can make!

GR-371MX— Heathkit 25" ultra-rectangular color TV. The Heathkit GR-371-MX is fast earning a reputation as the finest color TV on the market today! A feature-by-feature comparison with any other set made shows why.

Heath MTX-5 ultra-rectangular matrix picture tube. The new square-cornered design offers the largest picture in the industry — 25" diagonal measurement — displaying, for the first time, the complete transmitted image with no wrap-around at the sides. Specially formulated etched face plate cuts out unwanted glare, increases contrast without sacrificing brightness. Matrix screen around phosphor dots eliminates reflected light for clearer, sharper pictures.

"Top-of-the-line" features. High resolution circuitry for improved picture clarity, plus new adjustable video peaking that lets you select the degree of sharpness and resolution you desire; an exclusive solid-state VHF tuner with MOS Field Effect Transistor for superior reception even under marginal conditions; Memory Fine Tuning; 3-stage solid-state IF, factory assembled and aligned; Automatic Fine Tuning; VHF power tuning; "Instant-On"; Automatic Chroma Control; adjustable noise limiting and gated AGC; adjustable tone control; hi-fi sound output to your stereo or hi-fi system.

A choice of three beautiful cabinets. Pick either Mediterranean, Early American or Contemporary cabinetry. Or custom install the chassis yourself.

GR-371MX, chassis and all parts, less cabinet, 125 lbs. . **579.95***

GR-269 — New Heathkit 18" "compact" color TV. The new GR-269 has the same highly sophisticated circuitry found in the GR-371MX, modified to accept the popular 180 sq. in. color picture tube, and put into a compact cabinet. It delivers console-quality performance, yet is a "middle-weight" that can easily be moved from one room to another.

Big-set features. Automatic Fine Tuning brings in perfect picture and sound at the touch of a finger; solid-state VHF utilizes MOS Field Effect Transistor for less noise, visibly better reception; 3-stage IF unusual in a "compact", provides increased signal gain for better all-around picture quality; switch-controlled degaussing circuit lets you demagnetize set after moving it from one area to another, thus assuring pure, clean color; "Instant-On" is standard.

Kit GR-269, chassis and all parts, less cabinet, 100 lbs. . . **399.95***

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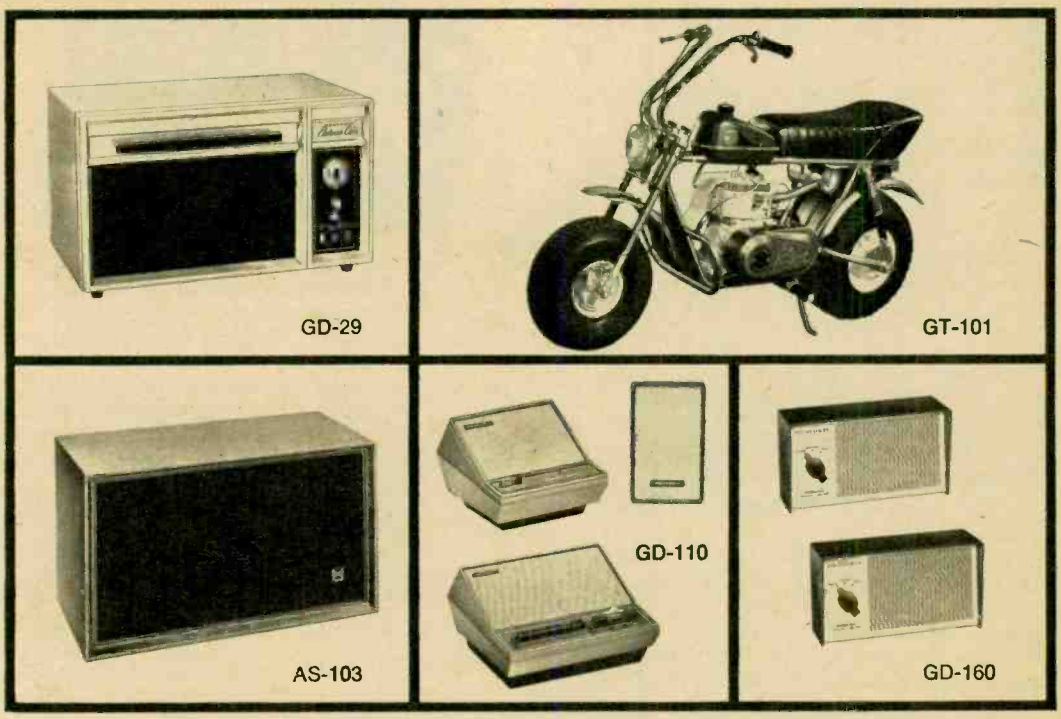

Self-service is built into every Heathkit design.

AS-103 — New Heathkit Stereo Speaker System.

No other stereo speaker system is so consistently rated "number one" by all audiophile publications. And now the famous Acoustic Research AR-3a is available in kit form! Provides acoustic suspension 12" woofer for superb bass response to the limit of human hearing, hemispherical dome tweeter and mid-range driver for unexcelled mid and H.F. dispersion. Has output level controls for independent control of tweeter mid-frequency level to match room configuration. Unquestionably the finest Heathkit stereo speaker system to date!
Kit AS-103, speakers, cabinet and all circuitry, 68 lbs. **189.95***

GD-160 — New Heathkit Cab-to-Camper Intercom.

Economical, two-way communication for the camping family on the move. Allows driver to converse with passengers in the camper or travel trailer, or monitor sleeping children. Master unit in cab has "Standby", "Talk" and "Monitor" positions. Remote unit in camper has "Standby", "Talk" and "Radio" settings, with the latter bringing music and news into the camper directly from the front-seat radio. Kit includes master and remote intercoms, 15' connecting cable. Quick disconnect coupling optional. Operates on 12 volt automatic system.
Kit GD-160, master, remote and cable, 5 lbs. **25.95***

GD-110, 120, 130 — New Heathkit Home Intercom System.

With this amazingly flexible system you design your home intercom to your own communication requirements. Master unit provides six channels which allow two-way conversation with six remote units or six other masters. Master unit has "All-Call" button which opens all channels; "Talk" which sends voice to any given station, and "Dictate", holding "Talk" button open for longer conversations. Master can be wired to monitor any four remote stations, or can be built to leave all remotes "private". Indoor remote intercom has "Talk" and "Dictate" switch positions. Outdoor remote unit is completely weatherproof — can be used to identify front-door visitors. All intercoms include mounting hardware.
Kit GD-110, master unit, 4 lbs. **39.95***
Kit GD-120, remote unit, 3 lbs. **12.95***
Kit GD-130, outdoor remote unit, 3 lbs. **9.95***

GD-29 — Heathkit Microwave Oven.

There's no more modern way to prepare food. Microwave cooking gives you time-saving convenience of up to 70% faster food preparation, plus added nutrition through better retention of vitamins. The low-profile Heathkit Microwave Oven features one of the largest capacities in the industry, operates on standard 120 VAC household current. Kit includes specially prepared cookbook that gives a delightful introduction to the fascinating world of electronic cooking.
Kit GD-29, 97 lbs. **399.95***

GT-101 — New Heathkit Hilltopper Trail Bike.

Here's a trail bike that combines portability with ride and handling characteristics found only in much larger machines. Features telescoping fork up front, adjustable shock absorbers at the rear wheel. Powered by a durable 5-h.p., 4-cycle Tecumseh engine, coupled to an infinitely variable torque converter that gives low-speed pulling power or 35 m.p.h. cruising at the twist of the spring-loaded throttle. Hefty two-wheel brakes give sure stopping power. Big 18x8.50-8" rear tire provides great traction on the steepest grades, over sand or snow. Fold-down handlebars and collapsible foot pegs make it a cinch to stow. Options include running lights, powered by alternator, and front-wheel snow ski.
Kit GT-101, 160 lbs. **299.95***

See these and 300 other Heathkit suggestions at one of the following Heathkit Electronic Centers:

CALIFORNIA: Anaheim, 92805, 330 E. Ball Road; El Cerrito, 94530, 6000 Potrero Avenue; La Mesa, 92041, 8363 Center Drive; Los Angeles, 90007, 2309 S. Flower St.; Redwood City, 94063, 2001 Middlefield Rd.; Woodland Hills, 91364, 22504 Ventura Blvd.; **COLORADO:** Denver, 80212, 5940 W. 38th Ave.; **GEORGIA:** Atlanta, 30305, 5285 Roswell Road; **ILLINOIS:** Chicago, 60645, 3462-66 W. Devon Ave.; Downers Grove, 60515, 224 Ogden Ave.; **MARYLAND:** Rockville, 20852, 5542 Nicholson Lane; **MASSACHUSETTS:** Wellesley, 02181, 165 Worcester St.; **MICHIGAN:** Detroit, 48219, 18645 W. Eight Mile Rd.; **MINNESOTA:** Hopkins, 55343, 101 Shady Oak Rd.; **MISSOURI:** St. Louis, 63123, 9296 Gravois Ave.; **NEW JERSEY:** Fair Lawn, 07410, 35-07 Broadway (Rte. 4); **NEW YORK:** Jericho, L.I., 11753, 15 Jericho Turnpike; New York, 10036, 35 W. 45th Street; **OHIO:** Cleveland, 44129, 5444 Pearl Rd.; Woodlawn, 45215, 10133 Springfield Pike; **PENNSYLVANIA:** Philadelphia, 19149, 6318 Roosevelt Blvd.; Pittsburgh, 15235, 3482 William Penn Hwy.; **TEXAS:** Dallas, 75201, 2715 Ross Avenue; Houston, 77027, 3705 Westheimer; **WASHINGTON:** Seattle, 98121, 2221 Third Ave.; **WISCONSIN:** Milwaukee, 53216, 5215 W. Fond du Lac

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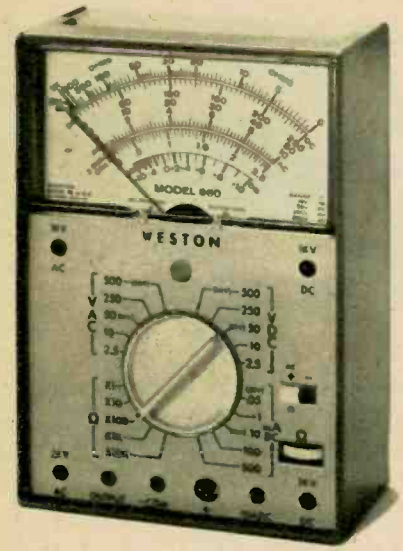


Peppy SSB. Single sideband is making inroads in CB and one reason may be the Telsat SSB-25. The rig has 69 modes of operation (23 AM, 23 USB and 23 LSB) plus RF gain control and an impulse noise limiter. It boasts 8 watts of PEP power. $299.95. Lafayette Radio, Syosset, N.Y. 11791.

BOUNCING New VOM. Smash is the sound of test gear hitting your workbench floor. Unless, of course, it's the new 660 VOM from Weston. This rugged instrument is designed to withstand the impact of a 5-ft. drop. It has a single range switch and external fuse. $68.00. Weston, 614 Frelinghuysen, Newark, N.J. 07114.

Electronic Marketplace

Power to the amplifiers. For those preferring separate components, Kenwood offers this matching pair. The KA-5002 amp has 30 watts (rms) per channel (8 ohms) with less than 0.3 per cent distortion. $219.95. The KT-5000 tuner features a two-FET front-end and mechanical-filter IF. $179.95.

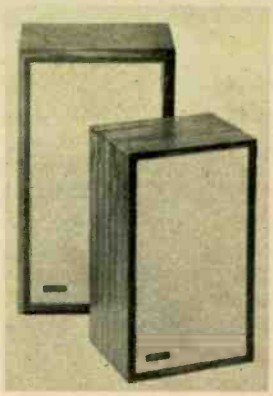
Solder Sucker. The Soldapullt has just one job—to inhale solder. It uses a spring-loaded trigger to create a high-impulse vacuum and features adjustable vacuum intensity. $9.95. Edsyn, 15954 Arminta, Van Nuys, Calif. 91406.

Electronic Marketplace

Snazzy Address. If your vocals are being drowned out by the boys on guitar, you might try this AM-387 PA amp at your next gig. The 22-watt rig accepts high- and low-impedance mikes in addition to a phono or tape input.

For mobile use the system has its own mounting bracket and 12-V power supply. $59.88. Olson Electronics, 260 S. Forge St., Akron, Ohio 44308.

Adventageous Speaker. Henry Kloss, the man who designed the reknowned AR-2 system and speakers for KLH, has done it again, this time for his relatively new company, Advent. Logically known as the Smaller Advent Loudspeaker for those who hate model numbers, it has the same bandwidth as the larger version. Designed as a bookshelf system, it has a nominal impedance of 4 ohms, in order to take advantage of higher output power afforded many amps



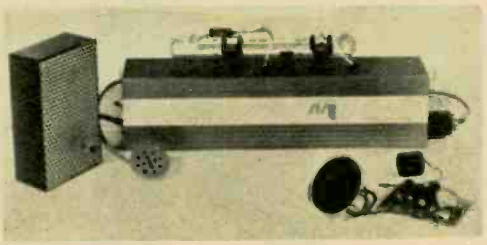
at this impedance. The Smaller has a low-vacuum drawn low-frequency cone that combats break-up noise. It uses ¾-in. dome tweeter with doughnut-roll suspension to enable it to handle large amounts of power at mid-range frequencies. $80. Advent Corp., 377 Putnam Ave., Cambridge, Mass. 02139.

Electronic Marketplace

Filling the generator gap. The latest entry in the service field is an IC Digital Color Generator from B&K. Model 1246 checks convergence, color, linearity, size and focus. Patterns are stabilized by flip-flop circuitry for all count-

ing functions. It features a 4.5-mc unmodulated carrier and crystal-controlled RF oscillator for channels 3 and 4. It produces nine different patterns, including 1 x 9 and 9 x 1 cross-hatches and a center dot, useful for static convergence. The power supply is transformer-isolated for ripple-free constant voltages. $149.95. Dynascan Corp, 1801 W. Belle Plaine, Chicago, Ill. 60613.

The laser is mightier than the pen. A low-cost laser communicator in both kit and assembled form has been announced by Metrologic Instruments. The communicator was designed for voice communications, but is adaptable to data transmissions as well. The system boasts a range of about 10 mi. and is free from radio inter-



ference and possibilities of jamming or eavesdropping. The transmitter consists of a ruggedized helium-gas laser tube that generates a safe, collimated red beam of light. The receiver has a photocell which converts fluctuations in laser power to AC. This current is amplified to drive a speaker. Input of transmitter accepts signals from mikes and tape. $150 in kit form and $200 in assembled version. Metrologic Instruments. 143 Harding Ave., Bellmawr, N.J. 08030. -●-

YOUR SOLDERING GUN IS OBSOLETE

Ungar's New #6760 makes it so!

Now Ungar gives you the better gun to tackle the most critical soldering jobs... the kind of jobs demanded by today's sophisticated electronics.

Here's why it's better. You get total electrical isolation—We grounded the gun—with a 3 wire NEMA plug and cord... so your sensitive I.C.s and densely packed components are safe from static electricity and stray currents. (It's also safer for you too.) The Isolated-Grounded Tip—a simple idea that protects both you and your circuitry.

But we didn't stop there. We designed an entirely new soldering gun for you. Instead of the usual *heavy*, transformer you get reliable advanced circuitry. It makes this new gun a feather-light five ounces! Now you can accurately pinpoint solder in hard-to-get-to-spots without hand fatigue.

Next we added versatility. You get two heat ranges (500° and 900°F approx.)—all with the same gun. And, you have a choice of three thread-on replaceable tips that won't give or bend in constant use—select the shape that fits your needs best. For greater accessibility, you can easily lock the tip to the exact angle needed for your job.

A few other standard bonuses you get only with Ungar's new trigger-activated #6760: a virtually shatter-proof case—U.L. listed—a guarantee of excellence on each and every gun—and separately replaceable parts. But don't just take our word for it. Try one... or ask another pro who has one. Then make up your own mind.

Prove for yourself that in the age of solid state, Ungar *really* outguns the heavyweights.

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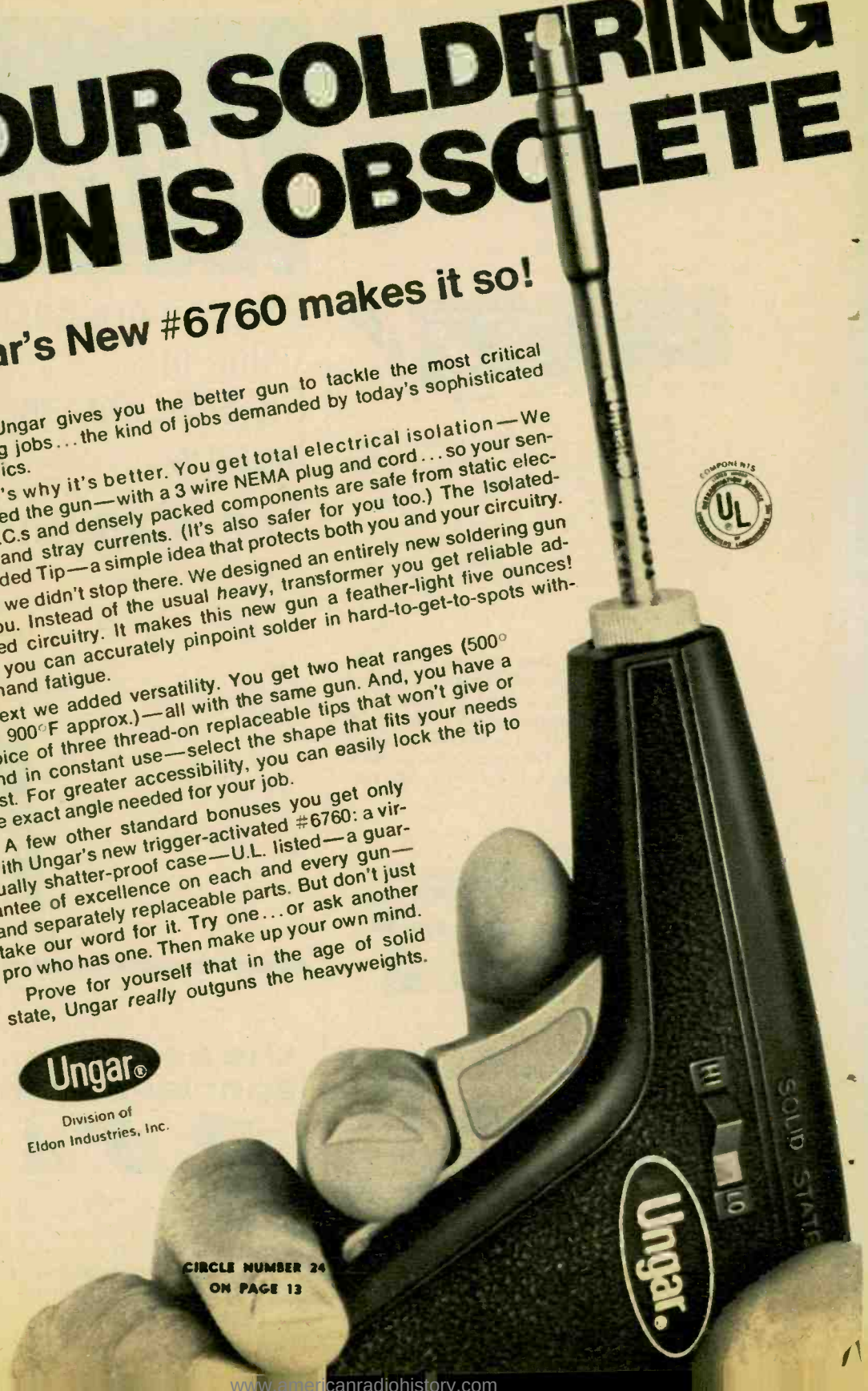

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EI's Win-the-World Contest!

GRAND PRIZE: Choose your favorite country from those among your QSL cards and EI will fly you there and back via Pan American World Airways, whose motto is "No place in the world is more than a day away from the USA by PAA." Stay as long as you like, see all the sights and maybe visit some of your DX friends. To keep you in touch with the news back home you will receive, as an added bonus, a Hallicrafters CR-44A portable short-wave radio, complete with direction finder. Truly a Grand Prize!

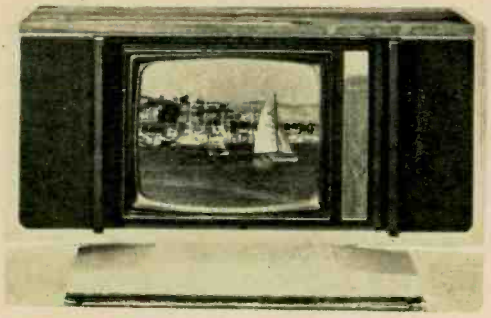
WHERE in the world would you like to go? Paris? Moscow? Tokyo? Auckland? Take the Grand Prize in EI's Win-the-World Contest and we'll fly you there and back! To win the trip of a lifetime or any one of 99 other valuable prizes all you have to do is practice your favorite hobby—radio. Ours is a DX contest in which you count up your QSLs to win. It's that simple!

Anybody can enter and it doesn't matter whether your game is SWLing, hamming, CBing or DXing the BCB. Just ply your rig according to the rules on the next couple of pages and you may find yourself aboard a Pan Am jet or the winner of one of many valuable prizes.

The Listening Period of the contest begins at Midnight July 15, 1971, so you have plenty of time to get your rig in order for the event. Following this period you'll have about a month and a half (read the rules carefully) to get your QSLs together and total them up. Then all you have to do is fill out the entry blank that will appear in the September issue of EI and send it in. (That issue also will have a beginner's guide to short-wave listening.)

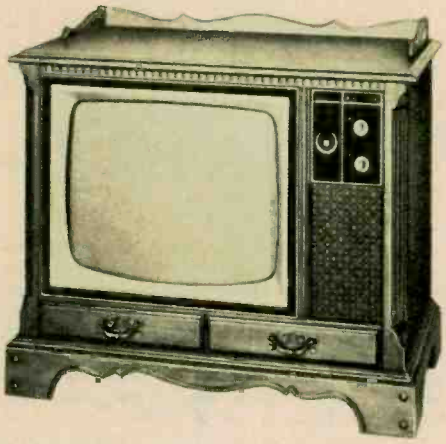
Just think, not only will you have a great time listening and talking to old friends—you may be rewarded for it! The Win-the-World Contest is one of the great DX challenges of all time, so if you've ever wanted to enter a communications contest, you won't want to miss this one.

EI's Win-the-World Contest!

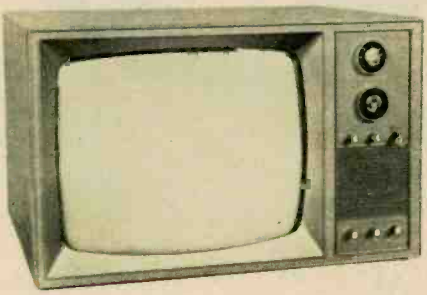


SECOND PRIZE: The futuristic RCA G-2000 color TV is one of 2,000 sets, each a numbered version, comes with a fantastic 23-in. picture tube.

THIRD PRIZE: A Heathkit/Thomas Theater Organ kit. 44-note keyboard and 19 organ voices make this a truly remarkable instrument. Worth over $1000!



FOURTH AND FIFTH PRIZES: The solid-state Heathkit GR-370 color TV kit. Modular, snap-on circuit boards make it easy to build and service.



SIXTH AND SEVENTH PRIZES: A color TV kit from Conar, a division of the National Radio Institute. Easy to assemble and light as a feather.

RULES

1. Electronics Illustrated's Win-the-World Contest requires a participant to be in radio contact with as many stations as possible within the Listening Period of the contest and to show evidence of these contacts by means of a verifying QSL card or letter.
2. Any legal station is an eligible target. Contestants may choose just to listen to the station, as with SWLing, or they may be in two-way contact with the station, as in amateur radio.
3. QSL cards and letters must indicate the date the station was heard. In the case of some remote or small stations, it is advised that contestants prepare a QSL with this information and send it to the stations with their verification report. Do not send EI any QSL cards with your entry. The winners will be notified when to supply proof of their contacts at a later date. Entries claiming more QSLs than can be substantiated will not be eligible for any prize.
4. Although all radio and television stations are eligible in this contest, only one contact with each station will count towards qualification.
5. The Listening Period of the contest, in which contestants will establish radio contact with stations, will begin Midnight EST on July 15 and run until Midnight, August 14, 1971. All QSLs must bear a date within this period.
6. The entry blank for the contest will appear in the September issue of Electronics Illustrated, which goes on sale July 15. This entry blank or a reasonable facsimile must be completed and should be sent to: Electronics Illustrated's Win-the-World Contest, Box 1035, Greenwich, Conn. 06830. To be eligible for the contest, all entries must be postmarked before Midnight, October 31, 1971. Name and return address with zip must appear in upper left corner on front of envelope.
7. The entry with the highest number of QSLs will be judged Grand Prize winner, the entry with the second-highest number will be judged Second Prize winner, etc.

8TH-13TH PRIZES: One of the best way to learn electronics is to study with a correspondence school in the privacy of your own home. For these six prizes, EI will assign the winners to one of the great schools listed below, where they will study the course of their choice absolutely free.

Cleveland Institute of Electronics
1776 East 17th St.
Cleveland, Ohio 44114

ICS
Scranton,
Pennsylvania 18515

National Technical Schools
4000 South Figueroa St.
Los Angeles, Calif. 90037

CREI
Div. of McGraw-Hill
Continuing Education Co.
3224 Sixteenth St., N.W.
Washington, D.C. 20010

National Radio Institute
Div. of McGraw-Hill
Continuing Education Co.
3939 Wisconsin Ave., N.W.
Washington, D.C. 20016

RCA Institutes
320 West 31st St.
New York, N. Y. 10001

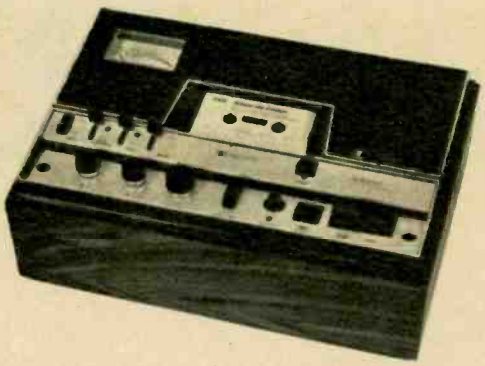
RULES

8. In addition to giving the total number of QSLs, each contestant will be asked to break this number down to the number of contacts with each continent. International contacts require more skill than local ones so that in the case of a tie, the person with the greatest number of international contacts in his entry will be judged to be the higher of the two entries.
9. The Grand Prize provides round-trip tourist-class accomodations aboard Pan American and connecting air carriers from the airport nearest the winner's home to any city having regularly-scheduled air service in the country of the winner's choice among those named on his QSL cards, providing travel to that country is not forbidden by law. The winner must provide passport and visa if required.
10. In the case of Prizes 8-13, the editors of Electronics Illustrated will assign each winner to a school and the contestant will be given a full scholarship. He must be academically qualified for the course chosen (i. e., advanced courses sometimes require prior educational achievements) and must maintain regular academic advancement.
11. All prizes are subject to manufacturer's specification changes.
12. The editors of EI will be the judges and their decisions will be final. All entries become the property of Fawcett Publications, Inc. and will not be returned.
13. The Win-the-World Contest is open to any individual except employees of Fawcett Publications, its wholesale distributors and advertising agencies and their families or employees.
14. Winners of the contest will be notified by mail after the publication of the list of winners in the March 1972 issue of Electronics Illustrated. Winners grant Fawcett Publications, Inc. the right to use their names and photos in connection with promotion resulting from the contest.

EI's Win-the-World Contest!

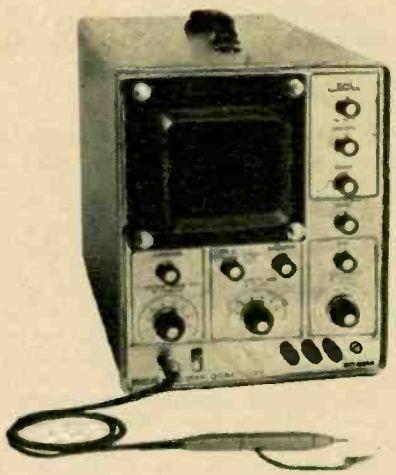
14TH PRIZE: Hallicrafter's finest communications receiver, the SX-122A, covers AM/CW/SSB. It offers dual-conversion from 535 kc to 34 mc. Digital clock-speaker is included.

15TH-19TH PRIZES: Hallicrafters newest entry in the communications receiver market, the SX-133, covers four short-wave and five amateur bands on AM/CW/SSB. Matching speaker is also included.



