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ELECTRONICS ILLUSTRATED

By the Publishers of MECHANIX ILLUSTRATED

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- * Newest in CB Equipment
- * CB and Mr. Nixon

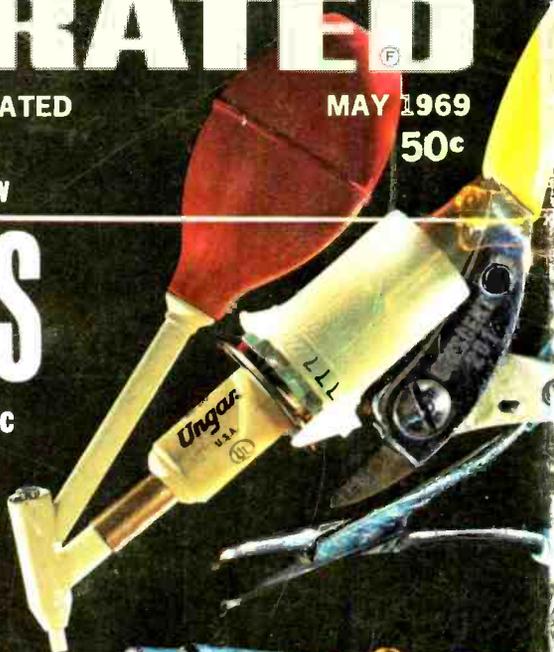
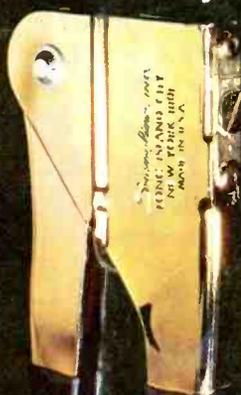
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- * Outboard Soup-Up for SWL Receivers
- * 13½ Ways to Kill Interference
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Hobbyists

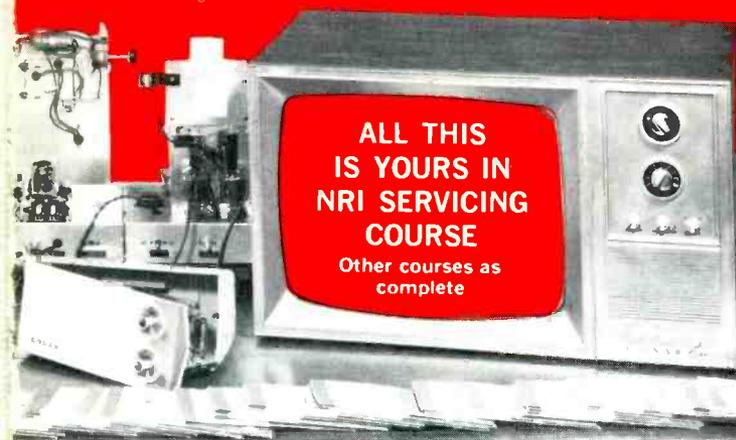


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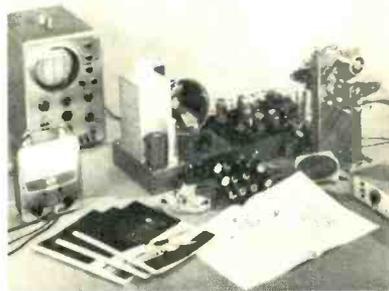
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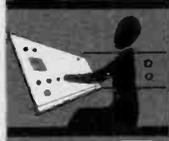
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TOOLS (clockwise from upper right): Xcelite R188 screwdriver, Ungar 7800 desolderer, Crescent 201 cutter, Techni-Tool 286 bent-nose pliers, Vaco SA711 self-adjusting nut driver, Crescent 941-4 cutters, Xcelite 56CG needlenose pliers, Klein 052C crimping cutters, Xcelite 33H curved forceps, Edsyn desolderer, Channellock 46 heat-dissipating clamp, Vaco K21 screw starter, Xcelite 62CG transverse cutter, Vaco K14 phillips-screw starter, Swingling CT2 riveting tool, Crescent 885 bent-nose pliers, Xcelite 69CG TV pliers.

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Uncle Tom's Corner

By Tom Kneitel, K2AES/KQD4552

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

★ *Every CB club I've ever heard of is torn apart by petty personal feuds. I'd like to start a CB friendship club and have all new candidates for membership bring along at least two friends to vouch for them. How would you like to be a charter member?*

Howard Dilman
Tucson, Ariz.

If I had two friends I'd take you up on the offer, Howie.

★ *We know there are vibrations which cannot be detected by the human ear because they are higher in frequency than our hearing range. Of even higher frequency are radio and infrared waves and then visible light, which our eyes do receive. Going even higher, we come to ultraviolet, X rays, gamma rays, and cosmic rays. Such radiation consists of particles which bombard the earth from outer space, filtering into the atmosphere at the north and south polar regions. But what lies even higher in the invisible radiation spectrum? Could there be strange combinations of radiation and energy mixed together? Could such ultracoscopic particles comprise unseen objects or other forms of life which can pass amongst us unseen? Might this explain so-called ghosts or even the soul? What about teleportation or UFOs? During the 1965 cosmic activity peak there was a sudden increase in UFO sightings, including the famed Michigan marsh gas and Exeter (N.H.) light displays. There was also a dramatic UFO sighting by the Chilean Navy at the South Pole, an entry point of cosmic rays. What do you think of this theory?*

Karl M. Allanday
New Kensington, Pa.

Theories on radio, video, the Beatles and maybe even ultraviolet I'm willing to go out on a limb for, but when you stomp around in ultracosmics, UFOs, ghosts and souls you not only exceed my bandwidth, you overload my circuits. Any wideband readers care to offer some scientific comments? We'll run them here as space permits.

★ *I live in a northern suburb of New York City where I can get all the N.Y.C. TV channels. I understand that if I aim my antenna northeast I can also pick up channel 3 in Hartford, Conn. I'd like to do this since they run the N.Y. Giant pro football games (not seen on N.Y. channels) and some great films. What is the best rotator for my antenna? Can I get one installed on my existing TV mast, or do I need a small tower?*

W. Maxwell Harrison
White Plains, N.Y.

If you're only receiving in two directions why not try a \$10 yagi specially made for channel 3? It could mount right on your mast and the two antennas can be switched at the receiver. Not only is this system a money-saver, but a good yagi cut for a specific channel will probably give better reception than your all-channel job.

★ *What the heck's a Sylvania 1237 tube, anyway? I've looked through tube manuals, handbooks, and industrial books without any success in identifying it. It looks like Edison's first attempt to produce a full-wave rectifier in an octal base.*

Scott Falke
Hilmar, Calif.

It's just the bird you called it. It has a 2.5-V filament and takes 100 V (max.) on the plates. Typical operating plate voltage is 20 V.

★ *I've got a loudspeaker in each room of my house connected to my communications receiver and an audio amplifier. By means of a switching panel I can run short-wave programs or background music into any*

[Continued on page 8]

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CIRCLE NUMBER 52 ON PAGE 11

Uncle Tom's Corner

Continued from page 6

room of the house. The frightening thought occurs that the amplifier or receiver might be turned on with all of the speakers switched off. Is there a simple way of protecting my gear against such a disaster?

Edward MacGregor
Albany, Ga.

Just wire a 22- to 33-ohm, 1-watt resistor across the output terminals of the equipment. While such protection is a must for transistor circuits, vacuum-tube equipment is considerably heftier and can be run at normal volume minus a speaker for short periods of time without damage.

★ **Amoosin' but Confoosin' Dept.** An outfit called D&D Citizens Band Sales, in Livermore, Calif., copped out on CB by getting a license in the Business Radio Service for their own communications. While this is discomforting, it is not as unusual as a group called UHF Engineers in Champaign, Ill., who took out a license for company communications on the non-UHF frequency of 151 mc. A few hundred kc higher can be found an even more improbable resident of 151-mc Business Band frequencies. This is Mesa Microwave of Oklahoma. Last time I looked, the lower edge of UHF was at 300 mc, while microwave frequencies started at 1000 mc and went upwards. Wha hopen, boys?

★ *I'm just getting started in short-wave listening and would like to know a good frequency for hearing rare DX stations.*

Larry Mawkin
San Jose, Calif.

Depends on how frequently you listen, Larry.

★ *Where can I get plans for a receiver to cover the hydrogen-line frequency (1420.4 mc) and the hydroxyl-ion frequency (1600 mc)?*

Emmett Redd
Halfway, Mo.

I presume you intend to plug this set in and listen for the little green men from other galaxies. Well, if you've got the cash, you can build one from plans appearing in most

[Continued on page 10]

Our Research People

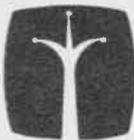


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CIRCLE NUMBER 2 ON PAGE 11

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Uncle Tom's Corner

Continued from page 8

ham publications or even use some of the military surplus microwave gear now available. You may find the amplification and noise filtering circuits a bit troublesome to build and your neighbors might not take too kindly to a 200-ft. dish antenna on your roof. Radio astronomy hasn't reached the point yet where individuals have either the technical ability or finances to hear anything more than static.

★ *Have you heard the one about a suppressed version of the Beatles' Sergeant Pepper record album? Capitol Records denies the story but several friends insist that there really is a version which was never released here.*

*Mick Rafferty
Saugus, Mass.*

Your pals are on the ball. The master used to cut the version released in England was different in that it contained a strange little message from the Beatles. The message was a constantly-repeating (it was in the end groove) chant of the words, "I never could be any other." Only a few copies of this disc ever made it to the States and Capitol has avoided any discussion of the whole crazy thing. Bob Fass, an offbeat, all-night radio personality on New York's FM station WBAI, has a copy of the disc and plays it from time to time.

★ *I recently discovered that the place where I order pizza uses two-way radio-equipped delivery trucks. Wouldn't it be great to monitor their frequency and know exactly when dinner's about to be delivered? How can I find out their frequency and call? They're Van's Pizza in Houston.*

*Ralph Montaigne
Houston, Tex.*

What you're suggesting puts a small dent in the Secrecy of Communications Law. However if you should happen to tune your VHF receiver past 151.805 mc and hear KFO475 talking about the ETA at your house, you can start taking the brew out of the refrigerator. On the other hand, if you hear KDS963 sending someone over to see you. cool it and don't bother with the suds.

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Feedback from Our Readers

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

● 0 TO 1



Your Magnetic Stirrer (March '69 EI) was an interesting project and I had only a little trouble building it (I have trouble putting batteries in flashlights also). But there is a problem that scares me. What if I mix up a martini in it, forget to take out the magnet and give it to a friend—who swallows it?

Richard Arthur
Toronto, Ont.

You're going to have one mixed-up friend.

● FAIR WARNING

In July '68 you promised a super-duper 100-mw broadcast station for the License-Free Band. So where is it? Please hurry because the airwaves around here are getting more stagnant every day and I think it's time to clear the air. (WAAB, WORC & WTAG, take notice.)

Bob Trachimowicz
Screaming Banshee Radio
Worcester, Mass.

PS—Anybody know where I can get plans for a BCB kilowatt linear amplifier?

Why don't you ask those friendly chaps at FCC down in Washington about the linear, Bob? They know all about those things. As for the mini broadcaster, see July '69 EI.

● LARGE COMPLAINT

The Electronic Musical Instruments are really in. I built several and sold them to

friends at a hefty profit. I have one complaint, though, about your EMI articles. You don't put enough IC's in them.

David Baker
Meadville, Pa.

Only one, David? How many friends have you got left?

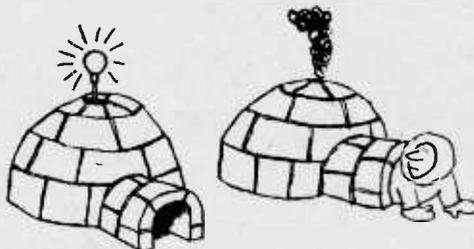
● C'EST LA VIE

I'm a new subscriber and have a question. I have a VHF monitor and I use an antenna I built from your plans. I get police, ambulance, fire, etc., but only the base stations. I can hear the mobiles only when they're quite close. What can I do?

James Doyle
Houston, Tex.

You can do what the fuzz does, Jim. A high-gain, non-directional antenna with a lot of height. Like go down and see what the cops have. But most SWLs just live with the fact that they get the base stations but not the low-power mobiles.

● CHILLING THOUGHT



I live in Alaska and I saw your article on building a Freeze-Up Guard in your March issue. When the temperature gets down to 50 degrees, you say, all kinds of bells go off and lights light up. That's very nice but what would you do if water in a bucket on your kitchen floor froze up every night? It's that way in the 49th state.

Judy Bromley
Miami, Fla.

(Temporary thawing-out address)

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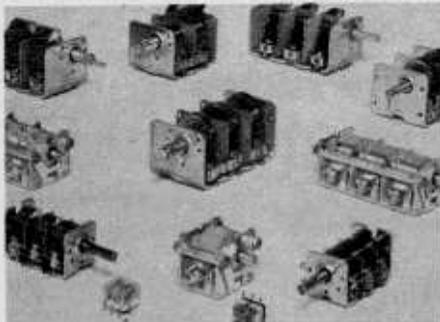
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CIRCLE NUMBER 16 ON PAGE 11



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For those who like to buy their **electronic tubes** in gross quantities, two catalogs are available which list complete stocks of consumer and industrial types. Thor Electronics Corp., 741 Livingston St., Elizabeth, N.J. 07207, has a 16-page catalog that contains over 7,000 tubes ranging from CRT's, photomultipliers, nuvistors and iconoscopes to microwave devices.

Metropolitan Supply Co., 468 Park Avenue S., N.Y., N.Y. 10016 offers people a catalog running to 38 pages that has **entertainment, industrial and military tubes** of over 10 major manufacturers. Discount prices are given for all types.

Eico's 1969 catalog offers constructors a bonanza of kits and wired electronic equipment for all tastes. Cortina line of hi-fi equipment, test instruments and hobby items are all included. For a free copy write to Eico Instrument Co., 283 Malta St., Brooklyn, N.Y. 11207.

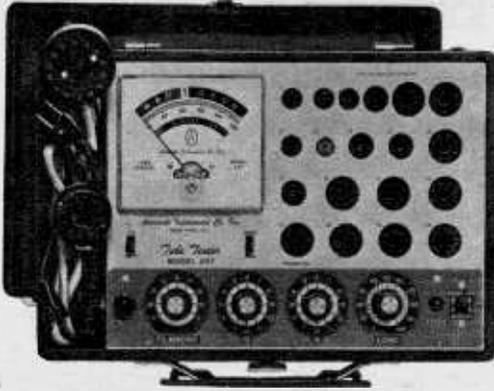
Catalog of **CB antennas** describes Hustler line for both base and mobile operations. Jam Ram and SDT models are featured as well as single and double installations for home or car. Full specifications, measurements and prices are given. New-Tronics Corp., 3455 Vega Ave., Cleveland, Ohio 44113.

For a complete selection of **CB equipment**, the catalog of Amateur Electronic Supply, 4828 West Fond du Lac Ave., Milwaukee, Wisc. 53216, should interest you. There are 40 pages packed with values in CB base and mobile stations, antennas and antenna towers and special antennas for marine, aircraft and car use.

A 48-page catalog lists all kind of **surplus equipment**. This communications and test gear comes mainly from industry and the military. Radar and high-frequency equipment is included. Free from Lectronic Research Labs., 715 Arch St., Philadelphia, Pa. 19106.

Catalog C6900 is pocket sized and offers a fantastic assortment of **tape accessories** for audiophiles. Robins Electronics Corp., 15-58 127th St., Flushing, N.Y. 11356 will let you have it for 10¢. It runs 24 pages.

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CIRCLE NUMBER 41 ON PAGE 11

Two more examples of how RCA Institutes provides up-to-the-minute Home Training in all phases of electronics:

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The demand is heavy for technicians in the booming field of CATV (Community Antenna Television Systems).

CATV was initially used to make it possible for large numbers of television receiver users to get good reception in remote areas through the use of a common antenna. It now brings to more people more programs than are available from local stations. It also improves reception where multipath signal transmission exists.

RCA Institutes includes two comprehensive lessons, covering the practical phases of CATV systems and servicing in Television Servicing and Communications courses and programs at no additional total tuition cost. Get in on the ground floor of this rewarding and expanding field. Send for full information today!

Prepare yourself for a career in the expanding field of CATV.

NEW COLOR TV KIT

To make courses even more practical and to better prepare you for a more rewarding future, RCA Institutes now includes an exciting Color TV Kit in both the beginner's program and the advanced course in color TV servicing. The cost of the kit is included in the tuition—nothing extra to pay. You also get five construction/experiment manuals plus a comprehensive service manual.

You'll receive all the materials and components to perform over 50 information-packed experiments. When you finish you'll have constructed an 18" (measured diagonally) high quality, color TV set, complete with rich cabinet in wood grain design.

Get all the details on RCA Institutes' valuable new Color TV Kit!

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Learn electronics at home faster, easier, almost automatically—with RCA AUTOTEXT

Are you just a beginner with an interest in the exciting field of electronics? Or, are you already earning a living in electronics and want to brush-up or expand your knowledge in a more rewarding field of electronics? In either case, AUTOTEXT, RCA Institutes' own method of Home Training will help you learn electronics more quickly and with less effort, even if you've had trouble with conventional learning methods in the past.

THOUSANDS OF WELL PAID JOBS ARE OPEN NOW TO MEN SKILLED IN ELECTRONICS!

Thousands of well paid jobs in electronics go unfilled every year because not enough men have taken the opportunity to train themselves for these openings. RCA Institutes has done something positive to help men with an aptitude and interest in electronics to qualify for these jobs.

HOME STUDY CAN TRAIN YOU FOR REWARDING CAREER OPPORTUNITIES

To help fill the "manpower gap" in the electronics field, RCA Institutes has developed a broad scope of Home Training courses, all designed to lead to a well paying career in electronics in the least possible time. You also have the opportunity to enroll in an RCA "Career Program" exclusively created to train you quickly for the job you want! Each "Career Program" starts with the amazing AUTOTEXT Programmed Instruction Method. And, all along the way, your program is supervised by RCA Institutes experts who become personally involved in your training and help you over any "rough spots" that may develop.

VARIETY OF KITS ARE YOURS TO KEEP

To give practical application to your studies, a variety of valuable RCA Institutes engineered kits are included in your program. Each kit is complete in itself, and yours to keep at no extra cost. You get the new Programmed Electronics Breadboard for limitless experiments, including building a working signal generator, multimeter, and a fully transistorized superheterodyne AM receiver.

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Start today on the electronics career of your choice. Pick the one that suits you best and mark it off on the attached card.

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ADVANCED TRAINING

For those already working in electronics, RCA Institutes offers advanced courses. You can start on a higher level without wasting time on work you already know.

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RCA Institutes offers a unique tuition plan that lets you progress at your own pace. You only pay for lessons as you order them. You don't sign a contract obligating you to continue the course.

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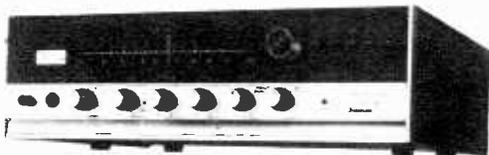
Address _____

City _____

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Electronic Marketplace

Silicon Sound? Sansui 800 is 70-watt stereo AM/FM receiver incorporating an all-silicon transistor amplifier. Frequency response is 15 cps to 50 kc, with a power bandwidth (IHF) of 20 cps to 40 kc, according to the manufacturer. Power transistors are protected from overloads



and short circuits. Receiver has FET front end, 3-gang variable capacitor, four IF stages and three limiters. The 800 also has automatic stereo switching and a noise canceller that eliminates noise on FM stereo without altering high-frequency characteristics. Ceramic filter is employed in IF stage of AM receiver, as well as an AGC circuit. Other features are an AM/FM tuning meter, loudness control, tape monitor switch and headphone jack. A local/distance FM switch permits reception of either strong or weak signals. \$259.95, Sansui Electronics Corp., 34-43 56th St., Woodside, N.Y. 11377.

Quickie Checks. Model DT-100 diode and transistor checker is a low-current model said to quickly determine whether or not a transistor or diode is good. RF transistors and low-current



diodes may be checked without causing any damage, according to the manufacturer. The tester is useful where components must be checked while still mounted on a printed circuit board. \$14.95. Technical Products Div. Texscan, 7707 Records St., Indianapolis, Ind. 46226.

[Continued on page 22]

The remarkable difference about Pearce-Simpson's Guardian 23 and Guardian 23-B: they work.



What's the most important thing about a CB base-station and mobile-unit combination?

When some guy says something, the guy at the other end should be able to hear it.

In other words, "10-4" should sound like "10-4" — not "snap, crackle and pop."

So the great thing about the Pearce-Simpson Guardian 23 and Guardian 23-B (in fact all Pearce-Simpson's radios) is that the transmitters transmit and the receivers receive.

Don't laugh. Not every CB manufacturer can make that statement.

If you want to get technical, here's the explanation. Pearce-Simpson's exclusive HetroSync circuitry sharpens transmitted signals. High level saturation limiting provides automatic speech clipping. And the Superhet receiver hears signals that ordinary sets distort or fade.

Guardian 23 comes with palm microphone, mounting cradle, AC and DC power cords. Guardian 23-B comes complete with built-in, all transistor, solid state pre-amplifier that lets you stay a comfortable distance from your mike and still broadcast loud and clear. And Pearce-Simpson's new SuperMod desk mike is available as an option.

Guardian 23 and Guardian 23-B — Pearce-Simpson's super twins.

They work.

For more details on all our New CB Radios write Pearce-Simpson, Inc., Dept. EI-569, P.O. Box 800, Biscayne Annex, Miami, Fla. 33152

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CIRCLE NUMBER 18 ON PAGE 11

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OUT THERE CONTROL OUR LIVES?

THE OTHERS

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CIRCLE NUMBER 50 ON PAGE 11

Electronic Marketplace

Continued from page 21

Faithful Ears. Model SE-20 stereo headphones are said to be scientifically designed for maximum listening comfort. In spite of low price, the manufacturer claims a frequency response of 20 cps to 18,000 kc with virtual absence of distortion. The headphones are said to have low power requirements to permit use with hi-fi systems having modest outputs. Earcups are



made of molded vinyl and are slightly larger than average. Model SE-20 comes complete with 8-ft. cord, 3-conductor stereo plug and storage case. \$19.95. Pioneer Electronics Corp., 140 Smith St., Farmingdale, N.Y. 11735.

Mobile Transceiver. Arvin's model 10Y64-15 lightweight communications transceiver is said to have 1,000-mw output and a range of up to 4 mi. Solid-state operation is provided by 13 transistors. Crystals for channel 11 are included; another set of crystals may be added for dual-channel use. The transceiver has a squelch control, over-modulation limiter and automatic noise limiter. There is a standby switch and a push-to-talk button. Other features include a battery indicator, whip antenna, earphone jack and AC adaptor jack. Operation requires eight penlight batteries. An application for FCC license is also provided. \$56.95. Arvin Industries Inc., Electronic Systems Div., 13th St. and Big Four Railroad, Columbus, Ind. 47201.



Electronics Illustrated

Now... for the first time... a brand-new service that offers you stereo tape cartridges—at great savings!

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YES, IT'S TRUE! You may have any 3 of the best-selling 8-track cartridges shown here—ALL 3 for only \$5.95! That's the fabulous bargain the brand-new Columbia Stereo Tape Cartridge Service is offering new members who join and agree to purchase as few as four additional selections in the coming year.

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YOUR OWN CHARGE ACCOUNT! Upon enrollment, the Service will open a charge account in your name. You pay for your cartridges only after you've received them—and are enjoying them. They will be mailed and billed to you at the regular Service price of \$6.95 (Classical, occasional Original Cast and special cartridges, somewhat higher), plus a mailing and handling charge. **YOU GET FREE CARTRIDGES!** Once you've completed your enrollment agreement, you'll get a cartridge of your choice FREE for every two cartridges you buy! That's like getting a 33½% discount on all the 8-track cartridges you want... for as long as you want!

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Please enroll me as a member of the Service. I've indicated below the three cartridges I wish to receive for \$5.95, plus postage and handling. I agree to purchase four more selections during the coming year at regular Service price, and I may cancel my membership any time thereafter. If I continue, I am to receive an 8-track cartridge of my choice FREE for every two additional selections I accept.

SEND ME THESE 3 CARTRIDGES (fill in numbers below)

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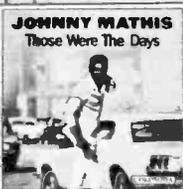
424-3/1C



7114. Also: By the Time I Get To Phoenix, Honey, Welcome To My Heart, April Again, etc.



6366. Includes Mrs. Robinson from "The Graduate," "Fakin' It," "At The Zoo, Old Friends, etc.



7045. Johnny sings the title hit; plus Light My Fire, Little Green Apples, Turn Around Look At Me, etc.

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<p>RAY CONNIFF and the CONNIFFERS TURN AROUND, LOOK AT ME Plus *My Romance *I Was 10 MORE</p> <p>6897. Also: People, The Good, The Bad and The Ugly; 11 in all</p>	<p>ROGER WILLIAMS ONLY FOR LOVERS PLUS Theme for "ELVIRA" 9 MORE</p> <p>7245. Also: Up, Up and Away, Talk to the Animals; 11 in all</p>	<p>BIG BROTHER & THE HOLDING COMPANY Featuring JAMIS VOPLER CHEAP THRILLS</p> <p>6876. Includes: Ball and Chain, Summer-time, etc.</p>	<p>THE GRADUATE Songs Performed by Simon & Garfunkel</p> <p>6140. Plus: Albatross, Sisters of Mercy, Sky Fall, etc.</p>	<p>THE GRADUATE Songs Performed by Simon & Garfunkel</p> <p>6313. "Like the movie... a hit album!" -Billboard Magazine</p>
<p>RON BUTTERLY In-A-Gadda-Da-Vida</p> <p>7035. Also: Are You Happy, Termination, My Mirage, etc.</p>	<p>BERNSTEIN American Classics GERSHWIN Rhapsody in Blue An American in Paris GROFÉ Grand Canyon Suite 10 MORE</p> <p>6238-6239. Twin-Pack. Two Counts As Two Selections</p>	<p>AT FOLSOM PRISON Jackson 10 MORE</p> <p>6415. Tolson Prison Blues, The Long Black Veil, The Wall, etc.</p>	<p>ANDY WILLIAMS HONEY By the Time I Get to Phoenix 9 MORE</p> <p>6358. Plus: Love Is Blue, Whisky, Up and Away, etc.</p>	<p>BARBRA STREISAND A Happening in Central Park</p> <p>6364. Cry Me a River, People, Second Hand Rose, many more</p>
<p>DIANA ROSS THE SUPREMES Reflections Plus "Forever" Come Today 10 MORE</p> <p>6448. Also: Up, Up and Away, Ode To Billie Joe, etc.</p>	<p>Country & Western STAR TRACK, Vol. 6</p> <p>JOHNNY CASH RAY PRICE JIMMY DEAN FLATT & SCRUGGS 10 MORE</p> <p>6718. Includes: Folsom Prison Blues, Ode To Billie Joe, 12 in all</p>	<p>TWIN PACKS Twice the music—yet each counts as one selection</p>	<p>Andre Kostelanetz and His Orchestra WONDERLAND OF GOLDEN HITS I WISH YOU LOVE 10 IN ALL 10 MORE</p> <p>6237. Plus: Java, Ebb Tide, Walk On the Wild Side, 26 in all</p>	<p>THE JIMI HENDRIX EXPERIENCE ELECTRIC LADYLAND All Along the Watchtower 15 MORE</p> <p>7179. Also: Voodoo Child, Rainy Day, Dream Away, 16 in all</p>

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Swap Shop

Individual readers (not commercial concerns) may swap electronic gear by sending one listing, name and address to Swap Shop, ELECTRONICS ILLUSTRATED, 67 West 44th Street, New York, N.Y. 10036. Space is limited; only most interesting offers are published.

AMATEUR RADIO

HAMMARLUND HQ-105TR, other gear. Want Hickock 288X or later signal generator, other good service gear, or best offer. Harold Dalton, P.O. Box 641, Easley, S.C. 29640.

EICO 720 transmitter. Will swap for Knight T-150 transmitter or R-100A receiver. Jack Shea, WN3KXG, 4343 Ludwick St., Pittsburgh, Pa. 15217.

VIBROPLEX bug. Will swap for other ham gear or best offer. Paul Baillie, 14 Keene St., Bourne, Mass. 02532.

HEATH Twoer, model HW-30. Want 160-meter ham transmitter or best offer. Stan Garfield, 53 Glenwood Rd., Tenafly, N.J. 07670.

SURPLUS World War II Navy short-wave receiver. Will swap for transmitter. Tom Caltabiano, 703 Rita St., Redondo Beach, Calif. 90277.

ROOF MOUNT antenna, 20 ft., with ground plane. Will swap for 40-meter novice transmitter. Bill Kornfeld, 10 Kings Park Rd., Commack, N.Y. 11725.

HALLICRAFTERS S-120 receiver. Want novice transmitter. Frank Ward, WN4KTH, 1111 Frederick Rd., Opelika, Ala. 36801.

CENTRAL ELECTRONICS 10B SSB transmitter, 458 WFO. Make swap offer. Don Petersen, 9404 NE 8th St., Vancouver, Wash. 98664.

KNIGHT T-60, R55 receiver. Will swap for stereo phono equipment. Wayne Jackson, 4715 Old Bullard, Tyler, Tex. 75701.

HEATH Apache TX-1, HR-108. Will swap for ham transceiver. Rick Miller, WA0UAY, RR 3, Sumner, Iowa. 50674.

HOME BREW 12-watt CW transmitter, other gear. Would swap for Heath AA-14, or Knight KG-865 or equivalent transistor amplifier. Jean Heroux, 3555 Lemieux, Cite Universitaire, Quebec 10, P.Q., Canada.

NATIONAL HRO-50T receiver. Want SSB ham transceiver or 23-channel CB transceiver. Herb Whipple, K0ELK, 306 2nd St., Pevely, Mo. 63070.

GLOBE Chief 90A CW transmitter 80/10 meters, 75/90 watts. Make swap offer. Art Stefanelli, WN2GNO, 2303 Beverly Rd., Cinnaminson, N.J. 08077.

EICO 723 60-W CW transmitter for 10, 15, 20, 40, 80 meters. Will swap for VHF equipment, tape recorders or hi-fi. R.H. Gauger, 20 Glen La., Glen Head, N.Y. 11545.

AUDIO & HI-FI

PORTABLE tape recorder. Want ham, CB gear or best offer. Bob Smallwood, 625 Tompkins Dr., Oklahoma City, Okla.

STEREO tape recorder, other gear. Will trade for 8-track tape players and recorder. Roland Kulish, 5075 Heisig, Beaumont, Tex. 77705.

ROBERTS 770X stereo recorder. Will swap for ham gear or best offer. Carlo A. Pinto, 28 Manson Pl., Little Silver, N.J. 07739.

ELECTRO-VOICE 15-in. speakers. Want Lafayette RK-142 portable tape recorder, best offer. Steve Johanson, Rt. 2, Box 3, Ontario, Ore. 97914.

BOGEN turntable with stereo cartridge. Will trade for electric guitar or Koss PRO-4A headphones. Darrell Roman, 1350 Madison Pk., Chicago, Ill. 60615.

KNIGHT KG-250 stereo amp., walnut case. Will swap for VTVM, color organ, CB or ham gear, or best offer. Mat Restivo, 3547 Tuscala St., Seaford, N.Y. 11783.

PRESTO T-2 turntable with amp. Will swap for Hammarlund HQ-129X short-wave receiver, Heath GR-54 or best offer. Rev. Frank J. Lunn, Rt. 1, Box 43, Tyler, Minn. 56178.

HEATH 20-watt amps (two), other equipment. Want short-wave receiver and tape deck. Dr. Charles Myler, 1902 Edgehill Dr., San Antonio, Tex. 78209.

EICO ST-96 AM/FM tuner. Want Heath GR-54 receiver or equal. Harold Morgan, Kuttawa, Ky. 42055.

VIKING 75 tape deck with preamp and E-V 664 mike. Want Dual turntable. James Laning, 553 West F Ave., Kalamazoo, Mich. 49001.

ANTIQUE ELECTRONICS

ATWATER KENT model E. Will swap for best offer. Dan Evans, 6100 NE 199th St., Vancouver, Wash. 98665.

RCA 121 and three more table radios. Will trade for Norden Hauck 10. Arthur Dineen, Box 247, Sharon, Wis. 53585.

ATWATER KENT 55. Want amateur receiver. Dave Slone, Box 9, Lafayette, Ohio. 45854.

CROSLEY 79 AM/SW (60-16 meters) receiver, spare tubes. Will swap for SLR 35-mm camera. Narcis Radkiewicz, 1015 Cross Ave., Elizabeth, N.J. 07208.

ATWATER KENT model 44 in playing condition. Will swap for early battery set. Ken Roberts, 57 East La., Columbus, Ohio. 43201.

101 TUBES: O1As, 371s, etc. Swap for VHF gear or best offer. Dave Poppke, Jr., WN0VYF, 1414 16th St., Bismarck, N.D. 58501.

ATWATER KENT 1926. Want HF receiver or best offer. William Richardson, RFD 1, Wilton, N.H. 03086.

SHORT-WAVE LISTENING

HALLICRAFTERS WR-600-W (similar to S-120). Want ham band receiver, 80-10 meters. James J. Blumenfeld, Belmont Dr., Monticello, N.Y. 12701.

NOVA-TECH Pilot II. Want Nova-Tech action or Nova CB receivers. E.A. Sjolander, Jr., 119 7th St. W., Ashland, Wis. 54806.

GONSET 3012 (152-162 mc police, fire, etc.) and 3011 (40-50 mc highway patrol, etc.). Richard M. Jacobs, WA0AIY, 4941 Tracy Ave., Kansas City, Mo. 64110.

KNIGHT R-55A receiver. Swap for sextant or other sailing gear. Stanley Piquet, RFD 2, Tomah, Wis. 54660.

RCA 3BX672 7-band AM/SW receiver, other gear. Make swap offer. Allen Curtis, 1337 Brookline Rd., Cleveland Hts., Ohio 44121.

HALLICRAFTERS S-41W, 550 kc to 30 mc. Want CB transceiver or best offer. Jack Wheeler, 14121 Edbrooke, Riverdale, Ill. 60627.



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CIRCLE NUMBER 47 ON PAGE 11

KNIGHT Star Roamer, like new. Will swap for Heath HO-10 keyer, crystals or portable HF ham receiver. Larry Schoen, 1446 E. 52nd St., Brooklyn, N.Y. 11234.

LAFAYETTE HA-225 communications receiver, matching speaker. Will swap for CB transceiver or best offer. Donald Hobbs, 212 Railroad St., Milton, Fla. 32570.

HEATH GR-64 receiver. Want HRO coils and crystal calibrator for HRO-50. Mike Niklas, WA8WYN, 1337 Linwood Ave., Columbus, Ohio. 43206.

KNIGHT KG-221 VHF receiver. Want FM stereo tuner or best offer. John Brennan, 2614 Falcon St., East Meadow, N.Y. 11554.

OTHER EQUIPMENT

ASSORTED tubes. Want radar parts or best offer. Scott Bertilson, 12640 Westport Dr., Creve Coeur, Mo. 63141.

GEIGER COUNTER, portable (9-V battery) with meter, headphones, instructions. Will swap for X-ray tube. Jeff Scheetz, 907 McKinley St., East Rochester, N.Y. 14445.

OSCILLOSCOPE 115/230 VAC. Want FM business band transceiver (low or high band), or equivalent. Jim Clark, 3671 Dover Rd., Cheyenne, Wyo. 82001.

SAMS Photofacts. Will trade for kits that do not work or unworkable factory-built equipment. James Fred, RR 1, Cutler, Ind. 46920.

ASSORTED electronics magazines including QST from 1935 to 1951. Want 6- or 2-meter converter, transmitter or transceiver, Drake 2B or CB transceiver. Lad Nagurney, 727 Marion St., Scranton, Pa. 18509.

DON BRITTON harmonic bug/infinity telephone scrambler transmitter. Make swap offer. Gary Denman, Rt. 3, Box 164, Grapeland, Tex. 75844.

WHAT DO YOU WANT? I want antique jukebox for 78-rpm records. Dean R. Kazmierczak, 886 Eggert Dr., N. Tonawanda, N.Y. 14120.

SONY 5-307UW all-channel portable 5-in. TV. Will swap for Garrard SL-95 turntable and cartridge. J. Koniecki, 11 W. 81st St., New York, N.Y. 10024.

ULTRASONIC Omni-Alarm. Want 5-watt CB transceiver. Steve Zane, 843 Bradford Ave., Westfield, N.J. 07050.

SERVICE GEAR

HICKOK combination VTVM and signal generator, 90 kc to 144 mc. Will trade for R/C gear or best offer. Sandy McEachern, 943 Duncan Ave., Manhattan Beach, Calif. 90266.

DeVRY (Bell & Howell) oscilloscope with manuals. Swap for complete record player, tape recorder, walkie-talkie set or best offer. Jack C. Riften, 7041 Avalon, Parkville, Mo. 64152.

RADIO CITY PRODUCTS model 705A signal generator, 100 kc to 75 mc. Want ham gear or best offer. Jerry Hinshaw, WB6ZGQ, 618 Delaware Dr., Claremont, Calif. 91711.

EICO 628 tube tester. Make swap offer, Michael A. Barone, 1637 Steinhart Ave., Redondo Beach, Calif. 90278.

COMBINATION tube tester/VOM/capacitance meter, other gear. Want Mammarlund HQ-110A, SB-310, SB-301 or HW-16 or similar gear. Warren Tucker, Box 26, Ochlocknee, Ga. 31773.

WESTON 433 15/150-VAC voltmeter. Will swap for oscilloscope or short-wave receiver. Joseph Lau, 65 Pike St., New York, N.Y. 10002.

EICO 221 VTVM. Want Drake 2B or other amateur receiver. Mike Snyder, 2510 Avery St., Parkersburg, W.Va. 26101.

CENTURY in-circuit capacitor tester, oscillograph, other gear. Want Amprobe RS-3. Dail Skaggs, Westbury Dr., Clinton, Tenn. 37716.

HEATH IG-52 TV/FM generator. Will swap for best offer. Roger Kloeper, 1428 Ormond St., Lansing, Mich. 48906.

KNIGHT KG-670 R-C tester. Want police receiver or best offer. Jimmy R. Armstrong, Box 255, Mt. Vernon, Tex. 75457.

EICO 232 VTVM. Want RCA Mark VIII. Dewey Altizer, Centerburg, Ohio 43011.

CITIZENS BAND

LAFAYETTE transceiver. Will swap for Lafayette RK-77 or similar astronomical telescope or best offer. Larry Stafford, 553 Victor Ave., Lebanon, Tenn. 37087.

REGENCY RG-II, 2 ground-planes. Will swap for good stereo tape recorder or best offer. Bill Hadley, 2004 Morgenthau Dr., Mobile, Ala. 36618.

[Continued on page 118]



Still plodding through math and electronics problems the slow pencil-and-paper way? Smash the paperwork barrier with this new Electronics Slide Rule.

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Is Johnson's new 23-channel Messenger 123 at \$169.95 . . . Legal?



You be the Judge.

Is it unfair competition for Johnson to produce a 23-channel solid state unit with the incomparable Johnson "talk-power" for less money than you had to pay yesterday for a 12-channel unit with crystals?

Is there a law against operating a rig whose specifications are close to theoretical perfection—such as 0.4 microvolt sensitivity . . . and sharply filtered 7 kHz selectivity?

Is it a crime to build in a special speech compression circuit for unsurpassed voice intelligence? Or the famous Johnson high-efficiency noise limiter that virtually wipes out ignition and other extraneous radiated interference?

We think you'll agree: For sheer value, Messenger 123 is the exception to the rule.

E. F. JOHNSON COMPANY
WASECA, MINNESOTA 56093



CIRCLE NUMBER 34 ON PAGE 11

Electronics Illustrated



Amazing New Tools for Electronic Hobbyists

Special tools for those unique jobs will make life a lot easier.

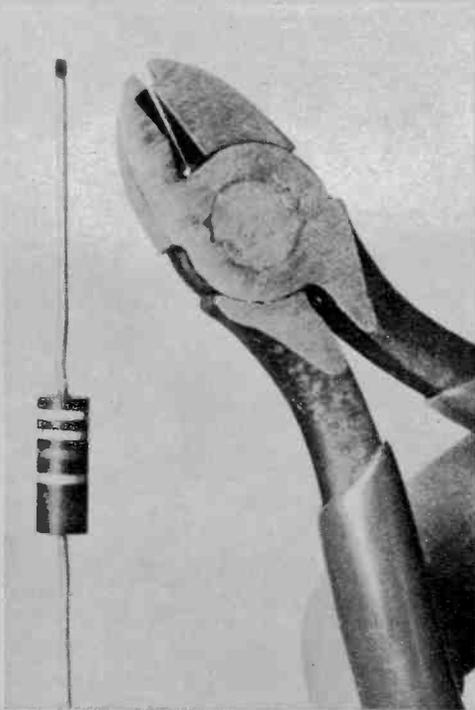
By SAL STELLA

IF you're like most electronic hobbyists you are experiencing trouble these days with those exotic and tender new components. Wrecked midget printed-circuit boards, burned integrated circuits and blown FETs are costly in terms of both wasted time and temper.

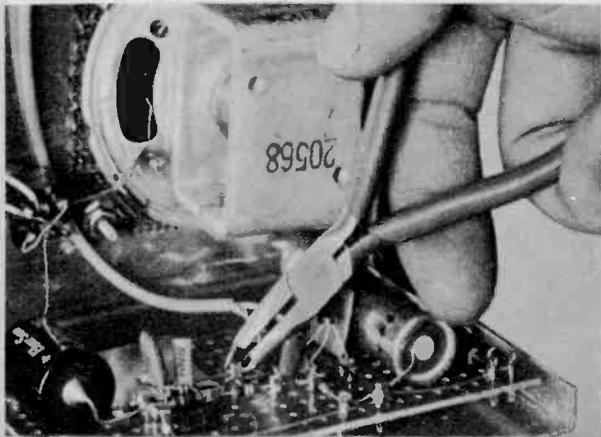
But don't lose your cool quite yet. Some amazingly helpful new tools are coming along to do specialized jobs that previously could drive you crazy. They won't solve all your problems but they sure can reduce the number of headaches. And, in the long run, they can save you money.

Now you can use the right tool for the task at hand and simply forget about the three or four other gadgets you may have bought to do the job. Miniature components have been shrinking faster than a miniskirt. Tool designers have failed to keep pace, but now they're catching up.

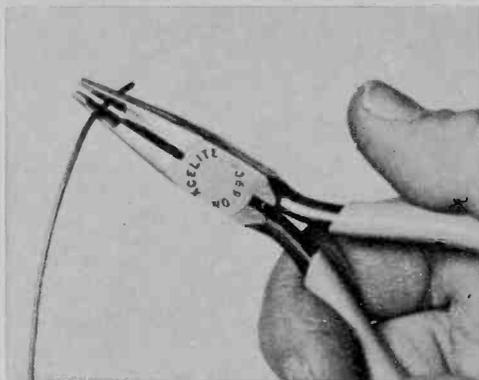
New Tools



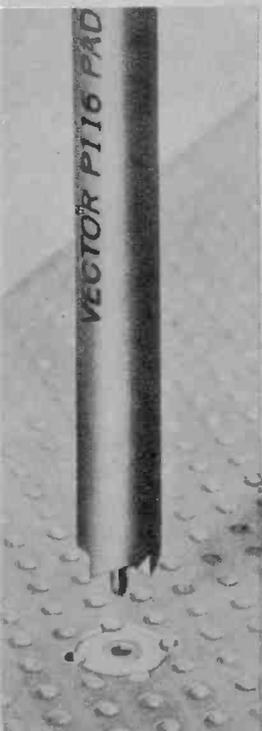
Klein type 052C crimping cutter cuts lead and crimps end of wire so it can't fall through board.



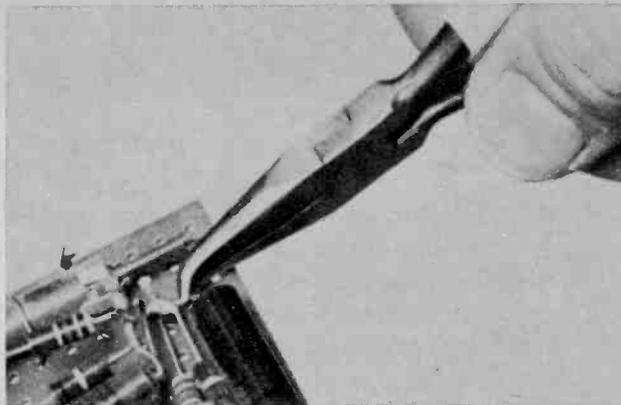
Kraeuter type 20106 tip cutter reaches down at an angle to cut hidden lead from top of circuit board.



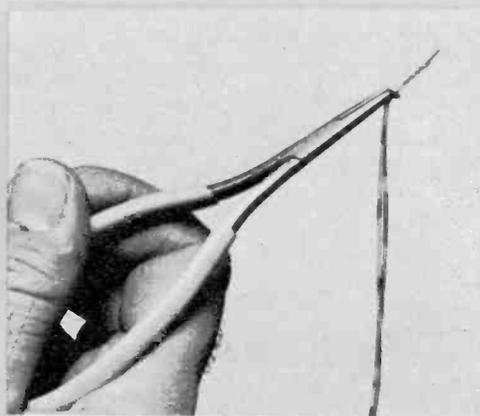
Xcelite type 69CG TV pliers has cutter up front; jaws taper to fine point. Flick of wrist can cut wire.



Vector type 116 pad cutter mounts in drill chuck and cuts off ring of copper around hole to isolate it from rest of copper cladding. Small pad is left.



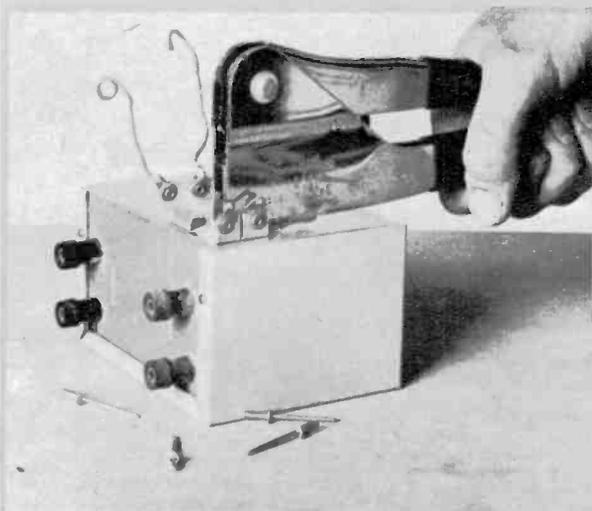
Crescent type 885 bent-nose pliers is $4\frac{1}{2}$ in. long and has $\frac{1}{8}$ -in. bend that allows you to grip wires without disturbing other components on crowded boards.



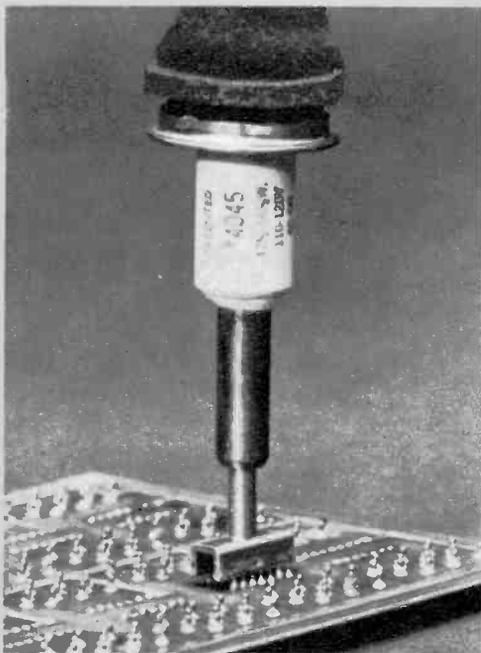
Precista type 286 bent-nose pliers has jaws with special tip for holding several wires at a time.



Ungar Model 6900 Princess Soldering Station is a mini iron complete with holder, sponge and tips.

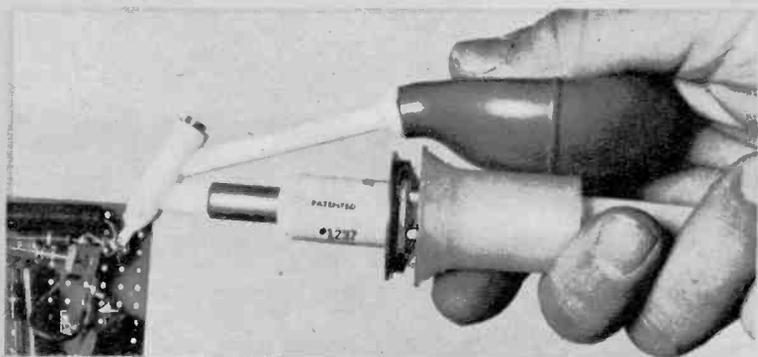


Swingline Model CT-2 riveting pliers holds terminal strips to boards, makes pivot hinges for covers.

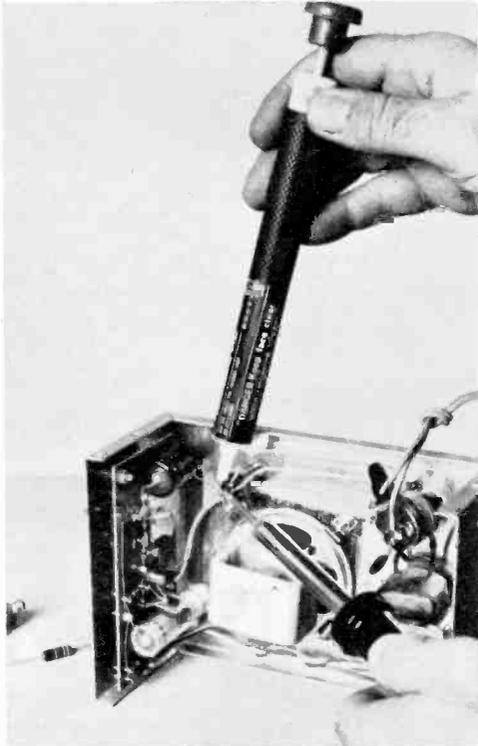


Ungar Model 859 IC remover is a desoldering tip that can melt 16 IC terminals simultaneously.

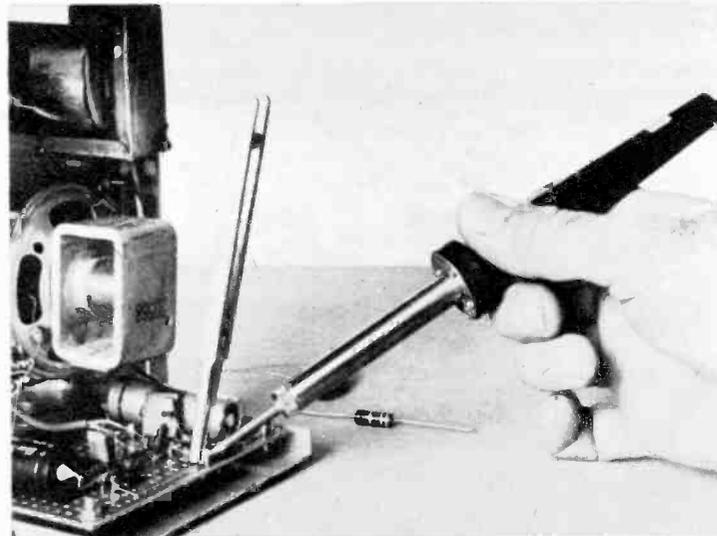
Ungar Model 7800 Hot-Vac is desoldering tool which permits you to melt and remove solder from terminal; you use only three fingers. After bulb is squeezed, solder is drawn into bulb.



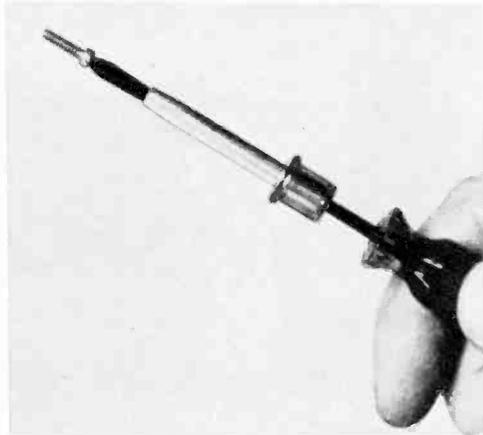
New Tools



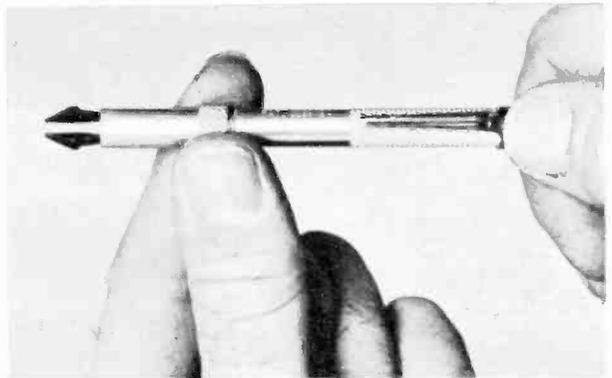
Edsyn Solderpull is vacuum device which removes solder. Plunger is pushed in and then released.



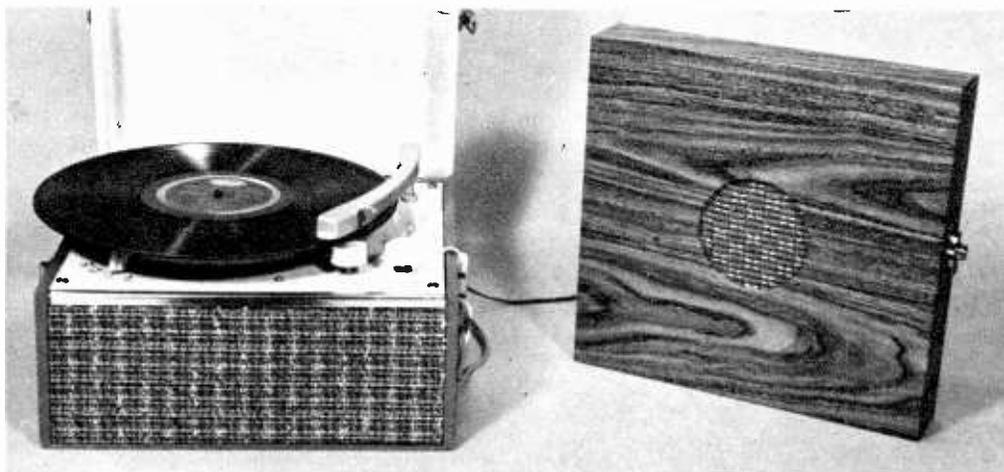
And there's a starter for phillips-head screws, too. Vaco's type K15 consists of two V-shape blades that firmly grip cross-slotted screws. Type shown is 5 in. long. Other lengths are available from 3 to 9 in.



Vaco type K21 screw starter has split shaft that grips slot of ordinary small screw to get it started.



Channellock type 46 Heat-sorb clamp dissipates heat to keep components cool during soldering operation. Spring-closed clamp actually is a heat sink and acts as heat shield between junction and components.



Stereo Conversion for Mono Phonos

By **VINCE DANIELS** DRIVEN to the wall by the kids because they nag for what they call a *stereo*? There's a way to shut them up and avoid bending the budget—just convert the old mono phono to stereo.

The conversion of any phono, whether new or old, to stereo is a one-evening project because the heart of the conversion—the 5-watt stereo amplifier—is available assembled. You add only a four-component power supply, volume and tone controls, a new pickup arm, a second speaker. If you want to make a deluxe conversion you can add a stereo/mono switch.

The photographs show our conversion. First step is to remove the existing tube amplifier and mono arm. Before installing the stereo amplifier drill a $\frac{3}{8}$ -in.-dia. hole for the ganged tone controls. Since the tone and volume controls can be located anywhere, you can utilize the existing volume (and tone) control holes. If you want a stereo/mono switch, install it now on the motorboard.

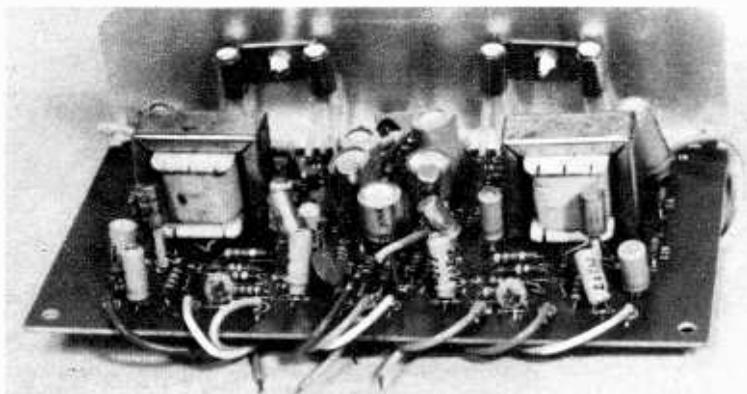
While the amplifier may be located anywhere inside the cabinet, there generally is more than enough room on the underside of the motorboard for both amplifier and power supply. Mount the amplifier, using the three existing holes in its board. To prevent bending the board and possibly breaking some of the etched foil, place a $\frac{1}{4}$ -in. spacer or a stack of washers between the amplifier and motorboard at each mounting screw.

Next, mount power transformer T1 away from the amplifier and the pickup's mounting hole. The transformer also should be away from the tone and volume controls. Before wiring the power supply, install the volume and tone controls and the new pickup.

It is best to install a complete stereo cartridge (crystal or ceramic)/arm combination rather than just replace the mono cartridge with a stereo cartridge. Reason for doing this is that many mono arms are heavy and will ruin a stereo record. A complete arm/cartridge combination costs just a little more than a cartridge alone. We installed a Lafayette Model 99 T 1024 (\$1.95). Of course, the more you spend for the arm and cartridge the better the sound.

While the instructions supplied with the amplifier show a separate volume control for each channel we recommend ganged volume controls because it permits the volume of both channels to be changed simultaneously. If you

Stereo amplifier used for the conversion. Plate at the top is a heat sink for the output transistors. Wires along bottom edge connect to numbered eyelets. Eyelet No. 12 is at top and has a red wire connected to it. Three mounting holes are in lower left and right corners and top center.



Stereo Conversion for Mono Phonos

prefer, install ganged controls with *concentric* shafts to allow independent control of each channel. The tone controls should be the type specified. Power switch S1 can be on the back of either the tone or volume controls.

Connections. The amplifier is supplied with connecting leads but you'll find they may be too short. Note that a metal eyelet is the connection point on the circuit board for each lead. This allows a new lead to be soldered-in from the top of the board. Simply remove the existing wire, tin the eyelet and solder in the new lead.

Each eyelet is numbered. The eyelet to which the red wire is connected is No. 12. (The number may be hidden by a resistor.) Connect the volume and tone controls, the pickup leads, and the stereo/mono switch leads (if used) to the eyelets as shown in the schematic.

If the pickup you use has a three-wire lead, two hot and a shield, connect the shield to eyelet No. 13. If your arm has separate shielded leads for each channel, connect both shields to eyelet No. 13.

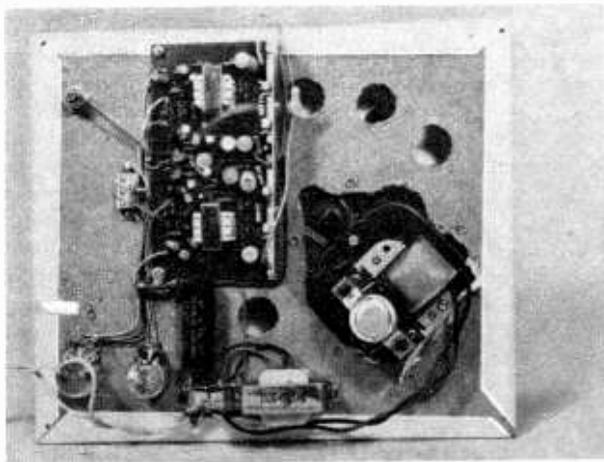
Note that the power supply has a *negative* output. Connect the center tap of T1's secondary to eyelet No. 13. Make certain the polarity of diodes SR1, SR2 and capacitor C1 is correct.

Connect *one* amplifier output to the existing speaker. Mount a phono jack anywhere on the back of the cabinet for the external speaker. To maintain similar sound quality, try to use the same size and type of

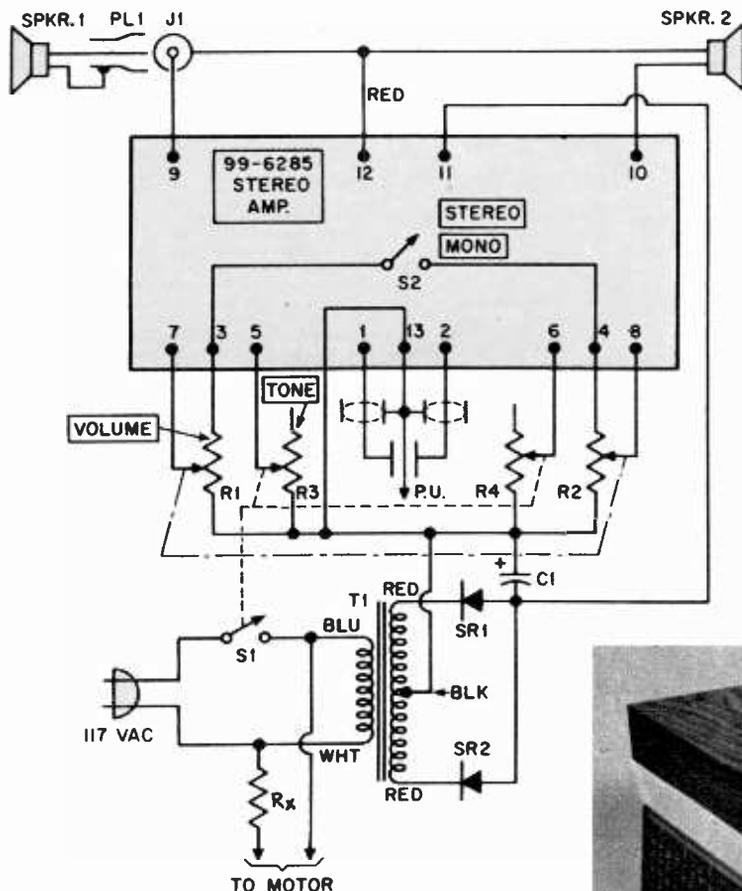
external speaker as the existing speaker.

While the output impedance of the amplifier is 8 ohms you will have no difficulty using the 3.2-ohm speakers found in many portable phonographs. If you hear unusual distortion simply connect a 3.9-ohm 1-watt resistor in series with each speaker.

The External Speaker. For maximum portability and convenience the external speaker should be attached to the phono when not in use. In our conversion, we made the external speaker enclosure the same size as the phono's cover. A catch on each side locks the external speaker to the cover. The enclosure need be only as deep as the speaker, plus an extra 1/4 in. or so for the connecting cable. To avoid a squawky sound put a back on the rear of the external-speaker enclosure and

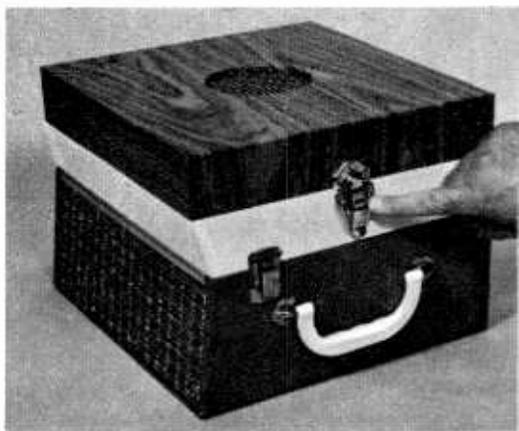


Complete stereo conversion can be made on motorboard. Amplifier is at top. Power transformer, motor resistors and the filter capacitors are below.



Conversion schematic. Stereo/Mono switch S2 is optional. Wires (ground) going to the bottom of controls R1, R2, R3 and R4 should be soldered to controls' cases. Resistor Rx must be installed if the motor was connected in series with tube's filament in the original tube amplifier.

The external speaker enclosure should be made the same size as the top of the phono cabinet and attached with snap catches. To avoid a squawky sound, cover the back of the enclosure and drill three 3/8-in. dia. holes in one corner. The speaker wire can be passed through one hole.



drill three 3/8-in.-dia holes in one corner; the connecting lead can be passed through one of the holes. When you play a mono record set S2 to *mono*. For stereo, set S2 to *stereo*, and place the speaker 4 to 6 ft. to the side.

The greater the separation the better. If you sit 10 ft. from the speakers, a good separation is about 8 ft. If the speakers are too close, you will have to sit close to them to notice separation.

If the phono's motor was originally connected across the AC line do not use resistor Rx. If the motor was originally connected in series with the tube filament of a one-tube phono amplifier it is a 90-V motor. Series resistor Rx must be used with such a motor.

Resistor Rx may be from 80 to 85 ohms and must be at least 20 watts. Two series-connected resistors can be used to obtain the desired resistance. Because Rx runs hot, mount it on a terminal strip—far away from the amplifier and cabinet.

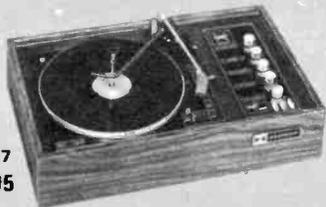
PARTS LIST

- C1—1,000 μ f, 25 V electrolytic capacitor
- J1—Phono jack PL1—Phono plug
- P.U.—Crystal or ceramic stereo pickup (see text)
- R1,R2—500,000 ohm dual-concentric or ganged audio-taper potentiometer
- R3,R4—500,000 ohm ganged audio-taper potentiometer
- Rx—20 watt wirewound resistor (see text for resistance)
- S1—SPST switch (on R1,R2 or R3,R4)
- S2—SPST slide or toggle switch
- SPKR 1—3.2 ohm speaker (see text)
- SPKR 2—Existing speaker
- SR1,SR2—Silicon diode; minimum ratings: 500 ma, 100 PIV
- T1—Power transformer; secondary: 26 V center tapped (Lafayette 99 T 6289)
- Misc.—5 watt modular stereo amplifier (Lafayette 99 T 6285)

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NEW
kit AD-27
\$169⁹⁵



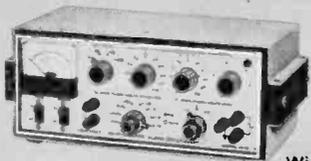
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kit TA-38
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NEW
kit GR-58
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NEW
kit IG-18
\$67⁵⁰
Wired IGW-18
\$99⁵⁰

HEATHKIT AD-27 FM Stereo Compact

The new Heathkit "27" Component Compact was designed to change your mind about stereo compact performance. How? By sounding as if it were made of top quality stereo components... which in fact it is. Heath engineers took their highly rated AR-14 solid-state Stereo Receiver, modified it physically to fit the cabinet, and matched it with the precision BSR McDonald 500A Automatic Turntable. Performance? Here's the AD-27 in detail. The amplifier delivers 30 watts music power... 15 honest watts per channel — enough to drive any reasonably efficient speaker system. Response is virtually flat from 12 Hz to 60 kHz, and Harmonic & IM distortion are both less than 1% at full output. Tandem Volume, Balance, Bass & Treble controls give you full range command of all the sound. Select the FM stereo mode with a flick of the rocker-type switch and tune smoothly across the dial, thanks to inertia flywheel tuning. You'll hear stations you didn't know existed in your area, and the clarity and separation of the sound will amaze you. The adjustable phasing control insures best stereo separation at all times. And the automatic stereo indicator light tells you if the program is in stereo. AFC puts an end to drift too. The BSR Automatic Turntable has features normally found only in very expensive units, like cueing and pause control, variable anti-skating device, stylus pressure adjustment and automatic system power too. Comes complete with a famous Shure diamond stylus magnetic cartridge. The handsome walnut cabinet with sliding tambour door will look sharp in any surroundings, and the AD-27 performs as well as it looks. For the finest stereo compact you can buy, order your "27" Component Compact now. 41 lbs.