20TH PRIZE: The new Advent 201 cassette tape deck incorporating the Dolby system of noise reduction and a brand new tape transport to make for incomparable listening pleasure.

21ST PRIZE: The Sony STR-6055, a new stereo-FM/FM-AM receiver. 40 watts (rms) per channel at 8 ohms plus the latest in stereo-FM tuner design.



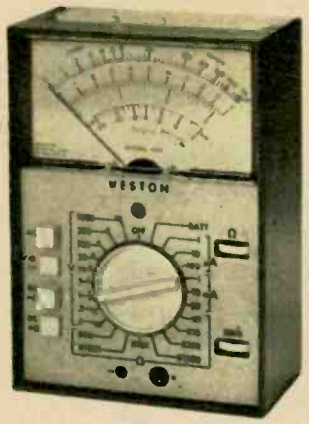
23RD PRIZE: Lafayette Radio's Telstat SSB-25 one of the first CB rigs with SSB on all 23 channels. This results in 46 operating channels and 15 watts PEP input power.

22ND PRIZE: RCA's WO-505A solid-state oscilloscope has 5-in. CRT, flat frequency response to 5 mc and sweep to 1 mc.

24TH PRIZE: The RCA WR-52A Stereo FM Signal Simulator. This generator produces signals for aligning the RF and multiplex sections of stereo FM tuners and receivers.

25TH PRIZE: Allied Radio Shack's Patrolman PRO-3 VHF/UHF receiver tunes police and fire departments on 30-50, 152-174 and 450-470 mc.

27TH PRIZE: Weston 666 solid-state VOM is designed for troubleshooting semiconductor equipment. It's protected against overload and is ruggedized. Features include 10-megohm AC/DC input impedance and low full-scale DC range of 100 mv. It also measures AC and DC current as well as resistance.



26TH PRIZE: Sansui's QS-1 Quadphonic Synthesizer converts any standard two-channel stereo system into a four-channel system with addition of only two more speakers.

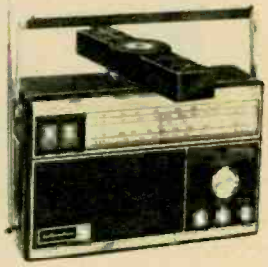
28TH PRIZE: Courier Citation solid-state base-station CB transceiver, has a digital clock, walnut cabinet, and PA capability. It comes with crystals for 23 channels.

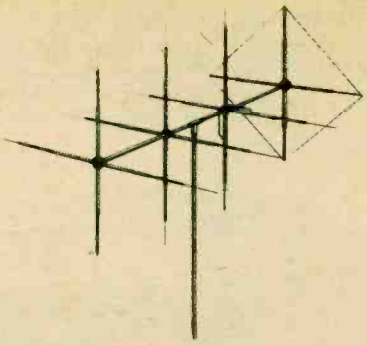
29TH PRIZE: Olson RA-280 stereo FM/AM solid-state receiver delivers 60 watts of power, has an FM sensitivity of 2 μv and stereo separation of 25db. It comes with two speakers.

30TH PRIZE: RCA WR-502A solid-state color-bar generator produces color bars, dots, cross-hatch lines, vertical and horizontal lines and blank raster for color TV servicing.

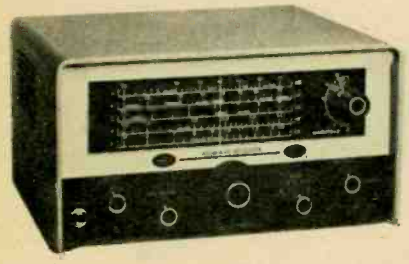
EI's Win-the-World Contest!

31ST-35TH PRIZES: The Hallicrafter's CR-44A Ranger portable short-wave receiver. Covers 30 short-wave services, AM, FM, police and fire and ship-to-shore. Comes with direction finder for three bands.





36TH PRIZE: Avanti's Moonraker CB base station antenna. The antenna combines half-wave cross dipole elements with design reflector.

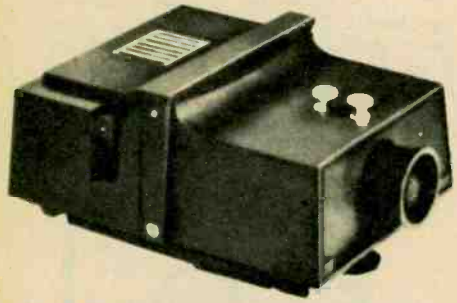


37TH PRIZE: This AMECO R-5A receiver covers 540 kc to 54 mc which includes police, fire, short-wave and ham bands. Fully transistorized and can be used for portable operation.

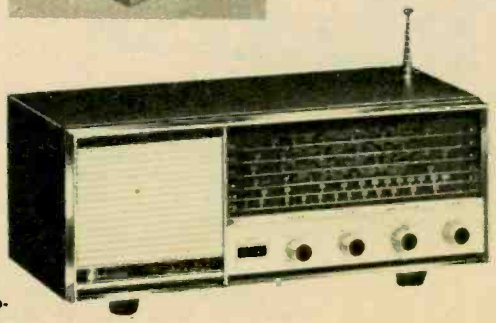
38TH PRIZE: The DeltaAlert ultrasonic intrusion detector. This device protects against illegal entries over a 150 to 300-sq.-ft. area. Also includes are two powerful DeltaHorns.

39TH-41ST PRIZES: Combination entertainment-communications receiver from Hallicrafters, the S-240. Includes BFO and signal-strength meter.

42ND PRIZE: Two great CB mikes from Turner. Included are a Turner +3 base-station mike with the patented Modugard. Also included is a M+2/U transistorized mobile mike.



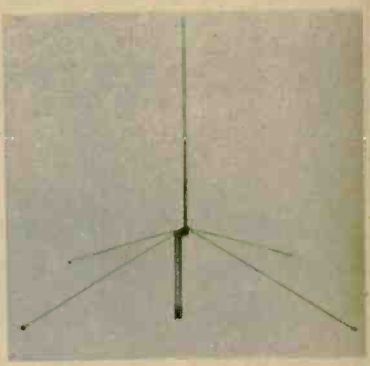
43RD PRIZE: Edmund Scientific's top-of-the line Deluxe Visual Effects Projection Set plus Rippling Color Accessory for exciting light shows.



44TH AND 45TH PRIZES: Hallicrafter's skip-band receiver designed with SWLs in mind. Covers 49-, 31-, 21- and 19-meter bands. Special World Capital Locator.

46TH PRIZE: EICO's four-channel color organ, Model 3450, converts sounds to four dazzling colors with the beat.

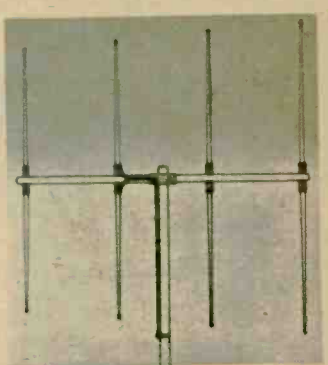
47TH PRIZE: A $100 credit with Electro-Voice for any equipment in their latest catalog, including this miniature 651C communications mike.



48TH PRIZE: A complete library designed for hams and SWLs from the Howard W. Sams publishers. Many titles to help you improve as a hobbyist.

49TH PRIZE: A $100 credit for any antenna in the latest catalog of Antenna Specialists, some especially designed for VHF and UHF DX.

50TH PRIZE: Mallory's MCR-1232 portable cassette recorder plus built-in AM/FM radio. Also included are six Duratape cassettes.



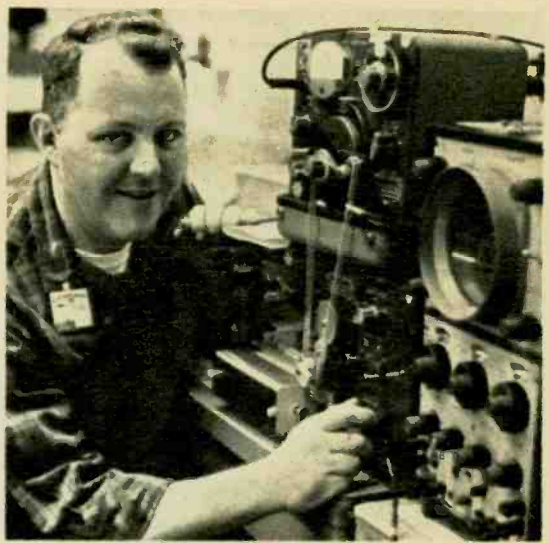
51ST PRIZE: $100 credit with Shakespeare, one of the leaders in the CB antenna field. Everything from base to mobile antennas.

52ND PRIZE: A library of the latest bestsellers from the Tab Book Company. Titles run the gamut of all things electronic.

53RD-100TH PRIZES: A one year subscription to the electronics hobbist's favorite magazine—ELECTRONICS ILLUSTRATED.

One of our students wrote this ad!

Harry Remmert decided he needed more electronics training to get ahead. He carefully "shopped around" for the best training he could find. His detailed report on why he chose CIE and how it worked out makes a better "ad" than anything we could tell you. Here's his story, as he wrote it to us in his own words.



Harry Remmert on the job. An Electronics Technician with a promising future, he tells his own story on these pages.

By Harry Remmert

AFTER SEVEN YEARS in my present position, I was made painfully aware of the fact that I had gotten just about all the on-the-job training available. When I asked my supervisor for an increase in pay, he said, "In what way are you a more valuable employee now than when you received your last raise?" Fortunately, I did receive the raise that time, but I realized that my pay was approaching the maximum for a person with my limited training.

Education was the obvious answer, but I had enrolled in three different night school courses over the years and had not completed any of them. I'd be tired, or want to do something else on class night, and would miss so many classes that I'd fall behind, lose interest, and drop out.

The Advantages of Home Study

Therefore, it was easy to decide that home study was the answer for someone like me, who doesn't want to be tied down. With home study there is no schedule. I am the boss, and I set the pace. There is no cramming for exams because I decide when I am ready, and only then do I take the exam. I never miss a point in the lecture because it is right there in print for as many re-readings as I find necessary. If I feel tired, stay late at work, or just feel lazy, I can skip school for a night or two and never fall behind. The total absence of all pressure helps me to learn more than I'd be able to grasp if I were just cramming it in to meet an exam deadline schedule. For me, these points give home study courses an overwhelming advantage over scheduled classroom instruction.

Having decided on home study, why did I choose CIE? I had catalogs from six different schools offering home study courses. The CIE catalog arrived in less than one week (four days before I received any of the other catalogs). This indicated (correctly) that from CIE I could expect fast service on grades, questions, etc. I eliminated those schools which were slow in sending catalogs.

FCC License Warranty Important

The First Class FCC Warranty* was also an attractive point. I had seen "Q" and "A" manuals for the FCC exams.

*CIE backs its FCC License-preparation courses with this famous Warranty: graduates must be able to pass the applicable FCC License exam or their tuition will be refunded in full.

and the material had always seemed just a little beyond my grasp. Score another point for CIE.

Another thing is that CIE offered a complete package: FCC License and technical school diploma. Completion time was reasonably short, and I could attain something definite without dragging it out over an interminable number of years. Here I eliminated those schools which gave college credits instead of graduation diplomas. I work in the R and D department of a large company and it's been my observation that technical school graduates generally hold better positions than men with a few college credits. A college degree is one thing, but I'm 32 years old, and 10 or 15 years of part-time college just isn't for me. No, I wanted to *graduate* in a year or two, not just *start*.

If a school offers both resident and correspondence training, it's my feeling that the correspondence men are sort of on the outside of things. Because I wanted to be a full-fledged student instead of just a tagalong, CIE's exclusively home study program naturally attracted me.

Then, too, it's the men who know their theory who are moving ahead where I work. They can read schematics and understand circuit operation. I want to be a good theory man.

From the foregoing, you can see I did not select CIE in any haphazard fashion. I knew what I was looking for, and only CIE had all the things I wanted.

Two Pay Raises in Less Than a Year

Only eleven months after I enrolled with CIE, I passed the FCC exams for First Class Radiotelephone License with Radar Endorsement. I had a pay increase even before I got my license and *another* only ten months later. I'm getting to be known as a theory man around work, instead of one of the screwdriver mechanics.

These are the tangible results. But just as important are the things I've learned. I am smarter now than I had ever thought I would be. It feels good to know that I know what I know now. Schematics that used to confuse me completely are now easy for me to read and interpret. Yes, it is nice to be smarter, and that's probably the most satisfying result of my CIE experience.

Praise for Student Service

In closing, I'd like to get in a compliment for my Correspondent Counselor who has faithfully seen to it that my supervisor knows I'm studying. I think the monthly reports to my supervisor and generally flattering commentary have been in large part responsible for my pay increases. My Counselor has given me much more student service than "the contract calls for," and I certainly owe him a sincere debt of gratitude.

And finally, there is Mr. Tom Duffy, my instructor. I don't believe I've ever had the individual attention in any classroom that I've received from Mr. Duffy. He is clear, authoritative, and spared no time or effort to answer my every question. In Mr. Duffy, I've received everything I could have expected from a full-time private tutor.

I'm very, very satisfied with the whole CIE experience. Every penny I spent for my course was returned many times over, both in increased wages and in personal satisfaction.

Perhaps you too, like Harry Remmert, have realized that to get ahead in Electronics today, you need to know much more than the "screwdriver mechanics." They're limited to "thinking with their hands" . . . learning by taking things apart and putting them back together . . . soldering connections, testing circuits, and replacing components. Understandably, their pay is limited—and their future, too.

But for men like Harry Remmert, who have gotten the training they need in the fundamentals of Electronics, there are no such limitations. As "theory men," they think with their heads, not their hands. For trained technicians like this, the future is bright. Thousands of men will be needed in virtually every field of Electronics, from two-way mobile radio to computer testing and troubleshooting. And with this demand, salaries have skyrocketed. Many technicians earn $10,000, $12,000 or more a year.

Send for Complete Information—FREE

Many men who are advancing their Electronics career started by reading our famous book, "How To Succeed In Electronics." It tells of the many electronics careers open to men with the proper training. And it tells which courses of study best prepare you for the work you want.

If you're "shopping around" for the training you need to move up in Electronics, this 44-page book may have the answers you want. We'll send it to you FREE. With it, we'll also include our other helpful book, "How To Get A Commercial FCC License."

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2. Your book on "How to Get A Commercial FCC License."

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The Listener

By C. M. Stanbury II

The Canadian Crisis

A MONTH after my column on the Canadian threat to jam the air waves and the international issue of listening freedom hit the stands, the Ottawa government with terrorist activity as justification (or excuse, depending upon which side of the debate you're on) assumed dictatorial powers, including arbitrary control over the broadcast media. These powers have been used with great restraint—little has been directly censored by the government. Or more precisely, Canadian mass media has been used to circulate many wild tales, primarily intended to further justify the government's drastic decision.

Figuring most prominently in the action so far are almost all of the privately owned stations in Montreal, most notably CKAC on 730 and CKLM on 1570 kc. Also in the foreground of the government action was a telephone talk program aired by CKNW at New Westminster, B.C. (1320 kc). CKAC was the first station actually to have an encounter with the government's censorship policies. The government-owned Canadian Broadcasting Corp.'s R. Canada had been accused of imposing additional restrictions on its own transmissions. One CBC reporter claimed control was so tight that, as he said, "We are always half an hour later than all the other stations." Private broadcasters also have engaged in some self-censorship. For example, Canada's second television network, CTV, cancelled a two-part Ironside adventure which depicted the framing of a secessionist cell. The CTV station in Montreal is CFCF (ch. 12) whose SW affiliate, CFCX, can be heard on 6005 kc. SWLs could hear the Ironside cancellation announced on 49 meters.

49 meters also provided another interesting twist during the crisis. From Oct. 20 through Oct. 23 English programs from the VOA at Greenville were showing up on 5975 kc. Unless the VOA has discovered some new propagation mode (which is possible), the last couple of hours on that frequency would have been audible only in North America. Normally VOA does not have transmissions for Canada.

If you're a newcomer to DXing, looking for an exotic catch can be quite a chore. R. Tahiti could be the station to satisfy your desires. Although the station only has a 4-kw transmitter, their 25-meter rig is heard in North America on 11825 kc with surprisingly regularity. The tropical location of the station is what makes it so widely heard, so you might give a listen at about 2200 EST.

The station is operated by France's O.R.T.F. at the town of Papeete. They offer broadcasts in French and Tahitian, but as the music is predominantly the twangy south-sea-island variety it shouldn't be too hard to spot. This station is known among DXers as one of the best when it comes to verification—usually within two weeks.

New News. R. Barbados reports that in the interim since the DXing the Indies article (Nov. 70, EI) the station has moved from 780 kc to 900. This presents problems to DXers, as they will now have to contend with interference from Mexican station XEW.

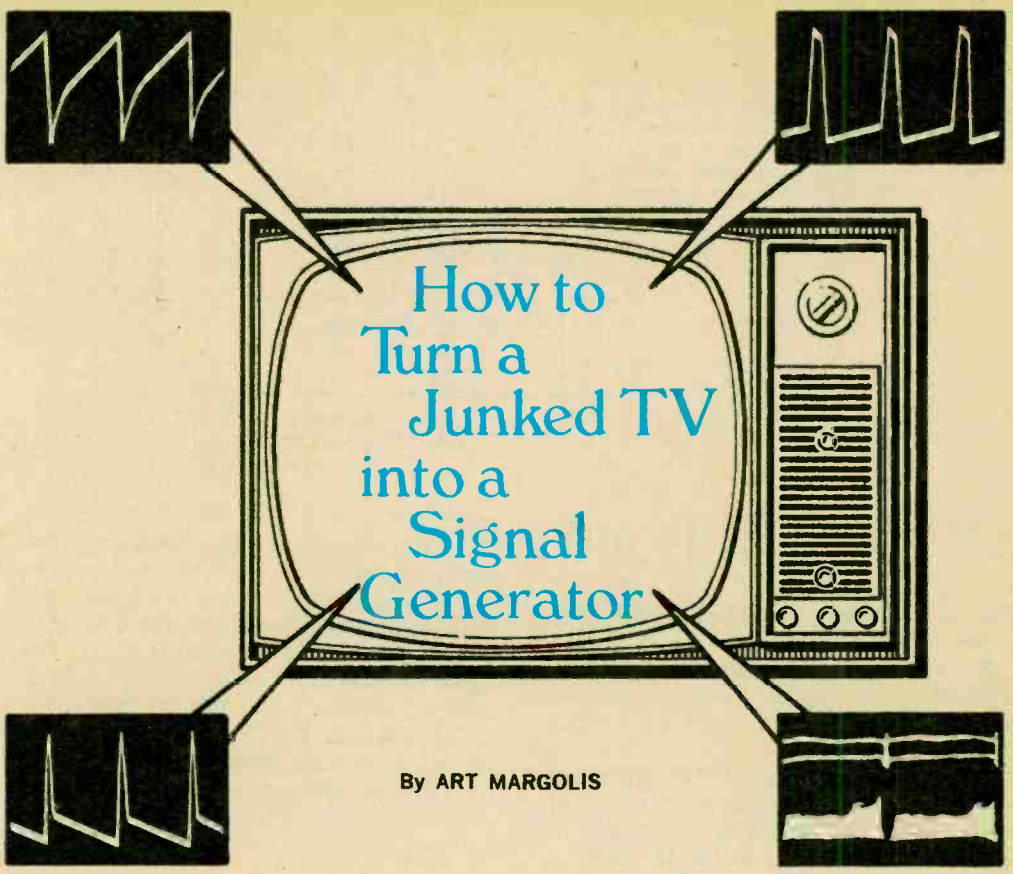
Reader reports on my column dealing with R. Peking seem to indicate that this station has begun to issue standard QSL cards for verification reports. Too bad these weren't prepared in time for the Chicom I satellite broadcast.

Propagation Forecast. During the summer months the 10 and 11 meter bands will be relatively ineffective for DX. 13 meters will be fair during the daylight hours, while 16 and 19 meters will be best for daytime long distance operation.

Short skip 10 and 11 meter opening will be fairly common during July and the beginning of August due to the seasonal formation of sporadic-E clouds in the lower ionosphere, which make the reflection of higher than normal frequencies possible. Sporadic-E propagation will also make periodic FM and TV DX possible.

During the nighttime hours, DX should be possible in all short-wave bands from 19 to 49 meters.

Because of the seasonal increase in local noise levels, DX in the broadcast band should be relatively poor. Some improvement will begin toward the latter part of August, however.



How to Turn a Junked TV into a Signal Generator

By ART MARGOLIS

YOU put the dead TV on the bench and routinely test the tubes. After finding they're all good, the thought of a big troubleshooting job hits you like a ton of bricks. You now must quickly localize the trouble to avoid wasting time checking circuits that are okay. Remember, time is money!

The fast way to do it? Substitute for each major circuit in the inoperative set a working circuit from an external signal source. And the cheapest signal source is another TV—one that has been junked—plus a handful of inexpensive parts.

A good junked TV for this purpose will run you $10 or $15. Most TV shops have plenty of them that are just taking up space. The extra parts will cost less than $10 and the setup can be put together in a few hours. This is a big financial saving when you consider what you'd have to pay for commercial signal-generating equipment.

Latching On to a Junked TV. The TV to use does have to meet certain requirements though. First, it should have a transformer chassis. It doesn't matter if it has a tube or a solid-state rectifier, but it must have a power transformer so it is isolated from the AC line.

Next, it has to be a working set. The picture tube could be weak, the tuner could work on only one or two channels, there could be a bend in the picture, a buzz in the sound, weak sync, but basically it must provide *sound, picture, brightness* and *sweep.*

The set should have a horizontal-output tube whose plate is attached to a cap on the top like the 6DQ6A. It makes things much more difficult if the plate connection is to a pin on the socket.

One of the main reasons TV's are junked is a weak picture tube. One of these sets is perfect. Just be sure that you can see something on the screen, no matter how dim. The only reason you must see something is to be sure the set is on and, therefore, producing the injection signals you'll need.

The set I found to convert to a signal generator is a Philco portable that dates back to about 1962. The chassis No. is 11N51. It is a transformer TV, has a weak picture tube and develops a bend in the picture after it's on a while. The owner lost interest in it

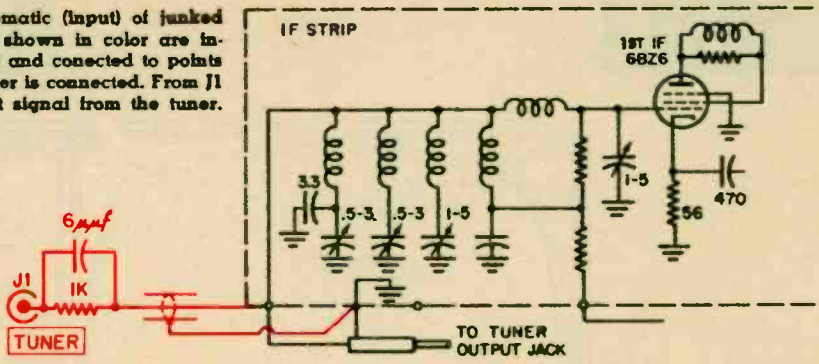


Fig. 1—Partial schematic (input) of junked TV's IF strip. Parts shown in color are installed on test-panel and conected to points where wire from tuner is connected. From J1 you will get RF test signal from the tuner.

TV Signal Generator

after he found out it would cost $50 to $60 to repair.

The Functions. I decided to tap into it to obtain six test signals. These are the most important and frequently used for trouble-shooting:

1. Tuner output (Fig. 1). This is the signal that during a brightness-only, no-sound, no-picture symptom, answers the question "is the trouble in the tuner or the IF strip?"

2. Video output (Fig. 3). This signal isolates a no-video or no-Y-signal symptom to a specific area in the video section where the trouble lies.

3. Vertical grid output (Fig. 4). This signal localizes the symptom of no-vertical sweep to the area of the trouble in the vertical-oscillator vertical-output area.

4. Vertical plate output (Fig. 4). This signal answers the question, "is the trouble in the vertical-output transformer or yoke area?"

5. Horizontal grid output (Fig. 5). This signal narrows the source of trouble down to either the horizontal-phase or the horizontal output if there is no high voltage.

6. Horizontal plate output (Fig. 5). This signal answers the question "is a no-high-voltage symptom in the flyback/yoke area?"

Construction. The first step is to get the schematic for your junked set. If you can't get a factory schematic, buy the Sams Pho-

Fig. 2—The horizontal-output tube on Philco 11N51 chassis was type with a removable cap. The chassis can be pulled easily for connections to the other test-signal tap-off points underneath.

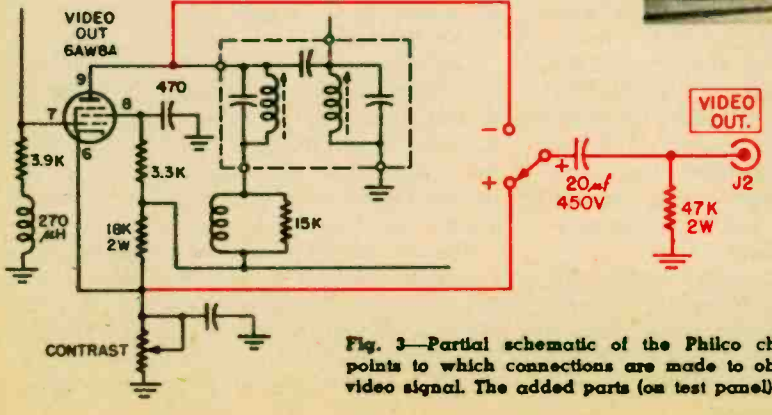


Fig. 3—Partial schematic of the Philco chassis (black) shows the points to which connections are made to obtain positive or negative video signal. The added parts (on test panel) are shown here in color.

tofact folder for the set. Each signal is taken from a specific point on the chassis. The connections contain some components to isolate the junked-TV circuit from the TV set you are going to inject the signal into. However, two signals can be obtained with isolation. We show here the points we made connections to in a Philco 11N51 chassis. You can easily find comparable points on your set's schematic.

The easiest permanent set up can be made with an 8 x 6-in. perforated-board panel attached to the rear of the cabinet as shown in Fig. 12. Drill and cut the panel and install output jacks (phono) in the holes. Mark the jacks *tuner output, video output, vertical grid drive, vertical plate drive, horizontal grid drive* and *ground*. The *horizontal plate drive* is not on the panel.

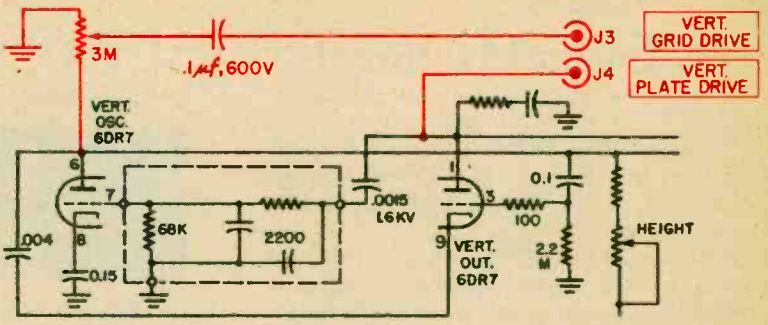


Fig. 4—Part of Philco schematic (black) shows vertical-oscillator and vertical-output stages. Added parts (on test panel) are shown in color.

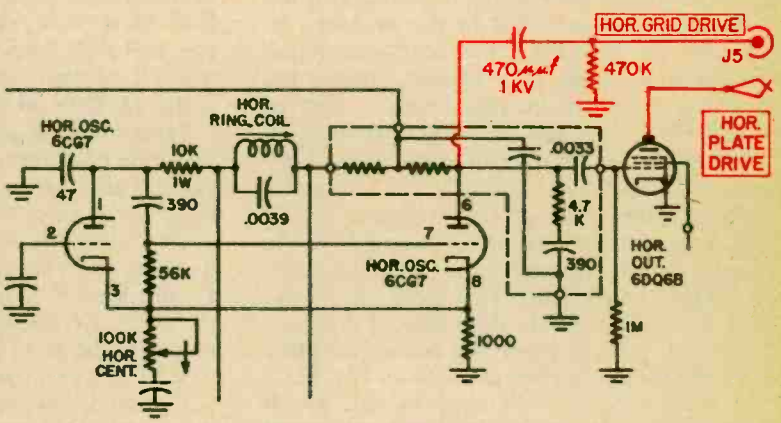


Fig. 5—Part of Philco schematic (black) shows horizontal-oscillator and output stages. Added parts (on test panel) are shown here in color.

Tuner Output. Connect a 6-μμf 500-V mica capacitor and a 1,000-ohm, ½-watt resistor to the tuner-output (IF input) jack (the input of the first IF) as shown in Figs. 1 and 6. Use a piece of coax to connect the capacitor and resistor to the chassis. Attach the shield of the coax to chassis ground.

Video Output. Connect a 47,000-ohm, 2-watt resistor from video-output jack J2 to ground on the panel. Connect the negative side of a 20-μf, 450-V capacitor to J2. Connect the positive side of the capacitor to the center lug of a DPST switch. Attach one side of the switch to the plate of the video-output tube. Mark that switch position *minus*. Connect the other side of the switch to the cathode of the video-output tube. Mark that switch position *plus*.

Vertical Grid Drive. Connect a .1-μf, 600-V capacitor to vertical-grid-drive jack J3. Attach the other end of the pot to the plate of the vertical-oscillator tube.

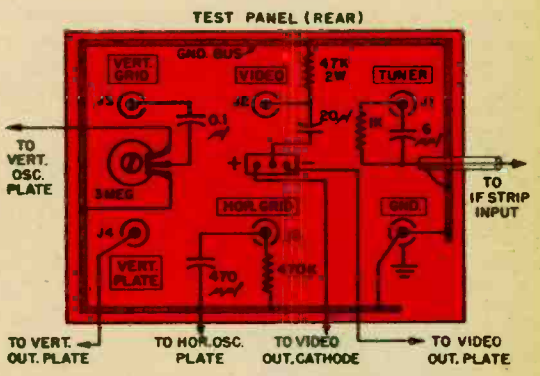


Fig. 6—Pictorial of rear of test panel. Panel is piece of perforated circuit board (shown in Fig. 12). The jacks can be either phono or pin-tip type.

TV Signal Generator

Vertical Plate Drive. There are no components in this jack (J4). Connect a wire from the jack to the plate of the vertical-output tube.

Horizontal Grid Drive. Attach a 470,000-ohm, ½-watt resistor from *horizontal-grid*-drive jack J5 to panel ground. Connect a 470-$\mu\mu$f 1,000-V capacitor to the jack. Then run a lead from the other end of the capacitor to the plate of the horizontal-oscillator tube of the junked-TV chassis.

Horizontal Plate Drive. There is no jack on the test panel for this function. You use a lead that is attached in this manner: remove the cap from the horizontal-output tube on the junked-TV chassis. Connect the lead to the cap on the tube—not the removed cap. The other end of the lead will be attached to the cap removed from the horizontal-output tube in the TV you are servicing. If the plate of the horizontal-output tube in the TV you are servicing is at the tube socket, the lead must be removed for the test. Lastly, run a lead from the *ground* jack on the panel to the junked-TV chassis ground. Bolt the panel to a convenient place on the back of cabinet as shown in Fig. 12.

Now, turn on the junked TV and attach an antenna. If your wiring is correct the set should work fine with one exception. You might lose a little bit of vertical sweep at the bottom of the picture. This is caused by the 3-meg pot that is now connected to the plate of the vertical-oscillator tube. Try turning the pot. The vertical sweep will vary a bit, but this is normal. For test purposes this small space on the bottom is meaningless.

Operation. What can you do with your signal generator? There are quite a few troubles and each requires a different approach. With these six signals at your fingertips you can make six important checks to narrow the seat of many troubles to a specific circuit area. Let's go through them.

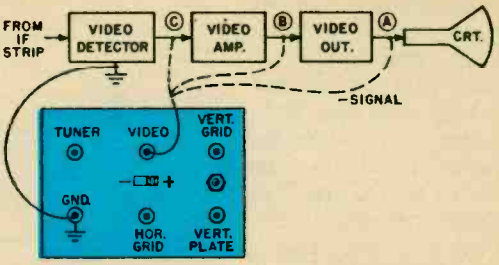


Fig. 7—Symptom: no contrast (or smeary color), sound okay. Injecting test signal at A,B,C isolates trouble to CRT, video output or video amp.

Symptom 1: Brightness okay, (raster), but no sound or picture. The trouble is indicated visually and can be located anywhere in the tuner or IF strip.

The answer is easy to come by. Simply use leads from the test panel from tuner jack J1 and ground. Attach the ground lead to the ailing TV chassis and connect the tuner output to the input of the IF strip (Fig. 8). The TV can be color, b&w, tube or transistor.

If picture and sound appear, you know the trouble is in the tuner. Should you still not get a picture nor sound, the IF strip is the culprit and the tuner is in the clear.

Sympton 2: Brightness okay, sound okay, but no video. In a color TV, the color will be okay, too, but there'll be no video (the color will be smeary looking). The trouble is visually and audibly indicated to be in the contrast circuits, which include the video detector, video amplifiers or drivers, video

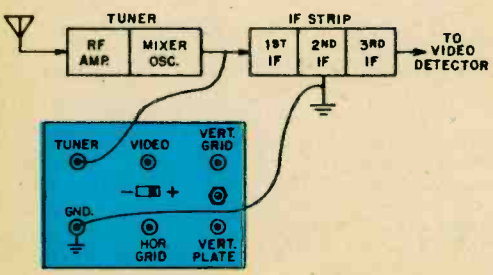


Fig. 8—Symptom: no sound, no pix, brightness okay. This test set-up will determine if the trouble is in the set's tuner or in the IF strip.

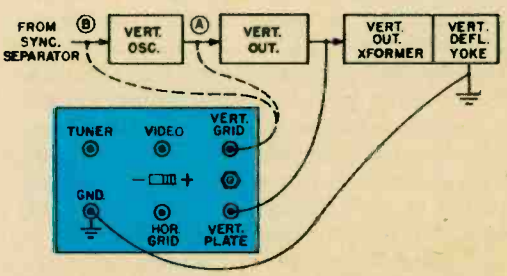


Fig. 9—Symptom: no vertical sweep. Injecting signal at points indicated isolates trouble to vertical oscillator, vertical output or yoke area.

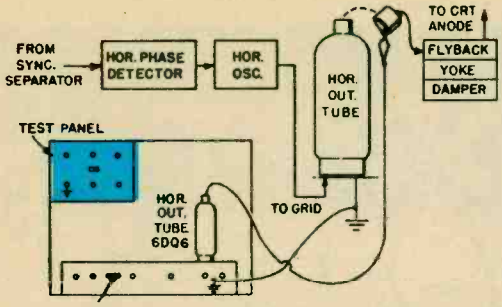


Fig. 10—Symptom: no brightness, no high voltage, sound okay. Horizontal-plate test isolates trouble to horizontal oscillator, output, flyback or yoke.

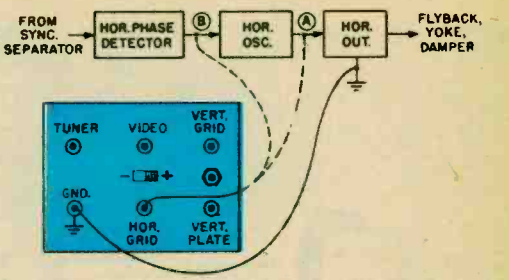


Fig. 11—Symptom: no brightness, no high voltage, sound okay. Horizontal oscillator, output, phase-detector test isolates trouble to the three areas.

output and the picture tube itself.

Use video-output jack J2. Take a plate signal (—) and begin injecting it at the cathode of the picture tube (Fig. 7) and work your way back to the plate of the video-output tube. You have crossed over the defective component as soon as you lose the CRT display you created with the injected signal. For instance, suppose you inject the signal into the CRT and a display appears. That clears the picture tube. Then you move your injection point farther back until you cross over a coil and the display no longer appears. Chances are it's an open coil.

If you arrive at the cathode of the video-output tube and the display still appears, set the SPDT switch to the positive-signal position and keep going back till you lose the display. This approach is good in color, b&w, tube or transistor TV's.

Symptom 3: No vertical sweep, that is, just a white horizontal line across the CRT. You must find where in the vertical-sweep circuit is the trouble. The vertical-sweep circuit extends from the input to the vertical-oscillator tube to the yoke.

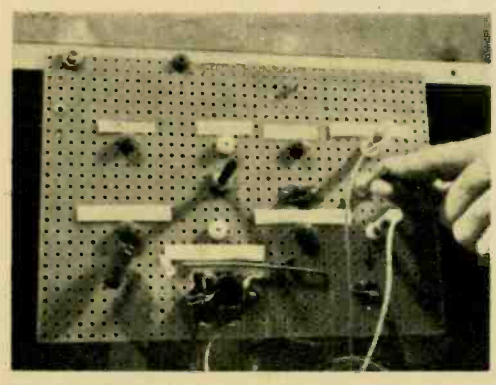


Fig. 12—Author's first test panel has some unused jacks. Three jacks at top (right) and underneath correspond to those on panel shown in Fig. 6.

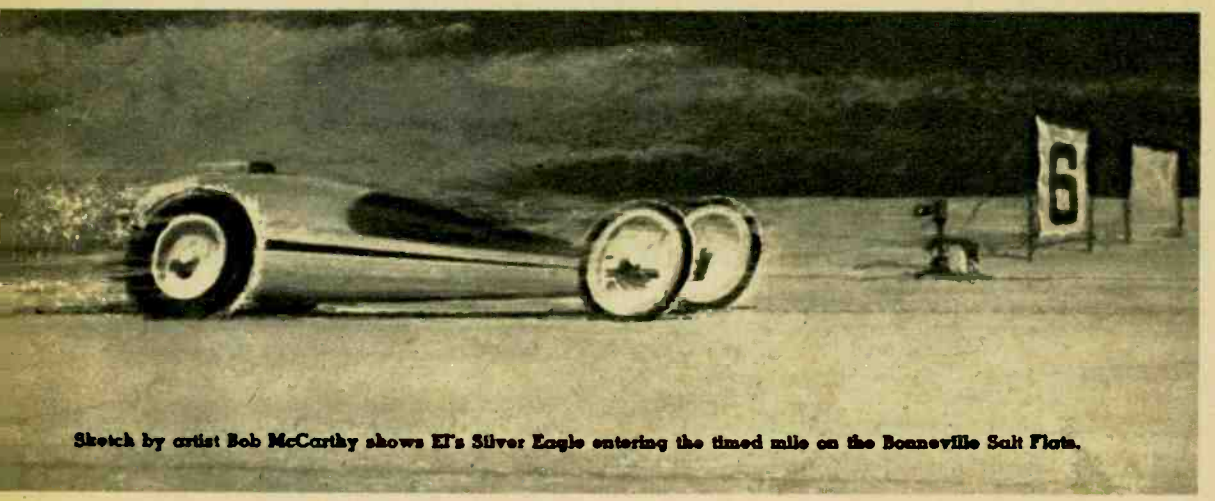
You'll use both the *vertical-grid-drive* (J3) and *vertical-plate-drive* (J4) signals for this test. You must answer the question, "is the trouble in the vertical-output/transformer-yoke area or in the tube circuits?" Connect a lead from *vertical-plate* jack J4 to the plate of the vertical-output tube (Fig. 9). Turn on the TV. Remove the tube from its socket. If it's a series-filament string, short the vertical-output tube's filament lugs on the socket so all the tubes light. If some sweep occurs the vertical-output transformer and yoke are cleared. It doesn't have to be much sweep; just a bit will do. When sweep does not occur, the trouble will be found in the transformer yoke area and not in the tube circuitry.

When some sweep occurs, remove the plate-drive lead, reinstall the vertical-output tube and take a lead from vertical-grid-drive output jack J3. Attach the lead to the control grid of the vertical-output tube (Fig. 9). Then adjust the 3-meg pot on the panel. If full sweep can be restored the vertical-output stage is cleared.

Should the condition of no-vertical sweep now occur, the trouble is in the vertical-output stage. Stop and make voltage and resistance tests to find the defective component.

If sweep continues to appear, move your touchdown point to the plate of the vertical-oscillator tube. If sweep occurs there move on to the vertical-oscillator's control grid. As soon as you cannot create sweep with your test signal, you have just passed over the trouble spot. This technique is applicable to tube color or b&w TV's. Solid-state vertical

[*Continued on page* 99]



Sketch by artist Bob McCarthy shows El's Silver Eagle entering the timed mile on the Bonneville Salt Flats.

We Go for a World Land Speed Record!

The international electric car mark of 138.862 mph is our target as El's Silver Eagle spreads its wings on the Bonneville Salt Flats.

HOW fast can electricity carry a man? We at Electronics Illustrated wondered about the answer to that question—to the extent that we have become a co-sponsor in a project designed to capture the world Land Speed Record for electric cars.

Though our quest for the LSR dates back more than three years, circumstances of pollution and public interest in ecology by coincidence made our work unexpectedly current. As little as two years ago ecology hardly appeared in our vocabulary and electric cars were something produced back around the turn of the century. But now air befouled by the exhausts of millions of gasoline engines has brought attention to the electric car as a possible alternative to smoke-belching monsters.

If the battery-power automobile is to become a major factor in traffic, it behooves us to know as much about its capabilities and shortcomings as possible. The maximum speed of which an electric car is capable then becomes an important factor by which to judge the breed—and a goal worthy of pursuit.

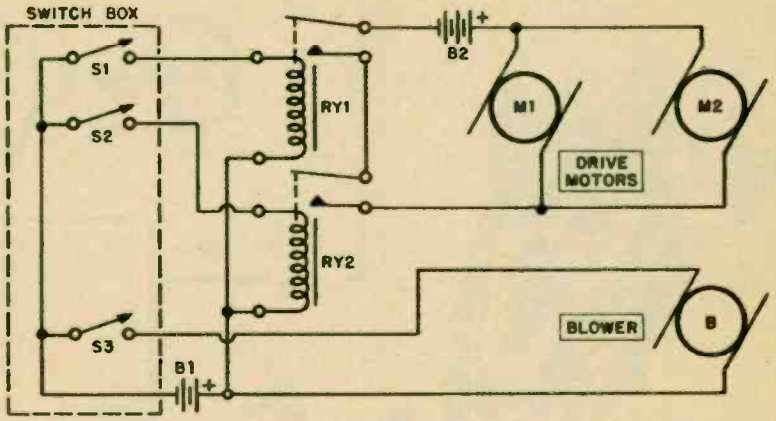
To summarize our story right here: we designed and built a space-age electric car, called the Silver Eagle, and we ran it at the Bonneville Salt Flats in Utah. We haven't yet succeeded in capturing the Land Speed Record . . . but we haven't given up, either.

Our co-sponsors in the Silver Eagle are our companion publication, Mechanix Illustrated; Eagle-Picher Industries of Joplin, Mo., a battery manufacturer, and the Firestone Tire & Rubber Co.

The immediate object of our quest is a record of 138.862 mph set Nov. 19, 1968, by the Lead Wedge, a car built and fielded by the Autolite division of the Ford Motor Co. The car, which made its runs for the record through the timed mile at Bonneville, was powered by a large mass of regular lead-acid batteries of the type used in passenger cars.

The Lead Wedge was a heavy car and, for Bonneville, 138 mph is not all that fast. A lightweight vehicle with exotic batteries seemed to be the best

We Go for a World Land Speed Record!



Simple schematic of the Silver Eagle reveals a pair of solenoids (RY1, RY2) hooked in series. They switch main power in 2-step operation that prevents weld-ups of the two. Thus driver always is able to cut off.

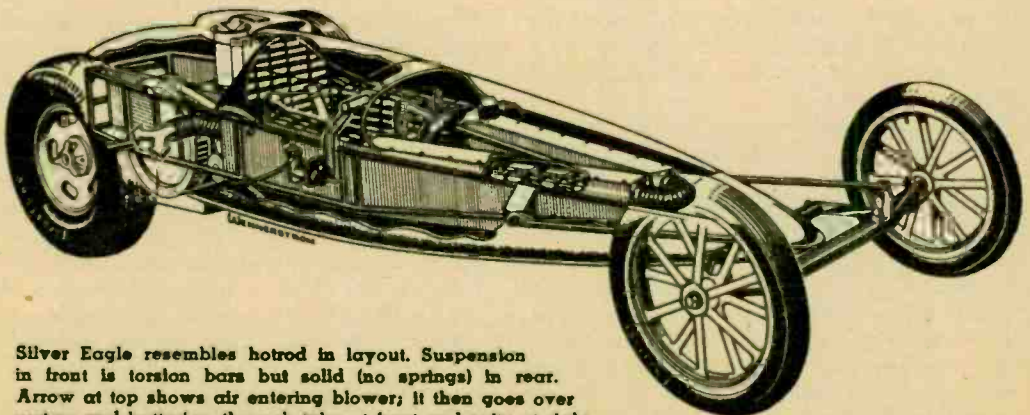
bet for taking the record away from Ford. We still think it is—but the job is not quite as easy as we first believed.

Our quest for exotic battery power led us quite naturally to Eagle-Pitcher because they are the major supplier of power cells for our space shots. The Apollo batteries on the moon bear the E-P imprint. The Apollo batteries are silver-zinc which, if designed and put together in certain configurations, can store an immense amount of electrical energy that can be obtained at an extremely high rate.

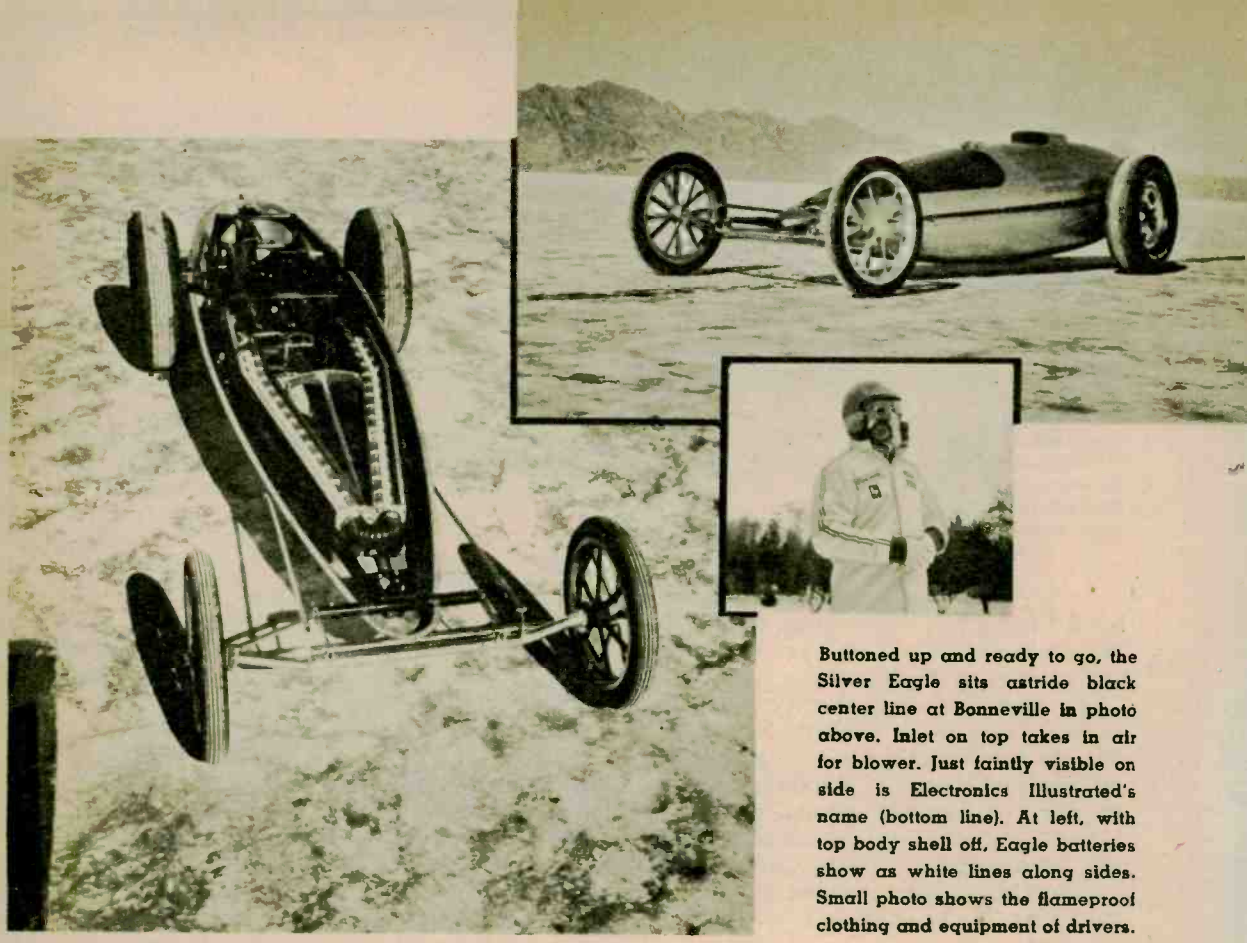
For an electric car that had to make two timed runs through a measured mile in opposite directions within an hour, silver-zinc seemed ideal. Eagle-Pitcher not only supplied batteries but much of the money for the project. Firestone supplied tires.

The Silver Eagle was designed by Jack Horton of Colton, Calif., a man with more than 40 years of performance-car building, and was fabricated by Arch Ary in his shop in Colton. The Eagle is a bit different even for Bonneville, where offbeat designers are common. The front end has the skinny wheels and tires used normally on high-power rail dragsters. At the back are fat drag tires. The body is a surplus aluminum aircraft fuel nacelle. The upper front portion of the shell has been cut out and replaced with a sheet of Plexiglas, which is the driver's windshield. The driver is in lie-down position in the cramped cockpit.

The workings of the Silver Eagle are quite simple. In troughs on either side of the interior are 60 silver-zinc cells with a nominal potential of 1.5 V. They are hooked in series, delivering a no-load 90 V to two electric motors twirling a toothed plastic



Silver Eagle resembles hotrod in layout. Suspension in front is torsion bars but solid (no springs) in rear. Arrow at top shows air entering blower; it then goes over motors and batteries, through tube at front and exits at right near rear wheel. Butterfly steering wheel, hand brake are visible. Specs: Wheelbase 111 in. Weight dry 435 lbs.; with batteries app. 730 lbs. Tires 2.75x18 and 8.45x15.



Buttoned up and ready to go, the Silver Eagle sits astride black center line at Bonneville in photo above. Inlet on top takes in air for blower. Just faintly visible on side is Electronics Illustrated's name (bottom line). At left, with top body shell off, Eagle batteries show as white lines along sides. Small photo shows the flameproof clothing and equipment of drivers.

gilmer belt which in turn drives a single gear on the solid axle.

The motors we used were surplus 24-V aircraft starter models rated at 24 V. Though the voltage to the motors would represent an overload factor of more than 3.7, we knew that the heavy load would drop the voltage quickly and, because the power cycle would be of short duration, the motors seemed the right answer to the problem of converting a large amount of electricity into mechanical force at a rapid rate.

Additional small batteries are used to turn a blower which cools both motors and the rows of batteries and to operate solenoids which switch the main power. The car's operating controls consist of a butterfly steering wheel, a hand brake and exactly three switches. One operates the blower. The other two throw solenoids, two of which are wired in series. With the heavy flow of current, it was realized that the contacts in a single solenoid could weld shut and the driver would not be able to cut off. With two in the circuit, no power flows when No. 1 is closed so it later will open for certain. No. 2 may weld but can be changed at the end of a run.

The EI/MI/Eagle-Pitcher/Firestone crew arrived at Bonneville with great expectations. The crew included two drivers, EI-MI editor Bob Beason and backup man Richard James, a Californian.

We scheduled a couple of trial runs and then, if everything seemed in order, we were going for the record with thoughts of 170 mph or so. With observers from the United States Auto Club, the official timing organization, on hand and ready, we started.

A trial shot down the Salt course showed everything in order so we buttoned up and went for the first run for the record. The Silver Eagle, after a 20-mph push start, picked up speed slowly and then more and more rapidly. Then it happened. A wisp of smoke. A lot of smoke. The car slowed and stopped. The overloaded motors couldn't take it and had burned out. Everybody escaped handily—except for wounded pride. So it's back to the shop for us—and off on a quest for motors that can do the job.

Hi-Fi Today

By John Milder

* The Right Turntable

FEW audio components produce the kind of subjective satisfaction that makes me sit back and say, "Right, that's the way it should be." The first to do so in many a day is Norelco's new turntable, the Model 202. It represents the company's first entry Over Here into record-playing equipment.

Norelco, or North American Philips Company, is of course, the American marketing arm of Philips of the Netherlands and that has made its name synonymous for the last few years with cassettes (a Philips innovation licensed to other manufacturers). You don't exactly expect the company with the biggest stake in cassettes to turn out a top-flight piece of record-playing gear, but so it has.

Norelco's 202, the latest entry into the turntable field. Just the right features, says John Milder, and for the right price—$130.

The 202 has the standards that I've been hoping some rig would meet someday. It is simple, with no automatic record-changing. It is free of any audible contribution of rumble or feedback, thanks in great part to the kind of suspension system used by Acoustic Research in the AR turntable. It shuts off automatically (via a sensitive photoelectric switch that doesn't restrict the integral arm) at the end of a record. It has super-simple and highly accurate tracking and skating-force adjustments. The turntable costs $130, which is not only substantially less than other tables that have satisfied me far less, but this price is what I've always thought one should cost for all these features.

There's nothing esoteric about what the Norelco 202 does and it has no features not found on other models in one form or another. What it does is put things together in the right way with the right performance at the right price. That, to me, is what makes a product worth talking about.

As long as I'm handing out compliments, I ought to say a bit about another entry into a different area. Concord, long a marketer of tape equipment of Japanese manufacture, now has moved into stereo receivers and its top-of-the-line model, the Mark 20, is a fine example of the kind of value you ought to expect in receivers these days.

For $300, the Mark 20 delivers upwards of 30 watts (rms) per channel into 8 ohms, which makes it more than adequate to drive my low-efficiency speakers to proper acid-rock levels in my large living room. Its FM-tuner section is excellent, not quite as selective as receivers in the $500-$600 class, but very sensitive and extremely easy to tune. Also worth healthy approval are its control facilities, including linear tone and volume controls which I'm finally beginning to like after long considering them a simple facsimile of the studio look. Altogether, the Mark 20 is a very nice way to enter the receiver business and Concord merits a welcome.

Another new manufacturer of blank cassettes, the Information Terminals Corporation, saw a recent column of mine on the importance of the construction of the cassette proper and sent me some samples of their own new cassettes, including some using DuPont's Crolyn tape. They are very impressive and their performance underlines my original feelings, since their extreme lack of eccentricity is undoubtedly due to their beautiful internal construction (precision rollers, a new kind of slipsheet etc.).

The big surprise was the perfomance of its C-120 cassette (using Hitachi SD tape), which provied the first of that length to meet what I would call hi-fi standards. Information Terminals is a West Coast company with apparently limited distribution (their main concern is industrial data processing applications), but their product is impeccable and well worth looking for. For information, you can write them at 1160 Terra Bella Ave., Mountain View, Calif. 94040.

Quick Service for Ailing CB Rigs

By TOM KNEITEL, KQD4552

ALTHOUGH modern CB transceivers score quite high in reliability, as age sets in they occasionally do fail to deliver top performance. Fortunately, most of the ills they're heir to can be cured with simple repairs by anyone who has ever changed a TV tube.

Fact is, most repairs aren't really that at all; they're adjustments, cleaning or locating a defective tube. And while a solid-state rig doesn't leave much room for owner servicing, applying a few of the tips here will get a tube rig perking almost like new.

Before you do anything, get hold of the rig's service manual or schematic. Check it for tube substitutions, circuit voltages and special tuning adjustments. Let's look at some typical CB service problems and their solutions.

Set completely dead—nothing lights. Make certain the rig is connected to the power line or battery. Frequently a plug is accidentally knocked from the receptacle or a battery cable breaks at the terminal screw. If power is obviously being applied, check the fuse, for metal fatigue will often cause a fuse to open. If the fuse is okay wiggle the connections at the plug, because corrosion can cause poor contact and power failure. If all this doesn't work, open the cabinet and look at the tubes; any that don't light are dead. Failure of all tubes to light can mean a defective power switch and/or power transformer in an AC model, although such problems are rare.

Tubes light but received signals are weak. Check the antenna plug to make certain it is connected. If it is, check to see that there isn't a poor connection in the plug. Check the connections on the antenna to see if they have come loose or have corroded. If these things are okay, then check the RF and IF tubes. If they are all lit, tap them a few times with a pencil eraser. If you tap a tube and this causes reception to improve, replace the tube. This failing, remove the tubes and check them on a tube tester.

Tubes light but no sound. Check the speaker leads and the leads from the voice coil to the lugs on the speaker frame. If okay, turn the volume control back and forth; if the sound cuts in and out squirt some cleaner into the control and turn the control back and forth several times.

Ringing when volume is turned up. Look for a microphonic tube, one that howls when tapped by a pencil (Fig. 1). Start at the front-end and work toward the speaker.

Scratchy, distorted sound. This can be a defective speaker. Mobiles, that sit out in the rain, can end up with a warped speaker cone caused by high humidity. Loosen the speaker so you can get at it and with gentle,

Fig. 1—Howling when the volume is turned up means a microphonic tube. Tap each tube with a pencil eraser; the bad one will cause a lot of noise.