HEATHKIT AD-17 Stereo Compact

Using the component approach of the AD-27, Heath engineers took the solid-state stereo amplifier section of the AD-27, matched it with the high quality BSR 400 Automatic Turntable and put both of these fine components in a handsomely styled walnut finish cabinet. The result is the "17" — featuring 30 watts music power, 12 Hz to 60 kHz response, auxiliary & tuner inputs, less than 1% Harmonic & IM distortion, adjustable stylus pressure & anti-skate control and much more. Order your "17" now. 27 lbs.

HEATHKIT TA-38 Solid-State Bass Amplifier

The new Heathkit TA-38 is the hottest performing bass amp on the market, for quite a few reasons. First, there's all solid-state circuitry for reliability. Then there's the tremendous power — the TA-38 puts out 120 watts of EIA music power, 240 watts peak, or 100 watts continuous. Extremely low harmonic & IM distortion too. Many amps suffer from "blow-out" problems, but not the new TA-38 — *YOU CAN'T BLOW IT...* it boasts two 12" heavy duty special design speakers with giant 3 pound 6 ounce magnet assemblies mounted in a completely sealed, heavily damped 3/4" pressed wood cabinet — those speakers will take every watt the amp will put out, and still not blow. Sound? The TA-38 is tailored to reproduce the full range of bass frequencies delivered by bass guitars and its sound with combo organs and other instruments is remarkable. Easy 15 hour assembly to the wildest bass amp on the market. Order one now and surprise the guys with the high-priced gear. 130 lbs.

HEATHKIT GR-58 Solid-State AM/FM Clock Radio

The easy way to get up in the morning. Choose the morning news & weather on AM or the bright sound of FM music. AFC makes FM tuning easy. The "Auto" position on the Telechron® clock turns only the radio on, or use the "Alarm" setting for both the radio and the alarm. You can even enjoy fresh coffee when you awake in the morning, thanks to the clock-controlled accessory AC socket on the back of the new GR-58. The handy "snooze" alarm feature lets you wake up gradually for ten minutes to the sound of the radio, then the alarm goes on... push the "snooze" button to silence the alarm for ten minutes more of music or news — the alarm sounds automatically every ten minutes and the "snooze" button turns it off, cycling continuously until the selector switch is moved to another position. Fast, easy circuit board construction, smart blue hi-impact plastic cabinet and top reliability make this GR-58 the clock radio for you. 8 lbs.

HEATHKIT IG-18 Solid-State Sine-Square Wave Generator

A precision source of sine or square waves at a low kit price... that's the new solid-state IG-18 from Heath. Delivers 5% accuracy thru the wide range of 1 Hz to 100 kHz. The sine wave section features less than 0.1% distortion thru the audio range, 8 output voltage ranges from 0.003 to 10V, switch-selected internal 600 ohm load or external load and metered output of both voltage & dB. The square wave section has a 50 ns rise time and three output voltage ranges from 0.1 to 10 V P-P. Both sine & square waves are available simultaneously and the frequency is switch-selected for constant repeatability and fast operation. Circuit board construction makes the new IG-18 easy to build... new Heathkit styling and engineering excellence make it easy to use. Put the new IG-18 on your bench now. 10 lbs.

Hobby... From The Leader



Now There are 4 Heathkit Color TV's ...
All With 2-Year Picture Tube Warranty

NEW Deluxe "681" Color TV With Automatic Fine Tuning

The new Heathkit GR-681 is the most advanced color TV on the market. A strong claim, but easy to prove. Compare the "681" against every other TV — there isn't one available for any price that has all these features. Automatic Fine Tuning on all 83 channels ... just push a button and the factory assembled solid-state circuit takes over to automatically tune the best color picture in the industry. Push another front-panel button and the VHF channel selector rotates until you reach the desired station, automatically. Built-in cable-type remote control that allows you to turn the "681" on and off and change VHF channels without moving from your chair. Or add the optional GRA-681-6 Wireless Remote Control described below. A bridge-type low voltage power supply for superior regulation; high & low AC taps are provided to insure that the picture transmitted exactly fits the "681" screen. Automatic degaussing, 2-speed transistor UHF tuner, hi-fi sound output, two VHF antenna inputs ... plus the built-in self-servicing aids that are standard on all Heathkit color TV's but can't be bought on any other set for any price ... plus all the features of the famous "295" below. Compare the "681" against the others ... and be convinced.

GRA-295-4, Mediterranean cabinet shown \$119.50
Other cabinets from \$62.95

Deluxe "295" Color TV... Model GR-295

Big, Bold, Beautiful ... and packed with features. Top quality American brand color tube with 295 sq. in. viewing area ... new improved phosphors and low voltage supply with boosted B+ for brighter, livelier color ... automatic degaussing ... exclusive Heath Magna-Shield ... Automatic Color Control & Automatic Gain Control for color purity, and flutter-free pictures under all conditions ... preassembled IF strip with 3 stages instead of the usual two ... deluxe VHF tuner with "memory" fine tuning ... three-way installation — wall, custom or any of the beautiful Heath factory assembled cabinets. Add to that the unique Heathkit self-servicing features like the built-in dot generator and full color photos in the comprehensive manual that let you set-up, converge and maintain the best color picture at all times, and can save you up to \$200 over the life of your set in service calls. For the best color picture around, order your "295" now.

GRA-295-1, Walnut cabinet shown \$62.95
Other cabinets from \$99.95

Deluxe "227" Color TV... Model GR-227

Has same high performance features and built-in servicing facilities as the GR-295, except for 227 sq. inch viewing area. The vertical swing-out chassis makes for fast, easy servicing and installation. The dynamic convergence control board can be placed so that it is easily accessible anytime you wish to "touch-up" the picture.

GRA-227-1, Walnut cabinet shown \$59.95
Mediterranean style also available at \$99.50

Deluxe "180" Color TV... Model GR-180

Same high performance features and exclusive self-servicing facilities as the GR-295 except for 180 sq. inch viewing area. Feature for feature the Heathkit "180" is your best buy in deluxe color TV viewing ... tubes alone list for over \$245. For extra savings, extra beauty and convenience, add the table model cabinet and mobile cart.

GRS-180-5, table model cabinet and cart \$39.95
Other cabinets from \$24.95

Now, Wireless Remote Control For Heathkit Color TV's

Control your Heathkit Color TV from your easy chair, turn it on and off, change VHF channels, volume, color and tint, all by sonic remote control. No cables cluttering the room ... the handheld transmitter is all electronic, powered by a small 9 v. battery, housed in a small, smartly styled beige plastic case. The receiver contains an integrated circuit and a meter for adjustment ease. Installation is easy even in older Heathkit color TV's thanks to circuit board wiring harness construction. For greater TV enjoyment, order yours now.

kit GRA-681-6, 7 lbs., for Heathkit GR-681 Color TV's \$59.95
kit GRA-295-6, 9 lbs., for Heathkit GR-295 & GR-25 TV's \$69.95
kit GRA-227-6, 9 lbs., for Heathkit GR-227 & GR-180 TV's \$69.95

kit GR-681

\$499⁹⁵

(less cabinet)



kit GR-295

now only

\$449⁹⁵

(less cabinet)

kit GR-227

now only

\$399⁹⁵

(less cabinet)



kit GR-180

now only

\$349⁹⁵

(less cabinet)



New Wireless
TV Remote Control
For GR-295, GR-227
& GR-180
\$69⁹⁵

New Wireless
TV Remote Control
For GR-681
\$59⁹⁵



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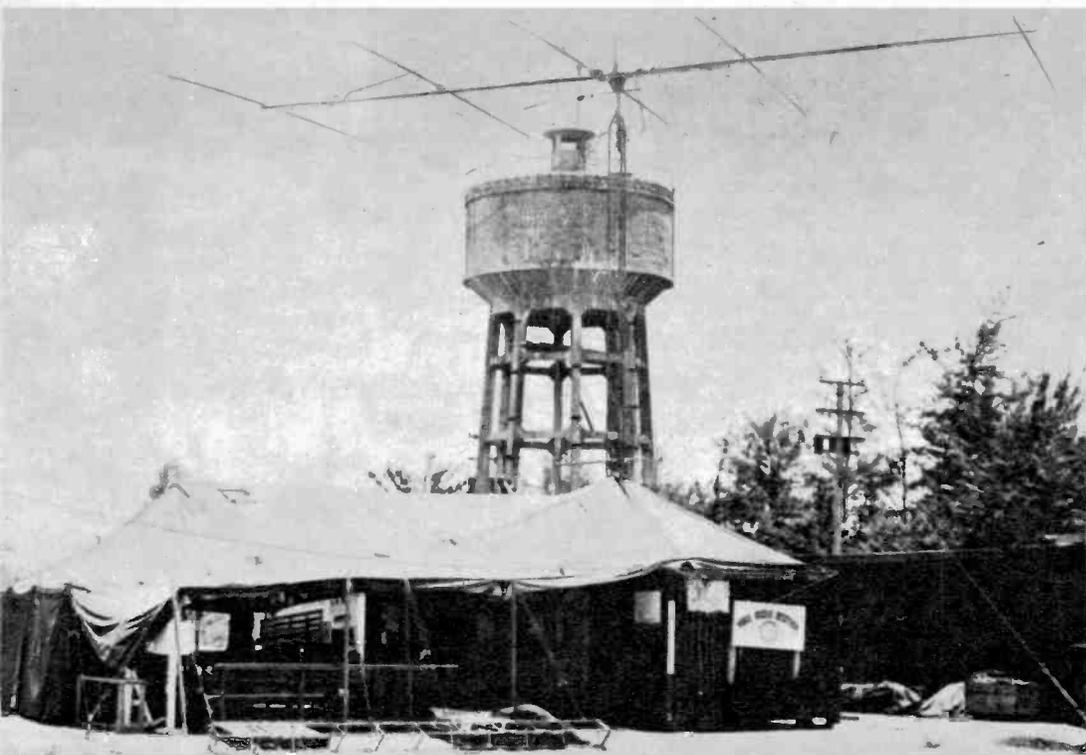
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CL-350



Marine Corps Photo

The Big Green Men from MARS

By DAVID WALKER

TALK IS CHEAP, says the phone company. But dial across the U.S.A. and the tariff could run to three bucks. A serviceman in Vietnam, however, can call home—10,000 mi. around the globe—for as little as a dime. He'll do it with the help of the big green men from MARS—the overseas GIs and Stateside hams who operate the Military Affiliate Radio System.

From points like DaNang, Pleiku, Cam Ranh Bay and Bien Hoa, MARS men beam a staggering number of personal calls toward the U.S. Their technical trick for squeezing some 1,000 mi. out of each penny is the phone patch.

It's proving to be one of the biggest morale boosters since Raquel Welch and the pull-top beer can. In 1967 alone, troops in Vietnam placed more than a quarter-million phone calls to Stateside residents. Now the calls are running about double that rate. And little wonder. The thrill of talking directly from Southeast Asia to wife, mother, father or girl friend is hard to equal. It's worth hours of waiting with a hundred or so other GIs at the MARS radio shack.

The cost-busting idea behind the phone patch works this way: a serviceman wanting to call home goes to one of approximately 71 MARS stations strung out in Vietnam from the highlands in the north to the delta in the south. The operator contacts a Stateside MARS station by radio. The Stateside operator then dials the number on a telephone and patches his radio equipment into



Airman in Vietnam calls home via MARS network. All calls must originate overseas.



This hut is home for Voice of the Green Berets—MARS station of 5th Special Forces at Nha Trang, Vietnam.

the phone line. The serviceman talks by radio across the Pacific and through the phone line to home. The Stateside party answers over the same circuit, but in reverse. His voice arrives by phone line and modulates the transmitter in the U.S. for the trip overseas. The conversation works like a regular phone call except that both parties can't talk at once. Each speaks a while and then says *over*.

The economics of the phone patch are impressive. The serviceman pays nothing for the first 10,000 mi. or so since that's the radio-borne leg of the circuit supplied by MARS. Only the Stateside link via commercial phone line is charged. (It's usually paid by the family and the call is made collect.) Thus a global call could cost a dime if the Stateside MARS station is near the caller's home.

Actually, most phone-patch traffic from Vietnam goes through West Coast stations because propagation conditions from Southeast Asia to that area are excellent. However, the bands do often open up in the East. When I recently visited the headquarters MARS station at the Pentagon in Washington, the brass had just completed 35 patches from Vietnam that day. Most calls, of course, run up tolls well beyond a dime. A MARS official estimates that patches average about \$5 each for the country as a whole. It's still a whopping bargain considering that a commercial call from Vietnam could cost about \$13 a

The Big Green Men from MARS

minute. An average MARS patch usually runs about three minutes.

The Vietnam MARS operation began life in December 1965. A GI trying to call home before that time faced a mountain of obstacles. There's only one commercial phone circuit out of the country and it's in Saigon. Even if a soldier could get there he probably would have to wait a week or so since this solitary cable carries a heavy volume of business, military, diplomatic and other traffic. Toll charges easily can soar to \$50 with little guarantee that circuit quality will hold up during the call.

So why not try the phone-patch idea used so successfully in ham radio? One snag was that ham operation is not permitted in Vietnam. Another is that many countries—like Japan, Korea, Germany and France—don't want phone patches taking business away from their phone companies.

The answer was to make it a military operation. After cutting some red tape and making agreements with the Vietnamese government, MARS men moved in to set up their first operation in a combat zone. Rigs sprouted everywhere—on truck tail gates, in tents and quonset huts. Business boomed and about 72,000 calls were placed during the first year alone.

Today MARS runs a sophisticated operation. Stations are likely to be in wooden structures equipped with air conditioning to



Marine Corps Photo

PFC Randy Chenier of Whittier, Calif., uses booth at Dong Ha station as Harry Boggs patches call.

Huge log-periodic antenna used by MARS station at Robins Air Force Base, Ga. Array cost \$1,700.



save the tubes. Many rigs are Collins single-sideband equipment running a kilowatt into costly log-periodic antennas that cover a wide range of frequencies (about 13-30 mc). Some stations have private phone booths and Coke machines. Yet the life of a MARS operator isn't all roses. He's been known to pull switches during a patch in the face of enemy mortar attacks and sometimes has had to exchange his microphone for a rifle. Though MARS stations are mostly transmitting morale traffic their primary reason for existence is to supply backup and emergency communications for military commanders.

MARS is a spit-and-polish operation that's strictly military on the inside. On the outside, it ties up with an elite group of civilian hams who perform with slick professionalism, at no pay, often for long hours and at some personal expense. In joining MARS, a civilian commits himself to rulebook military procedures and regular operating schedules.

Although the *A* in MARS once meant *Amateur* it was changed to *Affiliate* to give the outfit less of a ham-radio connotation. A significant aspect of MARS is that the ham ticket gives military officials proof of a civilian's basic proficiency in communications. In joining MARS, the ham must certify he has equipment that can be modified for MARS frequencies (more about that later) and that he'll devote at least six hours on the air to MARS every three months. During

the first three months a ham goes through a training period (conducted on the air) to learn military methods of communication. If the prospect doesn't measure up he'll be dropped. Otherwise he'll be assigned to an operating MARS network.

Although some 23,000 Stateside hams now operate their rigs at home in MARS networks, phone-patch traffic from Vietnam is another matter. The huge volume of calls is handled by Stateside military stations and a select group of civilian hams. And this special breed of ham numbers under 100. He usually has high-power equipment, an excellent antenna system and, perhaps most important of all, he's able to devote the long hours demanded by phone-patch operation.

Because of these dedicated volunteers, MARS officials aren't looking for more Stateside operators. A limiting factor is frequency. MARS stations operate outside regular ham bands on a few fixed frequencies. Pressures within a limited radio spectrum aren't likely to release more channels for phone-patch operation.

Phone calls are only part of the MARS operation. Message traffic also flows at high volume from Vietnam to Stateside stations and back. In 1967, more than a quarter-million free *MARS-grams* flowed over circuits by teletype, voice and CW. This is the activity of most Stateside hams who join MARS. Elaborate networks cover the U.S.

The Big Green Men from MARS

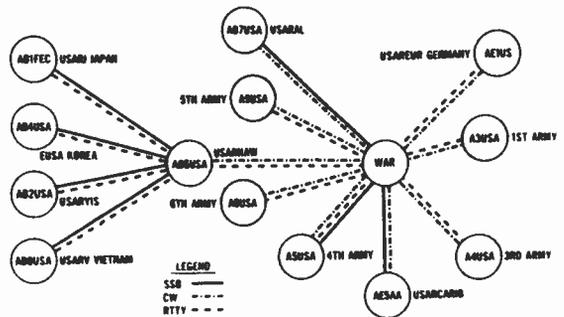


Headquarters MARS station for Navy is in Arlington, Va. Personnel operate station full-time to handle MARS traffic.



Marine Corps Photo
Sgt. Bill Apsey (left) of Tampa, Fla., and Sgt. Dick Stulz of San Diego, Calif., set up calls at station near DaNang.

WORLD WIDE DA MARS NETWORK



TYPICAL ARMY, NAVY AND AIR FORCE MARS FREQUENCIES

Army (kc)
2220 2258 2308 2360 3237 3245 3275 3289 4020 4025
4820 5217 5395 49760 148010 and others

Navy (kc)
2025 2720 3357 4001 4015 5765 and others

Air Force (kc)
2732 3183 3295 3311 3315 4417.5 4595 7305 7315
7635 15515 18155 49980 143460 and others

You can monitor MARS on some ham receivers or SW sets. Patches are mostly on higher frequencies.

for feeding the gateway stations which ultimately bridge the ocean to Vietnam and other points overseas. A message from an East Coast location may travel to the MARS station in the Pentagon (WAR), skip to Hawaii (AB6USA) and then on to Vietnam (AB8USA). Elapsed time for written messages might be a day or two.

If you're a licensed ham over 16 and want to handle written messages, MARS may be for you. You'll work channels remote from

Each of the three services has its own MARS network. Army system is shown here in detail.

the daily battle of QRM on ham bands and have an avid audience. After six months you're eligible for correspondence courses and surplus equipment.

When you join MARS you have to choose among the three major services. Though MARS is coordinated at the top, the Army, Navy and Air Force run separate operations and each assigns its own callsigns. If you join Army MARS, you're issued a callsign based on your ham call; only the prefix changes to begin with the letter *A*. For Air Force MARS, the prefix becomes *AF*. The Navy does it differently; you'll receive a new callsign beginning with *N*. The MARS certificate, incidentally, carries weight if you are going to enlist in the armed forces or participate in one of its reserve branches. You can get more details by contacting the MARS director at any large military installation.

A Robot Operator For Your Ham Shack



By **JIM WHITE, W5LET** IN ham radio's early days most everyone built his own equipment. Challenge and ingenuity were the words. Then things changed. Eventually it became a matter of simply opening a carton, hooking everything together and going on the air. Time marches on and now automation is the thing. So why not in the ham shack?

But, you ask, won't that take the last bit of fun out of hamming? Not at all. Take our Robot Operator, for example. Robbie will add to the convenience of operating to such an extent that you'll wonder how you ever got along without him. For example, have you ever wished that you could hear what you sound like to the ham at the other end of a QSO? The Robot Operator will turn on your transmitter, make a transmission, and then it will turn it off while you are across town listening.

The Operator will make it possible for you to CQ without wear and tear on your vocal cords. You can record any transmission from a CQ to a run-down on the rig and the Operator will key the transmitter automatically just as the material was recorded.

Maybe you would like to conduct some code practice sessions over the air, but do not have the time to spare. Put the transmissions on tape and the Operator will take care of

the chore for as many times as you wish. Have you ever wanted to let a friend know how his CW sounds at your place? With the Operator you can record his CW on tape at his house and play it back over your rig.

How it Works

The Operator is designed to be used with a four- or two-track tape recorder. The phone or CW transmissions are recorded on tape. Then you play the tape back feeding the output of the recorder to *input* jack J1. The signal from the recorder will control the transmitter and furnish the material for the transmission.

Take a look at the schematic in Fig. 2. *Input* jack J1 is connected to the 8-ohm winding of universal output transformer T1. The secondary of T1 is connected to potentiometer R1 which adjusts the level of audio fed to the relay circuit. This voltage is rectified by SR1, SR2 (a voltage doubler) and fed to relay RY1.

When switch S1A is in the *CW* position (open) capacitor C2 is out of the circuit. The capacitance of C1 is low; therefore, C1 discharges rapidly making the RY1's release time very fast. Relay RY1 keys the transmitter. With C2 in the circuit, as it is with S1A in the *phone* position, the release time is slowed considerably. Relay RY1 will now

close when you start talking and open when you stop talking. It can, therefore, control your transmitter's PTT circuitry.

You will note that T1's secondary also feeds a signal via R2 to audio gain control R3. This signal goes to transistor Q1. There is no need for further gain, but the impedance of T1's secondary is much lower than the mike input of most transmitters. Consequently the impedance is raised by Q1 so that audio quality will not suffer. The amount of audio fed to the transmitter via J2 is controlled by R3.

Construction

The Operator is built in a 5¼ x 3 x 2½ -in. Minibox. All the parts, with the exception of the 9-V battery, are mounted on the main section of the box.

Begin by mounting jacks, J1, J2 and J3 and be sure to leave room for T1 and RY1.

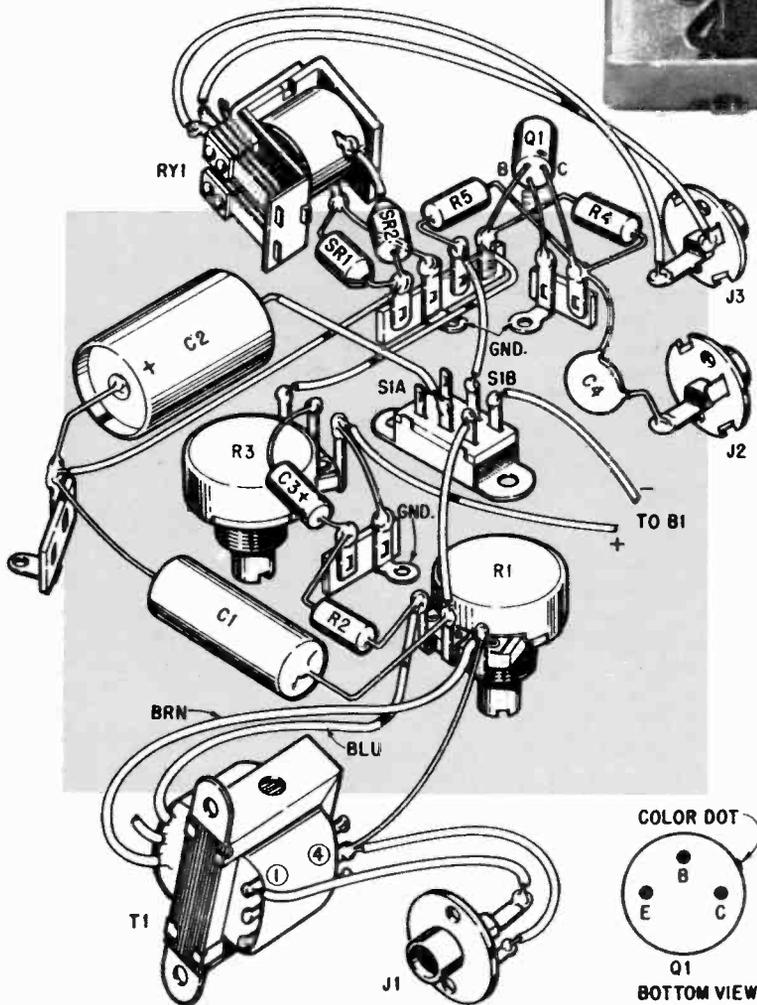
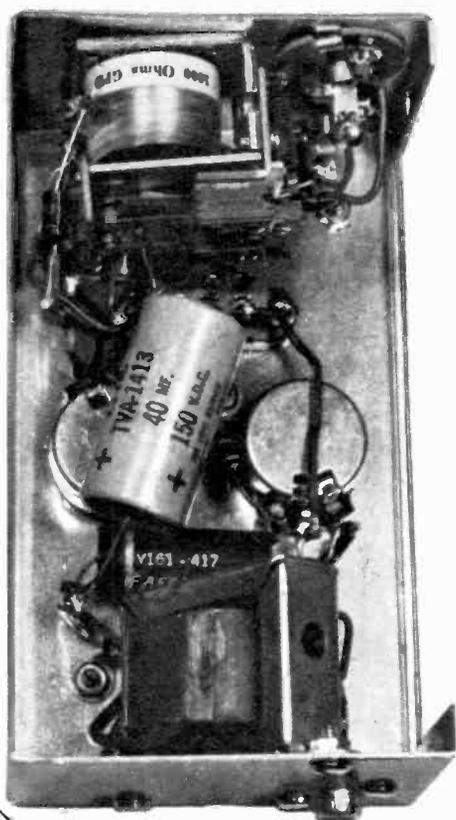


Fig. 1—Parts are mounted in main section of Minibox. Because the layout is tight, it is important to install parts in correct order. Install potentiometers R1, R3; slide switch S1; the terminal strips and jacks J1, J2 and J3 first. Then install transformer T1. Connect all the wiring to these parts and install silicon rectifiers SR1, SR2. Mount relay RY1 and make connections to it.

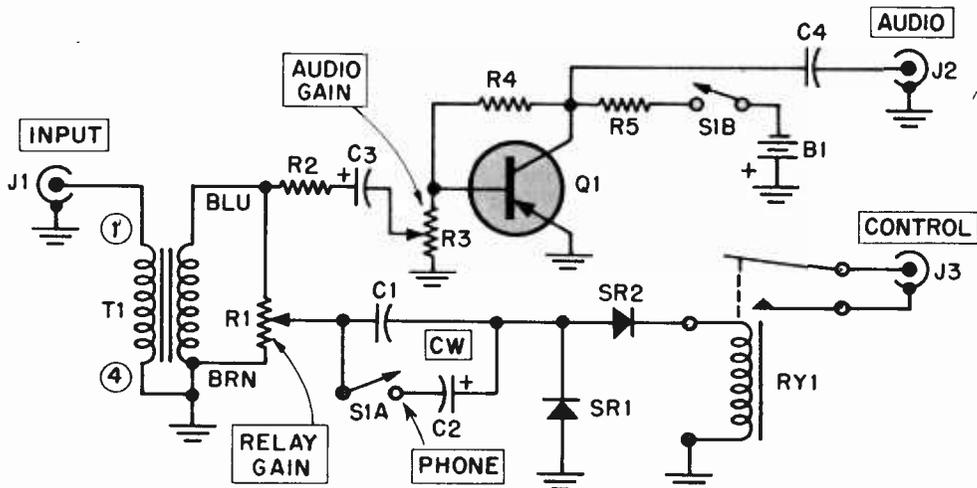


Fig. 2—Signal from tape recorder is stepped up by T1 and fed to RY1 and Q1. To send CW, connect J3 to key jack on transmitter. For phone, connect J2 to mike input and J3 to the PTT circuit.

Robot Operator

When you have mounted the jacks locate and drill holes for R1 and R3. Now mount S1, T1, R1, R3 and the terminal strips. Leave capacitor C2 and RY1 until later.

Mount transistor Q1 on the terminal strip located under the relay. Now install RY1 and connect its leads; install C2 where shown.

Using the Operator

First prepare the tapes you want to use. For phone these can be made using recorder's microphone. Tapes for CW can be made by keying an audio oscillator and feeding its output to the recorder. A 6.3-V filament transformer can be connected to the audio input of the recorder and keyed. The AC will not be heard on the air.

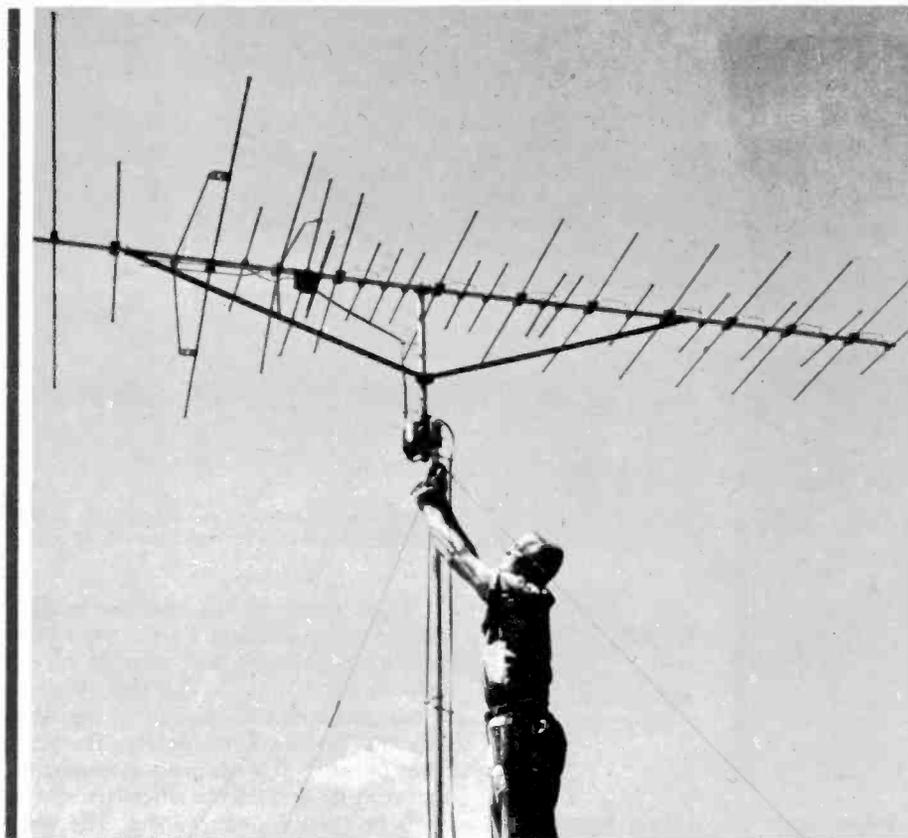
With the tapes prepared you are ready to use the Operator. For CW, connect J3 to the key jack on the transmitter making sure that the ground side of the Operator is connected to the transmitter's ground. If you are going to use the Operator for phone transmissions, connect J3 to the PTT circuit of the transmitter and J2 to the transmitter's mike input.

To complete the connections, connect J1 to the output of the tape recorder; be sure that you use the speaker output jack. Some small transistor recorders will not work satisfactorily because they do not have enough output to drive the Operator. If you have such a recorder and want to use it you will have to add a small amplifier (8-ohm output) between the two units.

After connecting the Operator to the recorder and transmitter, turn the recorder on. Advance R1 to near its full clockwise position. Then advance the volume control on the recorder so that the audio from the recorder makes RY1 operate smoothly. Use only the minimum amount of audio from the recorder. On phone you can advance R1 to the extent necessary to modulate the transmitter properly. Again, use only minimum audio from the Operator.

PARTS LIST

- B1—9 V battery
- C1—.1 μ f, 400 V tubular capacitor
- C2—40 μ f, 150 V electrolytic capacitor
- C3—10 μ f, 10 V electrolytic capacitor
- C4—.01 μ f, 500 V ceramic disc capacitor
- J1,J2,J3—Phono jack
- Q1—PNP transistor (audio type, RCA SK3004 or equiv.)
- R1—250,000 ohm, linear-taper potentiometer
- R2—470,000 ohm, $\frac{1}{2}$ watt, 10% resistor
- R3—10,000 ohm, linear-taper potentiometer
- R4—560,000 ohm, $\frac{1}{2}$ watt, 10% resistor
- R5—100,000 ohm, $\frac{1}{2}$ watt, 10% resistor
- S1—DPST slide switch
- SR1,SR2—Silicon rectifier; minimum ratings: 100 ma, 100 PIV
- RY1—5,000-ohm relay, Potter & Brumfield Type GPD with GP11-DPDT contacts, (Lafayette 30 T 8724 and 30 T 8756)
- T1—Universal output transformer; primary: 2,000-14,000 ohms (Allied 54 C 2023)
- Misc.— $\frac{5}{8}$ x 3 x $2\frac{1}{2}$ -in. Minibox, terminal strips, battery connector



How to Get a Perfect Color TV Picture

It's what's up front that counts—and that's a good TV antenna!

By ART MARGOLIS

EXPERTS QUIBBLE over whether you need a *new* antenna when you buy a color set. Some suggest that a color-rated antenna protects your investment while others say an old b&w antenna can do the job. As in most controversies, there's something to say for both sides.

A super-size 1969 antenna twirled by a rotator is hard to beat. But in my travels as a TV serviceman, I've encountered more than one b&w antenna that could be rescued for additional months of operation to grab color signals. Some vintage antennas, on the other hand, will flunk the color test. If you're wondering whether your old antenna will be

a good performer on color, one of these recent experiences may hold the answer. Take the case of the . . .

Blue Confetti. I was reading a report on color TV that described the problem of snow in blue areas of the picture when the phone rang. I couldn't believe my ears. "Art," the voice said, "I have blue confetti on my color TV."

I couldn't get over the coincidence. The customer, a man who lived a few streets away from my home, had a store downtown that rented out dishes and tables for catered affairs. I told him I'd be at his house on my last stop because it was so close to home.

Perfect Color TV Picture

He liked the idea since he wouldn't get home till then, either.