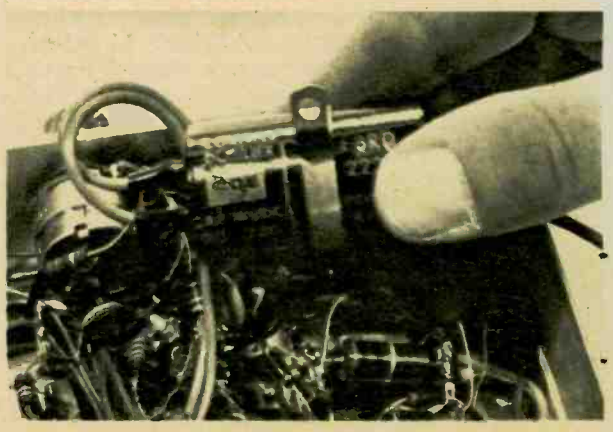


Fig. 2—Constant hum or buzz in the receive mode means a bad filter capacitor. Parallel each filter with a good one until the hum or buzz stops.

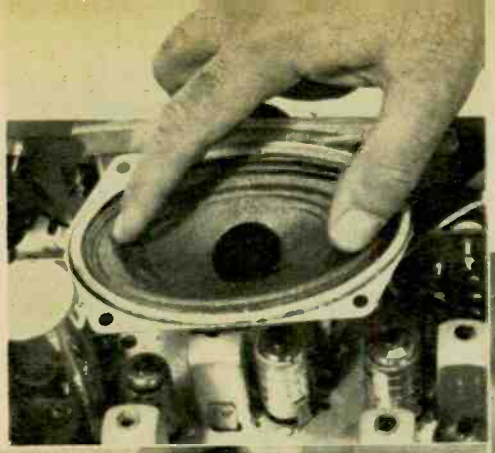


Fig. 3—To spot a speaker that's causing distortion, press the cone then release. Scratching means a warped cone, so replace the speaker.

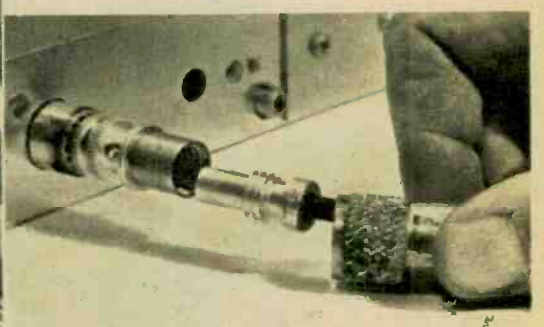


Fig. 4—Continuous crackling sound is generally caused by coax adaptors that were not soldered to main plug. Plug shown is defective because adaptor can be unscrewed.

Fig. 5—Noise caused when adjusting main or fine tuning is caused by dust between tuning capacitor's plates. Blast dust out using can of dust-free pressurized air.

even pressure around the voice coil, press (Fig. 3) the cone in and let it spring forward. If you hear a rubbing or scratchy sound the speaker is defective.

Another station reports there's hum or buzz on your modulation. Wiggle the mike cable at the connector or chassis grommet to make certain the cable isn't intermittent. If the cable is okay, replace the mike preamp tube, which might have a heater-to-cathode short.

Hum of buzz when receiving. Look for a defective power-supply electrolytic (Fig. 2). If nothing appears to be leaking out of any of them, bridge each electrolytic one at a time with a 20-μf, 400-V capacitor. If the hum level drops you have located the defective capacitor.

Hum or buzz only when a signal is received. No hum on interstation noise. Generally a tube in the front-end or IF has a heater-to-cathode short. Look for a short indication when testing the tubes.

Scratching when the volume control is turned. Caused by a dirty volume control. Give it a shot of cleaner.

Motorboating. Almost always caused by a weak (not necessarily defective) electrolytic capacitor—either a power-supply filter or an audio-amplifier bypass. Bridge the capacitors with a good capacitor until the motorboating stops.

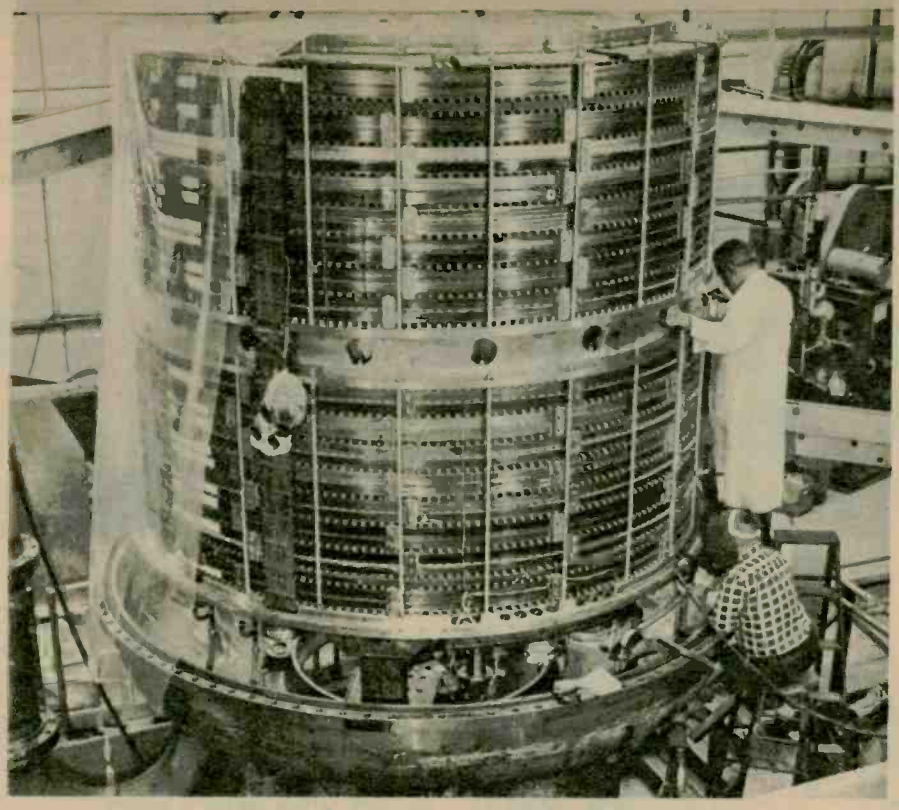
Constant crackling sound. Look for an intermittent or corroded connection in the antenna system. Check that coax plug adaptors were soldered through the solder holes in the main connector (Fig. 4).

Crackling sound when adjusting delta (fine) tuning. Generally caused by dust between the tuning capacitor's plates. Blast it out using a can of dust-free pressurized air (Fig. 5). This is available in photographic stores under the trade name Omit. Do not use the blower end of a vacuum cleaner as it puts out more dust than it removes.

These ideas should solve many of the major complaints which you will come across in in normal CBing, but there are other maintenance steps which you should take.

From time to time, remove the set from its cabinet and use a vacuum cleaner to remove dust. Shoot cleaner into all controls and into the transmit/receive relay. *Do not* touch the screwdriver adjustments on IF cans or anywhere else.

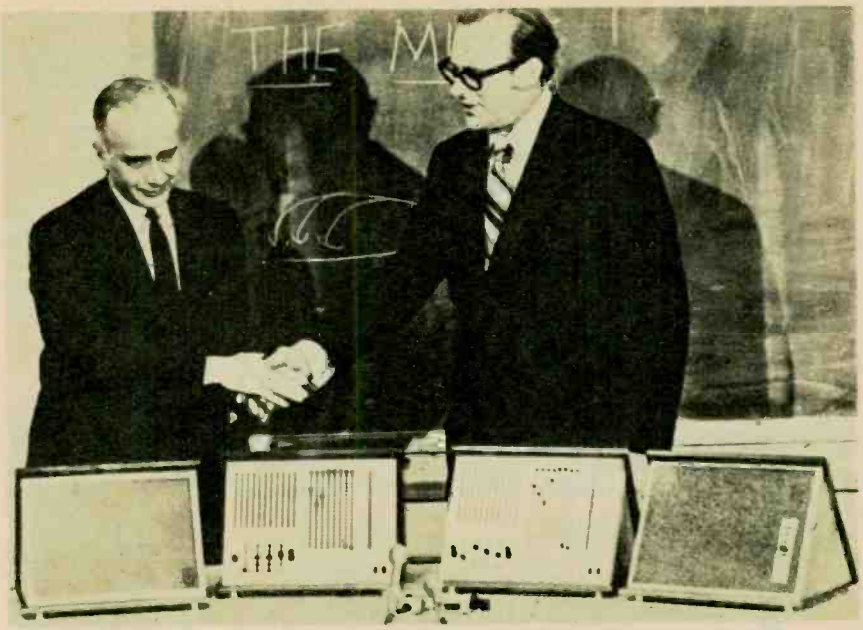
[*Continued on page* 94]



NO PLACE FOR WRISTWATCHES. The world's largest (8-ft. dia., 8-ft. high) and most powerful air-core superconducting magnet produces an operating field about 50,000 times stronger than the earth's magnetic field. By immersing the magnet in liquid helium (−450°F) the conductors lose their resistance to current flow and superconduct. The magnet fits around a bubble chamber at which physicists at the Brookhaven Natl. Lab detect and photograph the interaction of sub-atomic particles.

Electronics in the News

Bargain color camera. Mention a color TV camera and one thinks of a monstrous, expensive piece of equipment being wheeled around on a huge dolly. Would you believe a 20-lb. color camera in a cabinet slightly larger than a shoe box? Sony does because their new solid-state camera uses only one tube instead of the usual three or four that are in professional cameras. Sony says the camera will sell for around $1,000, which puts it in the ball park for some broadcasters as well as the video tape and CATV markets.



Binary rock. New addition to the Smithsonian Institution is the Muse, a desk-top musical computer/composer from Triadex, Inc., Newton, Mass. Its binary system's logic pattern controls the development and variations of a melody. Over 14-trillion melodies or tonal patterns can be produced by the settings of its switches. Muse creates one note at a time in the C-major scale and it has a six-octave range.

Royal ham station. During his recent visit to the U.S.A., JY1, King Hussein of Jordan, was presented with a Hallicrafters SR-2000 transceiver system at the Blair House in Washington, D.C. Because of the King's on-the-air popularity, he will use the 2-kw rig to cut through the QRM he encounters on the 80-, 40- and 20-meter bands. The system includes the P-2000 AC power supply and the HA20 VFO.

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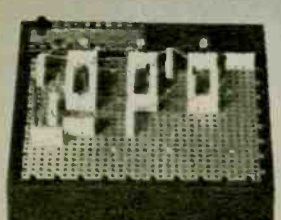

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Note: TV picture is simulated.

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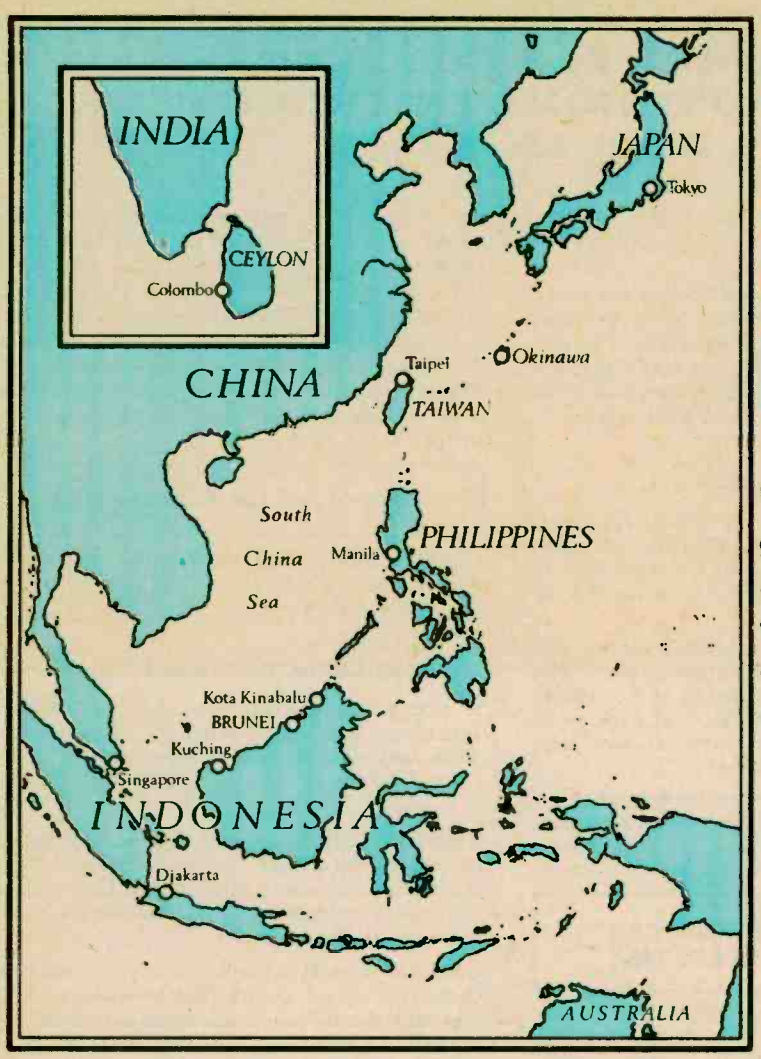


DXing the Asian Islands

With all that's going on in Southeast Asia, the radio voices of these tiny islands can provide exciting news in addition to fascinating DX.

By ALEX BOWER

CORAL is generally regarded as the skeletal remains of certain forms of sea life. Put two pieces of coral together and you've got a reef, more than that and you have an island. As shown in our map, the oceanic areas of East Asia are littered with thousands of these tiny coral islands. Some of the islands have legally joined hands to become island nations, such as the Philippines or Malaysia. Like many other countries of the world, these diminutive nations wish to make themselves heard and have established SW outlets that make dandy DX targets.

With all this Japanese radio equipment around, it is only fitting that the easiest of the Asian island nations to log should be Japan. R. Japan is the international service of the government-owned Nippon Hoso Kyokai (NHK). The Japanese maintain a sizable staff for their international voice and although you may not hear anything too startling, this easy DX catch is a reliable source of news with an Asian point of view.

R. Japan beams English transmissions to North America each afternoon beginning at 1745 EST on 15445 and 17825 kc. Its General Overseas Service can be heard quite often on 15105 kc prior to 1200 EST.

If R. Japan proves too simple for your level of DXpertise, take a crack at JJY, the Japanese time and standard frequency station that is operated by the Radio Research Laboratory in Tokyo. This station can be heard under our own WWV on 10000 and

1500 kc between 0400 and 0800 EST—a good time to try all Asian DX.

Another station that may offer a challenge for a limited time is the Voice of America relay on Okinawa. This tiny island is one of the Ryukyu Islands about 40 mi. south of Japan. These islands are scheduled to be returned to Japanese sovereignty sometime in 1972 and even if this does not disrupt the operation of the VOA there, it will raise questions as to the separate country status that DXers have assigned to the tiny atoll. Better log this one now to be sure.

Other American involvement on these islands in the way of broadcasting is primarily military in scope. The Voice of the United Nations Command is one to watch, for our information indicates that the UN has little to do with the operation of the station which is in the hands of a U.S. Army Psychological Warfare group.

VUNC, which dates back to the Korean War, employs rather old fashioned techniques such as nonportable transmitters to beam to outlets in South Korea. The Ryukyu transmitters use standard AM on 9915 and 14460 kc and should prove a good target if you have heard JJY in Japan.

The Voice of America's two most powerful Asian relays are found somewhat south of the Ryukyus at Poro and Tinang in the Philippine Islands. Both stations simply announce their identity as Voice of America from the Philippines—which is almost as readily logged in North America as R. Japan. Try 15185 kc around 2000 EST, or 11965 and 15210 during the morning hours.

There are many alternate Philippine SWBC targets. The Voice of the Philippines uses the original VOA relay base near Manila. This antique facility was given to the Philippine government in 1969. Because of its tropical location and relatively stable administration, the Philippines are a favorite spot for international relays and no fewer than three missionary broadcasters have taken advantage of this opportunity. The Far East Broadcasting Co., South East Asia Radio Voice and R. Veritas (affiliated with Vatican Radio) all maintain relays in the Philippines. Appropriate frequencies and times for these stations can be found in the chart on this page.

Moving down our DX map, we find to the south of the Philippines the island nations of Indonesia and Eastern Malaysia. The term Eastern Malaysia is used almost exclusively by DXers to refer to the Malaysian portion of Borneo. All of R. Malaysia's international facilities are presently on the mainland, although there is talk of an expansion to the underdeveloped portions of the country. For the time being your best bet is a regional outlet at Kota Kinabalu (Sabah state) on 4970 kc around sunrise.

Indonesia, which includes the rest of Borneo (except for the tiny kingdom of Brunei) and many of the islands surrounding Borneo, has just one international voice—R. Republik Indoneisa or The Voice of Indoneisa as

[*Continued on page* 98]

EI'S DX GUIDE TO THE ASIAN ISLANDS

Station	Location	Freq. (kc)	Remarks
V. of Free China	Taipeh, Taiwan	17890, 17780 17720, 15325 & 15125	2100-2250 EST
R. Singapore	Singapore	9635 & 6000	
Voice of America	Okinawa	7255 & 7165	Reports to VOA, Washington, D.C. 20547
V. of the United Nations Command	Okinawa, Ryukuyu Islands	9915 & 14460	Reports to APO 96248
Voice of America	Philippines	15185	Evenings
		11965 & 15265	See VOA Okinawa
Voice of the Philippines	Manila, Philippines	9580 & 11950	After 0230
Far East Broadcasting Co.	Manila, Philippines	15440	
South East Asia R. Voice	Manila, Philippines	15420	
R. Veritas	Manila, Philippines	11830 & 15170	
R. Malaysia	Kota Kinabalu, Malaysia	4970	
R. Malaysia	Kuching, Malaysia	4950, 5030	
R. Japan, (N.H.K.)	Tokyo, Japan	15445 & 17825	1745 Sign-on
		15105	Before noon
JJY	Tokyo, Japan	10000 & 15000	Reports to Radio Research Laboratory
AFRTS Far East Network	Tokyo, Japan	11750	Reports to APO 96267
R. Republik Indonesia	Djakarta, Indonesia	9770	
V. of Indonesia (R.R.I.)	Djakarta, Indonesia	11770	0730
Voice of America	Colombo, Ceylon	11835	See VOA Okinawa
R. Ceylon	Colombo, Ceylon	11800	
R. Brunei	Brunei	4865	

Good Reading

By Tim Cartwright

ADVANCED ELECTRONIC INSTRUMENTS AND THEIR USE. By Sol D. Prensky. Hayden Book Co., Inc., New York, N.Y. 208 pages. $6.95.

Test equipment is widely employed in radio-TV servicing and electronic manufacturing. But a new generation of instrumentation is arising—the sensitive and sophisticated devices for industry which measure, calibrate and test non-electronic processes. Common meters, for example, can't measure the thousandths-volt output of a bio-medical sensor, the tiny resistance change of a strain gauge or the body temperature of an orbiting astronaut. This is done through transducers, special amplifiers and graphic recorders.

The strength of this excellent book isn't in the number and variety of exotic devices it covers. It is in the author's analysis of operating principles. He clearly explains fundamental circuits comparators, bridges and choppers, all of which are hidden within advanced instruments. Clear pictorial drawings coupled with simplified schematics make this a good beginning reference for the industrial technician engaged in measurement and control.

CATV SYSTEM ENGINEERING. (Third Edition) By William A. Rheinfelder. TAB Books, Blue Ridge Summit, Pa. 256 pages. $12.95.

CATV (Community Antenna TV) is a glamor industry that may well eclipse broadcast-type TV within a generation. Cablecasters not only bring clear pictures to TV-starved towns and ghost-ridden cities, but are promising a multiplicity of other communication services for the home. The field has many career possibilities for the technician and this book is a good guide to making the transitions such as TV service to cablecasting.

It is a practical introduction to the planning, installation and maintenance of a cable system. After describing the basic layout, the author discusses the head-end, where signals are intercepted and translated, the amplifying and distribution networks and testing CATV equipment. Despite the engineering in the book's title, mathematics is held down and much of the data appears in chart and tabular form. This volume is recommended to anyone interested in the technical side of CATV.

A PROGRAMMED COURSE IN BASIC ELECTRICITY. (Second Edition) By New York Institute of Technology. McGraw-Hill, New York, N.Y. 362 pages. $5.95.

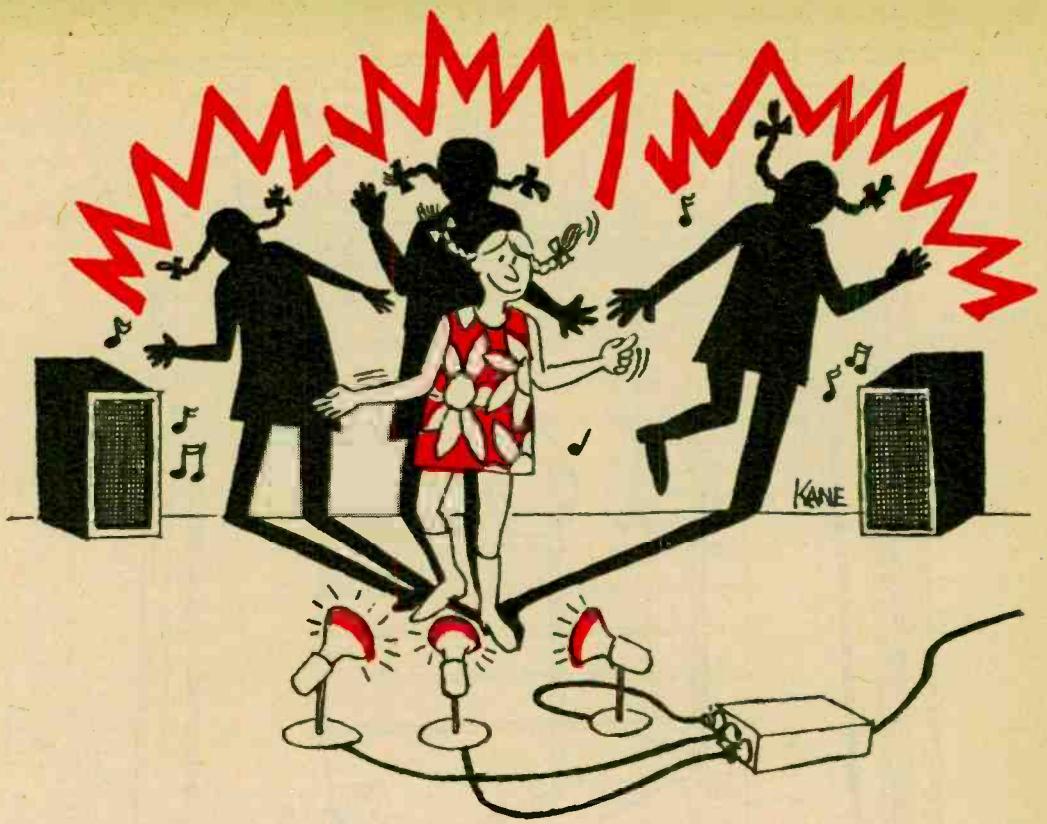
This text accompanies a formal Institute course, but it can be profitably used by anyone who wishes to go it alone. It uses a programmed learning format—each subject is split into fragments of information called frames. The student reads a frame, digests a bit of information, then answers a question about it. He discovers the correct answer before advancing further. Thus the student receives instant feedback, a check on his progress and acts as his own examiner. Since the publication appeared in 1963, it has been tested and revised in actual use.

Programmed instruction is not the new knowledge pill, but it helps the student over one hurdle. Basic electricity is often a foreboding subject that chills the beginner. The rapid reward in conquering each frame can ease the pain. The reader is never cast adrift on a sea of words and he can absorb the material at his own pace. All the ingredients for a future grasp of electronics are there: the nature of electricity, basic series and parallel circuits, AC, inductance, capacitance and resonance, to name a few.

THE SYNTHESIS OF TRANSISTOR AMPLIFIERS. By Michael Kahn and John M. Doyle. Holt, Rinehart and Winston, New York, N.Y. 400 pages. $10.95 (cloth).

This exhaustive text is aimed at the junior-college/technical-institute level. Although the authors dig deeply into the theoretical nature of the transistor amplifier, they also present a practical approach. Each new concept is offered with a real-life circuit use as an example.

No attempt is made to cover every amplifier type since the days of Lee De Forest. The authors believe the rise of the integrated circuit will render this kind of information meaningless. They concentrate on bias, gain, distortion, frequency response and other fundamentals they feel will remain unchanged. The treatment assumes the reader has a background in AC, DC and math.



Turn On with a Hi-Power Color Organ

By RONALD M. BENREY

Fig. 1—Control end of color organ which is built in 10 x 6 x 3½-in. Minibox. Wires from speaker go to terminal strip. Lamps plug in other end.

THE party's to start at 9. You've invited people who don't all know each other and, while awaiting their arrival, you worry about how well they'll all mix and how long it will take for the action to start. Music and drinks are good starters, but when you add a dash of colored lights that flash in time with the music—you've a guaranteed fast-acting turn-on.

A color organ controls the lights. You connect it to one of your speakers, plug three colored flood lights in its outlets, adjust the sensitivity control and everyone will be off and running. The organ will control the brightness of three 500-watt lamps, flashing them in time to the low-, medium- and high-frequency components of any kind of music—from Bach to the Beatles.

Many audiophiles are curious about but skeptical of color organs and their entertainment or social value. We were, too, until we

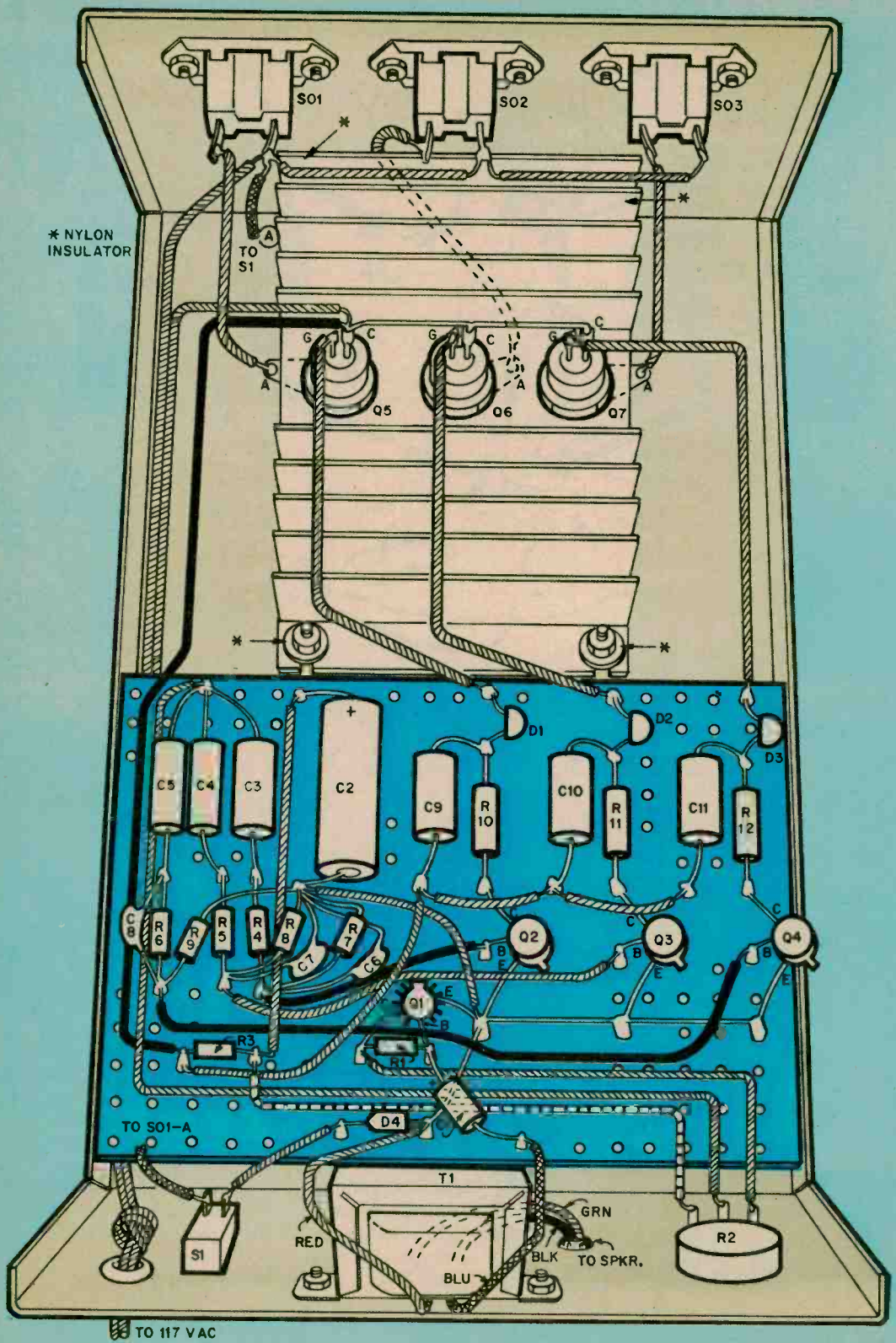


Fig. 2—Organ is built in main section of Minibox. Note that heat sink on which Q5, Q6, Q7 are mounted should be insulated from cabinet with nylon washers or fiber spacers to prevent cabinet from accidentally becoming electrically hot.

Hi-Power Color Organ

tried one. Our reaction: At a bash we gave recently, the effect produced by this color organ was synergistic (total effect was greater than the sum of two independent effects). We feel a color organ does for sound what sound did for silent movies.

The circuit of this organ is unusual in several respects. It has just four transistors and three triacs as active elements, the cost is under $35, it can handle a total of 500 watts of lights per channel. Our Circuit has built-in flicker that keeps the lamp brightness changing randomly even if the music does not gyrate wildly. However, the flicker stops whenever the music does become exciting—such as during the 1812 Overture.

How it Works. Take a look at the schematic in Fig. 5. Part of the circuit is similar to a triac lamp-dimming circuit. Triacs Q5, Q6 and Q7 function as electronic switches that control the brightness of the lamps because they are switched on at different times during a cycle of AC.

Switch-on time is controlled by the time constant of the R/C circuit made up of capacitor C9, resistor R10 and transistor Q2. Here, Q2, works as a variable resistor whose instantaneous resistance depends on the amplitude of the audio signal applied to its base.

If a large-amplitude signal is applied, the resistance of Q2 is low and C9 charges quickly. When the voltage across C9 reaches about 30 V, trigger diode D1 conducts, discharges C9 and supplies a switch-on pulse to triac Q5. Triac Q5 comes on for the remainder of the cycle and C9 begins to charge again. Because the resistance of Q2 is low, C9 charges and discharges fast supplying a steady barrage of turn-on pulses to Q5 which keeps the lamp brightly lit.

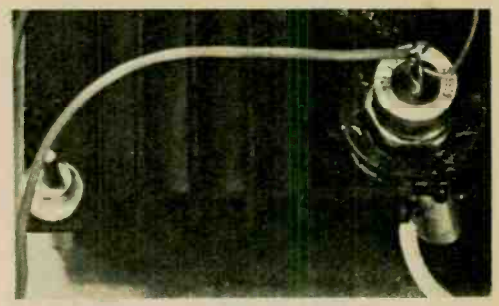


Fig. 3—Closeup photo shows how triac is mounted on heat sink with insulating mica washer. Note nylon washer under the heat sink's mounting nut.

If a low-amplitude signal is applied to Q2. its resistance is relatively high. Capacitor C9 charges slower, thus turn-on pulses are supplied less frequently, and the lamp remains dimly lit. The random timing of the turn-on pulses, in relation to the phase of the AC-line-current introduces the flicker.

Transformer T1 is an input transformer that isolates the output of your amplifier from the AC circuitry of the organ. You connect the input (primary) winding of T1 to the speaker terminals of an amplifier.

Transistor Q1 is a voltage amplifier that boosts the incoming signal to a level sufficient to drive the organ's channels. *Sensitivity* control R2 affects the response of the three channels.

The inputs of Q2, Q3 and Q4 are fed by frequency-selective filters. The band-pass filter comprising C3, C6, R4 and R7 allows only low frequenices (20 to about 400 cps)

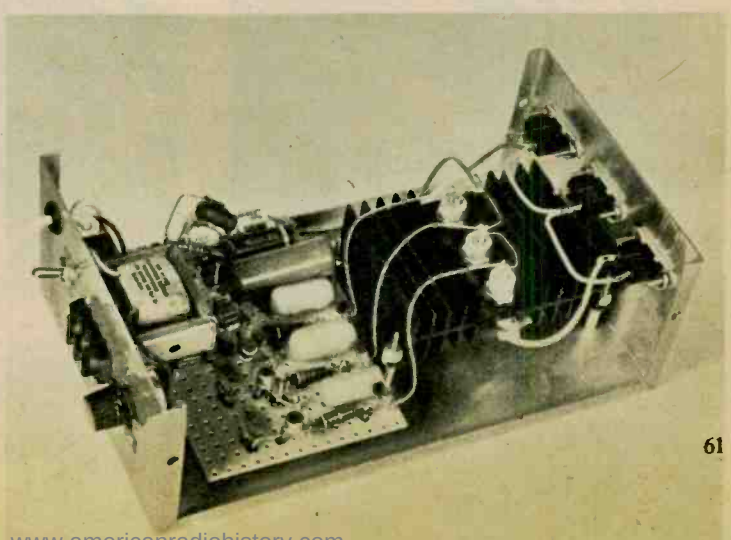


Fig. 4—Overall view of completed color organ. Perforated circuit board is mounted with spacers so its back is away from cabinet to prevent push-in terminals from shorting against cabinet. Use heavy wire to connect triacs to outlets on the back panel.

Hi-Power Color Organ

to activate Q2 and the Q5 channel.

The band-pass filter comprising C4, C7, R5 and R8 allows only mid-range frequencies (300 to about 2,500 cps) to activate Q3 and the Q6 channel.

The high-pass filter comprising C5, C8, R6 and R9 allows only high frequencies (over about 1,200 cps) to activate Q4 and the Q7 channel.

Since these filters are simple, low-cost R/C types, they do not have sharp cutoffs, and there tends to be some overlapping between adjacent bands, especially when the level of the input signal is high.

Construction. The circuit fits, with room to spare, in a 10 x 6 x 3½-in Minibox. All of the small electronic components, with the exception of the triacs, mount on a 5½ x 4-in. piece of perforated board. The triacs are mounted on a 3 x 4¾-in. aluminum heat sink.

Wire the circuit board first, following the layout in Fig. 2. This is important, since the voltage on the board is 150 VDC—high, indeed, for a transistor circuit. Use push-in terminals for tie points. Double-check the polarity of the electrolytic capacitors and silicon rectifier D4 before you solder to them. Note that the trigger diodes are not polarized.

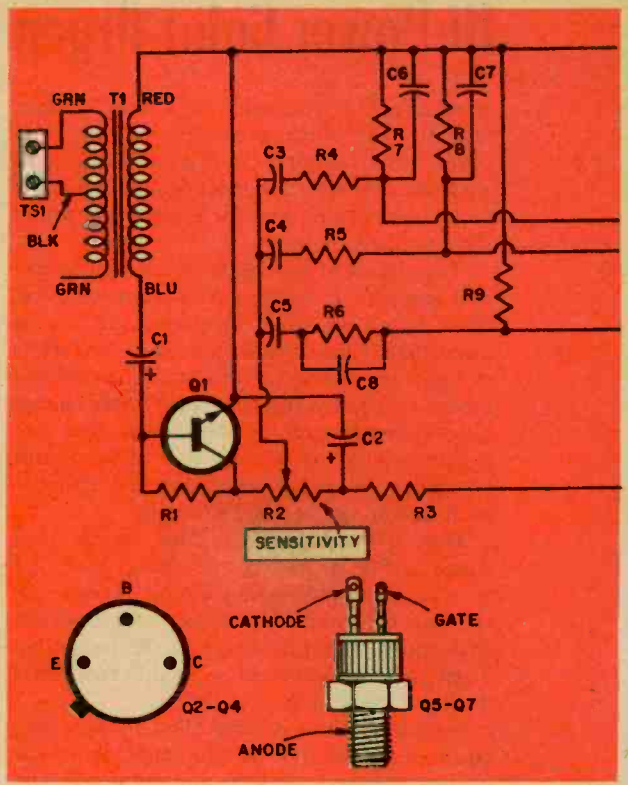


Fig. 5—Input signal is isolated by T1, amplified by Q1, then fed by R2 to R/C filters whose outputs are coupled to the three triac control circuits.

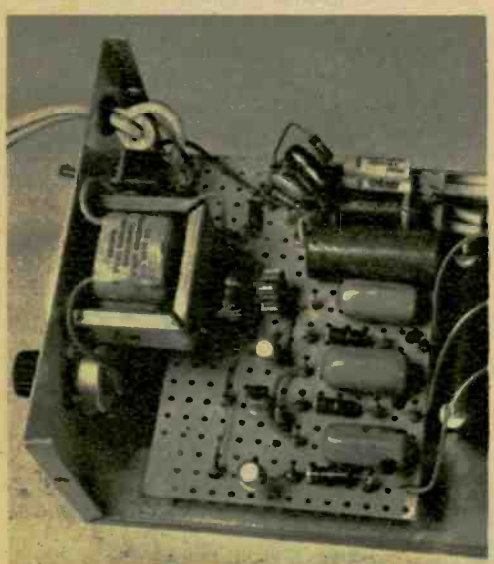


Fig. 6—Photo shows layout of parts on perforated circuit board. Much wiring on author's board is on back, although we show it on top in Fig. 2.

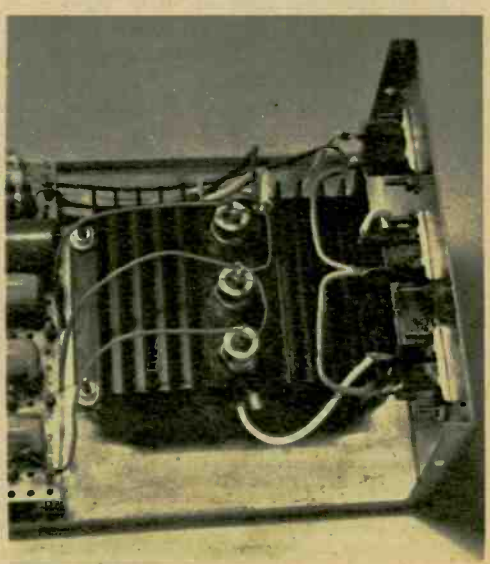
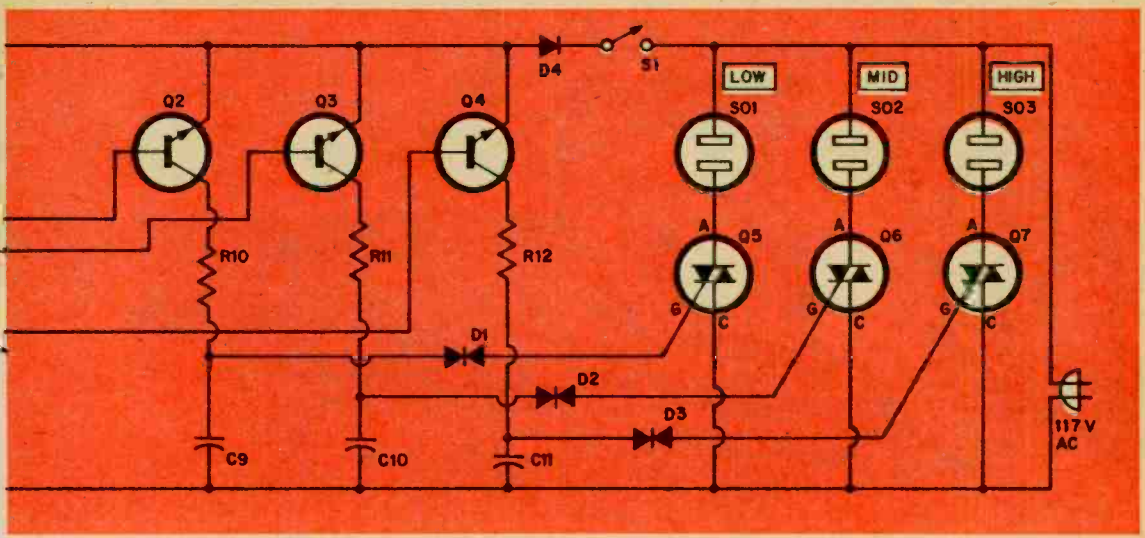


Fig. 7—Photo shows mounting of triacs' heat sink. Connections to anodes are made under heat sink. Note heavy wire connecting the triacs to outlets.



PARTS LIST

Capacitors:
C1—10 μf, 10-V electrolytic
C2—40 μf, 150-V electrolytic
C3—1 μf, 200-V mylar (not electrolytic)
C4,C5—.01 μf, 200 V paper or mylar
C6—.1 μf, 100-V mylar
C7—.01 μf, 100-V mylar
C8—.0039 μf, 500-V or higher ceramic disc
C9,C10,C11—.1 μf, 200 V paper or mylar
D1,D2,D3—HEP-311 bilaterial trigger diode (Motorola)
D4—HEP-156 silicon rectifier (Motorola)
Q1,Q2,Q3,Q4—HEP-712 medium-power NPN silicon transistor
Q5,Q6,Q7—Triac; minimum ratings: 200 V, 8 A (RCA 2N5569 or HEP-340)
Resistors: ½ watt, 10% unless otherwise indicated
R1—220,000 ohms
R2—5,000 ohm pot (2 watts or higher)
R3—1,000 ohms
R4—22,000 ohms
R5—4,700 ohms
R6—330,000 ohms
R7—47,000 ohms
R8—33,000 ohms
R9—5,600 ohms
R10,R11,R12—4,700 ohms, 1 watt
S1—SPST toggle or slide switch
SO1,SO2,SO3—Chassis-mount AC receptacle (Calectro F3-100)
T1—Transistor driver transformer; primary: 100 ohms, secondary: 100 ohms center tapped (Calectro D1-733)
TS1—Two-terminal barrier-type terminal strip (Calectro F2-234)
Misc.—10 x 6 x 3½-in. Minibox, perforated board, push-in terminals, 1-in. fiber spacer threaded for 6-32 screw (H. H. Smith 2134, *Allied Radio Shack 920-2134, 12¢ ea.), TO-5 heat sink for Q1 (Motorola HEP-502), 3 x 4¾-in. heat sink (*Allied Radio Shack 957-2950, $1.55 plus postage) * Industrial Catalog

They can be mounted in either direction. Put a TO-5 heat sink on Q1 after you solder its leads in place.

To mount the triacs, drill three ⅜-in.-dia. holes, evenly spaced on the heat sink's center surface. Carefully file and sand away all burrs. If these aren't removed they may perforate the thin mica washers that must be used to insulate the triacs from the heat sink.

Next, mount the triacs with the hardware supplied with them. The mica washers go between the triac body and the top surface of the heat sink, and between the underside of the heat sink and the mounting terminal and nut. The small plastic sleeve goes inside the mounting hole to insulate the triac's threaded stud from the heat sink. Place a small quantity of silicone grease on each washer, and spread it before you install the washer. This insures good heat conduction from the triac to heat sink.

Check that the case of each triac is insulated from the heat sink with an ohmmeter. And be sure to use insulated spacers to mount the heat sink in the Minibox. This precaution will keep the Minibox from becoming electrically hot. Use No. 14 wire for all connections between the triacs and AC sockets S01, S02 and S03. Be sure that the line cord is rated for 15-A service. Other wiring can be insulated hookup.

Switch S1 controls only the AC input to

[*Continued on page* 100]

The Fuzz Flies to UHF

The cops are finding new action on the UHF band and so can you!

By TOM KNEITEL

A FEW YEARS ago I ventured into New York City and while I was there I witnessed a horrendous automobile accident. When the boys in blue arrived it was obvious that more help would be needed to clear the mess and get things back to normal. Instead of reaching into the car to grab the mike, the cop asked his partner for a dime and went down to a corner phone booth to call in his report. When I asked him about this later, he replied, "To get through on that radio you have to make a reservation."

This rather weird story serves to dramatize the tremendous strain that the VHF frequencies, especially those used by police, have been operating under.

This problem of too many olives squeezing into the bottle caused the FCC to open up for full use an obscure part of the UHF band (450 to 470 mc, just below TV channel 14) to the channel-hungry public-service folks. Immediately following this announcement, license applications began pouring into the FCC. Large cities, realizing the possibilities of getting in on the ground floor of this new channel giveaway, applied en masse for just about every available police channel and many of the fire channels as well. The idea was to strike fast and reserve every channel in sight, often without stopping to give full consideration as to the availability of UHF communications gear, or where the money was going to come from to pay for it. Responding to the pile of applications, the FCC's computer merrily cranked out UHF licenses in ragtime tempo. In came the requests, out popped licenses—Philadelphia, Charlotte, Chicago, Boston, Washington, Dallas, Miami, Baltimore, Portland, Knoxville and all of the rest.

Chicago was on the ball. Their antiquated four-channel VHF system was long past being adequate. Their new UHF license authorized some 27 channels and they were in such a hurry to get it going that their first move was to establish UHF base stations that were equipped to work (via cross-band) VHF mobiles. Eventually the mobile units made the switch over to UHF, too.

Still, many other cities sat on their channels while they went around to their budget experts to get funds for equipment. Some

Fig. 1—Some of the new rigs that have appeared recently for bugging the fuzz are shown at right. In clockwise fashion, they are: The Allied Radio Shack Realistic Patrolman PRO-3, which covers action on UHF as well as on the high and low VHF bands. $198.50. The Bearcat by Electra has the automatic scanning function popular in many multi-channel receivers. The Unimetrics Reporter has manual tuning for UHF frequency selection and sells for $139.95.

channels were assigned to certain cities but have remained silent for years.

Besides the welcome relief of having more channel space, UHF users quickly learned that the new band offered some happy surprises. The band is quite free of noise from all sources—natural and man-made and this single factor alone made the channels particularly popular in cities where there is a normal high noise level. The very short wavelengths at these frequencies make gain antennas very practical and they are in extensive use in both base station and mobile installations. Omni-directional antennas for base station offering 6 to 10db gain are in wide use, as are 3 to 5db gain mobile antennas.

Because of their very short wavelength, UHF signals have greater penetration than either the high- or low-band carriers. Signals can be received inside buildings, under elevated railway structures and through other man-made obstacles to radio transmission.

The one apparent bugaboo noted by many early users of UHF was the fact that, under a given set of circumstances, the range of a UHF system proved to be about half that of high- or low-band VHF systems. Boosting the height of the base station antenna and/or adding a higher gain antenna seems to have solved this problem with a minimum of grief. Mountaintops and skyscrapers rapidly became sought after as sites for UHF transmitter/antenna sites (Los Angeles' Mt. Wilson sprouts countless UHF antennas, most users reporting reception at ranges of 100 miles).

Unlike standard operation on lower frequencies, where bases and mobiles share a single channel, UHF systems generally function with the mobile units operating exactly 5 mc higher in frequency than the associated base station (for instance, if the base station operates on 460.025 mc, the mobile units invariably operate on 465.025 mc). One reason for this is that the base station is automatically switched on whenever a transmission is received on the mobile channel and the mobile transmission is rebroadcast through the base station so that all other mobile units within the base station's range can monitor both sides of any communications. This is one big plus for the eavesdropper, for with VHF radio most listeners had to be content with hearing only the base side of the communications.

Upon becoming convinced that UHF was here to stay, equipment manufacturers produced a line of moderately-priced, superior quality monitoring gear for the hobbyist. A number of low-cost monitoring antennas (even gain antennas) are also available now. It is now possible to establish a top notch UHF monitoring station with the same ease (and cost) of a similar station for any other band (See Fig. 1).

The scanning type receivers, which have become so popular on the high, low, and

The Fuzz Flies to UHF

Fig. 2—High gain antennas for UHF come in small packages. This MON-20 by Antenna Specialists offers the user 4db of gain. $39.95.

EI'S GUIDE TO THE FUZZ ON UHF

City	Frequency (mc) in Use
Baltimore, Md.	453.05 453.20 453.30 453.35
Boston, Mass.	453.20 453.30 453.35 453.40 460.075 460.125 460.175 460.225 460.25 460.35 460.40 460.40 460.45 460.50
Chicago, Ill.	460.05 460.075 460.10 460.125 460.15 460.175 460.225 460.25 460.275 460.30 460.325 460.35 460.375 460.40 460.425 460.45 460.475 460.50
Cleveland, Ohio	460.125 460.15 460.225 460.275 460.35 460.40 460.45 460.475 460.50
Dallas, Tex.	460.025 460.075 460.125 460.175 460.225 460.275 460.325 460.375 460.40 460.425 460.475 460.50
Detroit, Mich.	453.25 453.30 453.35 453.55 453.75 453.80
Los Angeles, Calif.	453.35 460.40
Milwaukee, Wisc.	453.35 460.35 460.45
New York, N.Y.	453.50
Philadelphia, Pa.	453.15 453.20 453.25 453.30 453.35 453.40 453.55 453.65 453.75 453.80 453.95 460.15 460.35 460.40 460.45
Pittsburgh, Pa.	453.25 453.40 453.55 453.70 453.85
St. Louis, Mo.	453.40 460.025 460.05 460.075 460.10 460.125 460.15 460.175 460.20 460.225
San Francisco, Calif.	460.075 460.10 460.25 460.35 460.45 460.50
Seattle, Wash.	453.90
Washington, D.C.	460.025 460.10 460.15 460.20 460.25 460.275 460.325 460.35 460.40 460.425 460.45 460.475 460.50

aeronautical bands, are now available for UHF from Electra, Regency (Regency Electronics, Inc., 7900 Pendleton Pike, Indianapolis, Ind. 46226) and Unimetrics. These sets have the ability to scan across any number of crystal- controlled channels and sample each channel for a signal. When an active channel is detected the receiver locks onto the channel and stays there until the transmission is completed. It then resumes its high-speed scanning. Switches on the gear permit you to bypass any channels which are not desired, or you can manually tune the set across the channels. Sonar (Sonar Radio Corp., 73 Wortman Ave., Bkly., N.Y. 11207), which produces scanner receivers for lower frequency bands, will probably join the UHF scanning market in the near future.

Unimetrics (Unimetrics, Inc., 23 W. Mall, Plainview, N.Y. 11803) offers a 6-channel crystal controlled UHF receiver called The Reporter. This set does not scan, but permits manual selection of the channels. For those interested in exploring a wide variety of unknown channels, fully tunable receivers are available from Midland and Allied Radio Shack. These sets combine UHF-ability with facilities for also tuning the high and low VHF communications bands.

You can even get started in UHF monitoring on a flea-powered budget (less than $20) by means of a converter. Electra (Electra Corp., Cumberland, Ind. 46229) has a unit called the Little Tiger which will convert any modern AM radio having a ferrite antenna (even a small transistor set) into a single-channel UHF receiver. As mentioned above, the base stations rebroadcast the mobile transmissions, so that a single-channel receiver is sufficient to hear both sides of a UHF conversation.

A standard (unity gain) ground plane antenna is fine for local reception and these are available for about $9. If you really want to pull 'em in from out in the sticks you can get a monitoring antenna offering 4db gain for less than $40 (Fig. 2. Antenna Specialists Co., 12435 Euclid Ave., Cleveland, Ohio 44106). The small sizes of these antennas, as compared to their larger lower frequency brothers, makes mounting a snap and relieves you of fears about high winds or ice damaging the installations.

Once you have a rig and an antenna, you can count yourself among those in the *new* bugging the fuzz business. In the table you will find a representative listing of several cities, followed by

[*Continued on page* 102]

Heathkit GR-370 and GR-169

Two Solid-State Color TVs

COLOR TV advances occur so swiftly that to keep up you have to run to stand still. In addition to improvements in picture tubes and circuitry, the big news is the shift toward solid state and easier serviceability.

Examples of right-on state-of-the-art color-TV receivers are Heathkit's $539.95 Model GR-370 and the $349.95 Model GR-169 kits. To make apparent the changes that have taken place, go back to the Jan. '70 EI. In that issue we reported on the Heathkit GR-681 color-TV receiver. It was a tube set that had three printed-circuit boards attached to a vertical chassis that could be swung out for servicing.

In the fall of 1970 and the winter of 1971, Heath announced a new line of color-TV kits—and the differences and advances were notable. Except for the picture tube and high-voltage rectifier, the 370 and the 169 are solid state.

And instead of the not-so-easily removable circuit boards on the 681, the 370 has ten plug-in circuit boards (sound, luminance, video output, chroma, 3.58-mc oscillator, AGC/sync, vertical oscillator, horizontal oscillator, horizontal output and pincushion). The 169 has eight boards; there are no pinchushion or horizontal-output boards.

This design greatly simplifies construction and servicing and is the most important feature of the 370 and 169. Should a board be defective, you simply pull it off the chassis and send it to Heath for repair. (Heath boasts a mail-in repair service with 48-hour turnaround.) During the initial 90-day period of ownership, the board will be replaced or repaired free of charge. From 90 days to two years after purchase, any board will be serviced or repaired for $5. (The picture tube is warranteed for two years.)

Solid-state's advantage? One is cooler

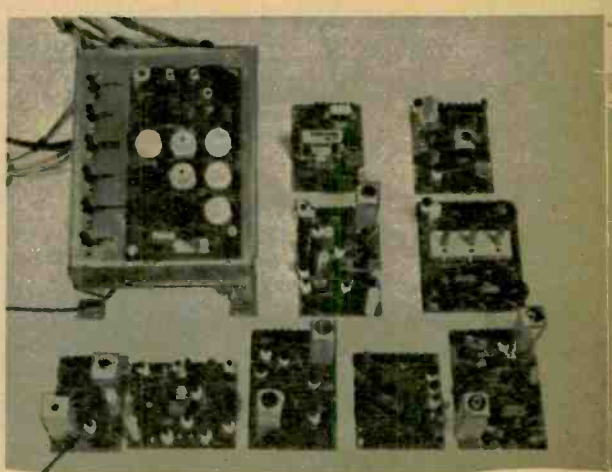


Fig. 1—Nine of 370's plug-in boards and convergence board (upper left). The 169 has eight plug-in boards; four of them are identical to the 370s.

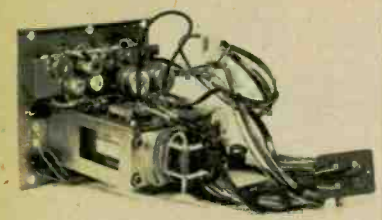


Fig. 2—370's front-panel assembly includes VHF and UHF tuners and operating controls. Note drive motor on VHF tuner.

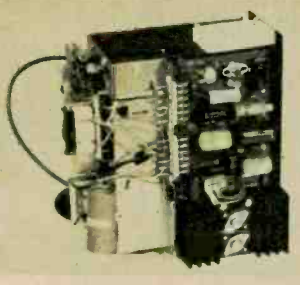


Fig. 3—370's high-voltage assembly comes completely built. Tenth plug-in board, horizontal output, is at top, right.

Fig. 4—Troubleshooter supplied with 370 and 169 is 20,000-ohms-per-volt volt-ohmmeter. It is used for check-out.

Two Solid-State Color TVs

operation. Another is low power consumption—something important in today's power-scarce markets. A large-screen tube color set draws 300 to 400 watts. A comparable transistor model draws about 200 watts. Reliability compared to a tube set? Time will tell.

The 370 has a 23-in. (diagonal), 295-sq.-in. rare-earth-phosphor picture tube. It also is available as the GR-370MX with a matrix tube for $10 more. Its kid brother, the GR-270, has a 20-in. (diagonal), 227-sq.-in. tube.

The latest version, which is electrically the same as the 370, is the GR-371MX. It boasts a 25-in. (diagonal), 315-sq.-in. ultra-rectangular matrix picture tube. It's $40 more than the 370.

The 370 shown in the photo at the top left of the first page of this report is in the $79.95 Contemporary walnut cabinet and has a $64.95 wireless remote control. This makes total cost $684.85.

The 169 portable shown at the top right has almost the same circuitry as the 370. The picture tube is a 14-in. (diagonal) 102-sq.-in. size. The price stated includes cabinet, but not wireless remote control, which is not available for it.

Let's take a look at some of the features of the sets. Instant-on . . . well, almost. The picture-tube filaments are kept warm. When the set is turned on the sound comes on instantly and the picture comes on a few seconds later.

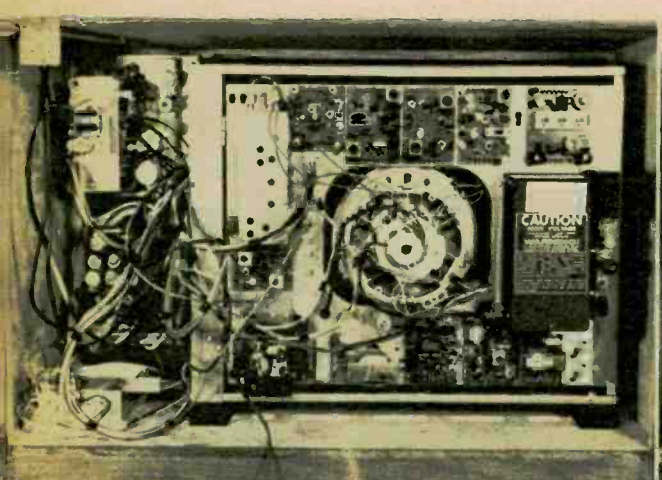


Fig. 5—Rear of 370. Front-panel assembly is in upper left, dynamic-convergence board is under it. Wireless remote control receiver is at the bottom.