I arrived at his house at sundown. As I looked over the antenna I gave it my usual Big Four visual test. First, I looked at the antenna's physical condition for loose connections, missing elements and damaged transmission lines. Second, I noted orientation. Is the antenna pointed in the correct

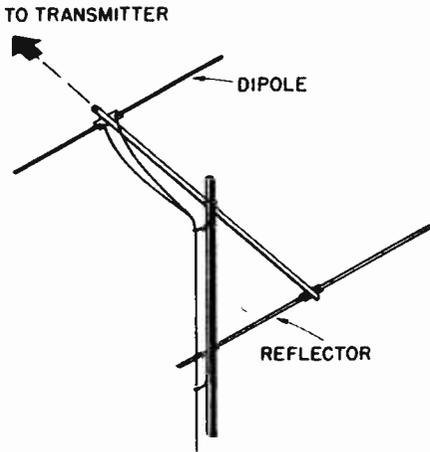


Fig. 1. Simple dipole with reflector has response which is too narrow for signal displayed below.

direction? Is it aimed like the neighbor's antenna? If it's a stack, are the two antennas aligned with each other? Third, how is the location on the roof? Is it mounted in a good spot? Are there any trees or obstructions between it and the transmitter? Is it too close to another antenna? Finally, I wonder about height. Is the antenna high enough to produce satisfactory reception? The antenna system, though, easily passed my test.

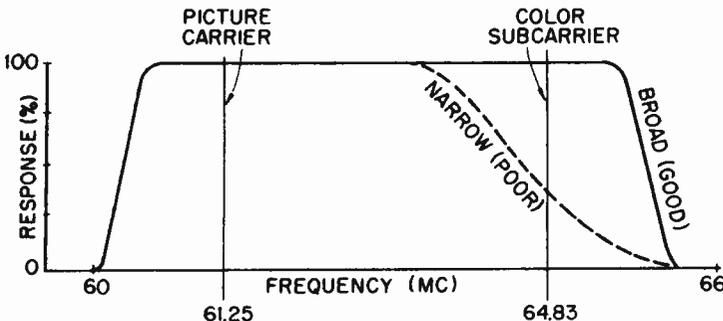


Fig. 2. Response curve illustrates inadequacy of dipole for reception of color signal (64-65 mc). While picture carrier is in maximum response area, color subcarrier is well outside narrow slope of dipole.

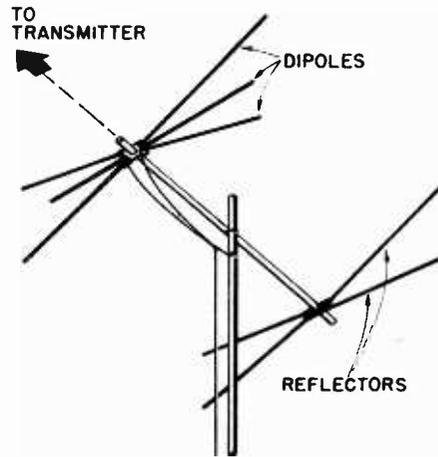


Fig. 3. Conical antenna offers multitude of elements to grab more signal current between 60 and 66 mc.

Then it struck. His antenna recalled the blue confetti problem I'd just read about. It was a single dipole and reflector cut for reception on channel 3. This type (Fig. 1) provides excellent b/w signals in our area but it can't handle color properly. The reason is that channel 3 is assigned a frequency slot between 60 and 66 mc where its b/w signal falls between 61 and 62 mc. The dipole, a turned circuit, responds between 60 and 63 mc and easily picks up the b/w signal.

The color subcarrier, though, falls between 64 and 65 mc. A dipole simply doesn't develop adequate current in this area, as shown by the response curve in Fig 2. For color reception, it's important to generate ample current all the way from 60 to 66 mc. A conical antenna (Fig. 3) provides this broad response.

Obviously, my customer needed a new antenna. No one was home yet and it was getting dark. So I climbed up, removed the

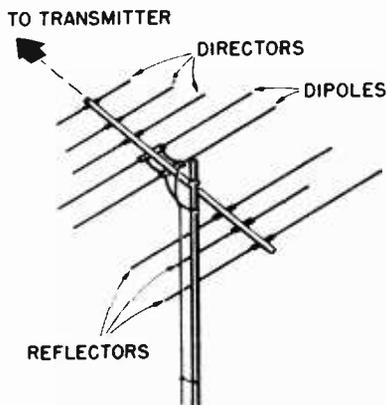


Fig. 4. Yagi antenna is designed to provide high gain and narrow response for distant stations.

dipole and installed a conical. As I completed the job my customer drove up.

"I didn't call you for antenna work," he snorted. "I have trouble in the set."

I nodded and said "Not this time. If you honestly think you don't need the antenna after you see your picture, the job is free." I was slightly annoyed. He shrugged and led me into the house.

As I followed him I explained, "With that particular type of antenna your color signal wasn't as strong as your black-and-white. That means the color circuits had to run wide open to get any color intensity. When they run at high amplification not only do they amplify color but the background noise, too. That's not all. Since the blue circuits are stronger than red and green, the first sign of trouble is snow or confetti in the blue areas of the picture."

He looked quizzical and turned on the TV to a color show. There was a blue object in the image. "Hey, that did make a difference! The color is beautiful. I'm sorry I was a grouch." I smiled . . . and began writing up the bill.

The Skinny Yagi. I have a cousin, Harry, a dentist, who lives about 90 mi. upstate. He is an exacting guy, especially when it

comes to spending money. I received a call from him a while back and he said, "Art, I'd like you and the family to come up Saturday, spend the day and have dinner."

If cousin Harry is going to spend \$10 or \$20 on us for the day, I pondered, what is he going to get in return? The mystery cleared as he continued, "Incidentally, I bought a new color TV and there's no color. If there's room in your car bring your tool box, will you?"

When the day arrived I packed my tube caddy, some color equipment and went visiting. After the amenities the kids took off and I went in to visit his color set. Sure enough, there was a children's show in color but it appeared only in b&w. I attached my color generator and bars of red, green and blue appeared on the screen. That meant the TV was fine but that color was not getting into the set. Could this be more antenna trouble? He had a yagi aimed at Philadelphia.

A yagi is an antenna cut to receive a narrow bandwidth. This one was cut for the b&w carrier of channel 3, around 62 mc (see Fig. 4). It could be slicing away the color signal. I went back into the house to see whether the color subcarrier was entering the set at all. I turned the color killer adjustment so the killer was off. Ah-ha! There was color. This meant color signals were weak and didn't have enough strength to turn off the color killer. With the killer on, no color.

Looked like Harry would have to turn off the killer during color shows and turn it back on for b&w. Since the adjustment was in the back of the set, a more realistic answer was to increase color subcarrier strength. So back to the antenna. Somehow, I had to broaden the response of this skinny yagi.

On the roof I discovered the dipole, directors and reflector of the antenna were not more than 1/4 in. in diameter, an ideal dimension for shrinking the bandwidth. To broaden the response I would have to fatten up the metal sticks. I went to a hardware

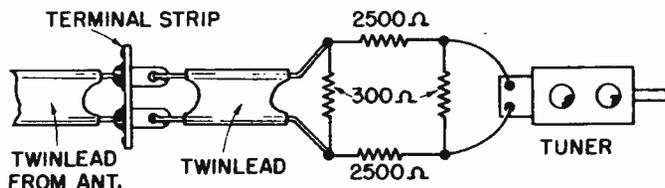


Fig. 5. Many reception problems with color TV are due to overloading of tuner's front-end. Disconnecting antenna and adding this 300-ohm pad may help to reduce interference from strong signals.

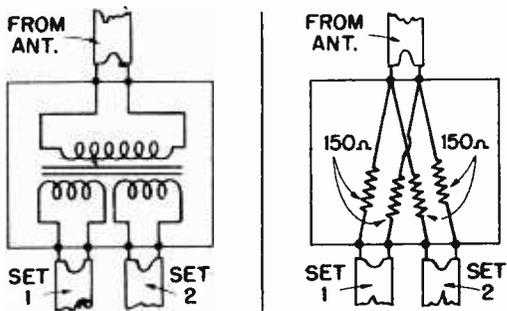


Fig. 6. Transformer (left) and resistive couplers distribute signal but latter's response is broader.

Perfect Color TV Picture

store and purchased lengths of 1/2-in. aluminum tubing. I took down the array and installed a piece of 1/2-in. tubing for every piece of 1/4-in. stock. Then I put the antenna back up.

A shout from the house announced the return of color. As I climbed down, Harry said, "That's great, Art! I wish there was some way I could return the favor."

I said, "Don't worry, Harry, there is." Then I yelled to the kids in the backyard. "Hey gang, get your teeth ready. Everybody into cousin Harry's office!"

When Pad Needs a Pad. I don't usually travel 30 mi. for a service call but I have one customer who is an unusual case. As I entered his apartment I saw fluorescent bulbs lying all over the place. Funny thing is, they weren't attached to anything but lit up anyway. The reason turned out to be powerful RF energy from a nearby group of radio and TV transmitters. (More on the spooky bulbs in a moment.)

My customer said, "Man, look at the crazy color TV I appropriated." A color show was on but the hues were mixed up and a herringbone pattern rippled through the picture in time with the audio. Sensing an antenna problem, I disconnected the twinlead. The picture disappeared but much of the interference remained. Then I took my finger and touched an antenna terminal. Presto! A beautiful color picture appeared. My finger was a better antenna than the outdoor job. This meant the signal was much too strong.

I took two 300-ohm and two 2500-ohm resistors and (as shown in Fig. 5) tied them together so they formed a square. Then I followed the lead-in from the antenna termi-

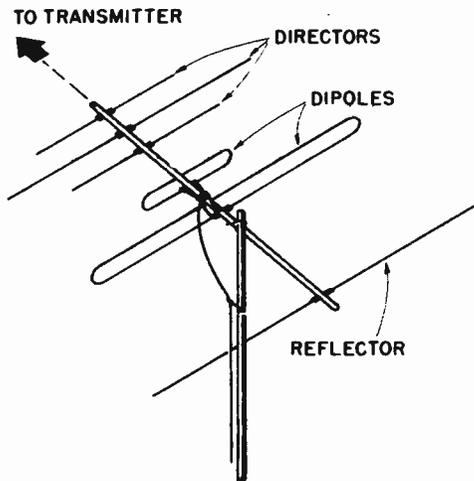


Fig. 7. High-gain yagi used for all-channel TV reception. Array must be rotated to face transmitter.

nals to the tuner. By attaching my device there I could force signal current through the resistors but still keep impedances matched at 300 ohms. In effect, I weakened or padded down the signal. As a further measure I took some aluminum foil and lined the inside surfaces of the TV cabinet to improve electrical shielding. Then I looked at the picture. It was beautiful on all channels.

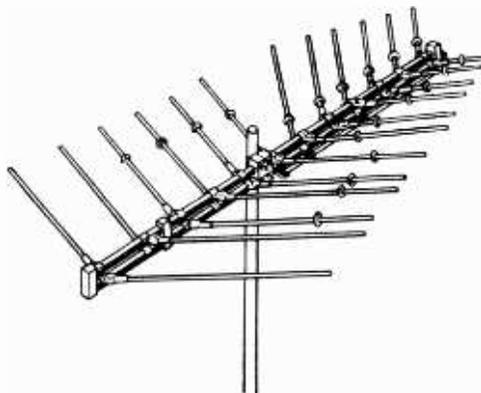
My acquaintance asked, "Man, what did you do?"

Borrowing his quaint manner I said, "I put a pad in your pad."

"Crazy!" he said.

Then I asked about the spooky fluores-

[Continued on page 116]



Log-periodic antenna gives equal response on all channels. Each of the elements is specially cut.

THE TOUGHEST QSLs OF ALL



By C. M. STANBURY II

WRINGING a QSL out of a station you've logged sometimes can be the hardest part of DX hunting. That adds to the challenge, it's true, but sometimes you feel the frustration more than the challenge. Picking up a signal from a rare land often is not half as tough as coping with the chap who reads reception reports at a powerhouse station only a hop, skip & jump away.

Take a simple case. In 1951 YSEB, La Voz de Latino America (El Salvador), was a potent new 10-kc operation on 1075 kc. Nearly all BCB DXers could log this one every night of the week. Just one hitch: YSEB didn't verify. After three months of waiting for a reply to my first letter (in English) I reported again, adding a verification form that the station merely had to sign and mail back. It also was in English with one exception—a sentence requesting the station to sign and return that form.

A letter arrived by return mail. YSEB finally understood what DXers wanted. To oblige, they simply had copied my form on their letterhead and signed it. Soon other BCB men were receiving similar QSLs.

Latin American stations, with some notable exceptions, are erratic verifiers even when the language barrier is broken. If your first report is ignored, a prepared form and persistence are the only real answers. Such devices as registered mail (to get their attention), souvenirs of your locale or tape recordings of the reception are expensive props that help only once in a blue moon.

Difficult verification situations are not always set up by lack of interest or communi-

cation. In the mid '50s English-speaking Radio Monserrat (Leeward Islands), then on 1550 kc, staged a DX test at 4 a.m., when that channel was more or less clear.

Conditions were rough. But R. Monserrat's chief engineer was even rougher. Perhaps the DX test's log omitted things like song titles and vocalists. Such information is not normally included on a station's log in this hemisphere but during a DX test the station usually tries to ease proof of reception.

Around 1960 the Antigua and Barbuda Broadcasting Service on 644 kc, with headquarters at St. John. A.B.B.S. has a small staff and, not being interested much in DX reports, verifies only occasionally. I sent them a report hoping to be one of those chosen few. Nothing happened. A second report also was ignored. The third try requested simply that they write the words *reception verified* across the report itself, sign it and mail it back to me. Almost immediately upon receipt of the letter at St. John a member of the A.B.B.S. staff did endorse it. Then the QSL sat on his desk for three months before he mailed it.

Problems encountered in verifying European, Asian and North African stations are entirely different. Most keep extremely accurate, complete logs and verify correct reports. If the DXer makes time notations in his own program notes as accurate as possible he should have it made. But some of these stations have a few tricks of their own.

If they operate at several frequencies or locations they may not specify either when confirming. A few will specify the *wrong*

THE TOUGHEST QSLs OF ALL

frequency. For example, Radio Andorra usually is received in eastern North America (when it is heard at all) on the BCB (998 kc) than on short wave (5995 kc) yet they show 5995 on all QSLs.

This doesn't bother the SWLs a bit but it certainly drives BCBers crazy.

One solution would be to log the second Andorra station, Radio des Valles, on 818 kc. They often relay Radio Monte Carlo. But if you want Andorra verified don't send your report to Monaco. Although R. Monte Carlo is one of the world's speediest verifiers—often by return mail—their card makes no mention at all of that Andorra relay.

Lack of frequency or transmitter location does not automatically invalidate a QSL. This depends entirely upon individual circumstances (and tastes). It becomes most im-

portant, of course, when location or frequency is particularly rare.

In 1954 I picked up Radio Moscow's relay at Khabarovsk, Siberia, on 629 kc. In this case the QSL had to be letter-perfect. Those were the days when one I. Petrov issued Radio Moscow's QSLs. If you were lucky he would acknowledge that you had heard *Moscow*. I wrote numerous queries in an attempt to draw, trick, entreat or even threaten the necessary information out of him but Petrov ducked everything. On one occasion, I asked him for the call letters. His reply, "the first notes of The Fatherland," seemed a deliberate confusion of call letters with interval signal. Problems like this were not solved until Mrs. Eugenia Stepanova took over from Comrade Petrov.

If I had to choose, I guess this Khabarovsk relay would have to rate as my toughest QSL. On the other hand, I'm currently sweating out a couple reports that may turn out to be rougher assignments. That's the thing about QSL hunting. You just never know what's coming next. [Continued on page 114]

(Date of letter) (Your address goes here)

Senor Director
(Station name, city, country)

Estimado senor:

Sigue un informe sobre recepcion de su emisora
..... fecha
(station name or call) (date of reception)
en kilociclos de
(frequency) (time reception began)
a la hora de
(time reception ended) (country name)
con senales y interferencia
(signal strength)
de
(static or interfering station)

Detalles Para probar mi recepcion de su emisora:
(Program details should be listed here giving
first the time and then the item heard)

Soy Radioyante de estanciones como aficionado
desde y he recibido
(date you began DXing)
confirmaciones de recepcion de
(number of countries verified)
países. Espero que este informe sea de interes
para Ud. Estaria muy agradecido recibir de Ud.
una tarjeta o carta verificando mi recepcion de
.....
(station name or call)

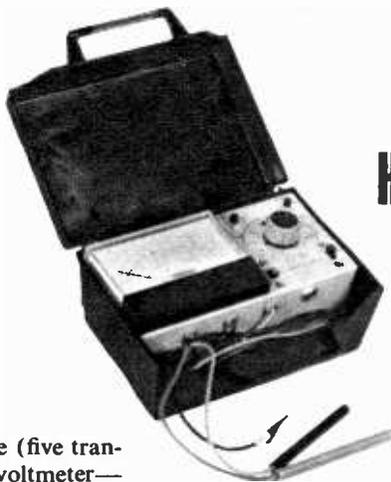
Muchas gracias por su ayuda.

Atto.y s.s.
(Sign here)

You don't need to know the language in sending DX reports to Spanish-language stations if you follow this form, using a Spanish dictionary to help you fill in the blanks with appropriate information. Three phrases that may be useful are: comienzo de las transmisiones (sign-on), fin de las transmisiones (sign-off), Identificacion como ... (station ID as ...). Typed reports are, of course, preferred to hand-written ones. Don't worry about accent marks—your typewriter won't have them so we omitted them. Time should be given or local time at the station.

El Kit Report

VO Meter



Heathkit IM-17

THE Heathkit IM-17 solid-state (five transistor) voltmeter is a utility voltmeter—an instrument used by appliance servicemen—with several features found in an electronic-technician's voltmeter. Consequently it can be used for both electrical and electronic troubleshooting, yet its \$21.95 price tag puts it in the utility-voltmeter class.

The voltmeter ranges are those of a utility voltmeter: 1 to 1,000 VDC full scale, with 1:10 decading (1 V, 10 V, 100 V, 1,000 V). The AC ranges are the same except lowest range is 1.2 V rather than 1 V. The ohmmeter has four resistance ranges from $R \times 1$ to $R \times 1$ megohm with 10 ohms at center scale.

Unlike some utility meters you do not have to move the IM-17's test leads to different jacks for different measurements; they're permanently attached. A single selector switch determines the voltage or resistance range: a DC polarity-reversing switch is provided. When the power switch is in the *off* position the meter movement is damped to prevent damage during transit.

The four meter scales are legible and accurate. One is resistance, one for all DC voltages, one for all AC voltages except 1.2 V and one scale is for 1.2 V. We had no problem putting our kit together in eight hours.

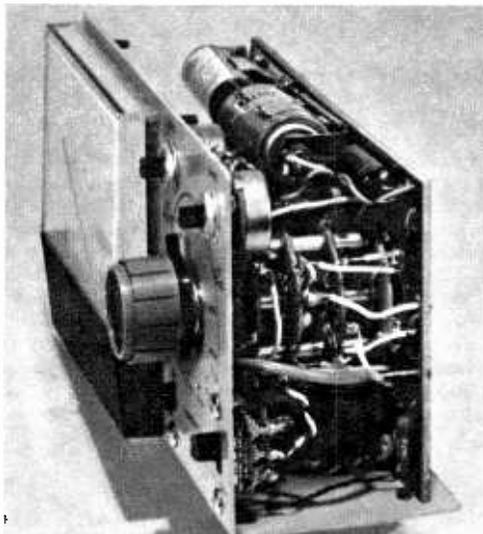
The IM-17's performance is extremely good. It uses a field-effect transistor (FET) to provide an 11-megohm input impedance (equal to that of a service-grade VTVM). The zero-set stability exceeds that of higher-priced commercially-built instruments. Once the meter is zeroed, it stays there regardless of the range to which it's set.

The meter's decading accuracy is within tolerance. While you can read 1 VDC with a full-scale indication, it is necessary to set the range switch set to 10 V to measure 1.5 V. This places 1.5 V way down at the bottom of the 10 VDC range—not the most convenient or accurate place to take a reading.

Similarly, normal line voltage of 117 VAC falls way down at the bottom of the 1,000 VAC range. (While this is common in utility meters, service-grade meters generally fill in with a 3- or 5-V decading—3 V, 30 V, etc.)

Calibration is easy. You connect the meter across a 1.5-V battery and adjust the DC calibration control for a 1.5 V indication. You then connect the meter across the AC power line and adjust the AC calibrate control. All AC and DC ranges are then calibrated.

If you require the portability and ruggedness of a utility meter and have an occasional need for a VTVM's high input impedance, the IM-17 is a perfect instrument. ●



Most parts including rotary function switch are mounted on printed-circuit board at rear. Circuit requires 1.5-V C-cell, 8.4-V mercury battery.

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.

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



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

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 Mr. Chet Martin, who has faithfully seen to it that my supervisor knows I'm studying. I think Mr. Martin's monthly reports to my supervisor and generally flattering commentary have been in large part responsible for my pay increases. Mr. Martin 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.

ENROLL UNDER NEW G.I. BILL

All CIE courses are available under the new G.I. Bill. If you served on active duty since January 31, 1955, or are in service now, check box on reply card or coupon for G.I. Bill information.

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 are urgently 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 \$8,000, \$10,000, \$12,000 or more a year.

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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.

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<input type="checkbox"/> Broadcast Engineering	<input type="checkbox"/> Industrial Electronics and Automation
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Check here for G.I. Bill information. **EI-81**

El Kit Report

90-Watt Combo Amp

Knight-Kit KG-387



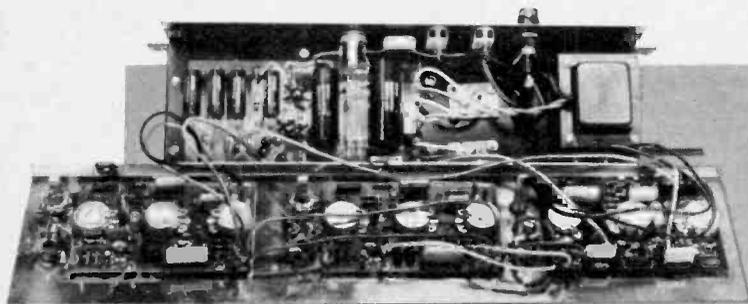
IN rock bands every instrument usually gets the boosted-db treatment. What better label, therefore, could Allied have given its new \$169.95 solid-state musical-instrument amplifier kit than *combo amplifier*?

The amp has two independent preamp channels, each of which has two inputs. The two channels feed a common power amplifier. Each channel's two inputs can simultaneously be fed any two signal sources, such as two guitars, guitar-organ, guitar-microphone or guitar-bass. One channel is *straight-through*. It has only a volume, bass and treble control. The second is the *effects* channel. It has volume, tone tremolo and reverb controls. Tremolo and reverb can be switched on and off independently with a two-switch foot pedal. Either channel can be used for straight amplification. The system consists of a 25½ x 10 x 22-in. speaker enclosure containing two 12-in. speakers, and a separate amplifier. A plug-in cable connects the units.

Building the kit. The amplifier is well designed and uses modular construction for individual circuits. Our builder—a novice at construction—was able to turn out in 20 hours a professional job that worked the first time. In addition to Knight's color-coded wiring and card-identified resistors, each potentiometer has a paper sticker on it imprinted with the pot's value. Also, connections are made to the modules (boards) with plug-in, rather than soldered, leads, thereby making final assembly easier. As shown in the photo, the amplifier consists of two preamps, the special-effects board (mounted on the front panel) and the power supply/power amplifier board, which mounts on the back of the cabinet cover. The shock-mounted reverb unit goes in the bottom of the cabinet.

How it sounds. To our ears the KG-387 is a top performer. Sound quality, even at thunderous levels, was extraordinarily clean

[Continued on page 117]



Circuitry at top is the power supply and power amplifier. Board at lower left is straight-through channel preamp. Center board is effects-channel preamp. Board at right contains tremolo and the reverb circuitry.

WHEN the Democrats surrendered the White House to the Republicans, CBers sniffed and tested the wind. Would the new administration tamper with the rules? Would CB start anew with a clean slate? And is the administration really new to CB, since Mr. Nixon was in high office when CB began 11 years ago? Though all the answers aren't in yet, there's no lack of speculation on CB's future.

A walloping number of CB license applications (about 20,000 per month) avalanche into the FCC, which could mean there are an awful lot of optimists in CB land who feel that every dark cloud has a silver lining. And the clouds for CB have been particularly dense. In 1967 the FCC handed out more than 4,000 violation notices, thousands of dollars in fines for improper operation and revoked almost 150 station licenses. In 1968 it was even worse.

The Johnson years saw the FCC propose a shackling of the CB industry with a plan which, if passed, would require CB transceivers to be examined and given a seal of approval before they could be licensed. Another Johnson-era brainstorm was to cancel the authorization for unlicensed walkie-talkies to operate on CB channels and move them near the 6-meter ham band. Both proposals were still hanging fire when the Democrats vacated office last January.

Let's face it, CB was left lying on the floor moaning. Equipment sales had dropped to a shocking low, several major manufacturers left the battle area for more serene prospects and only 10 to 20 per cent of five-year CBers were bothering to renew their licenses. The remaining operators tried other diversions or continued on the band as bootleggers.

What did the Johnson administration have to do with all of this? LBJ may never have heard of CB. Those who govern CB are mostly non-political Civil Service people at

CB Special Section

CB and Mr. Nixon



the FCC. And they stay in their jobs regardless of who's in office. The last White House gang probably wouldn't have known a CB rig if they had tripped over one on the stairs, despite the many CBers who complained while LBJ was in office. Other administration problems—such as war, the ghettos, unemployment and cost of living—took care of that. A President simply can't concern himself with problems of 1/200th of his constituents who are unhappy about not being allowed unlimited yakking on their 5-watt radio stations.

But as the Civil Service bureaucracy drones on remember that it's molded and shaped, led and misled, by various

commissars who are neither civil servants nor elected officials. Instead, they are appointed to their positions by the administration in power. These men are not required by law to have 8¢ worth of training or experience to qualify for their responsible, high-paying positions. At the FCC there are seven such political appointees. Known as Commissioners, they control more than 1,500 FCC employees and set policies which affect several dozen radio services.

Being an FCC Commissioner is much like being a Justice of the Supreme Court. Once you're appointed the term of office seems to extend until you quit. When President Nixon took office there were two vacant spots.

As a rule, the Commissioners are men who spend most of their time with problems concerning the multimillion-dollar radio and TV broadcasting industries. Other radio services seem to get shoved into the rumble seat while big, beautiful broadcasting, with its high-pressure lobbyists, gets the ride with the view. When broadcasters hoodwink the public with rigged quiz programs and fixed listener contests, the industry might get a slap on the wrist. But when CBers attempt to establish CB friendships, the Commissioners announce



they're considering a freeze on CB station licenses. You get the idea.

The Commissioners, whether they are hold-overs or new appointees, are sensitive to the administration in power. Obviously, appointees must reflect many of the

President's policies and opinions. The Johnson administration probably could be best described as being liberal. So was John Kennedy's. President Nixon, on the other hand, comes off as being more conservative, as are the men he has chosen to aid and advise him. FCC staff members are still waiting to see whether the addition of Nixon men to the Commission will make any substantial difference in the policies or work habits of the FCC and the outlook for licensees.

So far as CB is concerned, it's expected that the controversial equipment type acceptance proposal will be passed. It's been too hot a ball of wax for too long to continue ignoring it. The scheme of moving walkie-talkies to another band may also be approved, but in a vastly modified version.

Another pending item is the appropriation of two non-CB frequencies to be used as CB emergency channels in the Highway Emergency Locating Plan (HELP). That idea probably will slip into the never-never land of worthwhile ideas.

FCC people do not feel there will be any sweeping modification of Part 95 which will ultimately result in CBers being permitted to work skip, or any other hobby-type activity they've been daydreaming about through the last three administrations. If anything, it would seem that a conservative FCC might press harder for law and order.

The day-to-day lives of average CBers will remain about the same as it has been. Some will abide by the rules. Others will ignore them. Some will run illegal linear amplifiers while others will participate in REACT, HELP, Community Radio Watch and the Civil Air Patrol. And some CBers will continue to be activists in the so-far futile quest to get the CB rules changed. Letters will continue to make their way to the desks of Representatives and Senators demanding a better tomorrow. Perhaps a few of these elected officials will be moved to the point of agreeing with them. Then again, there's always another election. ●

Who's in Charge Here?

CITIZENS Band licensees all too often feel the FCC is some kind of mysterious computer which grinds out an endless stream of violation notices, fines, operator licenses and regulations.

During the past years we have seen few members of the FCC brass appearing at CB jamborees but we remember those days when no shindig was complete without a few words of moral support (and a general scolding) from the FCC's Amateur and CB Chief, Ivan Loucks. Loucks has retired and it's been sort of quiet ever since.

But that doesn't mean nobody cares. The difference is that the present amateur and citizens boss, Everett Henry, just isn't a speech-making kind of guy. He says that keeping track of 1 million CBers and 250,000 hams keeps him off the lecture circuit.

A native Oregonian, Henry worked his way through the University of Washington (E.E. degree) during the Depression years, supporting himself by working at a radio station. After college he was a sparks on several passenger and cargo steamers which chugged back and forth from the West Coast to the Orient. Then he spent some time at radio stations and at Bell Labs.

By 1938 he had decided upon a career with the FCC and had joined the Baltimore office. Before he was permanently stationed at the FCC's main office in Washington, D.C., he also served at field offices in Washington, D.C., and Seattle, Wash. In 1945 he was working on directional antennas for the FCC's Broadcast Division. Next he worked in the Experimental & Miscellaneous Division directly under the Chief Engineer. By 1953 he was promoted to the position of Engineering Assistant to FCC Commissioner Edward M. Webster. When Webster retired in 1957, Henry was made Chief of Engineering in the Opinions and Reviews Division; by 1960 he was Chief of Marine Division.

When Loucks retired in 1966, Henry was tapped to fill the spot as Chief of the FCC Division which has more licensees than any other. Aided by FCC staffers Richard Everett, William Grenfell and Robert Stark, the Henry team has been a dedicated group. But Henry confesses, "The Citizens Radio Service offers many excellent applications which would be better realized if there were only closer adherence to the rules." ●

CB Corner

By Len Buckwalter, KQA5012

Tortured Transducer

YOU'LL probably squeeze it, bark in its face, then give its lifeline a wrench. That's the fate of the CB microphone. But your mangled mike will survive for years if you know its weak points.

Toughest transducer around is the *carbon* mike. When it stops working give it a few taps and you'll probably loosen packed carbon granules that reduce audio output. However, the closest you'll ever get to a carbon mike may be when you talk into your telephone. Carbon mikes are seldom designed into CB rigs.

Another scarce type is the controlled-reluctance mike. It's rugged (originally designed to work near 16-in. naval guns), but it's costly and found only in fancy rigs.

Odds are, you own one of CB's two most numerous mikes: *ceramic* or *dynamic*. Ceramics usually stay in good health if you avoid cupping your hands between the mike and your mouth. This causes a pressure buildup that irreversibly twangs the aluminum diaphragm. Dynamics, on the other hand, usually have mylar diaphragms which spring back unharmed after an air attack. Neither mike can withstand a sharp blow, however. Ceramic elements sometimes crack, while a dynamic's voice coil can start rubbing.

Never use a *crystal* mike for mobile operation. It simply can't stand up under the high heat and humidity common to cars in summer. (Ceramics and dynamics easily resist these conditions.) And don't select a mike because it makes your voice sound like an operatic basso. Bell Labs has demonstrated that a limited response of 300 to 3,000 cps transmits the best voice intelligibility. The real test isn't fidelity but how well your voice is understood.

What happens when your mike stops modulating? Reputable manufacturers are quite liberal when defective models are returned for repair. One leading producer told us that if a mike doesn't show signs of excessive abuse, the internal cartridge may be replaced at no charge, even beyond the warranty period. (If there's a charge, you're informed before the repair is made.) Occasionally a voice-coil wire breaks in a dynamic mike and this could be considered a factory defect

to be repaired at no cost.

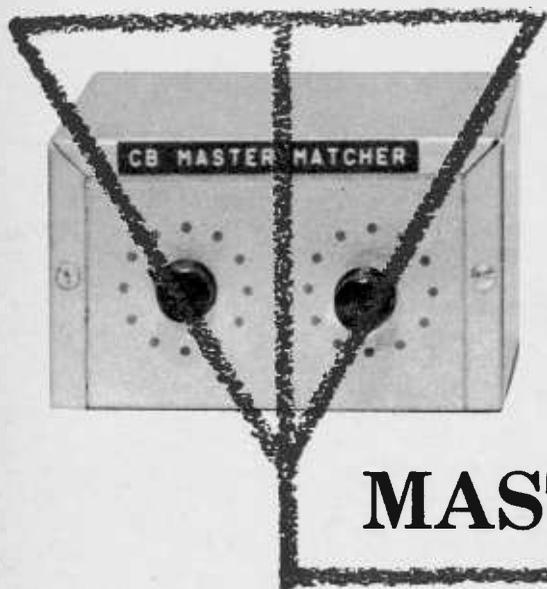
One of the biggest problems with mikes has nothing to do with the innards. According to one major manufacturer it's the coil cord. This company ran tests on cords by extending them repeatedly to full length (5 ft., for example). Some cords broke after 50 flexings. This might equal six months of service by a CBer since he normally would extend the cable only about 2 ft.

A critical stress point is where the cable enters the mike case. A CBer usually twists the cable at right angles (at that point) as the mike is pulled out for use. A good mike will have some form of strain relief at this weak point (a spring, extra rubber, etc.). This manufacturer suggests you check this weakest link first if your mike fails to work properly. The cord can be checked for continuity with an ohmmeter and wiggling the cable near the mike case often reveals an intermittent break in a wire.

Another common problem is a switch made defective by dirt or corrosion (a superior mike usually has a self-wiping contact that resists these hazards). Cleaning is a possible solution except in cheap mikes that are glued together. One manufacturer bemoans the fact that some CBers spend lavishly on a costly CB rig, then go out and buy a cheap mike.

We asked two manufacturers, "What's the best technique to use when talking into a mike?" Their answers were not quite in agreement. One says you should almost swallow the mike. Talking close, he says, cuts down background noise and keeps audio output high. He claims there'll be little distortion because of the audio's limited frequency response.

The other manufacturer says this: Hold the mike close to your lips but angle it away at 30 to 45 degrees. Talking slightly *across* the mike, he says, reduces popping sounds and keeps modulation high. This is one controversy everyone should try to settle for himself. Enlist a friend to monitor your voice level while you talk at varying distances and angles from the mike. Have him report when your audio is strongest and most intelligible. That'll be the best technique for your particular voice, mike and rig. —



MASTER MATCHER

By **JOHN S. RICHARDS** ALTHOUGH your CB rig could check out perfectly on instruments, you might be getting only a fraction of its potential performance. Reason for this is that few instruments are capable of indicating severe RF losses in the antenna system.

For example, take the operator who has just put a new set of tubes in his old channel blaster. The output-power meter indicates 3.5 watts into a dummy load. He checks the condition of the transmission line and finds everything in order. The SWR meter shows a near-1:1 match (he is using an exact half-wavelength transmission line) and with a smile he hits the PTT switch . . . and the signal just about makes it down the block.

Because this CBer treated the transmitter and antenna as separate items rather than a system, an antenna mismatch is preventing the transmitter from putting anywhere near 3.5 watts into the transmission line. What our man needs is a device that matches the transmitter's output impedance to the transmission line's input impedance because it is at this point that most RF energy is lost.

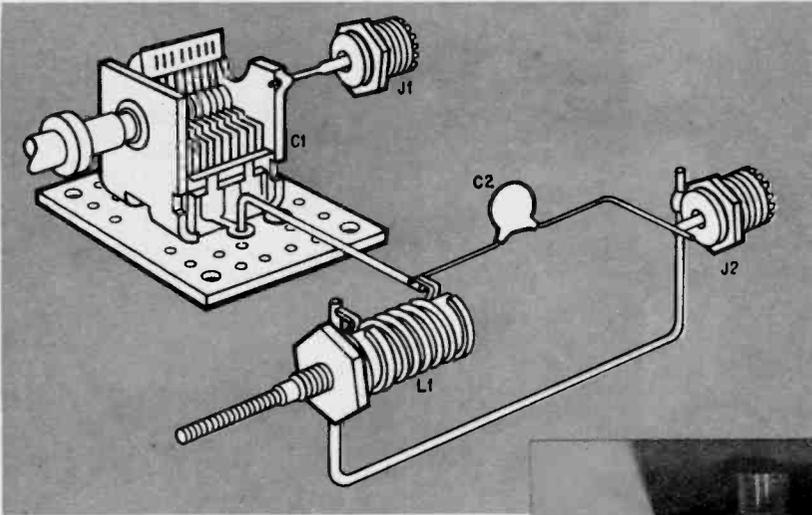
One way to solve the problem is to use E. F. Johnson's \$15.95 Model 250-49 CB Matchbox, which does an excellent matching job. The other way is to build our Master Matcher. It also does a good job of matching

and can be built with junk-box parts. Both their Matchbox and our Matcher use standard L-network circuitry, which can be found in any handbook—but which is not usually designed for CB frequencies.

How it Works. Maximum transfer of energy, be it RF or audio occurs when the impedance of the signal source matches the impedance of the load. In the case of a CB transceiver, the 50-ohm transmitter output matches the 50-ohm input impedance of the transmission line when the line is similarly matched to a 50-ohm antenna.

When the antenna's impedance is different from the line's impedance the impedance looking into the line changes (except if the line is a half-wavelength, or multiple thereof, long). The line's impedance may be either higher or lower than the rated impedance, and with a high SWR, it will depend on the length of the line. For example, a 50-ohm line connected to a 150-ohm antenna (3:1 SWR) can result in a line input impedance of 50 ohms, 75 ohms or perhaps even 150 ohms. Also, except at 150 ohms (the antenna impedance), there will be a reactance effect at the input of the line which can detune the transmitter's output circuit.

Since most CB transceiver output circuits are factory tuned for 50 ohms, the transmitter will deliver nowhere near its full RF out-



PARTS LIST

- C1—10-365 μf midget variable capacitor (Lafayette 32 T 1103 or equiv.)
- C2—50 μf , 500 V ceramic disc capacitor
- J1,J2—SO-239 coax connector (see text)
- L1—Ceramic coil form (J.W. Miller 4400-2, Lafayette 34 T 8951)
- Misc.—5 x 4 x 3-in. Minibox, perforated board, No. 20 enameled wire, insulated shaft coupling ($\frac{1}{4}$ -in. i.d.)

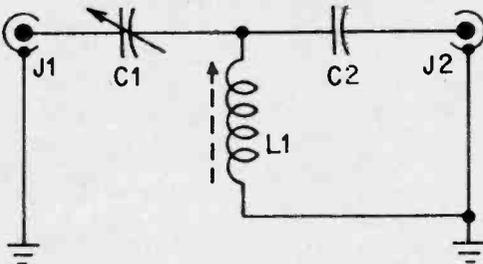


Fig. 1—Master Matcher is L-network that matches output impedance of transceiver connected to J1 to that of the antenna system connected to J2.

put into the transmission line because maximum energy is transferred to the line only when the line appears as a 50-ohm resistive load.

But, you say, the transmission line is an exact multiple of a half-wavelength, and a half-wavelength line acts as an impedance matching transformer. At this length the line reflects exactly what's at the antenna end, and the SWR meter shows 1:1. This is because the SWR meter is misleading you.

The half-wavelength line is simply a

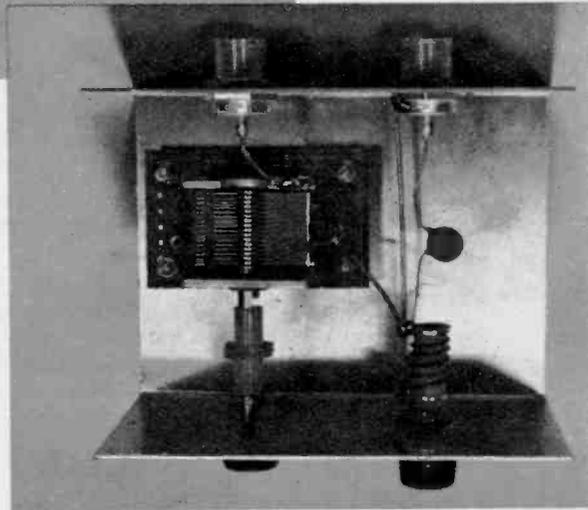


Fig. 2—Mount parts in U-section of Minibox as shown in photo. Be sure to mount C1 on a piece of perforated board so its frame is insulated from cabinet. Use an insulated shaft coupling between C1's shaft and knob's extension shaft.

matching device, but not impedance matching. Although it reflects at its input exactly what is on the antenna end, it will also transfer all energy fed into the line to the antenna. Hence, the SWR meter will indicate 1:1 even though the line is mismatched to the antenna. For example, assume a 50-ohm line and a water-logged antenna loading coil that has produced an antenna impedance of 150 ohms (3:1 mismatch). The input of the half-wave line reflects exactly what's at the antenna end so the input to the line appears as 150-ohms, resistive. Since the SWR meter compares the power fed into the line (forward power) to the power reflected back

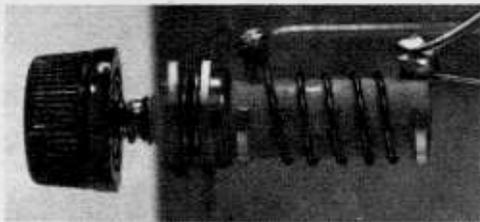


Fig. 3—The normal spacing for L1's winding takes up almost the full length of the coil form. This is good for SWR ratios that are less than 3:1.

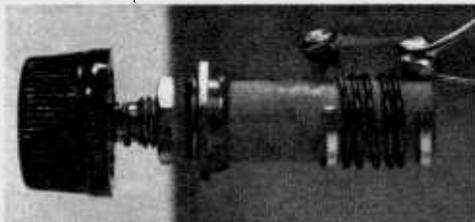


Fig. 4—For SWR ratios higher than 3:1 (or if Matcher won't reduce SWR to at least 1.2:1) compress winding so the lugs are about 1/2 in. apart.

MASTER MATCHER

from the mismatched (reflected power) the SWR meter indicates 1:1.

But the transmitter sees a 150-ohm line input, and since the transmitter has a 50-ohm output the maximum potential RF cannot be coupled from the transmitter to the line. Under optimum conditions, a transmitter with a 3-watt 50-ohm output can deliver a maximum of 2.26 watts into a 3:1 mismatched line. If there are reactance effects at the input of the line, which there will be except under most unusual circumstances, the power delivered into the line will be even less than 2.26 watts. And remember, the antenna system SWR may be even higher than 3:1 even though your SWR meter indicates 1:1.

Our Matcher insures maximum transfer of RF from the transmitter into the transmission line by presenting the proper impedance to both the transmitter and transmission line. It cannot compensate for losses between the line and the antenna, but at least you'll be certain your rig is putting out all it's capable of.

The Matcher, whose schematic is shown in Fig. 1, is a simple L-matching network which when properly tuned appears as 50 ohms to input jack J1. Regardless what is connected to antenna jack J2 (within limits), the transmitter sees only the 50 ohms at J1, hence, it delivers all its potential power into J1. The L-network (C1-L1) then converts the 50-ohm impedance at J1 to the proper impedance needed at J2 to insure maximum energy transfer from J1 to J2 and on into the transmission line. If the transmission line between J2 and the antenna is exactly an electrical half-wavelength (or a multiple thereof) all the energy fed into J1 will be coupled to the antenna.

Construction. The Matcher is built in the U-section of a 5 x 4 x 3-in. Minibox. Components C1 and L1 must be exactly as specified in the Parts List—make no substitutions. Note that capacitor C1 is insulated from the cabinet—and this includes its shaft.

Capacitor C1 is insulated from the cabinet by mounting it on a 2 x 2-in. piece of perforated board. Attach C1 to the board with two 6-32 x 3/16-in. screws. Make certain the screws are not longer or they will pass through C1's frame and short the stator plates. Attach the board to the cabinet using a screw at each corner and put a 1/4-in. spacer or stack of washers between the board and the cabinet to prevent C1's mounting screws from touching the cabinet.

The winding of coil L1 is critical. Slide a ring terminal on L1's form and push it on until it is 1/16 in. from the collar—the part threaded for a mounting nut. Tensilize a 12-in. length of No. 20 enameled wire by clamping one end in a vise and pulling, with pliers, on the free end until the wire goes dead slack. If the wire is not tensilized it will unwind after you wind the coil.

Scrape 1/4 in. of insulation from one end of the wire, tin the bare end, wrap it around the ring terminal near the collar and solder. Then wind five turns, wide spaced (see Fig. 3), so the end just reaches the second ring terminal, scrape away 1/4 in. of insulation, solder the end to the second ring terminal and cut off the excess wire. If you have made the coil correctly the windings will be tight on the form. If the winding is loose, do it over: the winding must be reasonably tight on the form. Mount coax jacks to match your existing plugs directly behind C1 (J1) and L1 (J2).

Depending on your antenna system, the windings of L1 may have to be squeezed together after the unit is completed; therefore,

[Continued on page 119]

Capsule Preamp for CB Mikes

By HERB FRIEDMAN, W2ZLF

AS GOOD as the newest solid-state transceivers are, they often suffer from the same problem that plagued the earliest rigs—they achieve only *averaged modulation*.

Unless a transceiver is equipped with a really effective compressor (sometimes called range or DX boost) the modulator gain is fixed at some value which will be adequate for an average-voice level with the mike at a specific distance from your mouth. The fixed-gain level is established for an average voice to avoid overload and distortion by moderate to strong voice levels.

But few CB'ers have an average voice—if such a thing really exists—and a CBer's speaking distance from the mike can vary from down at the tonsils to an arm's length away.

If your voice is less than average, or if you find a comfortable mike working distance is way out in front and your rig seems to lack that certain something known as talk power, just add our Capsule Preamp in your mike's line and you'll put the rig's modulation back to band-busting level.

The preamp is designed specifically for the low-impedance mikes used with modern solid-state transceivers; that is, mike impedances from 50 to 1,000 ohms. Do not use the preamp with high-impedance ceramic mikes, such as are found on tube-type transceivers, as the preamp's low-impedance input will load down the mike and virtually wipe out all low-frequency response.

Depending on your transceiver's mike input circuit, the preamp will provide between 10 and 20db additional gain—generally much



more than you will ever need. A volume control (R3) inside the capsule allows you to tailor the gain to your exact needs.

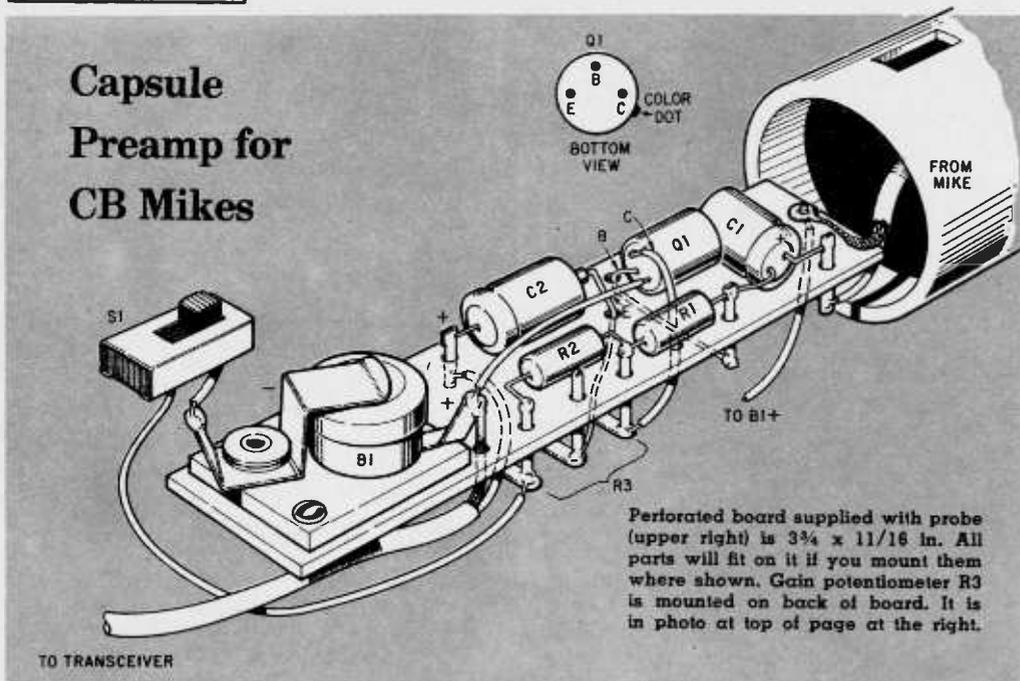
Construction

The preamp is built in a capsule-shaped test-probe shell which is installed in the mike's cable. The probe, a Keystone No. 1810 (kit), is supplied complete with a strip of perforated board, a shielding sleeve and flea clips. Holes on both ends of the probe are just the right size for the mike cable. You build the entire amplifier on the board using the flea clips for tie points.

First step is to cut ¼ in. off the back end of the board—the end without the solder lug. Cut 1¼ in. from the shield sleeve. The trimming must be done to allow clearance for mercury-cell holder.

Mount the mercury-cell holder as close as possible to the back end of the board with the positive terminal facing the front of board. (You must use the cell holder because soldering directly to the cell will most likely shorten its life or destroy it.) The miniature

Capsule Preamp for CB Mikes



components specified in the Parts List must be used as there isn't a spare bit of space for larger parts.

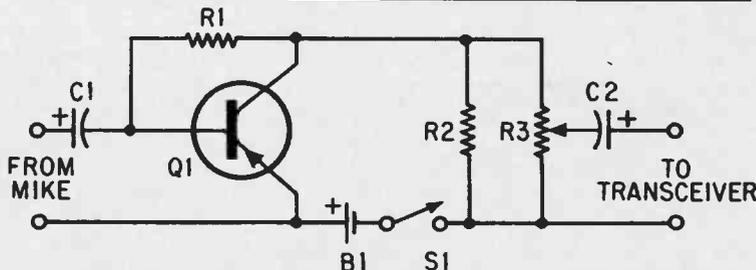
When connecting R3 to the three flea clips, cut its leads as short as possible, so R3's edge does not extend beyond the board. Leads are routed from the top to bottom components through the holes in the board. When the amplifier strip is completed, attach 3-in. wires to the battery holder's negative terminal and to the R2-R3 terminal which has a wire running to switch S1.

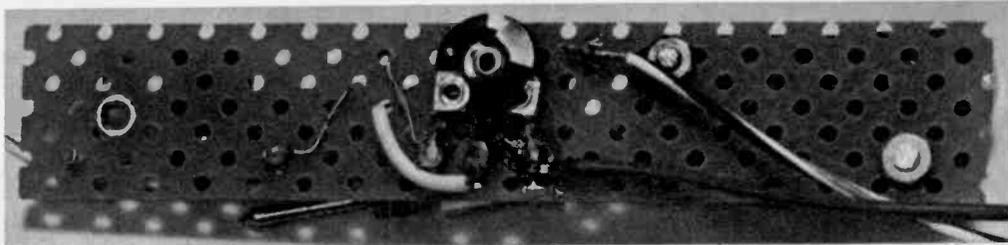
A standard slide switch is not used as it cannot fit in the capsule; a miniature switch must be used. If you don't want to spend the money for the subminiature switch specified, you can use a miniature phone jack (Lafayette 99 T 6314) which works well as a power switch and can be easily installed.

PARTS LIST

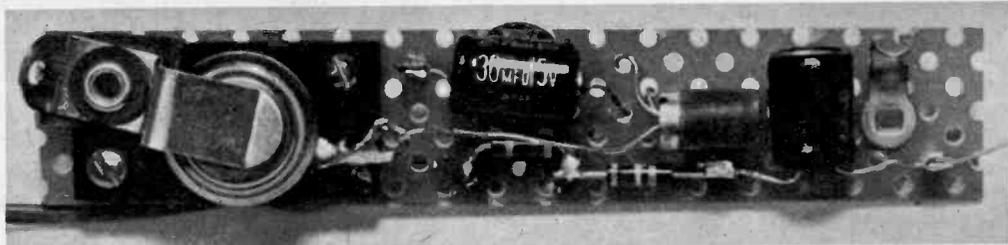
- B1—1.3 V mercury cell (Mallory RM625)
- C1,C2—30 μ f, 6-V printed-circuit electrolytic capacitor (Lafayette 99 T 6076)
- Q1—2N2613 transistor (RCA)
- R1—470,000 ohm, 1/4 or 1/2 watt, 10% resistor
- R2—4,700 ohm, 1/4 or 1/2 watt, 10% resistor
- R3—10,000 ohm, subminiature trimmer potentiometer (Lafayette 99 T 6144 or equiv.)
- S1—Subminiature SPDT toggle switch (Alco JMT-121, Newark Electronics Corp., 500 N. Pulaski Rd., Chicago, Ill. 60624. Stock No. 22F862, \$1.95 plus postage. \$2.50 minimum order. Or, use miniature phone jack and plug as specified in text)
- Misc.—Keystone No. 1810 probe kit, Keystone No. 117 mercury-cell holder. (A kit consisting of the probe kit, cell holder and Q1 is available for \$3.10 plus 50¢ postage from Custom Components, Box 352, Alden Manor, Elmont, N.Y. 11003. N.Y. State residents add sales tax. Canada add \$1. No foreign orders.)

Preamp circuit couldn't be simpler. Combined resistance of R2 and R3 is 3,300 ohms to provide correct load for Q1. If you can get a 3,000-ohm potentiometer for R3 instead of the value specified, eliminate R2.

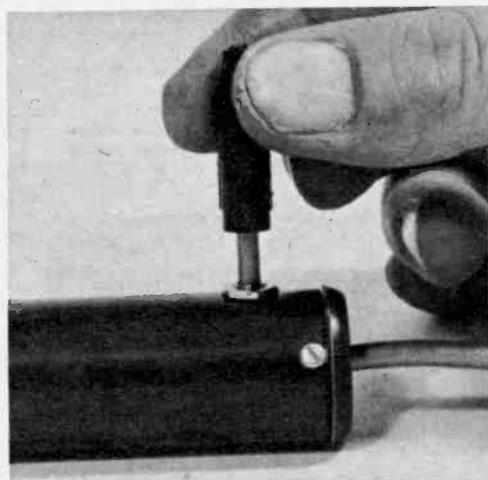




R3 is on underside of board (above) and is held by three flea clips which are used for tie points. Cut R3's lugs short so R3 doesn't extend beyond edge of board. Amplifier (below) is built on board supplied with probe kit. Parts must be close to board so shield sleeve (not shown) can be slipped over the assembly.



Slide the main probe body and the shield on the mike cable. Connect the mike's hot lead to C1 and the shield to the board's solder lug. Route the mike cable's push-to-talk wires toward the back of the board. (For clarity we don't show the wires in the pictorial.) From the back end of the board slide the shield over the amplifier as far as the solder lug. If necessary, bend the battery holder's positive terminal toward the center



If you don't want to spend the money for the miniature switch specified in Paris List, an ordinary miniature phone jack can be used as a power switch. Insert plug in jack to turn off the power.

of the board to provide clearance for the shield.

If a component has been positioned so that it prevents the shield from being placed against the solder lug, slice the shield lengthwise so its diameter can be increased. If it appears the shield will touch a part, insulate the part with tape.

Slip a short length of shielded mike cable (three or four conductor) through the capsule's end cover and connect the hot lead to C2 and the shield to the battery holder's positive terminal (which is connected to the board's solder lug). Connect the PTT wires to the PTT wires from the mike cable.

Install B1 in the holder and turn on the transceiver. Using a modulation meter or another station, adjust R3 for close to 100 percent modulation while speaking in your normal voice with the mike at a comfortable distance.

Using the Preamp

Once R3 is set for the correct modulation level, further adjustment is not necessary. Since the preamp is an integral part of the mike cable the entire assembly can be used with different transceivers if the cable is equipped with a plug. Power is applied by simply removing the plug inserted in the jack (if you used one instead of a switch for S1). To prevent the plug from being misplaced, tie it to the mike cable. —

The Newest In CB Equipment

By H. B. MORRIS

YOU can forgive CB engineers if they look like fat cats sitting next to an empty canary cage. Not only have they come up with some of the best solid-state circuits around today, but they've made them available at low cost. Until recently, only the best CB transceivers offered nuggets like FETs (field-effect transistors), mechanical filters, ICs (integrated circuits) or noise silencers. Try bragging about these items now and you just get a stifled yawn in return. What once was the high-price option is this year's standard buy.

So there are no shattering breakthroughs this year. But you can watch for emerging trends, a novelty or two to tickle the eye and some practical innovations in the crop of CB equipment being offered in 1969.

This year, more than ever before, CB transceivers split up into the base and mobile category. The dual-function rig is still here but signs are that it's a disappearing breed. People want more selective features.

Consider some examples from the base and mobile units offered by the manufacturers. Johnson's new Messenger 223 (photo below) is a good indication of what's happening in base stations. As you can see, there's no attempt at miniaturization. The rig features all 23 channels and a mike with a desk stand. This set has mostly tubes and just one small, solid-state circuit board. Despite the



Johnson Messenger 223 Transceiver

hoopla about transistors and midget size, the vacuum-tube base station still is much in evidence. CBers still like it big on base.

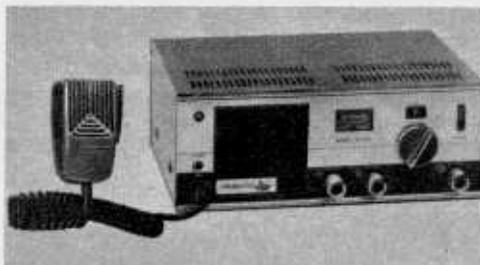
They may like them good-looking, too, as shown by the new base station manufactured by Pace. This rig can move right into the living room of any fussy wife because it has



Pace Base Station

a wood-grain cabinet and styling that make it a ringer for a stereo FM receiver.

It's still possible to choose a set that's equally at home on base or in the car. Midlands' new Model 13-875 has a built-in power supply which operates from either house current or 12 VDC. In the same category is Radio Shack's new TRC-29, an all-channel rig boasting 22 transistors, an integrated



Midland Model 13-875 is shown above. Below is Radio Shack's new TRC-29.

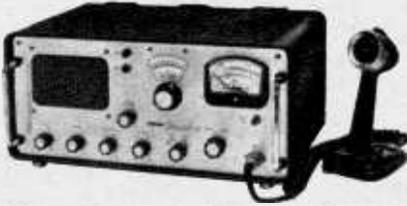


circuit and a mechanical filter.

Beefiest new base station on the market is aptly named Titan II by Tram. Built like a battleship, it can transmit normal AM or double sideband. With this power-boosting technique, the RF carrier is suppressed and its energy added to the sidebands that carry

the intelligence. At \$482, the Titan II is one of the most deluxe base stations available.

The second important CB team is the lineup of mobile rigs. The trend here is to ram the greatest number of circuit refinements into the smallest possible package. And the



Titan II Base Station

result often is a gem-like transceiver having uncanny proportions and performance.

One example is Allied Radio's A-2569 transceiver. As you can judge by the size of the microphone, the rig is about as large as a book. Yet it includes all 23 channels, a dual-conversion receiver and nearly everything that's found in the bigger base stations. And note the new nod to safety. Flattened panel knobs and buttons protect your shins in the event of a sudden stop.



Allied A-2569 Mobile Rig

Another example of a tiny transceiver packed with king-size features is the Browning Eaglette. This rig includes a *local/distance* switch to reduce the sensitivity of the receiver. This setting could help reduce interference, possibly from skip stations, when the desired signal is strong. Another entry in the mini-category is a unit called the Beaver. This stylish model (PC 23c) is manufactured by Polytronics. Not only does it sport a wood-grained front panel, but it also permits you to match it with your Ferrari or GTO with a choice of panel-trim colors (green, red, blue or beige). No QRM from this baby!

The mobiles just described are all in the deluxe category. But there's also some activity in the utility class. This includes uncomplicated mobile rigs with less than 23

channels. Stripped of such accessories as an S-meter, and bearing few knobs, these sets are mainly for the buyer who couldn't care less about FETs and ICs. The rig is simply



Above is Browning Eaglette for mobile use; below is Beaver made by Polytronics.



a black box for yelling *help* on the highway.

One example is Pearce-Simpson's new Panther. It's unobtrusive, easy to operate on five channels and has one set of crystals supplied for channel 9 (the unofficial frequency for emergencies).

A trend toward the self-testing CB transceiver is suggested by B & K's new Cobra 98. This rig has a built-in SWR meter which measures the standing-wave ratio of the antenna system. This is an indication of how much power is reflected back to the transceiver. The operator merely works two switches to take a reading. If the meter indicates a ratio of more than 1.5:1, it's a sign that power is being lost in the transmission line or antenna due to a mismatch between the transmitter and radiating elements.



Pearce-Simpson Panther

Most surprising new rig? That title is captured by Lafayette Radio with its Telsat 150.

[Continued on page 110]

The Skeletons in CB's Closet... Verrrry Interesting!

*Two-way communications on 27 mc
have a history you won't believe.*

By MITCHELL WAHLS

SOME NIGHT when CB carriers shriek like banshees, try backing off the receiver's gain control. Then listen, really listen. You just might hear . . . "Ice Floe off the port bow" . . . "Achtung" . . . "CQ DX." Is the receiver trapping signals from an alien band? Probably not. You may be hearing ghosts of CB's past. Although the band has squatted on 27 mc for more than ten years, CB has skeletons which date back over decades of war, scientific exploration and electronic pioneering.

It began about 35 years ago when a shaky band of transmitters ventured up to 27 mc. The frequency has been around as long as the universe but technically it had remained an electronic Mt. Everest. In radio's early days anything above the broadcast band (about 1600 kc) might as well have been up in the microwave region. But as more stations took to the air to broadcast and communicate, the push for more spectrum space became a battering ram. Operating frequencies soon reached the dizzying heights of 8 or even 9 mc.

The conquest of 27 mc, so far as we can trace, happened in 1933. A radio station in Yuma, Ariz., operated by a Dr. A. H. Schermann took out a license for the world's first VHF remote-pickup transmitter. Its call: W6XBC, which stood for Experimental Broadcaster, 6th Radio District. The transmitter operated on 27.1 mc (just below CB



channel 12) and was on the air about ten minutes a day seeking reception reports. Dr. Schermann's idea turned out to be a raging success. Today there are thousands of VHF remote-pickup transmitters serving the broadcast industry.

As signals were hopping around Yuma, another early source of 27-mc signals appeared. This time it was a quaint wooden-hull schooner called the Effie M. Morrissey. The Morrissey, operating under callsigns VOQH, WHFZ and W1ØXDA, sailed to the Arctic each year for scientific and exploration purposes. Its ancient homebrew transmitter was licensed to croak out signals on six different channels ranging between 6 and 27.1 mc. Although the rig had a powerful 203-A tube, it wasn't really successful when trying to operate on 27 mc.

Maybe there just weren't enough people listening. At about that time ham operators were starting to experiment on higher frequencies and the 10-meter band (28 mc) was flickering to life. A ham's typical VHF range formula in those days (to quote from a 1933 issue of QST Magazine) was, "when signals within 500 miles are very strong on 14 mc, signals from 800-1,100 miles will be

heard on 28 mc." The Morrissey experiment was a failure but lots of experiments were continued to find commercial uses for VHF.

By 1940 fate took over and solved the researchers' dilemma. World War II touched off a technological revolution in two-way radio. The war effort required a whopping slice of the radio spectrum for aircraft, ship, Jeep, tank and foxhole communications. Among the frequencies paraded off to battle was 27 mc. It was assigned by Allied and Axis forces mainly to tanks and beachhead landing networks. By a strange turn of events it appears that the peculiar nature of what is now known as CB skip may have cost German General Rommel (the Desert Fox) the battle of North Africa.

As the story goes, a ham operator in Rhode Island made recordings of strange, foreign-language transmissions he heard every day on 27 mc. One day he played the discs for a friend who could speak German. The friend quickly realized the broadcasts were part of a vast military communications system of German tanks and base stations. What Allied forces were missing on their rigs was being picked up at a distance of 3,000 mi. When the U.S. Navy was called in it decided the tanks were Rommel's in North Africa. The Germans were engaged in a notorious cat-and-mouse game with the British.

Although skip signals were heard on an almost daily basis they had one baffling quality. They were only readable within a few square miles of Rhode Island territory. Military Intelligence immediately took over a Rhode Island farmhouse and crammed it full of 27-mc receivers and German translators.

Every command to Rommel's tanks, every position report, every request for supplies by the Germans was promptly monitored, translated and flashed back to Montgomery, the

British general in Africa. The battle of El Alamein may very well have been lost by the Germans because of CB skip!

Our own tanks were doing a lot of 27-mc yakking too. Three of their channels were smack dab in the frequency band you're now using to earn FCC citations. Fact is, when the war ended Uncle Sam did a thriving business unloading battle-scarred 27-mc transceivers onto the public. Ah, those old sets! Some are still going the rounds on the surplus market.

Anybody out there recalls the TBY, a little rig once used to communicate between trans-

port ships and LSDs? (Better yet, does anybody remember when LSD meant a navy ship?) The TBY was a 27-mc transceiver which the government built to last forever. The big problem was that they were so rugged you couldn't get at their innards to fix them and fixing they needed! Not only were they finicky, but the receivers had a habit of drifting from one frequency to another. That really didn't matter much since the sets

had superregenerative receivers with barn-door selectivity.

Another oldie was the BC-1335, an early version of today's CB rig. It has some interesting features which might still be useful in CB if it had survived. For instance, you could hear your voice coming through the receiver at low volume while you were transmitting so you could check your own signal quality. The set could be operated from either 6 or 12 V—a feature of many early CB rigs but one that's disappearing today. Running 4 watts, the BC-1335 used 18 tubes and weighed in at about 25 lbs. Hardly suitable for mounting under the dash of your Charger.

These are just a few of the military rigs which eventually found their way to the sur-



Skeletons

plus bargain counters. Their day was over when the war ended. But they proved the value of 27 mc as a communications channel under extremely difficult conditions.

After the war, shortwave broadcasters, hams and doctors with their diathermy apparatus returned to 27 mc. It soon became apparent that returning to pre-war frequencies on a status-quo basis was a pipe dream. The conflict had done more than turn the cities of Europe topsy-turvy; it also made a shambles of the radio spectrum. International radio treaties were forgotten during the war and many countries set up transmitters on any frequencies which happened to suit their needs at the moment. Now that the war was over, they claimed squatters' rights to frequencies they'd been using for more than five years.

So in 1947 the nations of the world sat around a conference table in Atlantic City to unsnarl the tangle. The doctors were given the green light to continue using 27 mc for their medical equipment. One ob-

vious trouble was that medical devices created so much radio noise the 27 mc band was useless for commercial two-way radio. It was decided to let ham operators in the Americas, South Africa, Southwest Africa, Australia and New Zealand occupy 27 mc along with the doctors. As the next-door neighbor of the popular 10-meter ham band, the new band became known as 11 meters.

The band laid an egg. Why should U.S. hams operate on 11 meters when exotic European DX stations couldn't talk to them there? Why should hams buck the horrendous interference from medical apparatus when there were other bands available? And why should hams load 11-meter signals into antennas which were tuned only to the 10-meter band? No, it was all too much bother

except for a few hearty isolationists who didn't care about DX and didn't mind the noise, and those operators who purchased low-cost surplus gear for 11 meters.

As the band languished, the Firestone Tire and Rubber Company asked the FCC in 1948 to grant it an experimental license for two portable 3-watt transmitters on 27.255 mc (which is now CB Channel 23). The FCC agreed and issued the callsign W1ØXXD. The experiments Firestone conducted are lost amid the pages of the company's corporate records, but they may have been testing forerunners of CB gear as we now know it.

Almost 10 years later the FCC decided that hams had had a fair shot at trying to turn 11 meters into a thing of beauty but that they had failed in the attempt. The commission also had been scanning the spectrum for an opening for the 465-mc Citizens Radio Service which itself was a smashing failure. It looked like 27 mc was as good a place as any for the move, so they issued Docket No. 11994 in early 1957. That's the proposal that outlined plans to pull hams off 11 meters and move in the CBers.