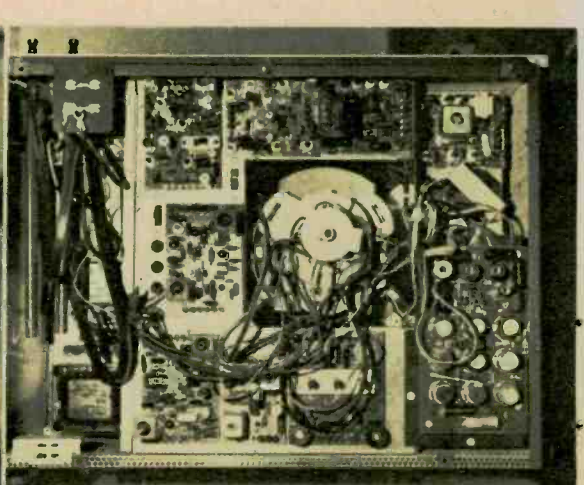


Fig. 6—View of rear of 169. Layout is similar to 370s. Dynamic-convergence board is mounted on the lower right corner of swing-out chassis.

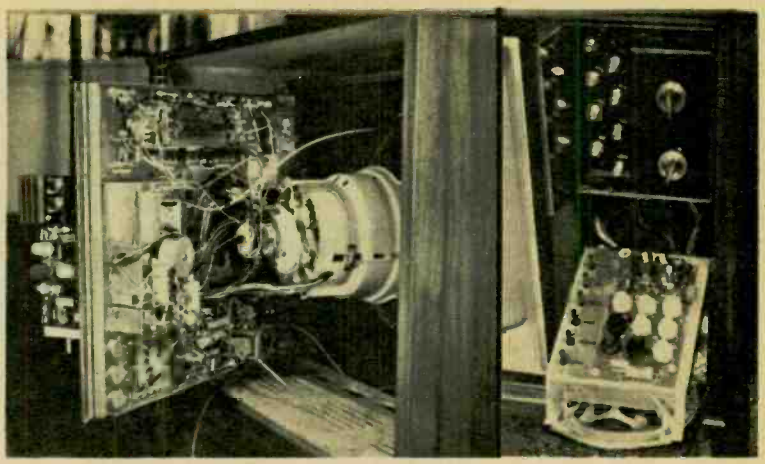


Fig. 7—The 370 exposed. Photo at far right shows operating controls at top. Beneath them is drop-down panel on which there are additional controls and dynamic-convergence board. Photo at near right shows how main chassis can be swung out for easier servicing.

The 370 has power tuning. Push a button and the VHF channel will be advanced by a motor until the button is released. Both sets have a three-stage pre-assembled IF strip, and can be wired for low or high AC line voltage. The 370 has four ICs, the 169 has three. All transistors are socket mounted. Degaussing is automatic on the 370, while on the 169 you push a button to degauss. There's a built-in dot generator, 300- and 75-ohm antenna inputs, 4- and 8-ohm and hi-fi outputs (1 watt, 8 ohm on the 169), swing-out chassis and preassembled wiring harnesses. The 370 has automatic fine tuning (AFT).

The 370 has gun-shorting switches; the 169 has clip leads which you connect to resistors to short each gun. Both kits are supplied with a 20,000-ohms-per-volt volt-ohmmeter for troubleshooting (Fig. 4). The 370 has a silicon controlled rectifier (SCR) horizontal-sweep system, the 169 uses ordinary horizontal-output circuitry. The dynamic convergence board comes out of the front of the 370 and is on the back of the 169.

There are other important features, too. The color oscillator uses an IC—unique with Heath. The IC and a varactor control the oscillator's frequency, thus simplifying that part of the color system. The APC (automatic phase control) detector supplies a correction voltage any time the color oscillator doesn't lock right in with the color-sync burst from the TV station.

The VHF and UHF tuners are transistor. Along with the low-noise three-stage transistor IF strip, this keeps internally-generated noise (snow) way down.

In the 370's video section there's a peaking control. What it does is vary the high-frequency compensation in the video-signal's path. This sharpens up the leading edges of video pulses, which makes the picture look sharper.

Another important feature is ABL (automatic brightness limiting). It protects the picture tube from too much beam current. To some degree it protects the high-voltage system from overload (although that's no problem with a tube high-voltage rectifier). This brightness limiting works almost instantly—in a few microseconds. You don't

[*Continued on page* 95]

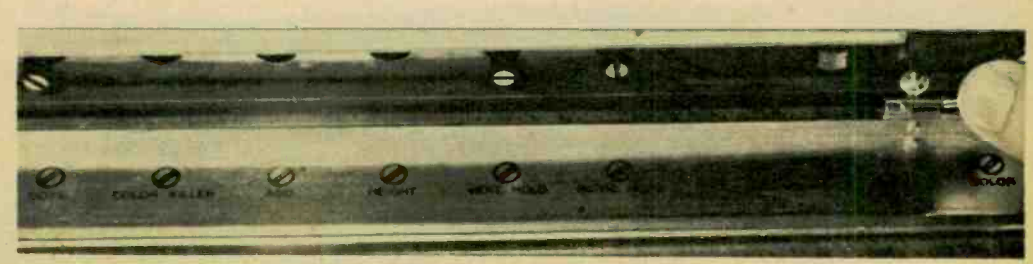
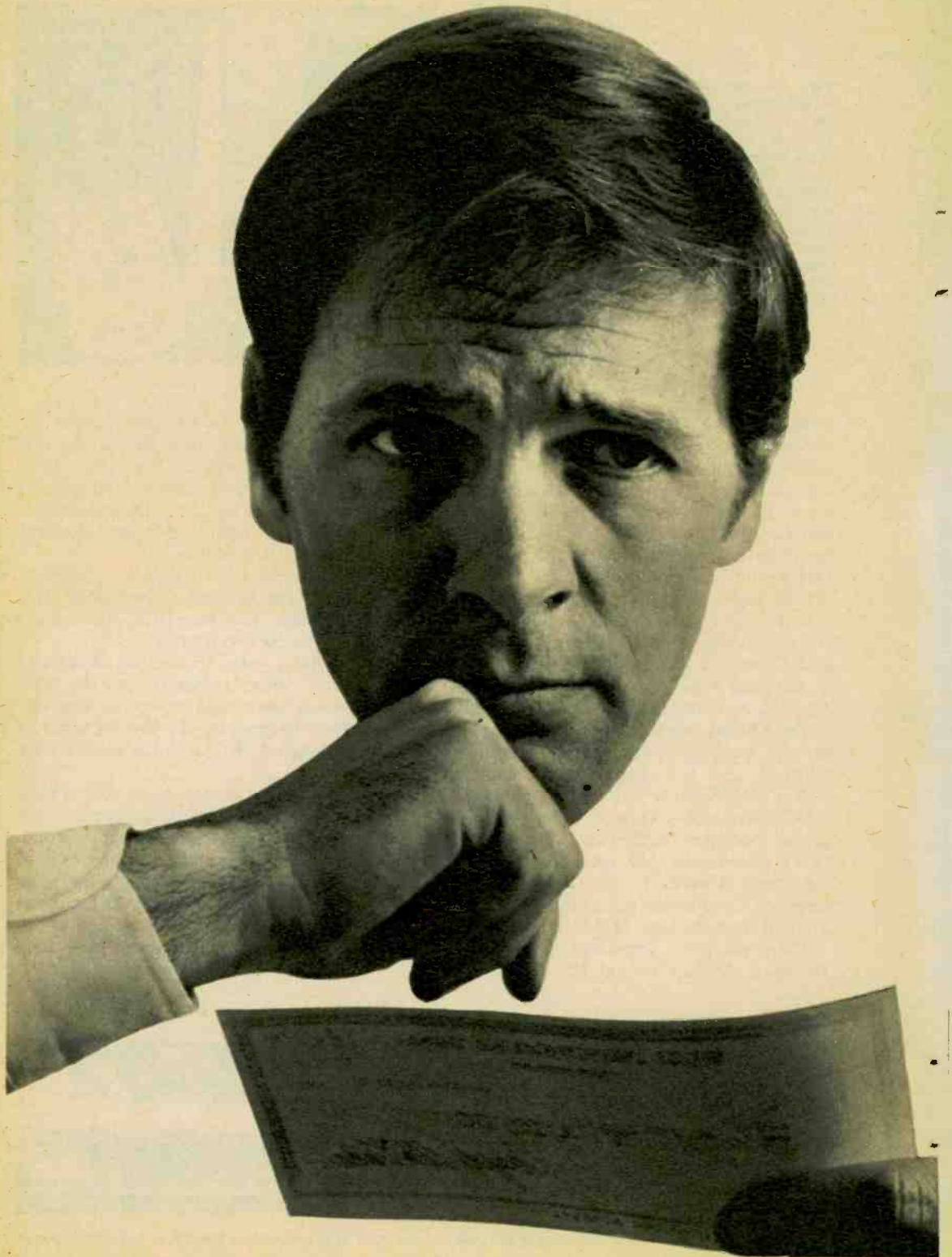


Fig. 8—The 169's operating and service controls are on front of set at bottom behind a drop-down panel.



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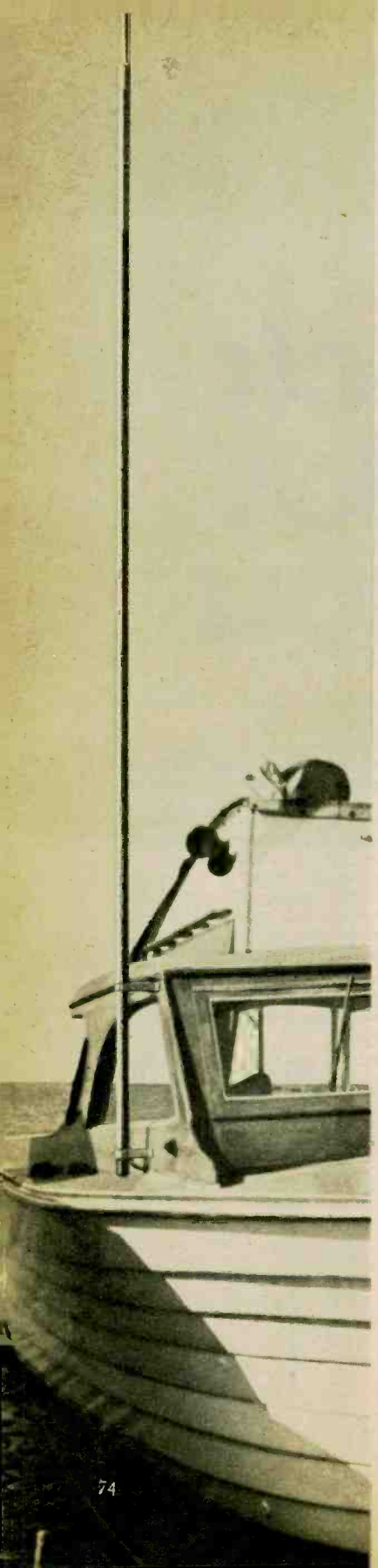


Low-Cost High-Performance Antenna for Boats

By RONALD LUMACHI, WB2CQM

SAFETY-oriented boat owners always put the ship-to-shore radiotelephone at the top of their list of essential nautical equipment. Since FCC regulations are quite explicit about the performance requirements of such transceivers, boat owners *must* purchase commercially-built, FCC-approved equipment.

To fully realize the potential of a radiotelephone, an antenna of proper design must be installed. FCC regulations do not prescribe any particular type; consequently, boat owners may construct one. And ours is equal or better in performance than commercial antennas selling upwards of about $60.

For those interested in a 24-ft. marine-band antenna boasting low cost, extreme durability, and maximum propagation characteristics consider this easily-constructed skyhook. The antenna may be used with any marine radiotelephone requiring a low-impedance (5-15 ohms) load. It may also be used to up-grade undersize marine antennas which, because of their lack of height, may restrict range.

The Design

Generally the small-boat marine antenna is a center-loaded vertical affair that has an omnidirectional transmitting and receiving pattern. To electrically lengthen the antenna a coil, positioned over an insulating support is connected in series between the lower and upper radiating sections. This combination of components resonates the antenna in the 2-5 mc marine band.

Coil Assembly

To start, purchase a 42-in. length of 1½-in. wood dowel. A 30-in. section serves as the series insulator and coil support. Coat the wood with either shellac, varnish or paint to weatherproof it.

At four equally-spaced points (Fig. 8) around the dowel dado or hand chisel ⅜ x ⅛-in. channels down the dowel length. These guide the plastic coil supports as the coil is slid on the dowel.

Drill the inside (Fig. 5) of a ¼ x 2-in. long brass nipple (¼ NPT) with a 21/64-in. bit, then thread the inside with

a ⅜-24 tap. Drill a 25/64-in. hole in the top of the coil-support dowel (Fig. 7) and force the nipple in the hole.

The coil length will be 21 to 24 in.; the final determination of length depends on the particular installation and radiotelephone's characteristics. For ease of construction, purchase commercially wound 1½-in. dia. eight-turns-per-in. coils. However, you may hand-wind the coil with No. 16 enameled wire. Commercial coils are wound only to a length of 10 in., therefore, purchase three and cut the third coil to length of 4 in. Solder the coils to each other (Fig. 4) for a total length of 24 in. Before sliding the coils in place apply a liberal amount of epoxy cement in the four channels on the dowel. Allow the coil to dry in position on the dowel. There should be space between the windings and the dowel.

Lower Vertical Support

The lower vertical support (the mast in Fig. 1) is made from a 12-ft. length of 1½-in.-dia. aluminum tubing; a heavy wall thickness is required. The inside dia. of the tubing will accept the wood coil support with a force fit. Drill a small hole for a self-tapping screw near the upper portion of the support, then connect one end of the coil to the mast. This connection is only temporary since final tuning will subsequently be made at this point. Force fit 6 in. of the remaining dowel into the base end of the mast. Drill a ¼-in. hole in the lower aluminum all-angle base support (Fig. 3) for a 1¾ in. brass nut and bolt. The radiotelephone's antenna wire will be attached here.

Upper Vertical Section

The upper section is a standard 102-in. stainless-steel CB whip threaded (⅜-24) at its base. Drill and tap the base (see Fig. 9) for a 6-32 brass screw. Thread the whip into the brass nipple at the top of the coil support. Connect the (upper) free end of the coil to the base of the whip.

Installation

Since it may be necessary to raise and lower the antenna to clear obstacles, you can add a lay-down feature. A small TV-antenna

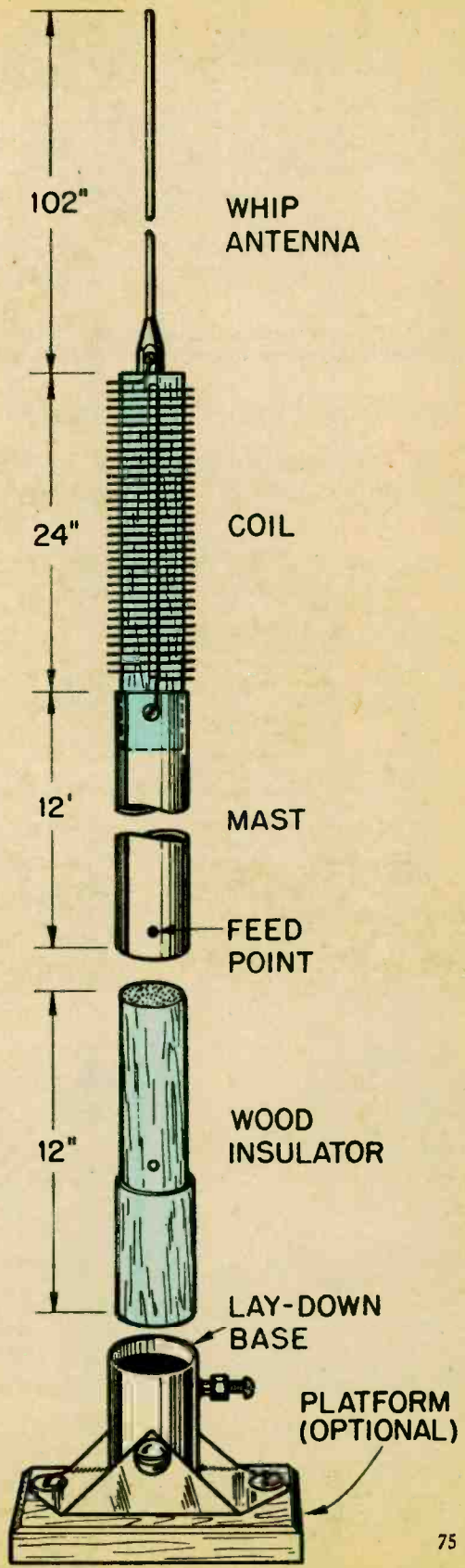


Fig. 1—Antenna consists of 102-in. CB whip antenna attached to 30-in. wood dowel on which is mounted loading coil. Dowel is forced in 12-ft. TV mast that's attached to base with 12-in. dowel.

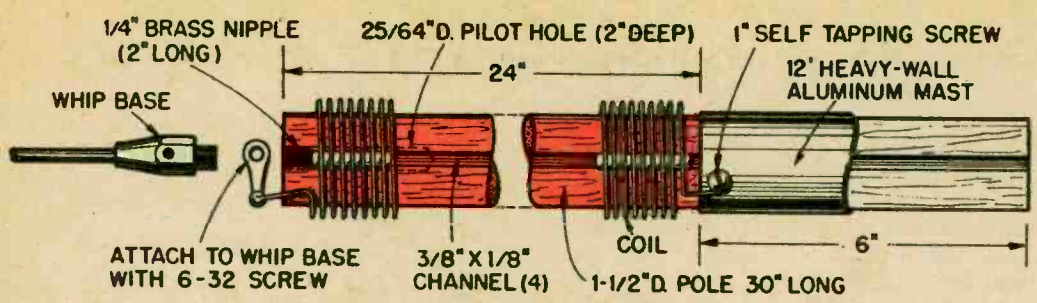


Fig. 2—Detail of loading-coil construction. Whip at left is screwed in threaded pipe nipple which is forced in 30-in.-long support dowel. Ends of coil are attached to whip antenna and to 12-ft. TV mast.

Low-Cost High-Performance Antenna for Boats

PARTS LIST

Base, all-angle (Burstein Applebee, 3199 Mercier St., Kansas City, Mo. 64111. 75¢ plus postage. Stock No. 7A206)
Bolt and nut, 1¾-in. long brass
Dowel, 42-in. long, 1½-in. dia.
Inductor, 1½-in. dia., eight turns per in., No. 16 wire, 10-in. long. (Air Dux No. 1208T. Jeff-Tronics, 4252 Pearl Rd., Cleveland, Ohio 44109. $3.18 plus postage)
Nipple, 2-in. long, ¼ NPT
Tubing, aluminum, 12 ft. long x 1½ dia. Heavy wall (minimum 0.058 in.)
Wall bracket, stainless steel (Lafayette 18 F 01968)
Whip, CB, 102 in. (Lafayette 42 F 10225 WX or Burstein Applebee 9A49. BA price $5 plus postage
Misc.—Alligator clip, solder lugs, self-tapping screw, epoxy cement

base mount (Fig. 11) provides this flexibility. The upper mount utilized one (of a pair) of stainless-steel TV-antenna wall brackets (Fig. 12). Wind several layers of black tape around the mast at this point.

For rapid lay-down it is only necessary to replace the two locking nuts with ¼-20 wing nuts so that they can be easily loosened by hand. If the lay-down feature is not needed, use the second wall bracket for the lower mount. In order to minimize strain, position the brackets as far from each other as possible. A 2-ft. separation is adequate.

Antenna placement, although not critical, should be given more than passing attention. Mount the antenna as close to the radio as possible to minimize long wiring runs. Avoid feed-thru insulators since they tend to restrict the flow of RF. They may also be dangerous if touched when transmitting. Solder all connections. Use solder lugs where necessary.

Fig. 3—All-angle base for TV antenna permits antenna to be swung down for a low bridge.

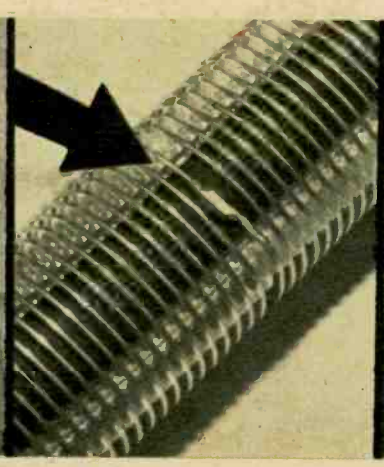


Fig. 4—Three 10-in. coils must be soldered together. Arrow points to connection of two coils.

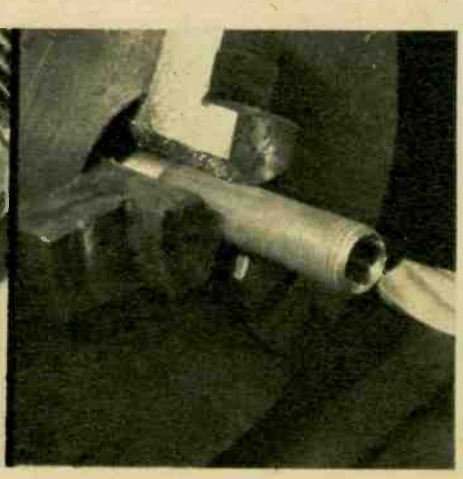


Fig. 5—¼ NPT pipe nipple must be drilled with 21/64-in. bit prior to threading it with a ⅜-24 tap.

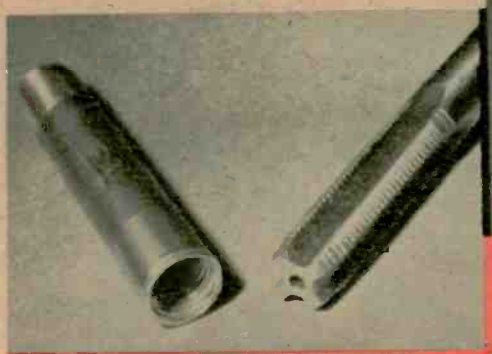


Fig. 6—Inside of nipple has been threaded with ⅜-24 tap. Base of CB whip, which has ⅜-24 thread, is screwed in nipple.

Fig. 7—Prepared nipple is force-fitted in 21/64 x 2-in.-deep hole drilled in top of the wood-dowel coil support.

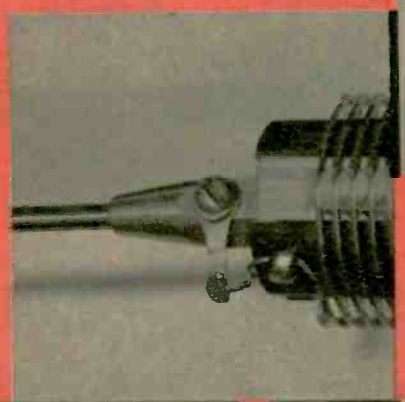


Fig. 8—Photo above shows dowel in which ⅜-in. wide x ⅛-in. deep channels have been cut to accommodate plastic supports on the coils.

Fig. 9—Photo at left shows coil connection to CB whip antenna. Whip base is screwed into the nipple which is in the wood dowel.

Fig. 10—Precise coil length is determined by shorting-out turns at tune up. Remove excess turns.

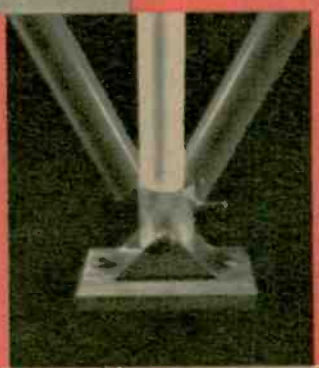
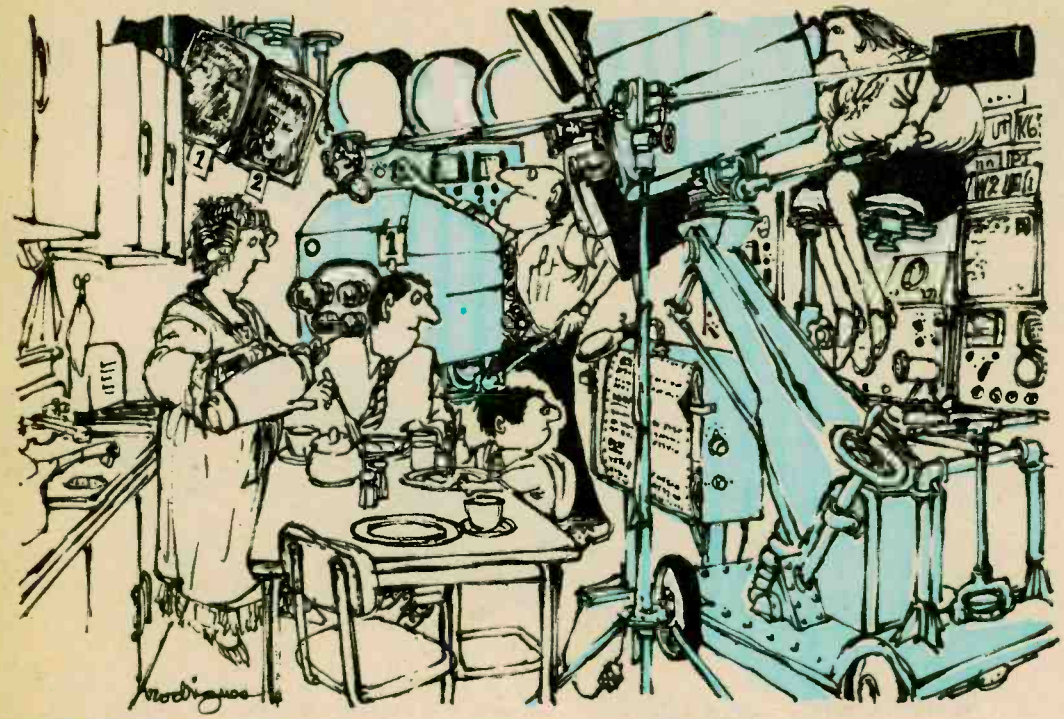


Fig. 11—Multiple exposure of all-angle base shows how antenna is lowered before a low bridge.

Fig. 12—Standard wall bracket supports mast 2-ft. above base. Insulate mast with electrical tape.

Final Tuning

Test the antenna with a full length of coil (24 in.). Should the transmitter refuse to load, disconnect the bottom end of the coil from the aluminum mast. Install one end of a length of wire to the self-tapping screw. Install an alligator clip at the other end of the jumper wire. Short out one turn of the coil at a time and check the transmitter's output. A 3-A RF ammeter will be helpful in this procedure. Tune for maximum meter indication. Remove the unused coil turns and reconnect the free end of the shortened coil to the connection point.



SSTV— Budget Television for Hams

Now you can see if that YL looks as good as she says she does.

By WAYNE GREEN, W2NSD/1

A PICTURE of Queen Elizabeth appeared on the screen of the small TV monitor. Moments later, after a break in communications, the streets of Tokyo appeared. These were both live transmissions of pictures over a distance of several thousand miles.

Under most circumstances, a description like this could apply only to a TV network fed via a multi-million dollar satellite. But in both cases, rather than coming to CBS Control in New York, these pictures were being viewed in a small ham shack in New Hampshire where a run-of-the mill SSB rig and a few hundred dollars in extra equipment were pulling in the latest vogue in hamming —slow-scan television (SSTV).

SSTV earns its name because it has a scanning rate that is much slower than conventional TV. To use a commercial TV camera for SSTV its horizontal and vertical sweep circuits would have to be modified for the slower sweep frequencies. Another way in which SSTV pictures are produced is with a flying-spot scanner. Here you cannot broadcast live action, but must rely on a slide that is scanned by a dot of light produced by the fast-moving electron beam of a CRT that is focused on a slide. The light passing through the slide modulates a phototube. This video information is combined with vertical and horizontal sync signals which modulate a conventional ham transmitter via the mike input.

An SSTV signal is a 1,500-cps tone which is shifted down to 1,200 cps for sync information and modulated upward to 2,300 cps for picture information. The 1,500-cps tone represents black and 2,300 cps is white, with tones in between giving shades of gray. The 1,500-2,300 shift is exactly the same for facsimile, by the way, so receiving converters can be used for either service. A 5-ms burst

of 1,200 cps tone gives the horizontal sync pulse while a 30-ms pulse of 1,200 cps is used for vertical sync. A horizontal sweep rate of 15 cps and a vertical sweep of eight seconds results in a horizontal resolution of 120 lines. None of these standards are critical, by the way.