As you might imagine, the uproar from hams was long and loud. Radio's law of the jungle dictates that one must hold his frequency assignments at all costs, regardless of whether they are needed or not. Wayne Green (then editor of CQ Magazine) jammed his typewriter into high gear with a frantic "Save 11" contest which did no better than rally about 400 hams to the cause. Even the ARRL demanded the FCC keep CBers off.

Battle cries notwithstanding, the FCC opened the band to Joe CBer in 1958. Within 10 years he and his kind have brought forth upon the band 3 million transmitters, countless clubs and a \$50-million industry.

But now the FCC is in a state of shock over the unmanageable Frankenstein it created on that spring day back in 1957. —



Direct-Reading Strobe Exposure Meter



By VICTOR KELL

MODERN cameras have so many automatic features that it is practically impossible to take an incorrectly exposed photograph. Whether you use a low-price or Leica-quality camera, you can be almost certain of getting perfect exposures because of built-in precision light metering.

But as soon as a situation requires the *added* illumination of a flashgun, all bets are off. Reason for this is you must depend on guide numbers to determine proper exposure and often they're inaccurate. In addition, the size of a room and the color of its walls can make the guide number relatively meaningless.

EI's Direct-Reading Strobe Exposure Meter will tell you instantly the correct f-stop setting for an electronic flashgun (strobe). The meter is used in much the same way as a standard incident-light exposure meter. You place it at the subject facing the strobe, fire the strobe and then read the f-stop setting for the film you're using directly from the meter's scale. The meter will hold its reading for several minutes, perhaps an hour depending on the quality of components you use.

Unlike some commercial strobemeters priced many times higher and which creep upscale before and after exposure (due to ambient light) our meter has virtually no creep. It features a scale calibrated directly in f-stops, an ASA film speed range of 25 to 400, built-in battery test and instant meter reset. Cost is in the neighborhood of \$20.

Construction. All connections and component values are critical and substitutions should not be made. If you can't obtain all the specified components don't build the project. For example, do not substitute a 250-ohm control (or some other taper) for the R1/R3 combination.

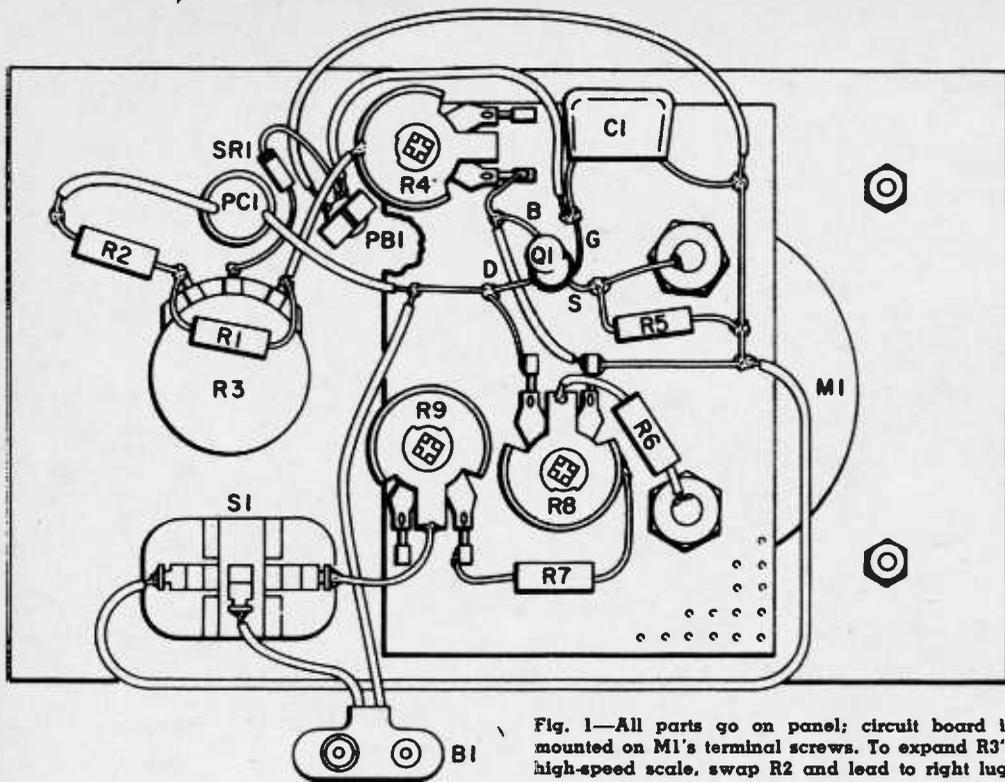


Fig. 1—All parts go on panel; circuit board is mounted on M1's terminal screws. To expand R3's high-speed scale, swap R2 and lead to right lug.

Strobe Exposure Meter

To avoid the use of a difficult-to-obtain industrial type control, we used a standard potentiometer for speed control R3. However, this results in a non-linear speed scale. The pictorial shows the wiring for an expanded scale from ASA 25 to 100, with the 100 to 400 range being somewhat crowded. This is satisfactory for slow-speed color films. If you prefer the higher speeds to be expanded, simply interchange the connections to R3's two end lugs. (The low speeds will now be crowded and the high speeds will take up most of the dial.)

The meter is assembled on the front panel of a *thin* Bakelite cabinet such as the type specified. Do not use a heavy-duty Bakelite cabinet because the panel is too thick and will most likely crack when you try to cut the opening for M1. Position M1 so the top of the plastic face is $\frac{3}{8}$ in. below the top of the panel. This space is needed to provide adequate clearance for the panel's mounting screws. Switch S1, R3 and the photocell (pilot light) assembly are mounted approximately on the horizontal centerline of the remaining panel space.

PARTS LIST

- B1—9 V battery (Eveready 222 or equiv., or 8.4-V mercury battery)
- C1—.1 μ f, 50 V mylar capacitor (TRW Type 601PE, Allied 43 F 1951. \$1.13 plus postage. not listed in catalog.)
- M1—0-1 ma DC milliammeter (Allied 52 B 7209)
- PB1—Normally-open push-button switch
- PC1—Photocell (Clairex CL903, Allied 60 C 7488)
- Q1—40468 field-effect transistor (RCA)
- R1—560 ohm, $\frac{1}{2}$ watt, 10% resistor
- R2—470 ohm, $\frac{1}{2}$ watt, 10% resistor
- R3—500 ohm, linear-taper potentiometer
- R4—300 ohm, linear-taper potentiometer (Mallory Type MTC-4, Lafayette 33 T 1668)
- R5—2,700 ohm, $\frac{1}{2}$ watt, 10% resistor
- R6—680 ohm, $\frac{1}{2}$ watt, 10% resistor
- R7—6,800 ohm, $\frac{1}{2}$ watt, 10% resistor
- R8—3,000 ohm, linear-taper potentiometer (Mallory Type MTC-4, Lafayette 33 T 1674)
- R9—5,000 ohm, linear-taper potentiometer (Mallory Type MTC-4, Lafayette 33 T 1675)
- S1—SPDT switch (with center off)
- SR1—Silicon diode (small-signal type, see text)
- Misc.—Pilot-light holder (Dialco 177-8430-0975-503, Allied 60 F 8334. \$1.51 plus postage. Not listed in catalog), $6\frac{1}{4}$ x $3\frac{3}{4}$ x 2-in. Bakelite box and panel (Lafayette 19 T 2001 and 19 T 3701), perforated board, flea clips

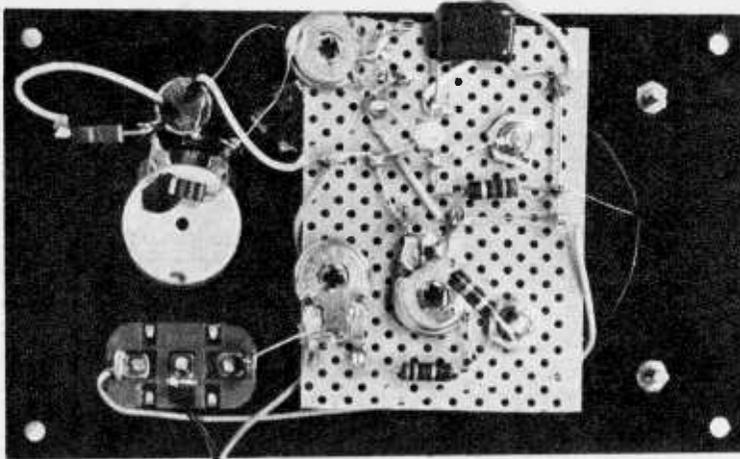
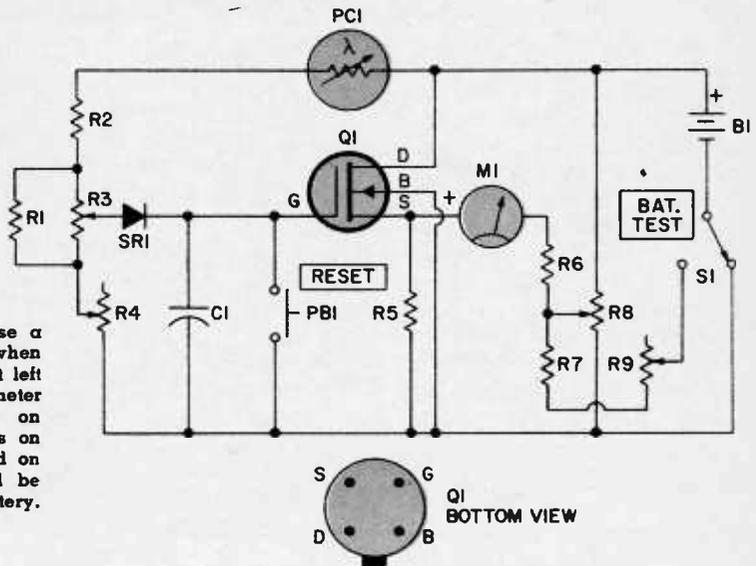


Fig. 2—Take it slow and use a sharp hole cutter and bits when drilling panel. Three parts at left—photocell holder, potentiometer and switch—are mounted on straight line. Install all parts on board before mounting board on M1's screws. Battery should be premium type or mercury battery.

Before mounting M1, you must break the face seals to get at the meter scale for calibration. On the back of the meter, in the center of each of the four sides of the meter face, you will find a thin white line of rubber adhesive which secures the face to the body of the meter. Using a sharp knife, cut through the adhesive and then snap off the plastic meter face by pulling the face outward from the top of the meter, using the bottom of the meter as the pivot. There are four indents in the meter face which provide a locking action, so it will take a firm snap-motion the first time it's done. After the face is off the meter, slip the knife blade gently under the meter scale and pry the scale off the body of the meter *without bending the pointer*. Just

Fig. 3—Light hitting photocell PC1 lowers its resistance and causes voltage to build up across C1. Voltage (proportionate to light intensity) is amplified by Q1 which drives M1. Charge remains on C1 because of Q1's high input impedance and fact that SR1 is open circuit after C1 is charged. Dirt on SR1's case forms discharge path for C1 causing it to lose charge and M1 to creep downscale.



loosen the scale, don't take it out. Unlike other meter scales, this one is secured by small strips of double-side tape. Just get the scale loose from the tape. Next, reassemble the meter.

Photocell PC1 is mounted in a modified pilot-light holder and you must use the exact unit specified as the circuit is designed for the opacity of the holder's dome. Using a hacksaw, cut through the body of the holder just about in the center of the back section and remove the guts so that you can slip PC1 all the way up in the dome. Remove the rubber O-ring from the dome, place the body on the front of the panel and screw the body onto the dome from the back of the panel. Discard the mounting nut supplied

Strobe Exposure Meter

with the assembly.

Solder two 4 in. No. 20, 22 or 24 *stranded* wires to PC1's leads (the excess will be cut off during the final assembly). Slip spaghetti insulation on each wire all the way to PC1's body. Insert PC1 into the lamp assembly all the way to the dome, making certain PC1's face is pointed directly forward, not tilted. Spread the wires so they hold PC1 in position and then fill the back of the lamp assembly with a small quantity of silicone rubber clear seal, such as GE's type RTV. When the seal dries PC1 will be mounted firmly.

The electronic circuit is built on a 3 x 2 1/4-in. piece of perforated board; push-in terminals are used for tie points. Trimmer potentiometers R4, R8 and R9 are held to the board by their outside terminals. If necessary, the terminals can be spread slightly to fit into the push-in terminals.

Field-effect transistor Q1 will be damaged if its leads aren't kept shorted during assembly. The FET is supplied with its leads inside a shorting rivet. Remove one single strand of wire from a piece of zip cord (lamp wire) and wrap the strand around Q1's leads, then remove the rivet. Keep the wire on until construction is completed. Use a heat sink,

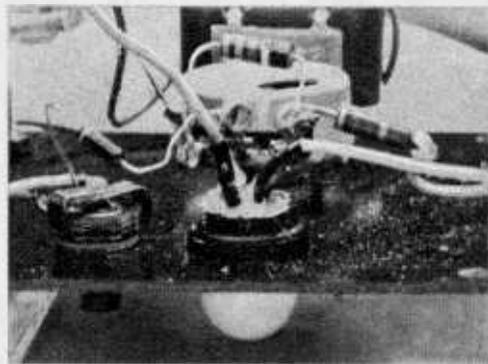


Fig. 5—Closeup of photocell holder which is pilot-light holder with back cut off. Photocell is slipped up in dome, unit is filled with sealer.

such as an alligator clip, on Q1's leads when soldering.

Silicon diode SR1 is the most critical part in the circuit and must be installed exactly as described. Since it may have to be removed temporarily, solder SR1 from R3's wiper terminal to PB1's lug, using the leads *full length*. After SR1 is installed, wipe its body with a rag soaked in acetone, tape-head

[Continued on page 109]

Fig. 4—To give instrument professional look, cut out scale and paste it over scale of meter specified in Parts List.

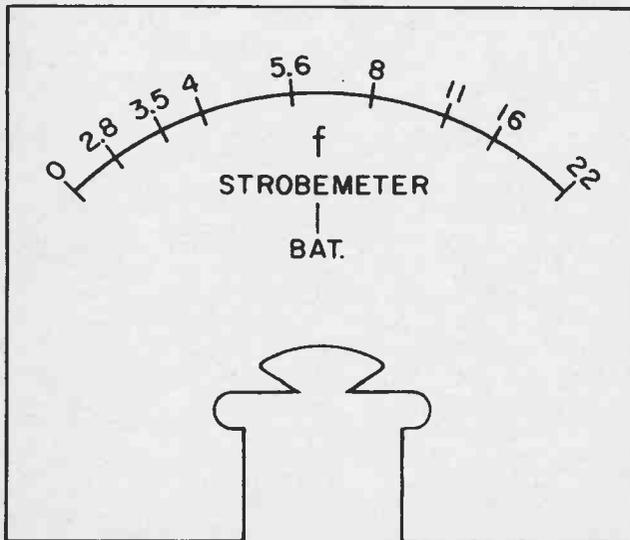


Fig. 6—Finished meter. Switch at left must have center-off position so unit can be turned off completely.



Hi-Fi Today

* Getting an Audio Profile

By John Milder

WHILE passing out compliments to Japanese audio equipment a couple of columns ago (Jan. '69 EI), I also had some less-than-flattering things to say about the penchant for gadgeteering that seems to characterize some of the expensive gear from Japan. Recently, though, I've come across some Japanese gadgetry that really does a good bit more than gild the lily.

Specifically, it's a row of five sliding linear controls (see arrow in photo) that comprise what the Japan Victor Co. (Nivico) calls a Sound Effect Amplifier. This array of controls (name and all) comes with several JVC amplifiers and receivers, and it's much more than it seems at first glance.

The controls replace the usual base and treble knobs. What they do is tailor the overall balance of five different segments of the audio spectrum. Instead of just fiddling with the bass and treble extremes of the audio, you have an opportunity to contour the signal fed to a speaker and thereby adjust the overall sound quality to your own taste.

To my knowledge, this is the first time that contouring has been built into an amplifier. Up to now it has been done in some of the better speaker systems and KLH has employed bass contouring in its portable phonographs and radios. While most audiophiles don't realize it, a certain amount of contouring has been built into the crossover networks of speakers dating as far back as the AR-2. In fact, the crossover networks of most good acoustic-suspension speakers developed since then have more to do with electronic tone-shaping than actually splitting the signal between woofer and tweeter.

If fooling around with five segments of the audio-frequency range seems a bit much, it really isn't. The object is not to emphasize one segment over another but to make subtle adjustments of the octave-to-octave musical balance. The uncertainties of speakers, room acoustics and recording quality all call for some method of compensation if you desire the best in reproduced sound. No single decision on musical balance by a speaker designer is likely to match both your expectations and the variations in balance favored by recording engineers. To hear how impossible that is, just pick any three or four recorded versions of Beethoven's Fifth and listen to the differences in reproduction and overall sound quality.

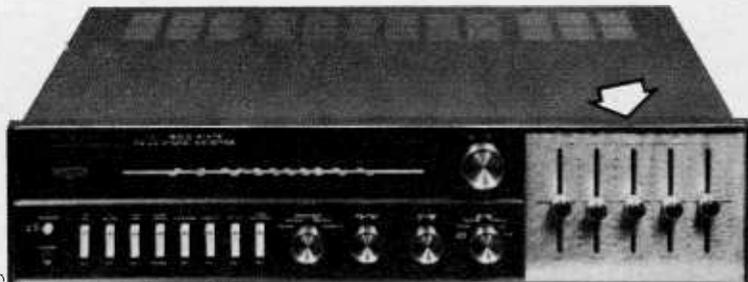
The JVC Sound Effect Amplifiers use vertical sliding controls to do the job. Most of the time, linear controls leave me cold (they are used all too often for a pseudo-professional look). But here the arrangement makes sense since you can tell at a glance whether a particular frequency range has been left up or down relative to the others.

Less to my taste is the contouring device supplied with the new Bose 901 speaker. Designed strictly for use with the Bose system, this little jigger goes between the preamp and power stages of an amplifier (via the tape outputs and tape-monitor inputs). The contouring of various frequency ranges is well thought out and flexible but part of the system includes a suppression (of about 18db) of everything above the low bass range.

This is intended to make up for the relatively poor bass coupling caused by the size

[Continued on page 114]

The Nivico Model 5003 AM/FM stereo receiver has a 140-watt rating. It features FET circuitry and five IF stages. Contour controls (right) are marked 60, 250, 1,000, 5,000 and 15,000 cps.





VENUS MEET APOLLO! If you're an astronaut waiting for splash-down, this gal has just what you want. Yes, it's a compact, watertight radio made by Sylvania for that tricky moment when you and your Apollo flight crew land in an off-target area. This pocket communications system, designed especially for our space program, will put you in touch with aircraft up to 45 mi. away. It also has a homing beacon with a range of 85 mi. for search-and-rescue. The 24-oz. device will go down in 50 ft. of salt water without suffering damage. Transmissions occur on two voice frequencies, one of which must surely be hers.

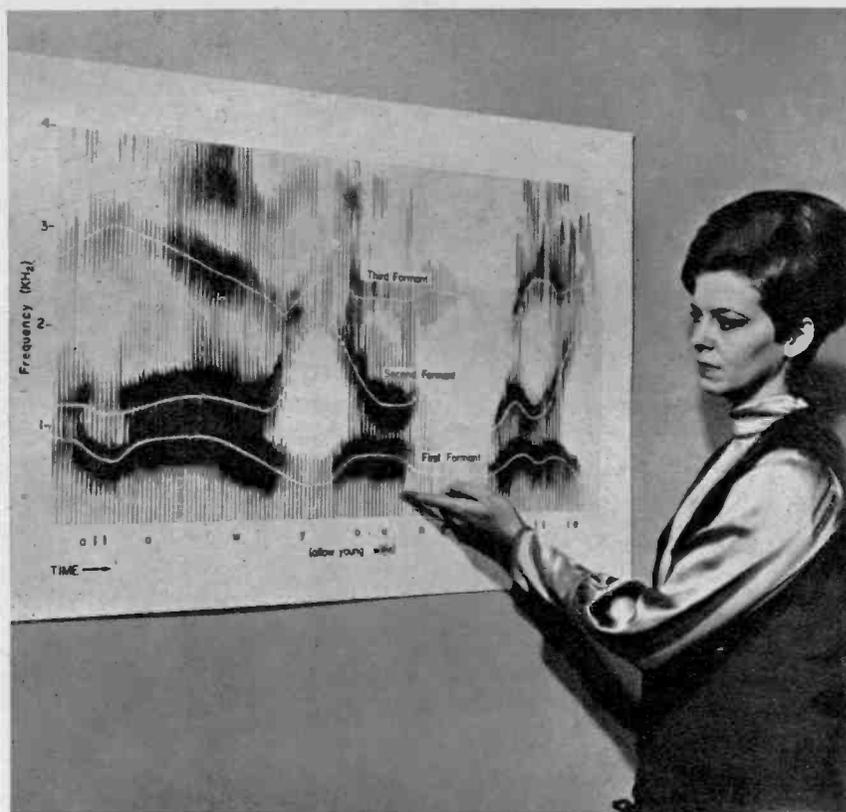
Typical Computer Addresses
(Second Formant)

110
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1

Electronics in the News



St. Louis Woman. He's at it again. Max Conrad, one of the world's most famous solo pilots, says, "That's the way," as he points north during a preflight discussion. Conrad's project: taking a Piper Aztec on a 33,000-mi. journey leading him over the North and South poles. The weather, often going from lousy to worse, seemed to call for some special kind of power—and this turned out to be a nickel-cadmium battery (above) made by Sonotone Corp. to start the engines and supply emergency power.



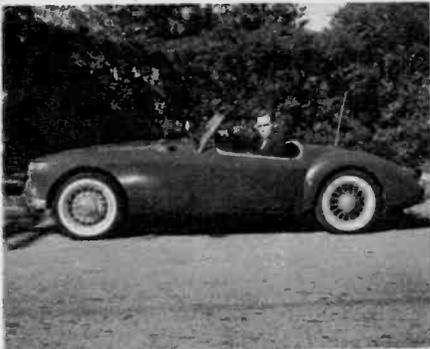
Sounding Off. IBM has decided that when machines talk back to people they should be intelligible. A new gadget called a formant generator has been developed to help improve the quality of synthetic speech. It's a tunable filter controlled by computer which simulates resonances in the vocal tract. Photo shows sound spectrogram of the phrase, "Allow young Willie." It's the dark traces (formants) which the computer must memorize and reproduce.

Low Boiling Point. How do you like seeing your soldering job turn into a lava flow that spews unwanted alloy over delicate components? Most people, including industry, don't dig this. So Cerro Copper & Brass, a division of Cerro Corp., has come up with a solder that has an ultra-low melting point. Called Cerrosolder, this bismuth-base alloy is liquid at 212° F. Developed to solve production problems dealing with ICs and thermal-sensitive components, it may be the forerunner of better solders for frustrated experimenters and servicemen.



6 good reasons to get into electronics:

1



2



3



4



5



6



Want more reasons?

Read on...

A future? Electronics *is* the future. Build **in** a career in a field that's growing this fast, and you should grow.

Security? When you're an electronics technician, you have the kind of security a man really wants: the knowledge that there now are more good jobs in your field than there are men to fill them.

Travel? Excitement? Advancement? Yes. Electronics has the good things you're looking for . . . and maybe even a few more that will surprise you.

Don't forget money. There's money in electronics. You can make a good living. And when it comes right down to it, that's what a career is all about.

What's the catch?

Just this: nobody can do it for you. You have to want to get into electronics. You can't become a highly-paid electronics technician by just saying a magic word.

It takes some work. But we can teach you what you need to know—in one of our schools—or at home, by mail. It's probably a lot easier and a lot faster than you think. Why not find out? Make the first move. Send in the post card . . . and make things start happening!

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ONE OF THE

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Good Reading

By Tim Cartwright

FUNDAMENTALS OF INTEGRATED CIRCUITS. By Lothar Stern. Hayden Book Co., New York. 172 pages. \$8.95

This book, part of the Motorola series in solid-state electronics, is a really first-rate production all the way. It presents IC state-of-the-art in the original, fullest sense of the phrase, showing the IC in conception, production and application—and in its almost unlimited potential. It also makes clear a fact that engineers have known for quite a while but that even many advanced hobbyists still aren't aware of: the IC encourages a whole new order of circuit experimentation and inventions, a really free and rambling kind of experimentation based on the availability of circuits and sub-circuits of incredible sophistication. There are almost as many of these—complete and ready to plug into the most esoteric kinds of applications—as there were vacuum tubes and transistors. Because this book is essentially a product of an up-to-date producer of ICs, it is really pertinent and on top of the subject in every respect. And it is well written and plentifully (and beautifully) illustrated. The value for the money, both in basic information and style of presentation, puts most present-day electronic books to shame.

INTEGRATED CIRCUITS, FUNDAMENTALS AND PROJECTS. By Rufus P. Turner, Allied Radio Corp., Chicago, Ill. 95 pages. 75¢

And here is the first book of home-brew IC projects to arrive at my house. (There probably are others but I have yet to see them.) The fundamentals here aren't exactly overwhelming in scope and detail but there's really no reason why they should be. The doing is the big bit here and there are a half-dozen accessible and worthwhile construction projects: a simple audio preamp, a high-gain preamp, a quarter-watt audio amplifier, a frequency-standard crystal oscillator, an AF-RF signal tracer and an electronic DC voltmeter. Here again the value for your money is good. The aim, after all, is to introduce the subject and sell parts rather than make money on the book.

FET PRINCIPLES, EXPERIMENTS AND PROJECTS. By Edward M. Noll. Howard Sams & Bobbs-Merrill, New York and Indianapolis, 272 pages. \$4.95

While the FET is not about to compete with the IC in long-term significance, its presence also is just beginning to be felt in electronics. It already has gotten out of the signal-circuit-only pigeonhole many engineers were ready to consign it to not so long ago. The book at hand has a lot to say about applications in AC amplifiers, audio amplifiers and oscillators. The basic coverage here is quite good. The projects themselves are of a pretty advanced variety, without the blow-by-blow kind of description that many hobbyists want. But the project interest is relatively high and the rewards in many instances should be equally so.

MAGNETISM AND MAGNETIC MATERIAL. By J. C. Anderson, Chairman & Hall, London (Distributed by Barnes & Noble), New York. 248 pages. \$8

The subject here is an esoteric one but the high level of progress that has been made in the past few years in magnetic theory and materials make this a worthwhile buy for advanced students. There is nothing discursive about this treatment. It's full of facts, facts—with equations to match.

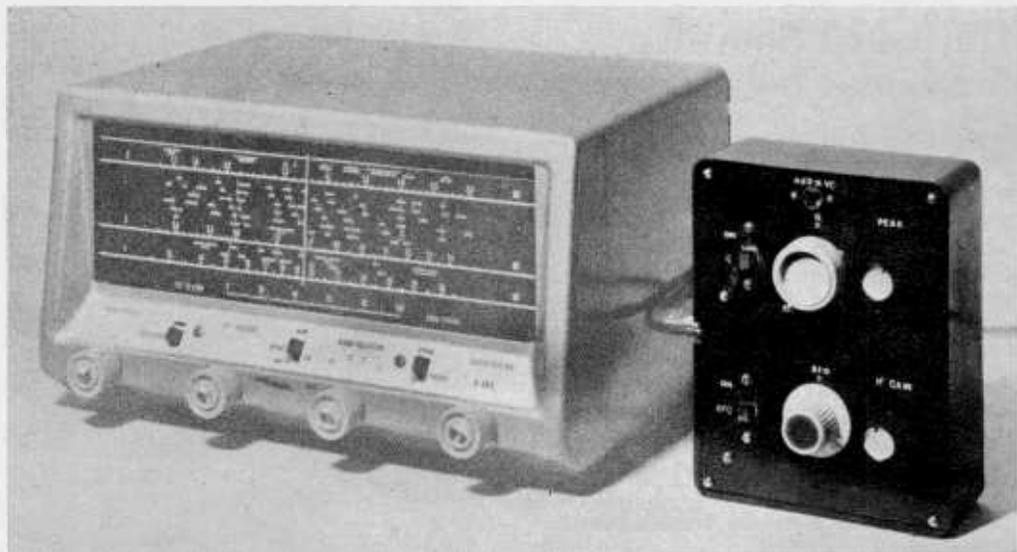
HI-FI LOUDSPEAKERS & ENCLOSURES. By Abraham B. Cohen. Hayden Book Co. (Rider Series), New York. 438 pages. \$5.95

Abraham Cohen is back (this is the second revised edition) with a good deal of added information on speakers. The strengths of the original treatment (copious coverage of things you can't find elsewhere in audio books these days) remain and so do the weaknesses (big gaps in the discussion of why speakers sound the way they do, and some folklore presented as fact).

And Make Note Of . . .

ADVANCED AND EXTRA-CLASS AMATEUR LICENSE HANDBOOK. By Howard F. Pyle, W7OE, Howard Sams, 192 pages. \$3.95

WORLD RADIO-TV HANDBOOK (1969 edition). Gilfer Associates, Box 239, Park Ridge, N.J. 07656. 360 pages. \$5.95. With Summer Supplement, \$7.95.



Outboard Soup-Up for Low-Cost Receivers

By CLARE GREEN, W6FFS LIKE all bargains, when you purchase a budget short-wave receiver, you get exactly what you pay for—minimum performance. Trouble with these stripped receivers is that they have only one IF stage, and this means poor selectivity. The receivers may be okay for the broadcast band but when you use them for SWLing on short wave, their performance leaves a lot to be desired.

To the rescue of the receiver you may have been planning to replace with a more expensive rig: our outboard soup-up accessory. It's a combination Q-multiplier/BFO that digs the signals out of the QRM. The Q-multiplier/BFO supplies additional selectivity for 455-kc-IF receivers. It also has a variable BFO for receivers that lack this feature.

How it Works. Look at the schematic in Fig. 2. IF signals (at about 455 kc) from your receiver's mixer are coupled via C1 to the primary of T1. Transformer T1 is adjusted to tune out the capacitive reactance of the coax.

When S1 is set to *on*, power is applied to Q1 and S1A connects the secondary of T1 to C3. FET Q1 is connected in a colpitts-oscillator circuit consisting of L2, C10, C11 and C12 which is tuned to about 455 kc. Potentiometer R4 controls the feedback so the oscillator operates as a regenerative amplifier below the point of oscillation.

The signal produced by Q1 is coupled via C3 and T1 back through the coax cable to the receiver's mixer stage. The oscillator is tuned by C10 so the signal is in phase with the IF signals. This produces an increase in effective amplitude of the IF signal and an improvement in selectivity. The Q-multiplier functions as a high-Q tuned circuit in parallel with the receiver's mixer-IF-transformer primary.

Outboard Soup-Up for Low-Cost Receivers

When S2 is set to *on* power is applied to Q2. Transformer T2, C5, C6 and C8 are connected with Q2 as an oscillator with a center frequency of about 455 kc. The oscillator's output is radiated to the Q-multiplier circuit by internal wiring capacitance and enables you to receive CW signals by tuning C6 for a beat note.

Construction. Our Q-multiplier/BFO is built in a 6¾ x 5¼ x 2¼-in. Bakelite box. All of the parts are mounted on the back of the box's panel on two pieces of perforated board. Take a look at Figs. 1 and 3. The Q-multiplier circuit is on the top board and the BFO circuit is on the bottom board.

Best place to start is to lay out the front panel and cut the holes for the controls. Mount the controls and position them as shown. Cut a 4½ x 1½-in. piece of perforated board and temporarily position C10 on it. Mark the location of C10's mounting holes on the board, and the holes for L1's tuning screw and T1. Note that T1's lugs are on the bottom of the board.

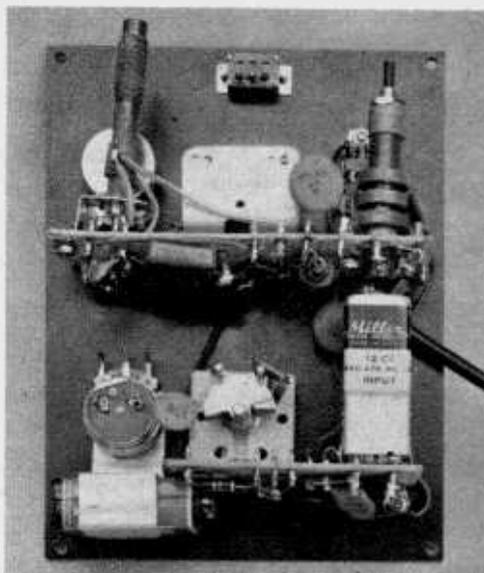
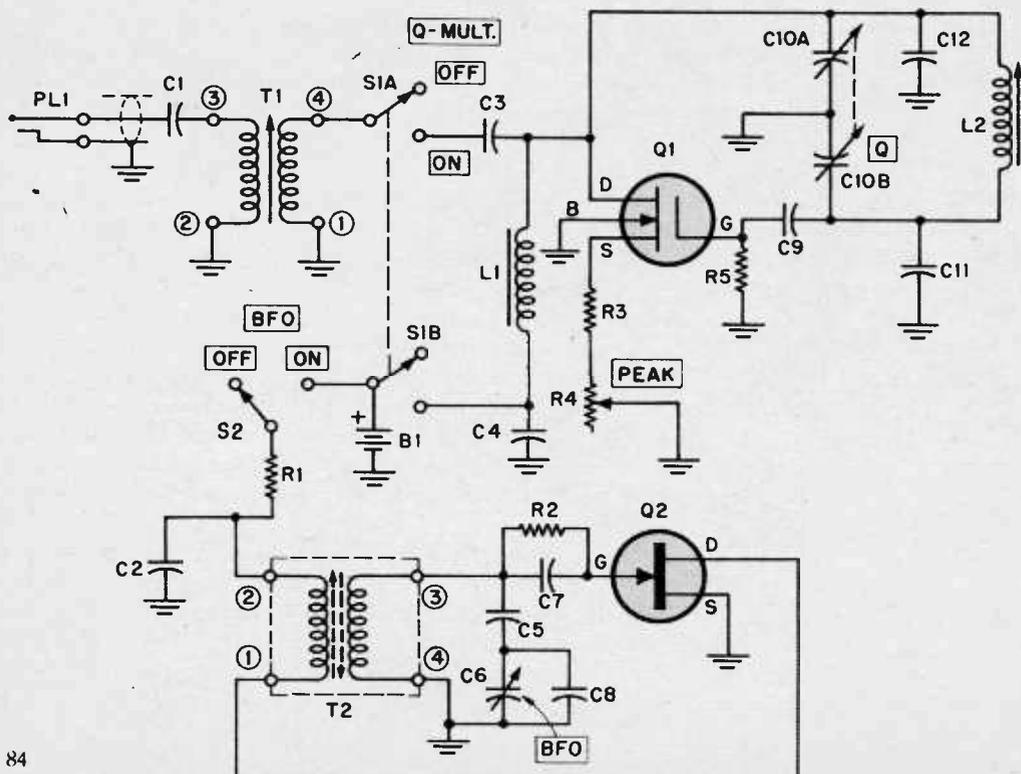


Fig. 1—Boards mount on box's cover. Q-multiplier is at top; BFO is at bottom. Note how battery (lower left) is held with a home-brew bracket.

Fig. 2—Schematic. Q-multiplier is 455-kc oscillator whose output is fed via C1 to receiver's mixer. 455-kc BFO oscillator circuit is at bottom.



T1 fits through a hole in the board. You must mount T1 this way so its tuning screw clears the inside of the box. Cut the holes and mount C10 on the board with 1/8-in. spacers to provide clearance for the capacitor's Bakelite strips on its sides.

Mount all parts on the Q-multiplier board with flea clips. Wire the components keeping the leads spaced as shown in Fig. 3. After the parts are mounted and wired on the Q-multiplier board, cut a 3 x 1 1/8-in. board and

temporarily position C6. Mark the holes for T2's lugs and adjustment screw. Cut the holes for T2 and mount it on the board by bending the lugs under the board. Adjust the top tuning slug as far to the top of T2 as possible. For extra support, we installed a small mounting bracket on the right edge of both boards and bolted them to the panel.

Wire the BFO board as shown in Fig. 3. Bend a small piece of aluminum to fit around the battery, and mount it under R6's bush-

Fig. 3—Note on Q-multiplier board (top) that ground lug to which C11, C12, etc. are connected is installed under C10's mounting screw. BFO board (bottom) ground lug attaches to C6's bracket.

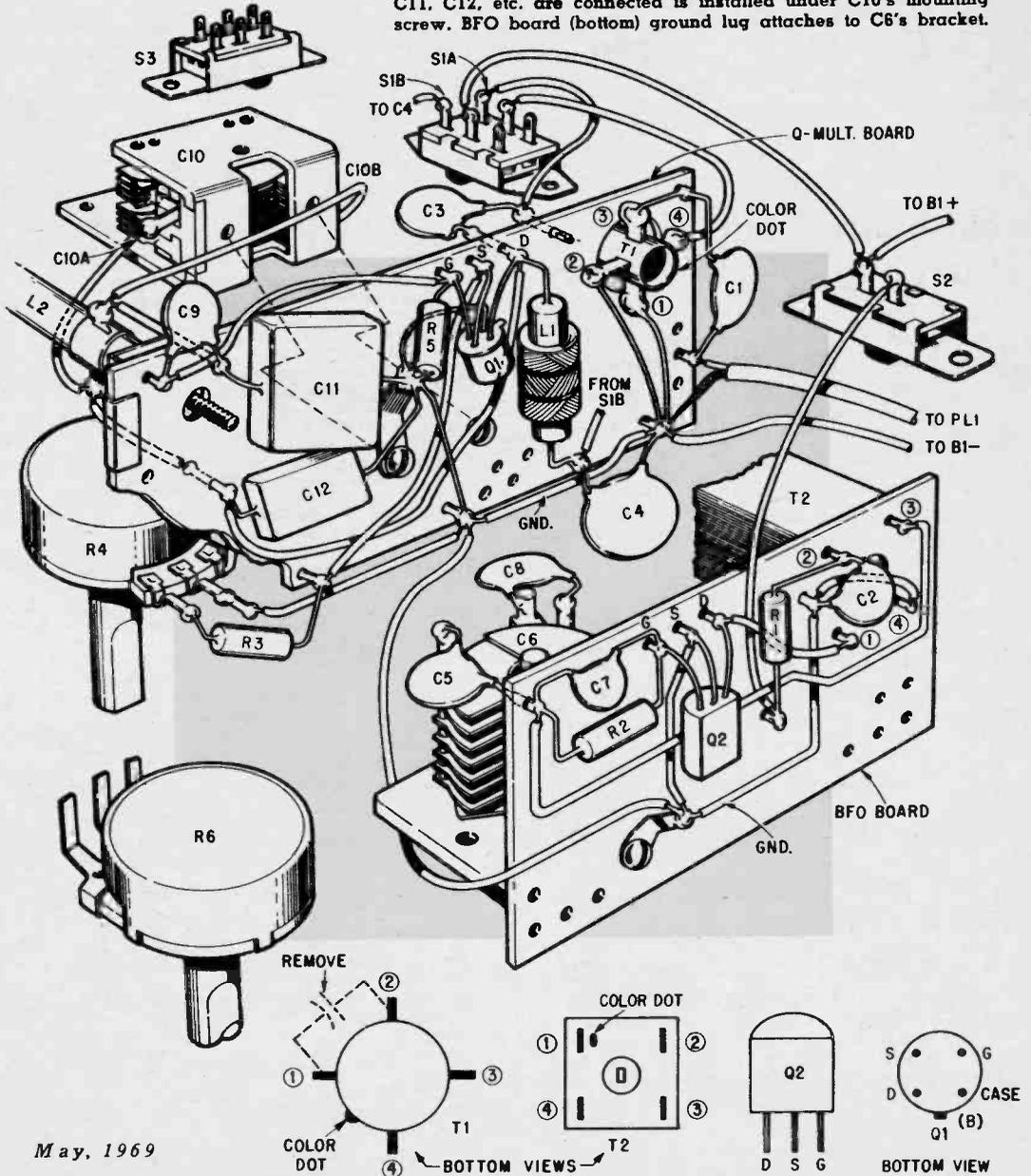
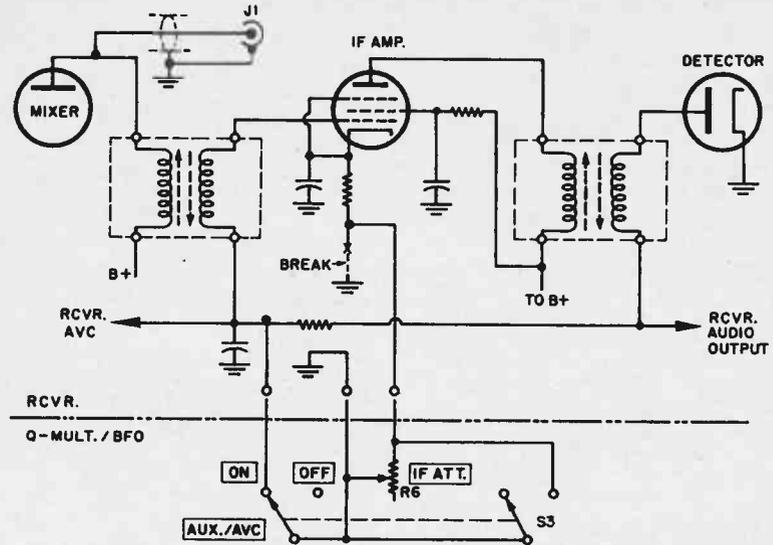


Fig. 4—Schematic of front-end of typical budget receiver. Wiring in color must be added to receiver. If receiver does not have IF gain control, connections to IF amplifier's cathode circuit must be made to provide control of IF stage's gain. If receiver does have IF gain control, do not make this modification and eliminate potentiometer R6 and switch S3 in pictorial in Fig. 3.



Outboard Soup-Up for Low-Cost Receivers

ing as shown in Fig. 1. Cut a 27-in. length of RG58A/U coax and connect it to the Q-multiplier board; install PL1 on the other end. Install the battery in the mounting bracket and connect it to the circuit.

Cut a notch on the top left side of the box for the coax and install the cover on the box with the corner mounting screws. Do not tighten the cover screws, as the cover will have to be removed for coil adjustment later on.

Receiver Connection. The Q-multiplier/BFO will work with almost any receiver having a 455-kc IF. A typical IF circuit is shown in Fig. 4. This circuit is that of a simple receiver with one IF stage and no IF or RF



Fig. 5—Rear of modified Hallicrafters S-38E receiver. Connections for R6, S3 are made with tube base (upper left). Other connection is below.

PARTS LIST

- B1—9 V battery
- Capacitors—ceramic disc, 25 V or higher unless otherwise indicated
- C1,C2—.005 μ f
- C3,C4—.01 μ f
- C5,C8—47 μ f
- C6—3.7-42 μ f miniature variable capacitor (Hammarland HF50, Lafayette 40 T 2883)
- C7,C9—470 μ f
- C10—10-130/10-78 μ f two-gang variable capacitor (J.W. Miller 2110, Newark Electronics Corp., 500 N. Pulaski Rd., Chicago, Ill. 60624 \$2.31 plus postage. \$2.50 minimum order. Stock No. 40F195)
- C11—.0033 μ f silvered mica
- C12—.001 μ f silvered mica
- L1—2.5-mh RF choke (J.W. Miller 6302, Allied 54 F 1893, 99¢ plus postage. Not listed in catalog)
- L2—Adjustable ferrite-rod antenna (J.W. Miller 6300, Newark 40F128. \$1.23 plus postage)
- PL1—Miniature phono plug
- Q1—3N128 field-effect transistor (RCA, Allied 49 F 1 3N128-RCA. \$1.45 plus postage. Not listed in catalog)
- Q2—MPF103 field-effect transistor (Motorola, Allied 49 F MPF103-MOT. \$1.00 plus postage. Not listed in catalog)
- Resistors: $\frac{1}{2}$ watt, 10% unless otherwise indicated
- R1—180 ohms
- R2—47,000 ohms
- R3—2,200 ohms
- R4—10,000 ohm, linear-taper potentiometer
- R5—3.3 megohms
- R6—25,000 ohm, linear-taper potentiometer (see text)
- S1,S3—DPDT slide switch
- S2—SPST slide switch
- T1—140-420-kc RF coil (J.W. Miller X-5495-A, Lafayette 34 T 8706)
- T2—455-kc miniature IF transformer (J.W. Miller 12-C1, Lafayette 34 T 8727)
- Misc.— $6\frac{1}{4}$ x $5\frac{1}{4}$ x $2\frac{1}{4}$ -in. Bakelite box (Lafayette 19 T 2002), panel for case (Lafayette 19 T 3702), knobs, perforated board, flea clips RG58A/U coax

gain controls. And there is no AVC disabling switch. If your receiver has these controls, the auxiliary connections to the Q-multiplier are not necessary. Just connect a short length of coax between the mixer plate and a jack mounted on the receiver's rear chassis apron. Connect the coax shield to the receiver chassis near the mixer tube.

In some receivers, an AM/CW switch causes the IF stage to oscillate when the switch is set to the CW position. Tuning the receiver changes the beat note for CW reception. For best CW reception, leave the AM/CW switch in AM position and use the Q-multiplier/BFO to tune CW signals. Connect the receiver AVC line, as shown in Fig. 4, to S3.

To prevent overloading the IF stage, many receivers have an RF of an IF gain control. If your receiver does not have this type of control, break the receiver IF cathode resistor connection to ground, and connect it to the Q-multiplier's IF-attenuation control R6 as shown in Fig. 4. The control should be connected so that the full clockwise position will insert the greatest resistance in the circuit and provide the greatest attenuation. The full counterclockwise position will put the least resistance in the circuit and provides greatest gain. Switch S3 should be connected to short out R6 and provide maximum IF gain for AM reception. For AM reception, set S3 to *off* to disconnect the AVC bus from ground.

In the pictorial in Fig. 3 and the photograph in Fig. 1, potentiometer R6 and switch S3 are shown simply sitting there with no connections to them. They're this way for purposes of clarity since there would simply be a lot of wires coming from them and going out of the box.

If you are going to connect these controls, cut another notch in the edge of the box for the wires (or, drill a hole in the back).

Keep the added receiver wiring close to the chassis and away from RF circuits. Check your receiver's schematic for the best place to connect the auxiliary controls.

Since the unit is battery powered and is housed in a Bakelite box, it can be connected to hot-chassis AC/DC receivers if safety precautions, such as taping all exposed metal on the connectors and using plastic knobs, are taken. The coax length is critical. If tuning T1 will not peak up the signal strength, change the length of coax.

Connect the unit to the receiver and set

S1 and S2 to off. Tune in a broadcast station to the center of the received signal. Do not tune an extremely strong station.

Adjust T1's slug for maximum signal strength, then check for receiver oscillation caused by the added Q in the receiver's mixer plate circuit. Tune the receiver across the received signal and check for whistling. If there is whistling, carefully adjust the receiver IF transformers while listening to the received signal for maximum clarity. Only a slight adjustment should be necessary. In some of the lower-priced receivers, the IF stage is very close to the point of oscillation to provide additional selectivity. If the receiver is unstable, try a large value resistor across the primary of the output IF transformer.

Set *peak* control R4 maximum counterclockwise (maximum resistance) and set C10 to midrange. Set power switch S1 to *on* and adjust L2's slug for maximum signal strength. Slowly turn R4 clockwise while carefully tuning C10 for maximum output signal. The selectivity of the receiver should increase as R4 is advanced. You can notice this by a distinct narrowing of the received signal's sidebands (speech will sound muffled). Advancing R4 further will cause the Q-multiplier to oscillate. When this happens, back off R4 below the point of oscillation.

Set BFO control C6 to midrange and set BFO power switch S2 to *on*. Adjust T2's bottom slug for zero beat with the received signal. Then tune C6 across the received signal and note if the beat note tone variation can be heard both sides of the center of the C6's tuning stage.

Set the AVC switch to OFF (either the receiver's or S3) and adjust the receiver's RF/IF gain control (or R6) to a convenient level that does not overload the receiver. Adjust T2 for a zero beat with C6 in its midrange position. Install the panel in the box and tighten the four corner screws.

Operation. For AM phone reception set S2 to *off* and S1 to *on*. Set the receiver's (or S3) AVC switches to *on* and R6 to maximum gain. For CW reception, set S2 to *on* and the receiver AVC switch (or S3) to *off*. Adjust the receiver's (or R6) RF/IF gain control to a level that will not overload the receiver.

Tune the receiver for a signal and peak the signal with R4. As R4 is turned clockwise the selectivity becomes narrower and the gain increases. The sharpest point is just below the point of oscillation. ●

Notes from EI's DX Club

IN A SURPRISING development, R. Prague has been issuing QSLs for reception of Free Czech Radio. These cards even specify those fateful dates last August when the fighting was taking place. Just how long the policy continues remains to be seen.

In Africa, Botswana refuses to stay out of the news. This country, which had been using old colonial-style calls, has been assigned the A2 prefix. Although single-letter/single-number prefixes have been used for years by amateurs in many countries (including the U.S.A.) this is the first time such a prefix actually has been allocated. This makes intriguing Botswana even more of a rare bird.

Regional station R. Nacional de Quetzaltenango of the Guatemalan government has returned to the international bands. Their TGQB transmitter is being heard on 11700 kc around 1730 EST. First EI DXer to report it was Massachusetts' Chris Lobdell.

Another rare bird, East Pakistan, is being logged on the 19-meter band. Gerry L. Dexter (Wisconsin) reports R. Pakistan's station at Dacca on 15455 kc at 2000 EST and on 15518 kc (actually above the edge of the band) at 2120 EST. Watch it, both frequencies tend to drift! Gerry also reports a one-in-a-million catch on 31 meters—R. Nor Peruana on 9655 kc. Logging was at 2205 EST.

A new frequency for Hanoi's Voice of Vietnam is 7416 kc. Watch for this one when weather is good. English broadcasts to Europe are at 1500 EST (1200 PST).

For Medium-Wave DXers, an excellent prospect in this year of increased sunspot activity is Radiodiffusion-Télévision Algérienne's powerful transmitter at Ain-Belda on 529 kc. Though previously reported off this frequency, the station now definitely is back on the beam. Watch for it around 1800 EST.

Spanish Guinea must be removed from our list of DX Outpost targets. It now has become the independent nation of Equatorial

Guinea. Still, it's pretty fair DX and member Mike Macken (Massachusetts) reports reception of R. Santa Isabella on 6250 kc until sign-off at 1800 EST.

Down in Haiti, the latest frequency for R. Capois-la-Mort (4VGA) is roughly 5035 kc (with plenty of drift). Mike Macken bagged this rare one at 2100 EST.

Regular Bob LaRose (N.Y.) tells us that the Greek military government's Hellenic National Broadcasting Institute can occasionally be heard in North America on 17745 kc with transmissions in Greek at 1230 EST (0930 PST).

Radiodiffusion Gabonaise's 4777-kc station at Libreville is on the air Saturdays until 1800 EST. This is the best day to look for them.

Down in Colombia, R. Reloj at Bogota is operating all night on 4795 kc and at last report was an excellent verifier. Meanwhile, another R. Reloj station (San Jose, Costa Rica) has been jumping up and down the 49-meter band but now seems to have settled on 6067 kc.

Propagation: As the number of sunspots continues to decrease, the range of useful frequencies for DX also decreases (during both day and night hours). Openings on 10 and 11 meters will occur, except on rare occasions, only over north-south circuits. Best times are during the late afternoon and early evening hours (local time).

During daylight hours, primary bands for DX will be at 15, 17 and 21 mc. At night, the bands from 6 to 17 mc should be open for DX; the higher bands are best for transmissions from the west, the lower bands are good for transmissions from the east. The entire range should be open from the south during a portion of the nighttime hours.

BCB DX will continue to worsen due to seasonally increasing noise levels in the northern hemisphere during the evening and night hours. ●



13½ Ways to Kill Interference

By LEN BUCKWALTER, K10DH

NEXT door, the TV has the screaming neemies. Upstairs, an SWL receiver crackles like Rice Krispies. Dad's car radio sounds like hail hitting the fan. Sister Jane's transistor radio acts like it's been zapped by the Ajax knight.

All of them, of course, are suffering from RFI, radio-frequency interference. To sniff, then snuff out RFI, try the 13 practical cures (and half a one that's not so) in this article. Then sit back and enjoy.

1. Bypass the Receiver

Electrical appliances pour noise into AC lines, which then feed the line cord of your receiver. Check for line noise by removing the receiver's antenna. If noise persists, it's entering with the AC.

To bypass it to ground, remove the receiver chassis and find where the AC cord enters. Wire in three 0.01- μ f 600-V disc capacitors as shown in Fig. 1. Also run a heavy wire (No. 18 solid copper) from the chassis to a good electrical ground. This can be the mounting screw on the outlet cover.

Caution: If it's an AC/DC receiver use only the ground terminal identified by the set maker. If none is marked install capacitors only, then try reversing the plug in the wall socket for least noise.

2. Bypass the Appliance

Noise also can be grounded at the source. It's difficult to wire inside appliances but you

can use a commercially available wall-plug filter sold for the purpose. They're priced according to effectiveness, from a single bypass-capacitor (like the Cornell-Dubilier Type IF-4 at 90¢) to an elaborate all-wave tuned job for more than \$6 (CD Type IF-18).

If your oil burner kicks up noise it's a job for a professional serviceman.

3. Loud Lamps

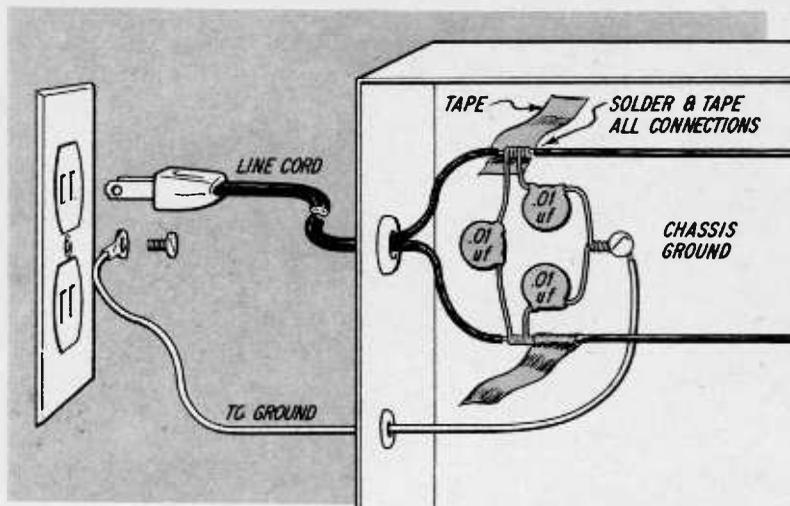
Notorious for noise is the fluorescent lighting tube. It's easily identified by a rough, 60-cycle buzz in the speaker when the light is switched on. Keep any receiver and lamp at least 4 ft. apart. If there's objectionable noise from an overhead fluorescent first switch it off, remove the house fuse and lower the fixture. Install three bypass capacitors, using the method shown in Fig. 1, being careful to cover exposed wires with electrical tape. The metal lamp fixture (properly installed) provides good electrical ground.

4. Improve Your Antenna

Much man-made interference is generated in every neighborhood—ignition noise from passing vehicles, sputtering electrical leakage from utility poles, machinery, neon signs, etc. Since you can't bypass it, best place to begin is at your antenna system.

Use of coaxial cable for the lead-in shields against noise pickup along the run from antenna to receiver. Avoid the simple long-wire antenna. If it's a TV set, change over

Fig. 1—Cover-plate on AC outlet is held in place by screw going into threaded hole on outlet—a good place to attach ground wire fitted with solder lug. Bypass capacitors installed inside receiver (right) may eliminate some types of noise but on AC/DC receivers should be installed only as outlined in the accompanying text (see Bypass the Receiver).



13½ Ways to Kill Interference

to a coax lead-in system, now widely available as an accessory. (Some new color sets take coax cable as standard equipment.)

Most man-made electrical interference lies close to ground level and tends to produce vertically-polarized waves. So use a horizontal antenna wherever possible and mount it as high as you can. Another noise-reducer is a mast-mounted RF preamp for TV or FM sets. And don't position any outdoor antenna near a power line.

5. Go Directional

Noise is reduced in two ways by a beam or directional antenna. First, it builds up the desired signal which, in turn, acts on the AVC to make the receiver less sensitive to interference. Second, a beam rejects noise arriving from all directions but the one in which it is pointed.

Beams are available for CB and ham work. Ordinary TV antennas are beams but the super-fringe-area TV and FM models further sharpen the pickup pattern.

6. Picture and Sound

Interference on TV sets caused by signals of other services—ham, CB, police—is attacked by a high-pass filter. Before you buy one, check with the TV-set maker. Many manufacturers provide the filter without charge. If not, install one like the Drake TV-300-HP shown in Fig. 2. It's connected to the antenna lead-in at the rear of the set.

7. Transmitting TVI

A filter on a TV set should not reduce interference above 54 mc (or it would kill TV reception) so it is useless against harmonics of a ham or CB transmitter that reach into the TV band and play hob with reception. (In CB, the 27-mc signal produces a 54-mc harmonic, on TV channel 2.)

The cure is careful adjustment of the low-pass filter already built into the CB set. (Follow the manufacturer's instructions.) If further filtering is needed, an external low-pass filter might attenuate harmonics. For ham rigs, a low-pass filter (Fig. 3) is a vital necessity in populated areas. Most commercial ham rigs have TVI-suppression devices but homebrew transmitters should be treated with techniques described in ham literature.

8. TV Birdies

Listening to a short-wave, ham or AM broadcast receiver can be marred by ITV—interference from TV sets. Steep sides of the wavefront generated by the TV's horizontal oscillator are prolific producers of warbling in nearby receivers. Signals with raspy harmonics occur about every 15 kc on the receiver dial.

Line filtering at the TV, described earlier, might help reduce them. For severe cases, the TV can be shielded with metal screening. Line the inside of the TV cabinet with screen, then ground it with a heavy lead. In an AC/DC TV do not permit the screening to touch the chassis or metal parts.

[Text continued on page 92]

Fig. 2 (below)—High-pass filter cuts noise entering TV from antenna.

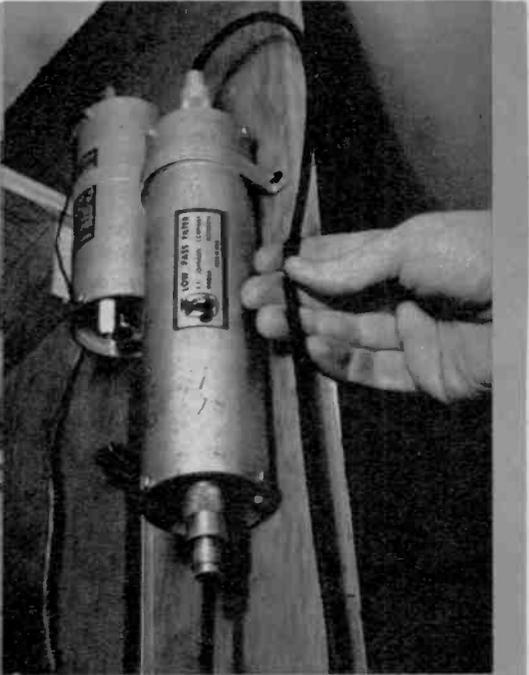


Fig. 3 (above)—Ham's low-pass filter reduces transmitter harmonics.

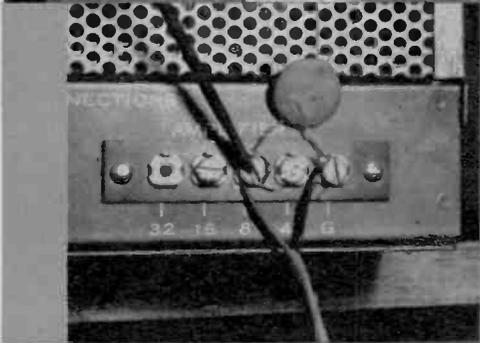
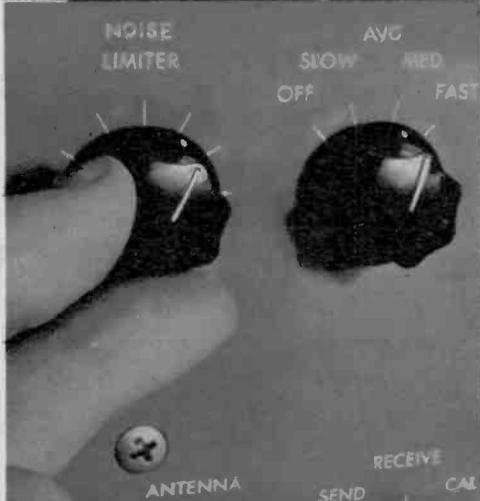


Fig. 4 (left)—Bypass filter capacitor on hi-fi speaker terminals.

Fig. 5 (lower left)—Sophisticated noise limiter can work wonders.

Fig. 6 (below)—Notch filter permits tuning-out of heterodynes,



13½ Ways to Kill Interference

9. Hi-Fi-I

Another odd (but common) problem is mystical voices on a hi-fi system, especially when it is playing records. Strong RF signals can get trapped in several places and need squelching. If you hear those voices in *stereo*, see your analyst. Otherwise, try these three remedies:

If interference affects *all* hi-fi functions (tuner, phono, etc.) connect a 0.01- μ f disc capacitor across the amplifier terminals that feed the speaker lines (Fig. 4).

Be sure the system has a good electrical ground (as at the outlet-plate in Fig. 1).

When interference occurs *only* on phono shorten the shielded cable between tone arm and amplifier. If this doesn't work, install a 50- μ f mica capacitor from the grid of the first amplifier tube (phono preamp) to chassis ground. Use very short connections at the tube socket.

10. Talking Telephone

Strange, but many people hear neighboring ham, CB or broadcast stations on the telephone. The phone company knows all about it and has special bypass capacitors to knock out RF. Call phone service and let them do it.

11. Notch Filter

Any add-on device that narrows the receiver's bandwidth reduces response to interference. This is not applicable to TV, which must have broad bandwidth, but works for ham, CB and SW receivers. A tunable notch filter like the Galaxy (Fig. 6) connects directly to the speaker leads. It punches a nar-

row hole in the audio and can be shifted manually across the frequency spectrum. Thus, it can knock out an irritating heterodyne that's riding in with an AM or CW signal.

12. Buy Better

There's no question but that a more elaborate and expensive receiver is apt to lessen the interference problem. Not only is selectivity better but noise-limiter circuits (Fig. 5) are more sophisticated and effective. In better TV sets the manufacturer includes additional traps that help reduce adjacent-channel interference (seen as jumping bars created by other channels)—and keyed AGC to reduce picture flutter when an airplane passes overhead. Bypassing and filtering are often better in more expensive circuits.

13. Car Ignition Noise

Whether you operate a ham converter, CB rig or FM receiver in your car, you're apt to get some ignition interference. Fig. 7 and its accompanying chart detail major sources [Continued on page 118]



Fig. 7 (above)—Automotive noise-suppression devices are referred to by number in chart below.

CAR-IGNITION NOISE CHART

NOISE SOURCE	SYMPTOM	TREATMENT (numbers refer to illustration above)
Spark plugs	Popping noise in step with engine rpm	Is there a resistance cable to plugs? If not, install plug suppressors (3) or resistor spark plugs.
Distributor	Popping noise in step with engine rpm	Is there a resistance cable to distributor? If not, install suppressor (2).
Generator	Musical whine—pitch rises with engine rpm	Replace factory-installed capacitor on generator with coaxial bypass capacitor (5) connected to generator armature terminal (marked A or ARM). Install generator filter (4).
Voltage regulator	Intermittent crackling	Install coaxial bypass capacitors (5) on terminals B (for battery) and A (for armature) of voltage regulator.
Wheel static	Static that begins above approx. 20 mph	Install wheel collector springs (1) under front-wheel axle housing.



Radio's Crisis of Identity



By **DESMOND SMITH** WHO AM I?—radio's most fashionable question in the late '50s—was, perhaps, prophetic of the searching '60s. The crisis of identity, long a stock-in-trade of the serious dramatist, has shown up in unlikely places during this decade. But nowhere is it easier to spot than in our radio stations.

Listeners to AM radio in many cities can identify most stations in the first few seconds, just by the type of announcer or music or subject matter. That's because these stations have personalities carefully shaped to reach a particular segment of the population. All-news, top-40 (hit pops), background-music and highbrow formats are among the most common categories for station identities, but each can be divided into almost as many distinct personalities as there are practitioners of the format.

The formula often is varied subtly through the day. All all-news format, for example, usually contains most features for women during the late-morning hours and often devotes late-afternoon time to market quotations following stock-exchange closings. Background-music stations serve up bright, zingy fare from 6 to 9 a.m. and save the moody muted brassy for midnight hours.

And so on. But still the style, the basic approach to what radio programming is all about, remains constant and recognizable on these stations.

Anybody who spends much time traveling nowadays finds that radio conjures up two words—*change* and *mobility*. These terms go with a communications medium that only 15 years ago was supposed to be down for the count, kayoed by TV. Well Africa, which had fewer than 400,000 radios in 1955, has more than 6 million today. In this country in 1967 the public went out and bought more than 43 million radios. To appreciate how this galloping change has come to pass it's worth taking a brief look at the not-so-distant past.

When television sets began to reach the consumer market in volume during the late '40s it was the radio industry's backlog of know-how and experience that provided the solid base for TV's rocket-like takeoff. But as television set sales climbed radio listening kept dropping. During the prime evening hours (7-10 p.m.) the home radio audience shrank like wool in hot water—from 17 million to less than 3 million. It was network radio, which had carried the big shows, that suffered the greatest audience losses. But, while millions of fascinated viewers were glued to their new TV sets watching endless roller derbies and Milton Berle, radio manufacturers noted something that the broadcasting executives had missed. People were continuing to replace their radios at exactly the same rate that they had before television. Then, in 1955, a peak TV-viewing year, they bought 14 million radio sets—3 million more than in radio's last big pre-television year, 1949.

Radio's Crisis of Identity

The size of this jump surprised even radio people. And where there are buyers there are listeners—but what kind of listeners and how could they best be reached? It was discovered that though *family* listening had gone down, individual listening had gone up. In television's weaker morning hours (6-9 a.m.) the size of the home radio audience had increased by about a million homes. Obviously, the clue to this new kind of market was going to be flexibility. Yet, if the four-legged radio console no longer was the prime source of evening entertainment for the family, with what was it to be replaced? Designed as a piece of furniture, it was hard—often impossible—to shift around the house.

Around 1950 a clock combined with a small radio was introduced. The results were spectacular. A sleepy America soon was waking up to music. And broadcasters were quick to present personalities that were pleasant to wake up to. Today, the clock-radio's popularity is exceeded only by that of the transistor radio which has had staggering growth.

Now that the furniture look no longer is the factor it was in the days before television, consumers are concentrating on other design features. Acknowledging this trend, Martin Bennet, RCA Vice President, Distributor and Commercial Relations, observes: "Today, 98 per cent of all radios bought in this country are bought on sound quality and it is in the area that we've tried to place our efforts."

Amoeba-like, the listener end of radio in 1969 is split into at least three major segments: the plug-in home audience, the battery-portable audience and the auto-radio audience. Even the location of the plug-in radio has shifted in recent years. Before 1950, better than 90 per cent of plug-ins were located in the living room. Bedroom and kitchen penetration of radio was insignificant. Today 66 per cent of all bedrooms and 56 per cent of all kitchens have radios. But probably no event in this time of radio's big change has influenced programming more than the astonishing growth of the out-of-home listening audience. Since the development of the transistor set, radio has become almost as easy to carry as a pocketbook or billfold and people listen to it in a bewildering variety of places.