Since an FM-type signal is used for sending the information, the receiving monitors can have a good deal of limiting built in, thus making the system relatively immune to interference from voice signals in adjacent channels. One of the major benefits of any FM system is this capture effect, which lets the dominant signal come through easily and reduces or eliminates the effect of the others.

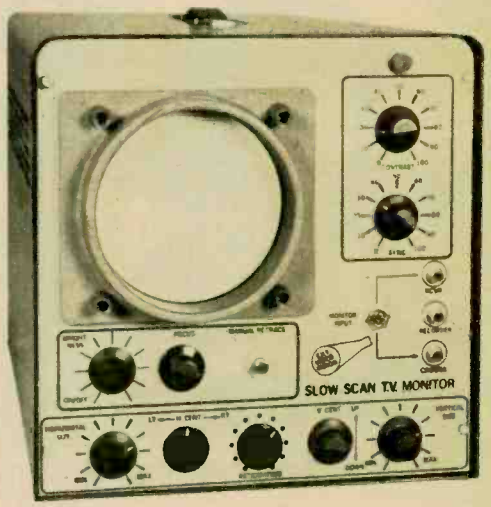
Although the idea of SSTV was widely circulated in the late '50s, the first serious ham experiments took place in 1967 when the FCC licensed a small group of amateurs to explore the feasibility of the idea. The experiments were a success and in August, 1968 the FCC announced frequency allocations for amateurs desiring to use SSTV.

The problem facing the pioneers of SSTV was one of narrowing the bandwidth of the television signal to a point where it does not take any more room in the crowded spectrum than a voice signal. Those of you who tune the amateur bands know that they succeeded, for you have been hearing amateurs pause in their voice contacts to send short transmissions of raspy bird chirpings. These are the sounds of SSTV pictures being transmitted.

By cutting out a few little frills of an ordinary TV signal, amateurs have been able to compress an SSTV signal to the point where instead of wiping out half of the short-wave bands for one signal, the bandwidth is no more than that required for a normal voice contact. This has also simplified the recording of these signals and they can be put on the average audio tape recorder instead of one of those thousand dollar video recorders.

Just what sacrifices do we have to make to cut the TV signal bandwidth down from 4 mc as with commercial TV to 2 kc? Well, we lose a little bit here and there. Picture, if you will, *Laugh-in* coming through to you, one picture every eight seconds instead of 30 pictures a second. As you might imagine, this slows down the motion a bit. In fact it stops it entirely. We also have to settle for a little cut in picture quality too. The 525 lines that make up the regular TV pictures are cut back to 120 lines, making the amateur SSTV picture look a lot more like a coarse newspaper photo or a wirephoto (see Fig. 2).

With SSTV we are sending individual pictures instead of movies. These pictures are normally sent in black and white, but as you



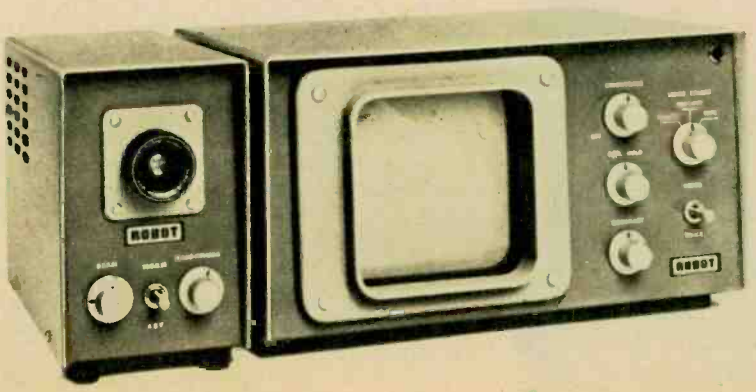


Fig. 1—Only two companies have really jumped into the slow-scan television pool so far. They include Robot Research, which manufactures the camera and monitor shown at left. These are known as the model 80 and 70 respectively and each sells for $569. The other outfit in the SSTV market is EKY Video Vision which makes the monitor above. It is available as a kit or in wired form at $300.

SSTV– Budget Television for Hams

Fig. 2—Although SSTV has more rudimentary specs than commercial-type television, a very high quality picture can be obtained as evidenced in these three photos taken of an SSTV monitor.

might imagine, a few amateurs have been trying their hand at sending color pictures.

It is exciting to be able to see pictures of the chap you are talking with, his ham station, his home, family, town, perhaps a map of the general area, and other illustrative material. Amateurs who are set up for this are extremely enthusiastic about it and most of them speak glowingly of the interest that is bound to develop as more amateurs find out what they are missing.

The equipment required for SSTV is somewhat complex, but it is certainly simpler than the apparatus required for regular ham TV. There are a couple thousand amateurs sending these ham TV pictures to each other, but they are restricted to the 450-mc band because they are using commercial TV standards. Their pictures can be picked up on any home TV receiver with a simple high-frequency converter. The SSTV signals cannot. A special monitor is needed to see SSTV pictures.

The eight-second long picture requires a special tube in the monitor, one which will hold the image for eight seconds instead of letting it fade out almost immediately. Military types will remember the PPI scopes used with radar to simulate the map of an area. The phosphor on this type of scope tube holds its image long enough for you to see the entire picture, but fades out fast enough so the next picture doesn't superimpose over the last one. Unfortunately the supply of these old radar tubes selling at $5 or under is dying out and most builders have to settle for new and much more expensive scope tubes.

Articles have appeared on constructing the monitors, cameras and flying spot scanners for SSTV. As with any other aspect of amateur radio, when a need pops up for something new, entrepreneurs immediately jump to fill the need. Two companies are already turning out equipment for SSTV, one a small one-man concern, the other a larger facility. (See Fig. 1.) The larger, Robot Research (1250 Prospect St., La Jolla, Calif. 92037) has recently started production on a camera and a monitor. The price is a little high by amateur standards, running to almost $1200 for the complete system.

The Robot Model 80 camera transmits a 120 line picture, equivalent to a one column newspaper photo, in eight seconds. This can be sent over the radio, telephone wires, or

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The Ham Shack

By Wayne Green
W2NSD/1

A RECENT letter from WB8HCL says, "I want to thank you for my ham ticket. Do you remember writing in the September 1968 issue of Electronics Illustrated that, 'It's not difficult to get a ham license. One week of serious work and you should be able to get a Novice ticket.'? That line was the reason I decided to get mine." Good for Bob, who now has his Advanced Class license and is having a ball.

It is still just as easy as ever to get that first license. It takes about six hours on the average to learn the code well enough to pass the 5-wpm exam. The theory required is on the high school level and really shouldn't take much more than a week of spare time to master. From there on you are in the running for fun.

Any radio amateur will be able to give you the Novice license exam. This license is free so you don't even have to worry about that $9 fee that goes with the higher classes of license. Basically the Novice is a permit to have the time of your life.

Novices are only permitted to use CW (code) and this is limited to special parts of the amateur 80-, 40-, 15- and 2-meter bands. Before you start groaning about being restricted to code, give the matter a little thought. Many old-time amateurs feel, with good reason, that CW is the only true amateur communication. The use of CW requires a skill that few others possess. The skill of using CW is like most other skills, the better you are at it the more fun it is to use. You will find no one who is capable of using code at high speeds who speaks disparagingly of code.

There is something almost magical to the uninitiated about copying code. It seems much more difficult than it actually is and friends watch in wonder as you sit there just listening to a bunch of beeps coming through and then know what was said. With a few weeks practice you can copy everything in your head, which is even more astounding to the non-ham. As you get better you can hear what is being sent and carry on a conversation at the same time with a visitor stopping only to answer back when your turn comes to transmit.

Novice CW can be fun if you have good equipment and it can be terrible if you are making do with rotten gear. A CW receiver should be stable and have a narrow filter for separating the stations. It might help if you keep this in mind when you are ready to invest in a receiver: the depreciation on a $100 receiver (perhaps worth $50 after a year) is not much different than the drop in value of a $300 receiver when trade-in time arrives. The best bet is to look around for a good used receiver such as an old Drake 1A or 2B or one of the better Hammarlunds. These old receivers hardly change in price from year to year and can often be used for your Novice year and then traded off for as much as you paid in the first place.

On the transmitter end you will want to run the full 75 watts permitted. There are enough problems with interference without having other chaps clobbering you with higher power. It looks as if the FCC may relent a bit on the crystal-control requirement for the Novice bands and permit the use of some variable—frequency oscillators. This will be a tremendous help in getting out from under interference. Novice crystals are not expensive and are resalable later on, so it is worthwhile to get in a good supply.

Many amateurs staunchly proclaim that home-brewing can be the most fun of all. This is undoubtedly the case, but the frustrations of trying to get a first rig going have knocked off more than one Novice. Building can be a lot of fun, but why not go the chicken route first and buy that first receiver and transmitter. If you are able to build a second one that works better than the commercial rig, you are ahead of the game. If not, well, you are still on the air and enjoying contacts.

Which bands are best to use? Let's forget the two-meter allocation, since CW activity there is zilch. The 15-meter band is fine for working DX. While some Novices are able to contact well over 100 countries on this band and develop some very interesting international friendships, the average Novice who is restricted to an hour or so after school each day finds that his country total gets up around 20 or 30 and then slows down dras-

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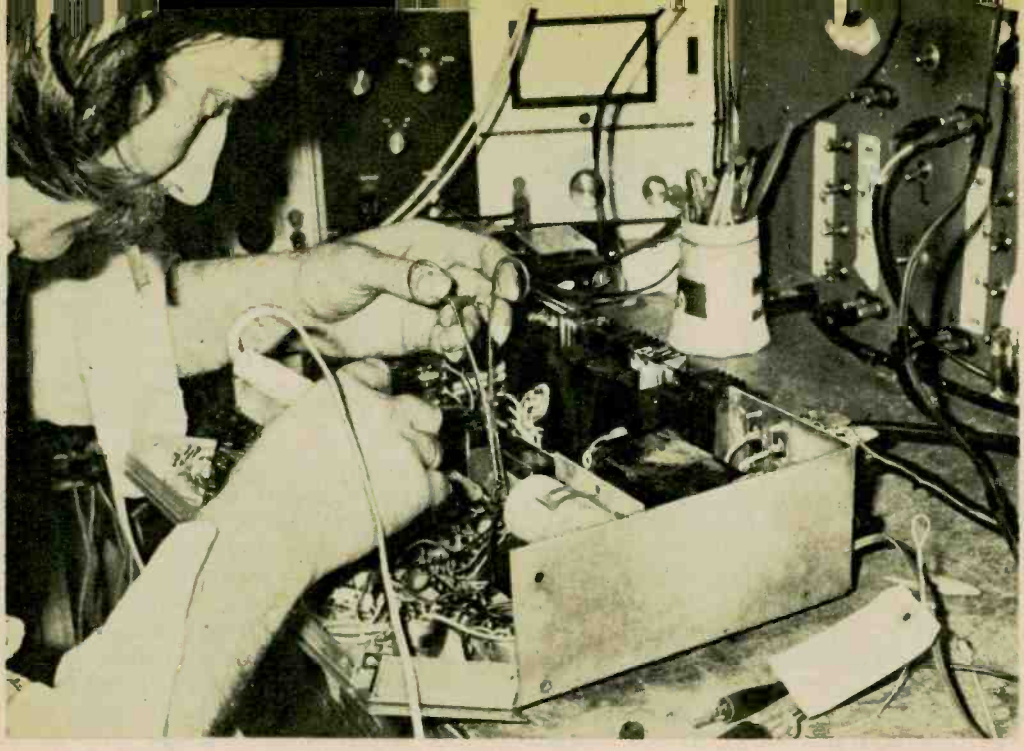


How to Service Stereo Amplifiers

Part II: Preamps and Transistor Substitution

By JOSEPH RITCHIE

IN OUR May '71 issue we discussed trouble-shooting a stereo amplifier's power supply, driver and output stages. In this article we will conclude with preamps, tone-controls, waveforms and transistor substitution.

Unlike troubles in an amplifier's power supply and output stages, where difficulties often are indicated by component overheating and burnout, breakdowns in preamp and low-level stages can be as elusive as a will-o'-the-wisp. There are two reasons why. First, the currents involved in low-level (low power) stages are so small that even dead shorts produce only minor amounts of heat, let alone smoke. Second, a small, almost unmeasurable change in a low-level current or voltage can cause large headaches of the now-you-see-it now-you-don't variety.

To illustrate the problems you can run into, we'll create some common troubles that can occur in a typical circuit such as shown in Fig. 1. The schematic is of a magnetic-phono preamp (Q1, Q2) driving a low-level amp (Q3) which in turn drives the tone controls. Figure 1 doesn't resemble all or even most of the low-level circuits in existence. However it is a representative circuit.

Fact is, even if you are working on one of the most modern amplifiers in which an IC is used in the magnetic preamp, instead of Q1 and Q2, you'll generally find that the IC consists of Q1, Q2, R5, R6, R7, R8, R10 and C6. The circuit is the same except these components are in the IC.

Magnetic-phono equalization is obtained by means of feedback through C4, C5, R3 and R4. Remove these components and Q1 and Q2 become a flat amplifier. Note that Q1's base bias comes through R9 from Q2's emitter. This arrangement is the AC and DC interlock used to provide a stabilized gain in the event Q1's and Q2's gains are not exactly what they should be. A DC voltage shift will appear as a change in Q2's collector-emitter current, which turns up as an increase or decrease in Q2's emitter voltage. Since Q2's emitter voltage is Q1's base-bias supply, Q1 will correct for changes appearing at Q2's emitter.

For example, suppose Q1 was replaced with a transistor with higher gain. Transistor Q1's collector current would rise and its collector voltage would fall. This would reduce

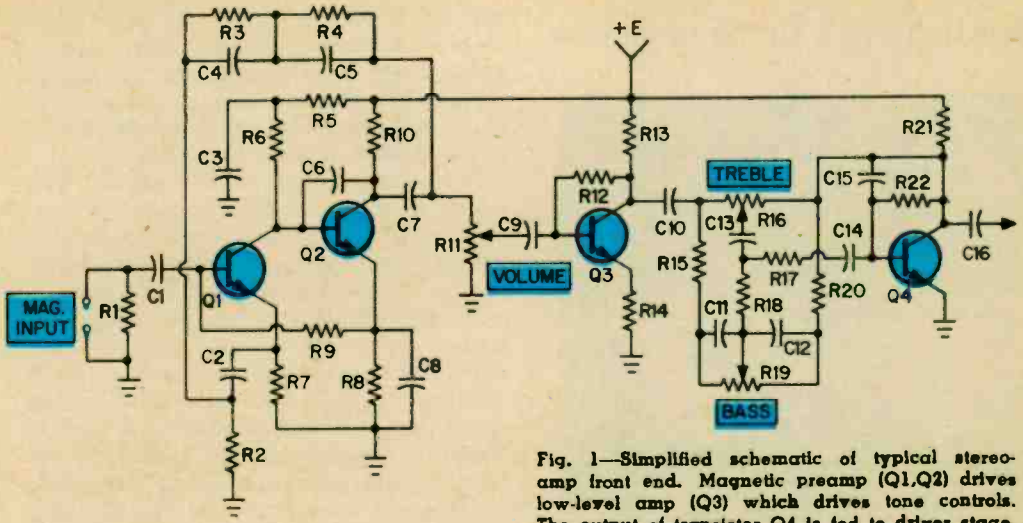


Fig. 1—Simplified schematic of typical stereo-amp front end. Magnetic preamp (Q1,Q2) drives low-level amp (Q3) which drives tone controls. The output of transistor Q4 is fed to driver stage.

Q2's base bias and collector current. This in turn decreases Q2's base bias and collector current to the design value. Similarly, if a voltage or current in Q1's circuit changed from the design value, the DC feedback to Q1's base would correct the error. Since the DC interlock stabilizes the overall DC gain, the AC gain rides along and is similarly stabilized.

Though the DC feedback interlock is a benefit in normal operation, look what you can expect when things go wrong. If Q2 shorts, its emitter voltage will increase, causing Q1's collector current to rise sharply (perhaps saturate), and almost the full supply voltage will be dropped across R6. If you measure the voltage across R6 first, it will appear as Q1 is shorted. On the other hand, if Q1 shorts, thereby effectively killing Q2's base bias, Q2's collector current will drop. There will be no voltage drop across R10, and if the meter is first connected across R10 it will appear that Q2 is open.

So take nothing for granted in a DC-interlocked circuit. You can measure circuit voltages forever and not find the trouble. The fastest service technique is to pull the transistors and test them on a transistor checker. That way, you'll at least know if the trouble is caused by the transistors or a part.

Now look at capacitor C6, (always a small value, 50 to 100 $\mu\mu$f) connected from Q2's collector to base. (Some amplifiers have it and some don't.) Note also that a similar capacitor (C15) is used at Q4. In fact, every low-level stage might have this capacitor. Capacitor C6 is a high-frequency bypass, or attenuator. Wideband stages, which low-level stages usually are, amplify well up into the RF region—up beyond the broadcast band. Capacitor C6 (and its brothers and sisters) is used to attenuate the RF frequency response so the circuit does not oscillate.

If they open, and they do, the amplifier may very well broadcast the input signal to a nearby AM radio. And the RF might block the following transistor and cause distortion. If you're servicing with a scope and the trace is blurry or fuzzy (and you are certain it is not hum) you can put money on RF from an open capacitor.

Loss of equalization, or improper equalization of the magnetic-photo input is generally caused by a defect in the equalization network—C4, C5, R3 and R4. Since this same circuit is used for tape-head equalization, (but with different part values) the same comments apply.

Sometimes an equalized stage will run wild, producing only heaven-knows-what for sound. If all DC voltages look good, check C3 and C8. Capacitor C8 removes any AC feedback through R9 and also prevents gain-reducing emitter degeneration in Q2. If C8 opens, just about anything can happen to the sound; if it shorts, all DC voltages go

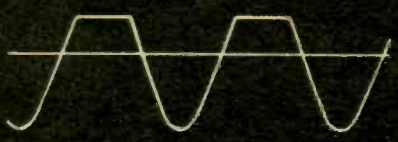


Fig. 2—Waveform reveals positive-peak clipping caused by decrease in gain of transistor.

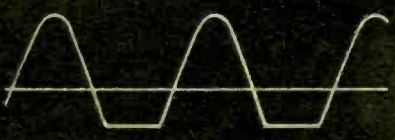


Fig. 3—Negative-peak clipping due to excessive transistor gain and collector current.

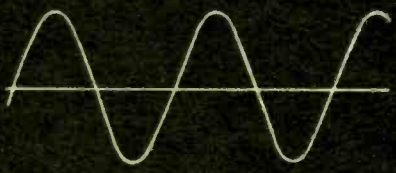


Fig. 4—A virtually undistorted sine wave is indicative of proper amplifier performance.

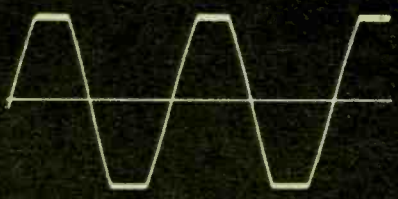


Fig. 5—Symmetrical flattening of positive and negative peaks reveals amp overload.

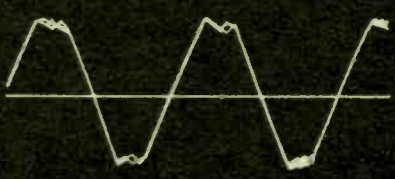


Fig. 6—Distortion produced by overdrive of low-level stages puts waves on the peaks.

haywire. Capacitor C3 and R5 form a decoupling network that keeps output signals, which might have leaked into the supply voltage, from feeding back to Q1 and Q2. If C3 opens the stage will generally motorboat—oscillate at a low frequency.

Moving on through *volume* control R11 to Q3, we find a low-level amplifier of simple design, very similar to Q4 which follows the tone controls. There's not too much that can go wrong here. If C7 and C9 become leaky, DC will be placed across the *volume* control and it will appear as a scratching sound when the control is adjusted.

About the only other thing that can go wrong with a simple amplifier is a shift in transistor characteristics that cause waveform clipping. All stages up to the output are designed for symmetrical amplification; they have an undistorted capacity well beyond the normal level of input voltages. But a change in a transistor's characteristics can cause unsymmetrical signal limiting, that is, one signal peak goes through undistorted and the other peak is clipped, as shown in Figs. 2 and 3.

A normal sine-wave signal to the magnetic input, aux or tape input (if there is one) should appear at the output at Q3 or Q4's collector as a clean sine wave as shown in Fig. 4. But assume that Q3's gain has sharply decreased. Though R12 will attempt to equalize the DC voltages and current, the gain loss may well exceed R12's feedback correction. Therefore Q3's current will decrease, the voltage at Q3's collector will rise toward the supply voltage, and the positive peak of the collector's signal will simply clip at the positive supply voltage producing an output waveform at Q3's collector as shown in Fig. 2. If things should go the other way, with Q3's collector current increasing, the voltage at Q1's collector will decrease and the output waveform will have negative peak clipping, as shown in Fig 3.

The waveform that is obtained from well designed and normally operating low-level stage is shown in Fig. 4, which is a perfect sine-wave output with essentially no distortion. When the input signal is increased to the point where an amplifier just starts to overload—called the clipping level—the output will show a very slight flattening of both the positive and negative peaks as shown in Fig. 5. When the input signal is driven well beyond the amplifier's overload level, both peaks will be clipped even more.

As a general rule, low cost amplifiers are not quite symmetrical at or near the clipping level, while the better designed, well made, high-priced amplifiers are symmetrical.

Tone control circuits almost never give trouble. The most that can happen is a noisy potentiometer. However, should the input capacitor to the following stage become leaky (C14 in Fig. 1), there can be a return path for DC through one of the tone controls to ground or the collector, depending on the tone control's design. If you trace through Q4's circuit, you will see that if C14 is leaky there is a DC path via *bass* control R19 from Q4's base to collector. Again, a leaky capacitor is revealed by a scratching sound when the *bass* control is adjusted.

Transistor Substitution. Except for the solid-state devices in an amplifier, replacement parts won't be a hassle. Just about any value resistor, capacitor, fuse and circuit breaker is available at a parts distributor. Solid-state devices are another story because distributors often don't stock other than the so-called general-replacement semiconductors, such as the Motorola HEP and RCA SK series. Frequently the normal gain variation of a transistor is sufficient to cause difficulty.

It comes about this way. Assume an amplifier you are working on has a defective 2N3391—a popular high-gain, low-noise transistor. The *normal* gain (beta) range for this transistor is 250 to 500. If the transistor is used in a DC-interlock circuit, such as Q1 and Q2 in Fig. 1, the DC feedback will equalize the gain range and you would most likely not have a problem. But if the transistor was used for Q3 or Q4, a simple replacement might cause more problems than it would cure.

Too high a gain in Q3 might result in the amplifier working with the volume control barely cracked open. Or the normal base bias would result in excessive collector current. If the replacement transistor's gain is too low, the normal base bias on Q3 and Q4 might result in excessively low collector current, which would push the collector voltage towards the supply voltage.

Amplifier manufacturers generally try to avoid gain-matching problems on the production line by specifying a narrow gain range from the transistor supplier. However, the gain range is only good within a specified percentage—80 per cent is typical. Unless each transistor is tested, 20 per cent of them go into the amplifier with characteristics beyond the design-center value.

Even if you were to obtain an exact replacement transistor from a distributor you might not end up with a repair restoring original performance. For example, let's use the 2N3391 again. Assume the amplifier you are servicing uses 2N3391s with gain of 500. The transistors you receive from the distributor have a gain of 250. If the amplifier originally could deliver 10 watts output for a 10 mv input, with the 250-gain transistor it would now require up to 20 mv for the same 10-watt output.

As a general rule you can assume that if a transistor is color coded, or has what is obviously a manufacturer's identification number, it has specified gain in addition to other characteristics (say, voltage).

Naturally, exact replacements aren't easily obtainable, and there will be times when you must use a general-replacement substitute. First thing is to find a substitute in a transistor substitution handbook. Now you must make certain the replacement has at least the voltage rating of the original transistor. Next, check the gain because many replacements will work only when the base bias is changed. For example, some replacements listed for the 2N3391 have a gain of only 100, yet the 2N3391's lowest specified gain is 250. Sure, the low-gain replacement will usually work, but the amplifier probably won't deliver its specified power.

As a general rule, any replacement transistor should be checked on a transistor tester to be certain its gain falls somewhere within the original transistor's gain range. If it doesn't, don't look for headaches. Try another replacement.

Even if a replacement transistor meets all the requirements for voltage rating, gain, etc., you have one more concern. Is the replacement germanium or silicon? Unless your back is to the wall and you must get the amplifier out of the shop to meet a deadline, do not substitute germanium transistors for silicon transistors and vice versa. Reason is, silicon transistors can take much more heat than germanium, and an amplifier designed for silicon transistors might simply be too hot for germanium.

Finally, keep in mind that most transistors used in preamps, such as for magnetic phono or microphones, are low-noise types. On the other hand, most general-replacement transistors are not low noise (though some have the lowest noise).

CB Corner

By Len Buckwalter, KQA5012

Sea-B

I DID a double-take recently when Ray Jefferson, a grand old company in marine electronics, introduced its first CB rig (see photo). The outfit is better known for radiotelephones that cost hundreds of dollars. So why a CB set for $149.95? Ed Silvey, the firm's service manager, points out that CB is going to sea in greater numbers and Ray Jeff dealers want a piece of the action.

One reason for the boom should jolt any active CBer. The CB band, say the salts, is *less* crowded than the regular marine band. Silvey estimates that 30 per cent of all head boats (which take people fishing for so many bucks a head) off the Jersey Coast are CB-equipped. The law requires these boats to carry conventional two-way radio, but CB is catching on because the marine band is jammed to the gills. If you think 27 mc is crowded, listen to 2 mc on a sunny weekend. Some 150,000 boats are putting it all together in a hulla-balloo that could drown a giddy CBer.

The Ray Jefferson CB rig that has been designed primarily for use on boats. With the overcrowding of marine bands, CB is making great inroads.

So the captains are turning to CB for relief. They get about five times more channels, and the cost is ridiculously low. A licensed technician is not needed for the installation, either. Despite new marine frequencies now on the way, I believe CB will easily outrace the number of radiotelephones at sea—as it's already done on land.

There's a moral here for any CBer who angles from a boat of his own. Careful scanning of CB channels could be the best method of fish-finding yet devised. Just eavesdrop on the professional skippers. They not only know the best spots, but blab it all over the airwaves. They're catching tuna and marlin up to 600 lbs. off Baltimore, Wilmington and Hatteras along the Atlantic Coast and revealing the exact spots on CB radio! The reason is that big-game fishing tournaments are making widespread use of the CB band for privacy, of all things. If a team communicates on regular marine radiotelephone, it'll surely be monitored by hundreds of other boats in a wide area. But on CB's shorter range, lower power and numerous frequencies, there's a better chance of foiling the competition. If tuna is your dish, some fancy CB channel-hopping could lead you to the big ones.

About eight years ago CBers were told of a sensational new rig that would double their channels from 23 to 46 and multiply watts from 5 to 40. Even the FCC gave it respectability by modifying the rules to allow the new mode. It was SSB or single sideband. It's not exactly new since hams have had it since 1933, but it's extremely effective because it slices away unessential parts of the signal and compresses the result into pure talk power.

Sideband for CB nearly died because of incompatibility. You could brag about a new sideband rig, but hardly over the air. In a conventional receiver you'd sound like a Siberian strangling in a salt mine. SSB inverts and distorts the speech unless it's properly detected. The medium, though, must now have a message since I can count 10 manufacturers now producing some form of sideband equipment for CB. Why the surge?

Sheer passage of time explains part of it. Sidebanders are still a tiny minority but a growing number of CBers are discovering its delights. CBers can work on a channel's upper and lower sidebands simultaneously without worry of interference because an SSB signal requires only half the spectrum space needed for a conventional AM transmission. In addition, the whomping, unintelligible side- [*Continued on page* 93]

The Thou Watt 99 Band Streamlined Mobcom Baby

By RON WREN

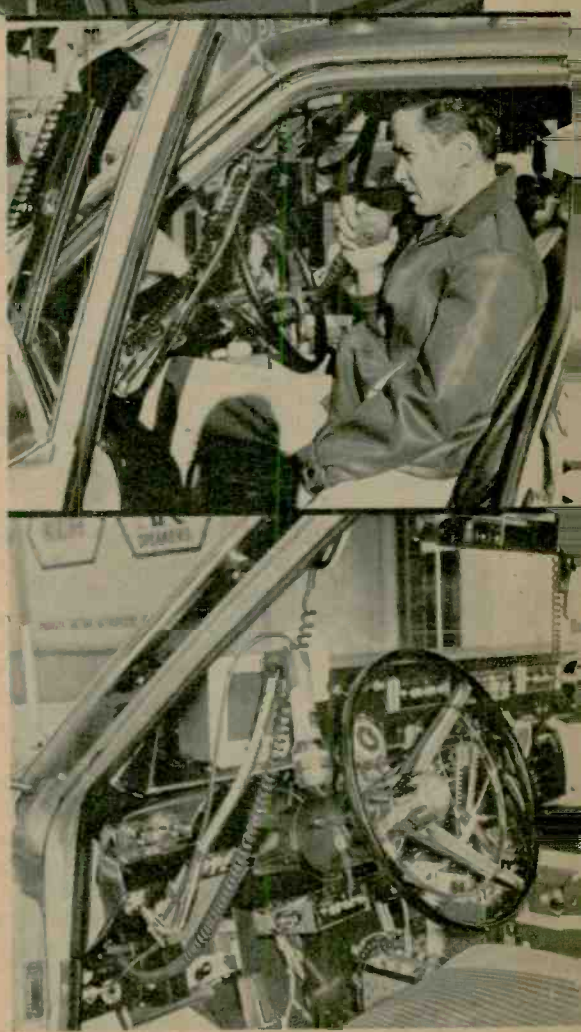
YOU know about the man who has everything. In the field of mobile communications that man has got to be John Nowack of San Francisco.

Within the confines of an otherwise large station wagon, John has stuffed gear for just about every part of the radio spectrum.

The result is a dashboard laden with receivers that cover AM, FM, ship-to-shore, police, fire, Civil Defense, CB, VHF TV, UHF TV, business band and mobile telephone.

It all started five years ago when John decided to put a TV receiver in the car. One thing led to another and, before he knew it, the roof of his Chrysler was sporting 18 antennas that cover 540 kc to 450 mc.

John doesn't keep all the receivers on at one time for, as he describes it, "That's enough to drive a man to drink." For this problem he has installed a fully equipped bar between the front and rear seats. Now all John has to do is worry about keeping his eyes and ears on the road.



SSTV—Budget Television For Hams

Continued from page 80

tape recorded. The Model 70 monitor has a picture that is bright enough to be seen easily in normal room conditions.

Obviously Robot is not thinking entirely of the amateur market with this equipment. It should be an excellent security system, for the pictures can be sent over regular telephone wires to a central monitoring desk or even to a police station. One picture every eight seconds is quite adequate to watch a warehouse, a bank, or any other space. A sequential switching unit can be used to continuously watch over a large number of areas from one vantage point. The ability to send the TV signals over a phone line should more than make up for the slow scanning drawback.

Another manufacturer of SSTV equipment is EKY Video Vision in Fairlawn, New Jersey. (The EKY comes from his amateur call W2EKY.) This small company sells both complete units and kits for the do-it-yourselfer. A complete monitor sells for just under $300. The circuits boards run about $10 and higher amounts for kits with parts. The boards are available wired and tested for $125, leaving the builder to add the scope tube and power supply under his own steam.

Build your own scanner. By far the simplest system for generating a television picture, slow or fast scan, is what is called the flying spot scanner. You remember that a television picture is made by rapidly passing an intense spot of electrons over the face of a phosphor-coated glass screen. By varying the intensity of the spot we get our blacks, whites and shades of gray.

You may have noticed that when you turn down the contrast and turn up the brightness on your television, that you end up with a screen that is all white with no picture at all. This white screen, formed by that flying spot, is the essence of our scanner.

The next step is to take a slide projector and modify it by replacing the projection bulb with a phototube. The slide projector is now used backwards with the flying-spot light source produced by the CRT focused on the lens on the slide. The spot, made dark and light by the slide hits the phototube.

A simple audio amplifier (or video amplifier in the case of fast scan television) then steps up the output of the phototube and we have a video signal to feed to our slow scan modulator.

SSTV can be hooked up to any station that has capability of transmitting CW or SSB. Most SSTV buffs just build a couple of control boxes, one for the receiver and one for the transmitter. The SSTV camera or flying spot scanner output is hooked right into the microphone input of the transmitter and the monitor hooked right to the speaker output of the receiver. With the control boxes, it is very easy to switch from transmission of picture to voice and the same is true with reception. This simple facet of SSTV is one more strong point that is sure to make it more widely used as time goes on.

Short-wave listeners and interested amateurs can listen for the SSTV net which generally gets together on 14230 kc at about 1800 GMT on Saturdays. It is also unusual not to hear some SSTV going on around that frequency most evenings. Particularly listen around 1830 GMT, when the international net meets. On the lower bands the normally used SSTV channels are 3845 and 7200 kc at about 0400 GMT. Give a listen.

As more and more manufacturers get into the game we should see lower prices and simpler equipment emerging. The day may not be far off when an avid SSTV operator will be able to not only work 100 countries, but will be able to sport audio-taped QSL cards for the effort. We most certainly will be seeing a lot of interest in this new mode of ham communications.

Ham Shack

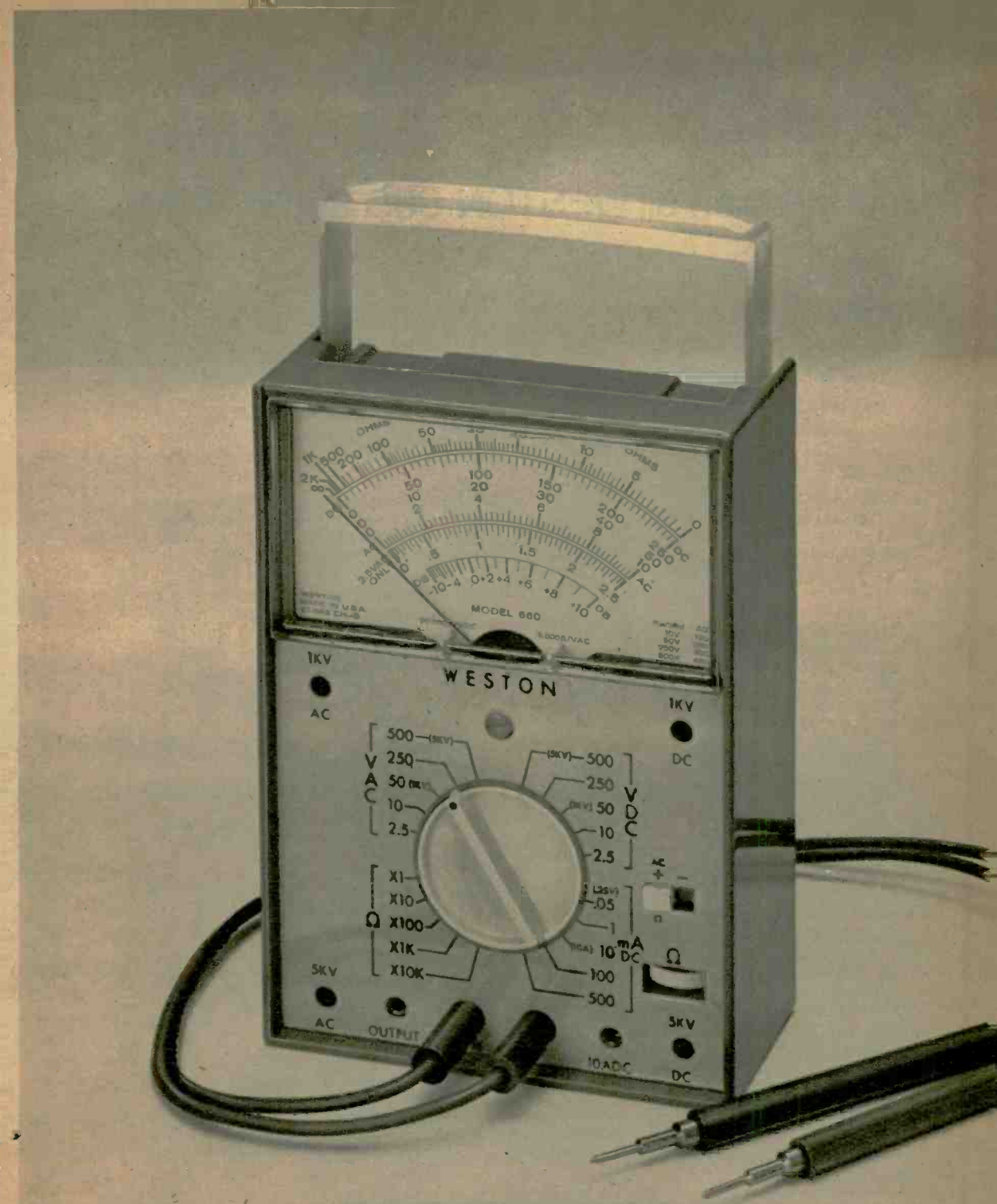
Continued from page 81

tically. The band is only open part of the time is rarely open at night at all.

40 and 80 meters are the nighttime bands, with 80 being useful for relatively short distances and 40 for longer. On 40 you have to contend with some of the European shortwave broadcasting stations, meaning that you have to work around them.

Let me say this to the reader who has been struggling along on CB: Hamming is legal, fun, and awfully easy to get into, so why waste all that time, money and effort setting yourself up for a big FCC fine on 11 meters? To the SWL, I have this to say: Why just listen? There are about 400,000 hams spread out all over the world who are

[*Continued on page* 93]



WESTON MODEL 660 VOM

CIRCLE NO. 5 ON PAGE 13

Standard on all WESTON 660 Series VOMs...

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- Diode meter protection
- Custom taut-band mechanism
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MODEL 660 VOM
This "drop-proof" multitester incorporates all of the features mentioned above and will provide dependable service in rugged field environments. Basic accuracy is 2% on DC, 3% on AC readings.

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Resistance: 0-2000 Ω (20 Ω center) to 0-20,000,000 Ω (200,000 Ω center) in 5 steps
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Mirror scale version of the Model 660, with basic accuracy to 1% DC, 2% AC. Price **$76.50.**

MODEL 662 VOM with Full Overload Protection
Ranges and accuracy are the same as for the Model 660, but this model is equipped with a re-settable overload relay to protect circuitry against 220 volt overloads. Price: **$101.50.**

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Has circuit overload relay plus mirror scale and basic accuracy to 1% DC, 2% AC. Price: **$110.00.**

MODEL 666 High Impedance VOM
Weston Model 666 is the first VOM designed for semiconductor circuit troubleshooting that is also rugged enough for any field servicing need. Input impedance is 10 megohms, and the unit provides special ohms ranges with the low-voltage drops required for semiconductor testing.

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DC Current: 1 μa / 10 μa / 100 μa / 1 MA / 10 MA / 30 MA
AC Current: 1 μa / 10 μa / 100 μa / 1 MA / 10 MA / 30 MA

Resistance: 7 normal and 7 "low-power" ranges from X1 to X1 Megohm

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CIRCLE NO. 5 ON PAGE 13

Ham Shack

Continued from page 88

just waiting for you to get on the air and talk with them. Keep in mind that virtually the only real person-to-person communications in the world today are via amateur radio! Tourists seldom get a chance to sit and talk with locals.

What do you do next to get your Novice license? Your local radio store probably has a copy of the ARRL book, How To Become a Radio Amateur and the License Manual. These are none too good, but they are about all that is available. You should be able to make it with these.

Next you write to the FCC, 1919 M St., Washington, D.C. 20554 for form 610. This is the form you must fill out to apply for your Novice exam. This form will be sent in to the FCC by the person you have selected to administer your exam and the exam will be sent directly to him in a sealed envelope.

Once you get your Novice license and get on the air, be sure to listen carefully for W2NSD/1—you'll find me in there every now and then practicing my code.

CB Corner

Continued from page 86

band signal often knocks the regular AM boys off the channel. One report says that West Coast operators are already migrating to specific sideband channels, thus eliminating the incompatibility problem.

Another group giving sideband a lift is the outright hobbyist. Rumor has it that illegal linear amplifiers of 500 and even 1,000 watts are added to sideband rigs to produce the most powerful signals thus heard on CB.

A regrettable part of sideband's growth is its poor showing so far in the business world. There had been hope that increased range would overcome one problem which cuts down CB's usefulness. But another fault—excessive chatter—would often be eliminated by turning up the receiver squelch control too high. This would reduce receiver sensitivity enough to cancel out the gain afforded by sideband operation. The answer is a selective call system that activates the receiver only when the correct code arrives. But if you've ever listened to sideband, you know why selective call is a stubborn hold-out.

[*Continued on page 94*]

In a conventional CB receiver, it's easy to unlock the squelch by audio-tone codes. The sideband receiver, though, must be tuned with incredible accuracy or incoming audio tones shift in frequency. This is the famous Donald Duck syndrome: if a sideband receiver drifts even a few cycles, the voice takes on a funny, high-pitched sound. The same effect occurs on audio-tone call signals and they fail to trigger the squelch. Although the engineers have licked this problem, the circuits are still too costly for CB.

So sideband's on the rise and one manufacturer says it could be repeating what happened in ham radio a decade ago. Hams switched from AM to sideband and added linear amplifiers to boost their barefoot rigs. Imagine if the ham-like trend continues—CBers might get their own communications satellite by 1975.

Quick Service For Ailing CB Rigs

Continued from page 49

The Antenna. Your skyhook can cause a lot of problems if it's neglected—more than you might imagine. Periodic lowering and inspection of the antenna is always advisable, and should you live within a few miles of the sea, this inspection is mandatory at least once or, better yet, twice a year. Salt corrosion can really put the whammy on your antenna.

Take the antenna apart—completely dismantle it as if you had just taken it out of the carton. If you have trouble getting any of the screws or nuts and bolts apart squirt *Liquid Wrench* on the screws and nuts. Rusted bolts and parts can then be easily taken apart.

Using fine sandpaper (or steel wool) give all of the antenna elements a going over to free them of oxidation, grime, soot, salt, rust, etc. Don't forget that while antennas don't rust, they do corrode and eventually oxidize.

Give the whole antenna a coat of aluminum paint to reduce weathering effects—but be careful not to get any of the paint on the plastic insulating material or at the connecting terminals.

If your coax is connected to the antenna by a PL-259 connector, remove the old connector and install a new one. If your cable is attached to screw terminals, cut the cable down an inch or two and prepare new leads. Then, either wrap the connector with plastic

electrical tape or coat the leads and the antenna terminals with nail polish, shellac, or Krylon plastic spray. Replace the coax after two years of use, or even sooner if you notice any breaks in the outer jacket.

Caution. When working inside the set remember that electricity can give you a severe sting. Unless it is absolutely necessary for the particular test you are to make, keep the set unplugged. If the set is on and you are working in its innards, keep one hand in your pocket.

Color TV Kits

Continued from page 69

even notice it. An overbright spot in a scene can't harm the CRT. Neither can turning the brightness control too high.

Putting Them Together. As we said in our report on the 681 last year, assembling a color set really isn't that difficult a job compared to building, say, a transistor radio. There's just more work to the color TV. It's a matter of degree rather than substance. Naturally, in a color-TV kit there are more places to make an error than in a radio, but by using care, headaches can be avoided.

What made the job so easy are Heath's manuals. For the 370 there are eight—one is for the wireless remote control. The 169 has four manuals. Frequent use of two-color printing makes it much easier to see where you are in crowded illustrations.

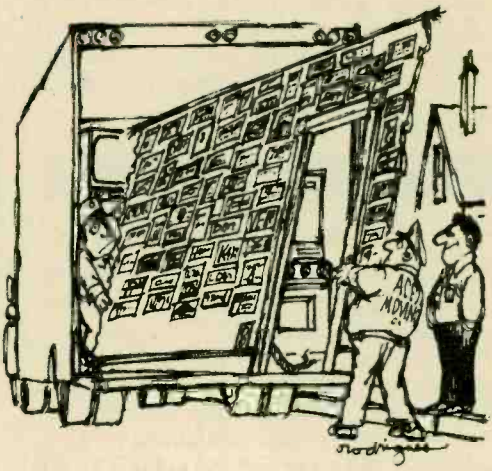
Of the 10 plug-in boards in the 370 (eight in the 169) you build nine. The horizontal-output board (not in 169) comes assembled and mounted on the high-voltage assembly (Fig. 3). The convergence board is not a plug-in type. It took us 11½ hours to build all the 370's boards. After they are completed you move on to the Chassis Assembly manual and then the Front-Panel Assembly (Fig. 2) manual.

Next comes the Picture Tube and Shield Assembly manual. Perhaps the most difficult part of the 370's construction was positioning the degaussing coil around the picture tube as shown in the manual. There was very little extra space between the metal sides, top and bottom of the tube shield and the tube. This made it necessary to depart from the specified placement of the degaussing coil. However, this did not adversely affect the coil's performance.

[*Continued on page* 97]

Over and Out

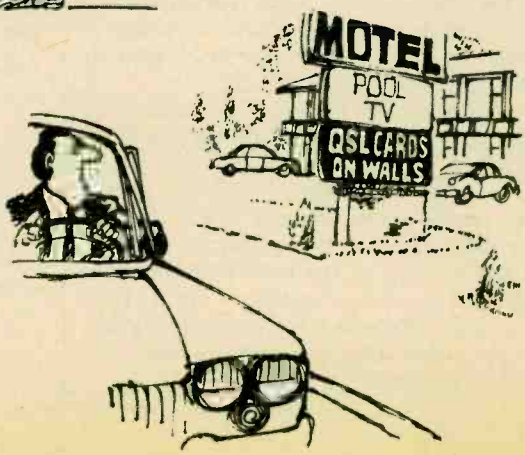
rodrigues



'On the second floor, there's a card on the wall that says Seychelle Islands — please, get it!"

"It was a cold February morning, about 2 a.m. I was tuning around the 20-meter band—I hear this chanting—sort of Arabic—there was just a slight heterodyne. Slowly I adjust my antenna tuner . . ."

"Thank you for the reception report on Radio Moscow. As you know, we invented the QSL card."



Color TV Kits

Continued from page 95

The Adjustments and Operation manual followed. At this point you take a break to build (30 minutes) the Troubleshooter (Fig. 4)—a volt-ohmmeter, then make resistance and voltage measurements. (Heath's detailed procedures are great.) You then go through static and dynamic convergence, purity, pincushion and other adjustments.

The Troubleshooting and Data manual includes troubleshooting information, voltage and resistance charts and instructions for checking all components with the Troubleshooter. Armed with all this information, you should easily be able to pinpoint any trouble if the set ever goes out of order.

How long did all this take? We were enjoying a program on the 370 43 hours after starting. The 169 took our builder two or three hours longer because of the extra care required to put the same amount of equipment in a smaller package.

Oh, yes, those times were an hour or so longer because neither set worked right off. There was no blue in the 370 because of a cold-solder connection on a choke in the video-output board. And after the set operated for about an hour, the horizontal-oscillator transistor failed. A new transistor restored operation and there has been no trouble since the set was completed some 500 operating-hours ago.

In the case of the 169 there was no picture because of a wiring error on the convergence-board plug. An error in the schematic caused us to destroy two transistors and an electrolytic when troubleshooting. When this was cleared up, the 169 worked beautifully. The pictures were every bit as good as any we've seen on many commercially-made color sets. (The builder of the 169 lives in an apartment about 10 miles from New York City.)

Both sets displayed soft, fully-saturated, accurate color. The picture was sharp, bright (without defocusing) and contrast was excellent. We feel Heath's sets still produce the best color going.

We felt one small thing was missing on the 169—a snap or lock on the fold-down cover over the front-panel controls (Fig. 8). Behind this cover are the color killer, height, AGC, screen, vertical hold, dots, horizontal-

[*Continued on page 98*]

Color TV Kits

Continued from page 97

hold, etc., controls. Until we securely taped the cover closed, our builder's two-year-old son trimmed up most of the controls several times—to his and his father's grief.

On the 370 it's a simple matter to swing out the vertically-mounted chassis for servicing (Fig. 7). But to swing out the chassis on the 169 you have to remove a dozen or so screws from the cabinet, handle and bottom and do a little disassembly—the job can take up to 30 minutes.

Convergence of both sets is neither time consuming nor difficult. As a matter of fact, dynamic convergence went a bit faster than it did on our 681. On the 370, the dynamic-convergence panel is on a hinged assembly with the speaker on the front of the set (Fig. 7). It drops down for easy accessibility. On the 169 it is mounted at the rear of the set (Fig. 6).

That's the whole ball of wax. Both builders enjoyed every minute spent building their sets. But that past pleasure is small compared to the enjoyment they constantly get watching them. Neither frets a minute about anything ever going wrong. They're confident that those plug-in boards and the extensively detailed troubleshooting information will keep the sets going forever.

DXing The Asian Islands

Continued from page 57

this government-owned station is known in its English broadcasts. It has English transmissions at 0730 on 11770 kc. Also keep an eye on 9770 kc which relays the station's home service.

The island of Singapore is just a few miles from the mainland and was once in fact part of the Malaysian Federation. When it withdrew from this political alliance it kept the short-wave facilities of R. Singapore. This one's a toughy for non-orientals as about the only way this station can be pulled in is through its Chinese service on 9635 and 6000 kc. At other times these two frequencies are jammed by other, more powerful Asian stations.

Staying for a minute with Chinese close to the Mainland, you can't get much closer than The Voice of Free China and R. Liberty on Taiwan. VFC has regular broadcasts

to North America as shown in the table. R. Liberty is one of those Asian mystery stations, with heavy doses of propaganda. Signals from this station are for obvious reasons heavily jammed, in addition to which, it has been reported that the station has transmitters in West Germany and Spain. Check 7220 and 7295 kc around 0600 EST for this one.

The Voice of America maintains a small relay on the island of Ceylon. This relay consists of two 35-kw transmitters that have been leased from R. Ceylon. VOA Colombo is logged in North America from time to time on 11835 kc at the sign-on of 0700. The national voice of this island is R. Ceylon, with programs at about the same time as the VOA, this time on 11800 kc. This good catch can be exasperating—the station is a terrible verifier.

For a tough assignment you can't beat trying to pull in R. Brunei, part of that tiny kingdom mentioned before in connection with Borneo. Anytime you hear R. Malaysia on 4970, tune down to 4865 kc and see if you can pick up this exotic regional outlet.

Every day you read about some new war or some new revolution in these islands. The radio that results can make for pistol-hot listening, something that's pretty hard to find on SW these days. -0-

Junked TV

Continued from page 43

circuits do not respond correctly to this procedure.

Symptom 4: Not enough or no high voltage. After you have performed the tube changing duties and have decided that the cause of no brightness is no high voltage, you can bring your test signal into play to localize the circuit that is causing the trouble. You'll use both the horizontal-grid-drive (J5) and horizontal-plate-drive signals for this test.

The circuits to suspect are the horizontal-phase detector, horizontal oscillator, horizontal output, flyback/yoke area, damper and in color TV's, the high-voltage regulator. This is quite a territory and you can waste a lot of time if you can't quickly pin the trouble to a specific section. The approach is to first split the high-voltage section in half and exonerate one half from the other.

A convenient halfway spot is the plate cap

Junked TV

Continued from page 99

of the horizontal-output tube in the inoperative TV (Fig. 10). Remove it from the tube and attach the horizontal-output jumper to it. Then remove the cap from the horizontal output tube on the junked TV. Attach the other end of the jumper to the cap of the junked TV's tube. Then turn on both TV sets.

Either brightness will return to the inoperative TV or it won't. If brightness does not occur, the trouble is in the flyback/yoke/damper area. If brightness with a full raster occurs the trouble is the phase-detector, oscillator, output area. Should brightness return but the raster is narrow, or blooming badly the trouble is in flyback or yoke or damper. When brightness returns but the raster takes the shape of a keystone the yoke is defective.

As you can see this test is an extremely important one and provides a lot of service information. When you decide the flyback/yoke/damper area is suspect, you turn off the TV and begin examining this section with resistance and substitution tests.

Should you feel the detector, oscillator, output area is suspect, turn the TV back on and switch test leads to the horizontal-oscillator grid drive. (Fig. 11). Inject a grid-drive signal into the control grid of the horizontal-output tube. If brightness still is displayed the output circuit is cleared. Keep moving back in the circuit till you lose brightness. As soon as you do, you have passed over the the defective component. At that time begin voltage and resistance tests. This procedure works only on tube TV's. —●—

Color Organ

Continued from page 63

the control portion of the circuit—not the power to the triacs. A switch is not needed here since the triacs are essentially open switches when input signals are not supplied. Keep this fact in mind when you work on the chassis. 117 VAC is present at several points on the heat sink and sockets whenever the line cord is plugged in.

Using the Organ. Simply connect terminal strip TS1 to the speaker leads of any radio, TV or either channel of a stereo amplifier

[*Continued on page* 102]

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Color Organ

Continued from page 100

and plug three lamps in S01, S02 and S03.

Before you turn the organ on, turn R2 full counterclockwise (minimum sensitivity). Next, adjust the volume of the radio or amplifier to the desired level. Finally, turn S1 on and turn R2 slowly clockwise observing the action of the three lamps. Stop when all three lamps show some activity—usually the low- and high-frequency lamps will be partially lit, while the mid-freqency lamp is almost fully lit. Do not set R2 too high. If you do you will upset the balance of the frequency-selective filters.

For the most exciting light patterns, the music should have a natural bounce, instead of being smooth and tranquil. Great volume variations are not properly reproduced because of the circuit's and the lamp's somewhat limited dynamic range.

An interesting effect can be achieved by using three flood lights (red, green and blue) aimed at a large light-colored surface such as a wall. But don't overlap them, because when their intensities are equal, the colors (if red, blue and green) will blend and produce white.

At large gatherings, such as dances, a discotheque effect can easily be achieved by aiming the three spotlights at the participants. Not only will they be grooving to the tempo, they will have a chance to react to the changes in the color of their bodies. It makes for a wild scene. Try it!

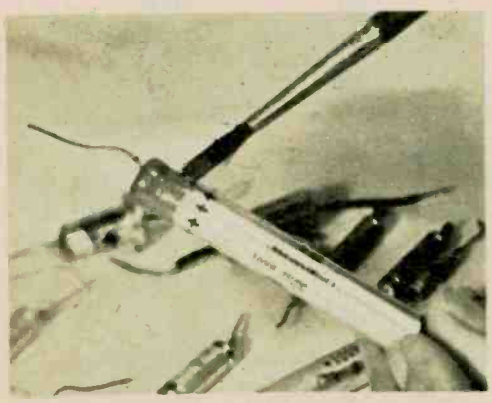
The Fuzz Flies to UHF

Continued from page 66

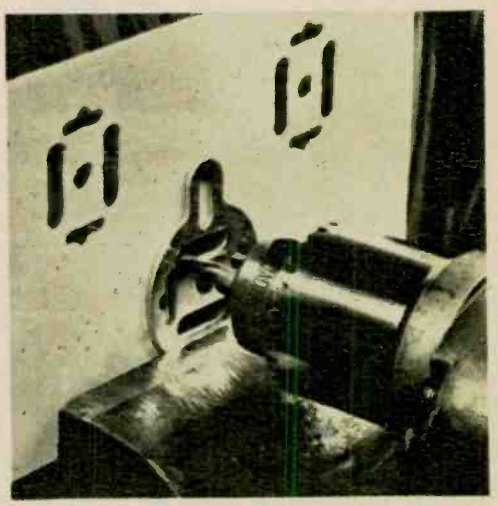
the UHF frequencies which they are presently using for police broadcasts. If the city of your particular interest is not among those in our little group, you can find out about which frequencies have been assigned to many different towns through publications of the Communication Research Bureau. The address is C.R.B., P.O. Box 56-EX, Commack, N.Y. 11725. Write for a catalog.

One thing is clear from this big switch to UHF. Cities and towns who are presently crowded on the lower frequency bands will be looking to this new communications bonanza to solve their problems. Who knows, maybe my friend in New York can stop worrying about those dimes.

TIPS



A blinding explosion and then a shower of bright metallic-blue flakes resulted from connecting a tantalum-foil capacitor with the polarity reversed. Because these expensive capacitors are used over and over again, markings wear away fast. (There was but one plus mark on a mate to the late exploded capacitor.) To insure that this won't happen to you, paint the positive end of tantalum capacitors with bright red paint which is easy to see and an ever present reminder of the polarity.



To mount an IF transformer directly on a printed-circuit board, use the transformer's mounting plate as a cutout guide. Here's how: Drill the center hole in the board. Position the mounting plate on the board with the center holes lined up and clamp the two pieces in a vise. Drill one or more holes through each plate cutout. Using a small side-cutting burr or reamer in an electric drill, mill out the rest of the cutout. Go easy on side pressure so you don't cut the plate.

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You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for television, Hi-Fi and Electronics.

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CIRCLE NO. 10 ON PAGE 13

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