Consider automobiles. Back in 1946 less than 9 million cars were radio-equipped. At last count, car radios had skyrocketed to an estimated 68 million. There are more car radios in use today than there are daily newspapers sold in these United States. In a Radio Advertising Bureau study it was estimated that for every eight minutes of driving the car radio is in use five minutes.

Given this situation, it is not surprising that any consideration of radio in 1969 must reckon with the fractionation of radio's audience and its tremendous mobility. The decline of radio network influence in the '50s brought about a mad scramble among independent stations which sought to create a brand image for their call letters. Although there long have been stations that specialized in jazz, rock, big-band, talk, show albums and concert music, it was the music-and-news format that achieved the greatest popularity with station owners (and audiences).

As it happened, this format with its built-in teen-age bias was to be the best friend FM radio ever had. In 13 years, from 1946 to 1959, FM stations grew in numbers from less than 50 to 634. Then, between 1959 and 1968 FM broadcasting *really* took off. There currently are 1800 FM stations and the figure continues to climb.

"The days of uncertainty and struggle for survival are over," says Abe J. Vernon, president of the National Association of FM Broadcasters. "The question now is one of getting our share of the audiences." But as FM finds itself in hot competition with AM for advertising revenues its owners and managers nowadays agree that FM no longer delivers the special audiences of the '50s.

The chief reason is that the music-and-news format, in turn, has been replaced by the single 24-hour program with an identity tightly tailored to the needs of a special audience. As radio reaches for the next decade its single most outstanding characteristic is that it has become a *service* medium. The mass audience of yesterday literally has been pulled apart as individual stations have sought to carve out their particular niches in local programming by servicing listener needs in a unique way. New York City, with no fewer than 63 AM and FM stations, is scarcely typical—but, in miniature, it is indicative of what is happening on the national scene. Increasingly, people are turning to radio for information rather than entertainment. The pocket transistor radio has become a personal information system, bringing traffic reports, supermarket bargains, neighborhood news. As the New York Times radio-TV critic noted recently, "When ideas and worries are of greater concern than pictorial images, radio has notable advantages."

Typical of the changing face of radio are these New York snapshots. In 1965, WINS gave its rock-n-roll record library to Fordham University, began broadcasting news—especially local news—24 hours a day. WNCN-FM has discouraged the general public from listening to its regularly scheduled programs of special interest to physicians. WEVD, formerly an all-Yiddish station, broadcasts in 13 tongues from Chinese to German. WLIB-AM/FM has become the voice of New York's Harlem, proud to be known as "ghetto radio." (During the confusion surrounding the assassination of Dr. Martin Luther King, WLIB ran a day-long telephone talk program credited by many with averting the kind of ghetto violence that occurred in other cities.)

As the evidence has demonstrated, radio is far from dead. Paradoxically, this probably is due to the impact of television which provoked the radio manufacturing industry to come up with a new idea. The transistor radio revolutionized the way we listen to radio and, as we have seen, the broadcasters have adapted to that change. As a service industry, radio seems destined to continue its fabulous growth.

How much more finely-honed can radio-station identities become? Well, KADS (Los Angeles) recently has made itself the first radio station in the nation devoted exclusively to classified advertising. ●

High Z for VOMs

By CHARLES GREEN, W6FFQ



Adaptor jacks up the input impedance of a VOM to that of a VTVM.

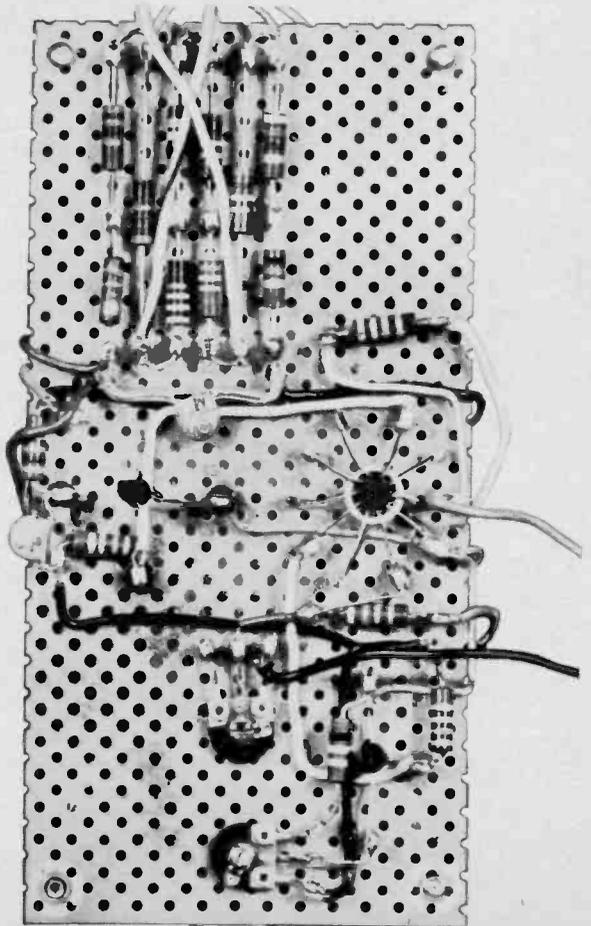
FEW hobbyists will deny that the VOM is the most basic and essential test instrument on the bench. And they'll add quickly that it has its limitations, too. Just as a soldering iron has a particular work capacity (a 47½-watt iron can't be used to solder ¾-in. copper pipe), a VOM has a definite work capacity.

A VOM can be used to check B+ and other non-critical voltages. However, for measuring voltages in high-impedance circuits, a VTVM or an EVM (electronic voltmeter) is necessary to prevent circuit loading and measurement errors. Typically, VTVMs and EVMs have an 11-megohm input impedance on all ranges. A 1-megohm probe resistor isolates the instruments from critical RF circuits.

With our High-Z adaptor connected to your VOM, you will own the equivalent of an EVM and will be able to measure DC voltages in high-impedance circuits. Our adaptor has an 11-megohm input impedance on all ranges. It can be calibrated to match a VOM's 50, 60 or 100 μ a basic meter movement. The adaptor has six ranges from 0.5/0.6 VDC to 1,000/1,200 VDC to match most VOM scales.

How it Works. The circuit (Fig. 3) is basically a balanced-bridge. When S2 is switched on, current flows through Q1 and Q2 causing voltage drops across R13 and R18. Balance potentiometer R20 is adjusted to bias Q2 and equalize the voltages across R13 and R18.

Fig. 1—Circuit board shown here is almost life size (actual board size is 2¾ x 5½ in. Voltage-divider resistors are at top. IC is center, right.



When a DC voltage is applied via the probes to J1 and J2, a portion of the voltage drop across the R2—R11 voltage divider is fed via S1 and R12 to the gate of Q1. This voltage unbalances the bridge and causes a different voltage to appear across R13. Integrated circuit IC1 amplifies this voltage and transforms it into a current change which is fed via J3 and J4 to your VOM.

Construction. Our model is built in a $6\frac{1}{4} \times 3\frac{3}{4} \times 2$ -in. Bakelite box. The controls are mounted on the top panel and the remaining components are installed on a perforated board. Component location is not critical.

Start by laying out and drilling the holes for the panel components. Bend a section of sheet aluminum around B1 and drill a hole in one end to fit the bushing of R16. Position B1 between R16 and S1 as shown in Fig. 2.

Cut a $2\frac{3}{4} \times 5\frac{1}{2}$ -in. piece of perforated board and then mount the board $\frac{7}{8}$ -in. from

the panel with spacers at each corner. Mount the board components with push-in clips and wire them as shown. Do not connect the leads to B1 until the wiring has been checked.

Mount J3 and J4 close to the top of the box and connect them to the circuit with leads long enough to permit easy removal of the panel. Drill two $\frac{1}{4}$ -in. holes in the bottom of the box to permit adjustment of R17 and R20 when the panel is installed. Install R1 in the probe near the tip.

Calibration. Before calibrating the unit, let the components cool down for a few hours to room temperature. Connect the probes to J1 and J2. Adjust zero potentiometer R16 to exactly midrange and connect your VOM's + lead to J3 and the - lead to J4. Set your VOM to a current range of 1 to 5 ma to protect the meter during initial balance.

Set S2 to on and quickly adjust R20 for a zero VOM indication (or as close to zero

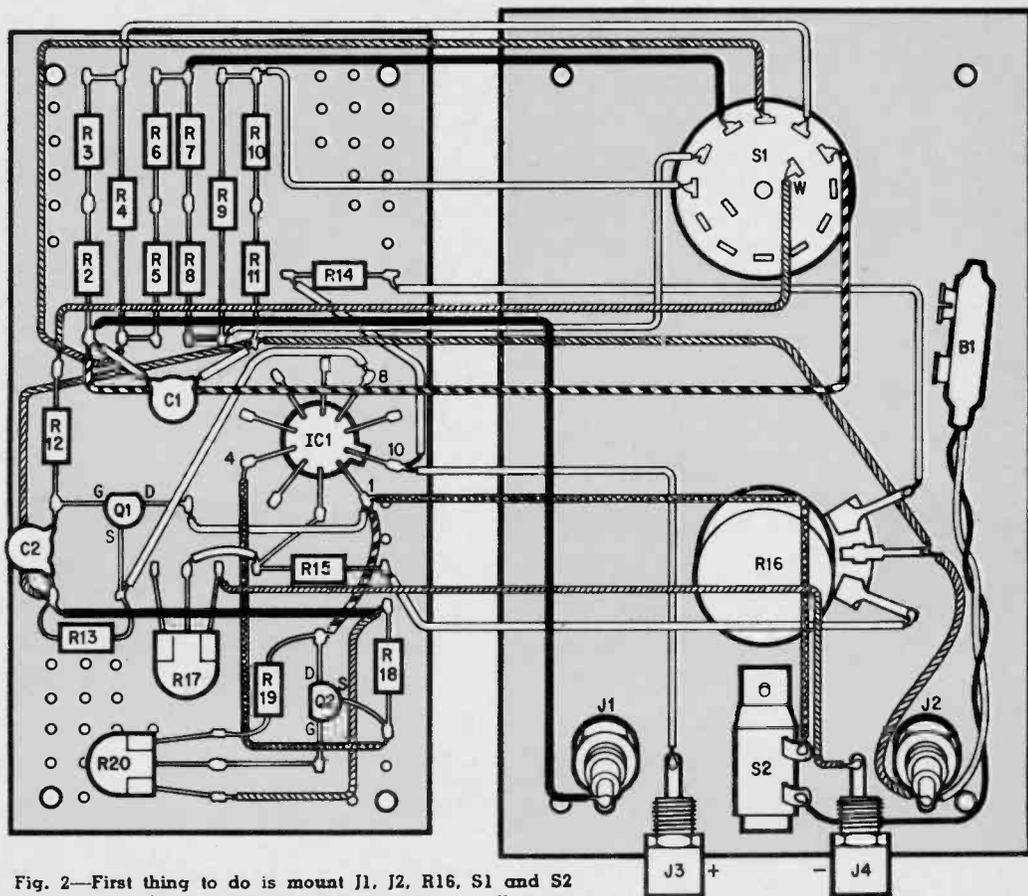


Fig. 2—First thing to do is mount J1, J2, R16, S1 and S2 on cover (right). Connect leads to parts, install parts on board (left) then connect leads to board's terminals.

High Z for VOMs

as possible). Set the VOM to its basic meter current range (50, 60, or 100 μa) and readjust R20 for a zero indication. Adjust R17 for maximum resistance and set range switch S1

to the 0.5/0.6 range.

You will now need a $1\frac{1}{2}$ -V battery and a potentiometer (approximately 1,000 ohms) to provide a calibration voltage. You also need another voltmeter that will indicate 0.5 or 0.6 VDC.

Connect the potentiometer across the battery and connect the calibration voltmeter to the negative battery lead and the potentiometer's wiper (center lug). Set the potentiometer for zero volts.

Connect the adaptor's + probe to the potentiometer arm and connect the - probe

to - battery lead. Adjust the potentiometer slowly to either 0.5-V for a 100 μa or a 50 μa VOM, or to 0.6 V for a 60 μa VOM. Adjust R17 for a full-scale VOM indication. Remove the probe from the potentiometer's wiper and connect it to the ground probe. If necessary readjust R16 for a zero VOM indication and repeat the calibration process.

If you have a VOM with a more sensitive meter movement than 50 μa , it may be necessary to increase the resistance of R17. Adjust R17 for a full-scale VOM indication of 0.5 V if the VOM had an even meter sensitivity (20 or 40 μa), or adjust to 0.6 V if the VOM had an odd meter sensitivity (30 μa). *Note:* If Q1 and Q3 can not be balanced, interchange them and rebalance. If they still can not be balanced, or if the zero drift is much more than 2 μa , try new FETs for Q1 and Q2.

Operation. Set the VOM to its basic cur-

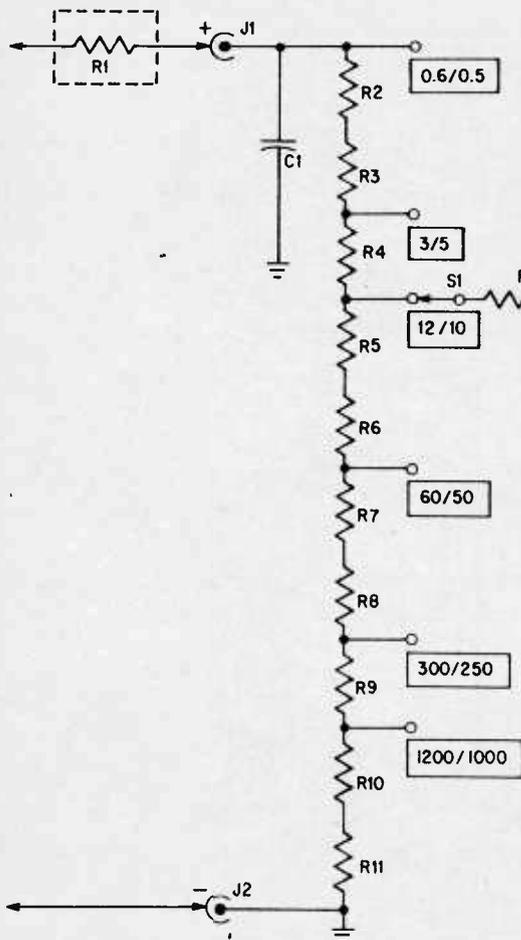
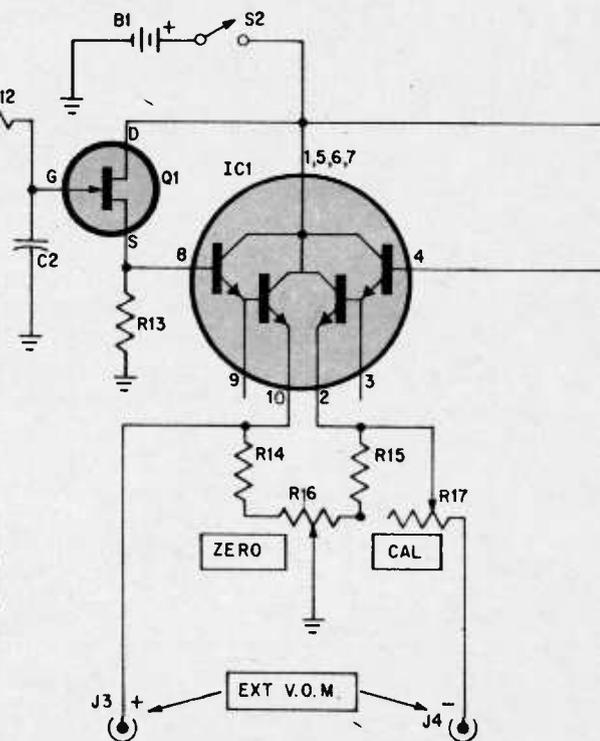
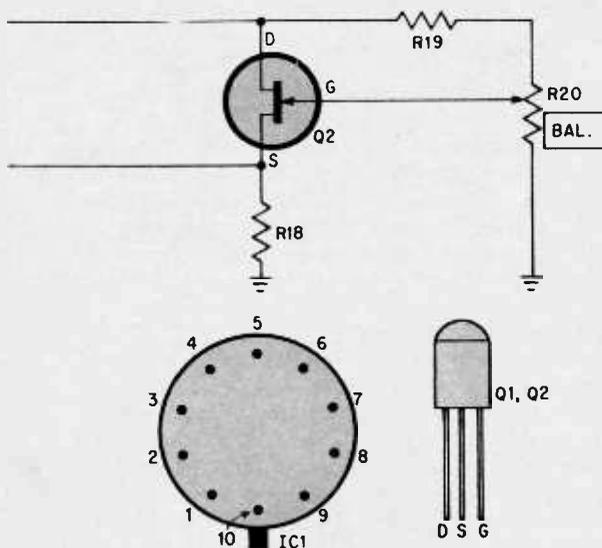


Fig. 3—Adaptor is basically balanced-bridge circuit. When power is on and there is no input signal, bridge is balanced and voltages across R13 and R18 are equal; there's no output from IC amplifier. Input voltage unbalances bridge causing IC to produce output at J3, J4.



PARTS LIST

- B1—8.4 V mercury battery (Mallory TR146X or equiv.)
 C1,C2—.001 μ f, 1,000 V ceramic disc capacitor
 IC1—CA3036 integrated circuit (RCA)
 J1,J3—Red phone tip jack
 J2,J4—Black phone tip jack
 Q1,Q2—MPF105 field-effect transistor (Motorola)
 Resistors: $\frac{1}{2}$ watt, 5% unless otherwise indicated
 R1—1 megohm
 R2—1.2 megohms
 R3—6.8 megohms
 R4—1.5 megohms
 R5—390,000 ohms
 R6—10,000 ohms
 R7—12,000 ohms
 R8—68,000 ohms
 R9—15,000 ohms
 R10—4,700 ohms
 R11—300 ohms
 R12—1 megohm, 10%
 R13,R18—15,000 ohms, 10%
 R14,R15—330 ohms, 10%
 R16—25,000 ohm, linear-taper potentiometer
 R17—10,000 ohm, subminiature potentiometer (Lafayette 99 T 6144)
 R19—100,000 ohm, $\frac{1}{2}$ watt, 10%
 R20—50,000 ohm, subminiature potentiometer (Lafayette 99 T 6145)
 S1—1-pole, 6-position rotary switch (2-pole, 6-position switch used; Mallory 3226J, Allied 56 C 4354)
 S2—SPST slide switch
 Misc.—Black and red test prods, $6\frac{1}{4} \times 3\frac{3}{4} \times 2$ -in. Bakelite box (Allied 42 C 7885), $6 \times 3\frac{1}{2}$ -in. cover (Allied 42 C 7887), $2\frac{3}{4} \times 5\frac{1}{2}$ -in. perforated board, push-in clips, spacers, knobs



rent range (50, 60 or 100 μ a), and connect it to the adaptor. Set S2 to on, short the probes together and adjust R16 for a zero indication. Set range switch S1 to the desired range. Use the even voltage ranges for a 50 or 100 μ a meter the odd voltage ranges (0.6, 3, 12, 60, 300, and 1,200) for a 60 μ a VOM. Recheck the zero adjustment occasionally while using the meter.

A Different Input Attenuator. We selected the most popular VOM voltage ranges for the input attenuator, but you can design an attenuator for other voltage ranges easily. Remember, select the new ranges so that you can mentally add or subtract zeros from your VOM's meter scale. For example; the VOM 50-V scale can be used for 0.5, 5, and 500-V ranges.

First decide on the voltage ranges. Let's say you want 0.5, 2.5, 10, 25, 100 and 500-V. The total resistance of the attenuator (R_A - R_F Fig. 6) will be 10 megohms.

First, divide the lowest voltage range into the next highest voltage range to obtain a division factor. In this case it is $2.5/0.5=5$. For the other ranges we picked the division factors are 20 ($10/0.5$), 50 ($25/0.5$), 200 ($100/0.5$) and 1,000 ($500/0.5$). Divide each division factor into the total resistance (10 megohms) of the attenuator to obtain the tap value for that particular range. ($10 \text{ megohms}/5=2 \text{ megohms}$. $10 \text{ megohms}/20=500,000 \text{ ohms}$, etc.) Subtract the first tap re-

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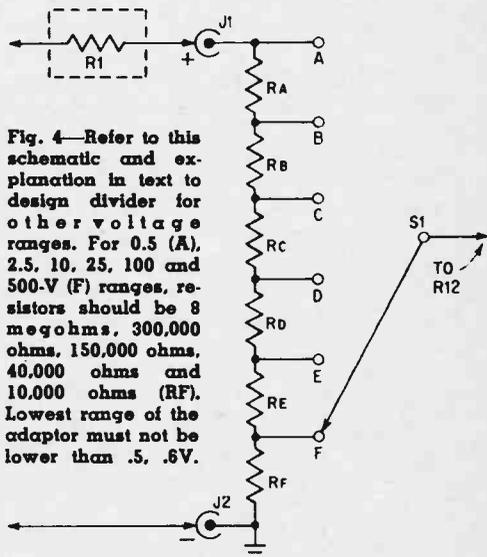
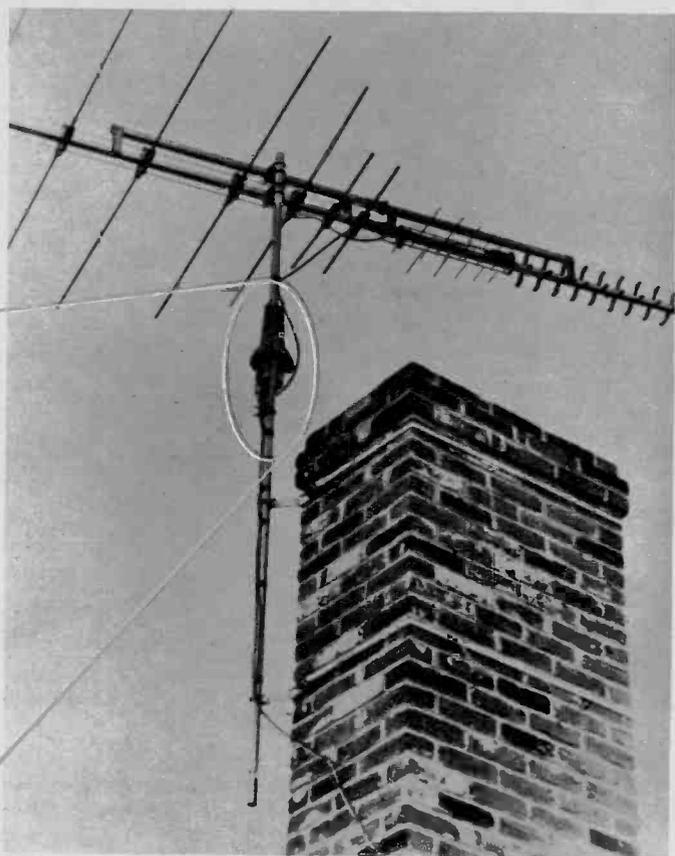
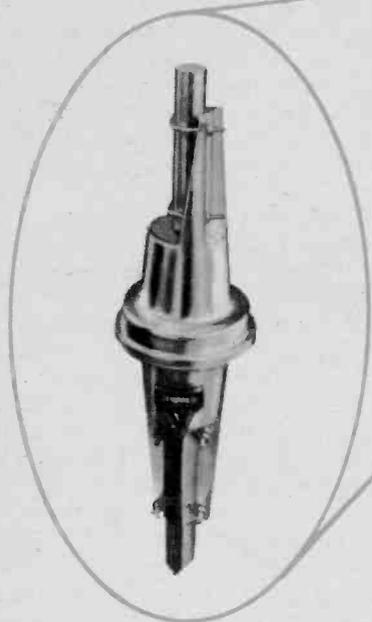


Fig. 4—Refer to this schematic and explanation in text to design divider for other voltage ranges. For 0.5 (A), 2.5, 10, 25, 100 and 500-V (F) ranges, resistors should be 8 megohms, 300,000 ohms, 150,000 ohms, 40,000 ohms and 10,000 ohms (RF). Lowest range of the adaptor must not be lower than .5, .6V.

Choosing an Antenna Rotator



Dyna-Rotor, manufactured by Jerrold, is new rotator having solid-state circuitry and in-line design.

By **VERNON SIMMS** ARE YOU using half an antenna and don't know it? A lot of antennas are high-gain jobs that provide good reception at great distances from the transmitter. Trouble is, the receiving patterns are highly selective and, thus, so directional you have to get your antenna beam closely aligned with the signal or you'll lose most of the energy.

What happens if you want to pick up more than one incoming signal? Unless the transmitters are located in the same spot, you'll have to realign your beam. There are two ways to do this. Either run up to the roof and give your antenna a quick shove, or latch onto a *rotator* and swing the beam from your armchair. Once you've tried an antenna rotator you'll wonder how you ever got along without one. Let's see why.

TV, FM, Hams and CB. When you see snow in your TV picture it's a sure sign of a

weak signal. A good cure is to mount an antenna that has additional elements for capturing more signal. Since the higher-gain antenna is more directional you'll lose stations that don't lie precisely within its beamwidth. With a rotator, however, you just turn the antenna until it's squarely on target. Some crafty viewers even eavesdrop on blacked-out ball games by turning their antennas toward a distant station.

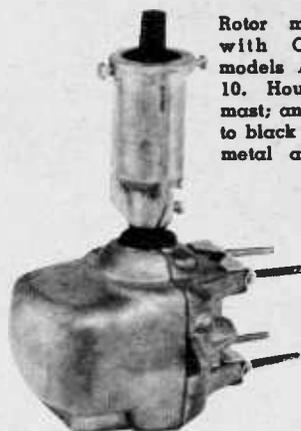
Ghosts are a problem you can attack with a rotator. A roving antenna helps reject reflected signals which arrive from different directions. This can happen even when all your TV stations transmit from the same location (like the seven channels atop the Empire State Building). Because of the different channel frequencies, reflections occur at varying angles; but the rotator can move the antenna until the multiple images merge on the screen. As for color TV, viewers may

tolerate snow and ghosts in black and white but they're a visual nightmare in color.

A rotator fitted to a rooftop FM antenna sometimes can double the number of stations you receive. FM broadcasts usually spring from cities and towns situated all around the compass so aiming your antenna can boost these signals and new stations will appear on the dial.

Of course, it's stereo FM that really stresses the need for a rotator. When a station flicks from mono to stereo it virtually cuts broadcast power in half. Again a hi-gain antenna (and rotator) will come to the rescue. A well-aimed antenna reduces the devastating multipath effect—where reflected signals produce ghosts (similar to TV) that result in signal cancelling and weakened separation between stereo channels.

Hams and CBers reap a harvest from a rotator because it means improved transmitting and receiving. Few ham operators can hope to compete in the worldwide DX scuffle without the sock-it-to-'em signals of a rotary-beam antenna. Similar tactics also are used by CBers to boost their 5-watt signals legally up to the equivalent of 50 watts or more. A rotating beam not only boosts the



Rotor motor supplied with Cornell-Dubilier models AR-10 and TR-10. Housing bolts to mast; antenna may bolt to black stub or require metal adaptor shown.

received signal, but its narrow pickup pattern rejects signals off the beam so that interference from many directions is cut to a minimum.

Take Your Choice. Search the marketplace and you'll discover about a dozen models produced by six major manufacturers. This is because there are differences in the amount of twisting force (torque) needed to rotate the beam. (A big ham array will require more turning power than a light TV antenna.) Accuracy also is an important factor for people who must get the antenna right on the button. To help determine which model you'll need for a specific job let's take a look at the scorecard and see just what's available.

Rotators fall into two major categories: *automatic* and *manual*. Most manufacturers offer them either way. The automatic is a set-it-and-forget-it proposition. If you want to swing the antenna toward a particular station you merely grab the control knob and turn it to the proper point on the dial. That's all you do—the antenna obediently circles around and stops when it's aligned with the signal.

Things aren't so easy with the manual type. You must hold the control all the while the antenna moves. And you must release it at the correct time or you may end up hunting for a signal. Most rotators take 40 seconds to a minute to go full circle so you have to hold the control for that duration. This isn't to say manuals are impractical. But the automatic type could prove more appealing to non-technical members of the family.

Another feature that puts the automatic out in front is the direction indicator. The automatic rotator has a compass-like control



Cornell-Dubilier control for Model AR-10 rotator is the automatic type.



Model T-45 of Alliance is a manual unit and comes with a voltmeter indicator.

Choosing an Antenna Rotator

which is usually marked in increments of about five degrees. This guides you in finding a direction and tells you where the antenna is pointing.

The manual direction indicator usually resembles a voltmeter needle that sweeps over a narrow arc. This system compresses the compass into a restricted area and makes direction a bit more difficult to read. In some models, the needle may show direction only when the antenna is actually being rotated. While these limitations aren't deadly, they do mean that more care and skill are needed to operate a manual unit.

Inside story. Inside the rotator (the part that goes on the mast) is a mechanical engineer's delight of gears and bearings. Manufacturers generally choose one of two systems: the spur or worm gear. Virtually all motors operate at about 24 VAC so the installer may snake the control cable just about anywhere without violating the National Electrical Code.

The motors are usually fitted with a thermal cut-out to kill power if something jams in the mechanism or the antenna strikes an unyielding object. A braking arrangement within the rotator keeps the antenna from windmilling after the motor comes to a halt. Also, the control box and rotator are usually synchronized so that their headings agree. In most models, the manufacturer uses the same basic rotator mechanism to go with either a manual or automatic control.

On Your Mark. To help you decide about power, accuracy and ease of operation, let's consider each major rotator now being offered. CDE (Cornell-Dubilier) has several models. The AR-10 (automatic) and TR-10 (manual) are recommended for TV antennas rated for city and suburban use. Out in the fringe areas, where large arrays or stacked antennas are needed, the heavier AR-22A or TR-2C will handle the extra load. Should you choose the AR-10 or TR-10, you may need a small adaptor. These models are already fitted with a short, permanent mast to which you bolt the antenna. This assembly (convenient for smaller antennas) will not accommodate larger cross-braced arrays (the stub mast isn't long enough), so you'll need the adaptor for a larger mast.

Channel Master offers two principal TV models: the 9503, a manual, and the automatic 9512. The company has also intro-



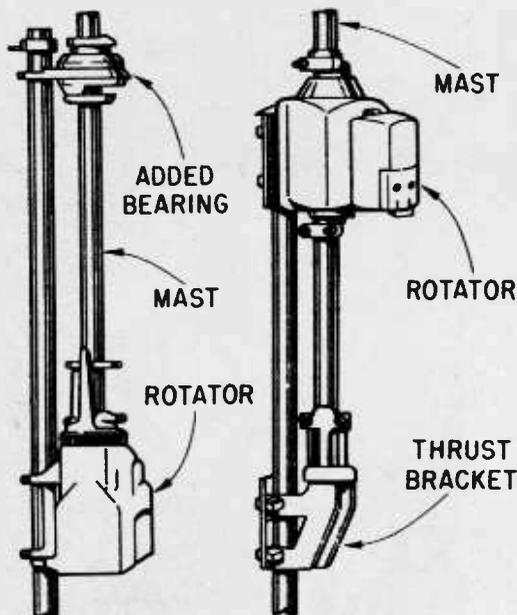
Styling counts, too! Slick Channel Master model 9516A has automatic control box, automatic sync.

duced a model which falls in between these categories. It's the *semi-automatic* 9513. This version eliminates the smaller meter indicator common to manuals and has a full-circle compass. Semi-automatic means you still have to hold down the button until the antenna reaches the desired point. To beef up its rotators when a big fringe-area array is used, Channel Master offers an optional rotator bearing. This can also be added to their standard models for better stability and wind resistance.

Three basic TV models are offered by Alliance. Their manual unit is the T-45; the



Control unit of Alliance's model C-225 is automatic and has transistor circuit for quiet operation.



Big arrays are a burden. Channel Master (left) utilizes a bearing; Alliance uses thrust bracket.

automatic version is the U-100. A recent addition to the company's line is the C-225. Its control unit is a transistor job which provides smooth, quiet control of the rotator. (Most other models click loudly at the control box as the rotator operates.) Alliance also has an accessory that helps reinforce the rotator when the antenna is a large array or installed in a windy region. It's a special thrust bracket that clamps to the mast near the underside of the rotator.

Jerold has recently introduced a TV antenna rotator that also has a solid-state control unit for quiet operation. Called the Dyna-Rotor, it features a highly compact rotator assembly and an *in-line* design for limited-space applications. The manufacturer claims a full 360-degree rotation can be accomplished in less than 40 seconds.

Any of the TV rotators just described can swing an FM antenna. Remember that even a large 10-element FM array is apt to weigh about 8 lbs., or nearly half the poundage of a large TV model. Also, many hams will find excellent foraging among TV rotators, especially since mass production keeps prices down. The VHF ham, operating above 50 mc, can mount a 6- or 2-meter beam on most any standard TV rotator.

Heavyweights. The lower ham bands require heavier beams, but it's still possible to stay within the TV category. This applies if you're using one of the popular *tri-band* beams for 10, 15 and 20 meters. However, be sure to obtain the optional bearing, thrust bracket or other supporting accessory offered with the rotator.

Two rotators specifically recommended for this class of ham antenna (VHF or a tri-band beam) are the CDE TR-44 and Alliance U-100. If you plan to rotate the largest of the tri-banders check with the manufacturer's literature. For example, HY-Gain recommends the Ham-M rotator for its Thunderbird Model—as does Mosley for its TA-33 antenna.

The Ham-M rotator is one of the most popular models on the market. Made by CDE, it can support over 1,000 lbs., so it's practical for the heaviest ham beams. These are full-size antennas that use no traps (like the tri-banders) to reduce the number of elements and their length. Deluxe rotators for ham antennas are found in the Telrex line. It includes five models which can support and drive enormous arrays. These units range in price from about \$300 to \$700 and are for the advanced amateur.

CBers planning a directional beam installation should be wary in choosing a rotator. A vertically polarized antenna (where elements point upward, as in CB) is subject to especially high wind loading. This increases the *bending moment* on the rotator—a force which tends to strain or break the mechanism. Therefore, a heavy-duty rotator may be the best choice for a CBER.

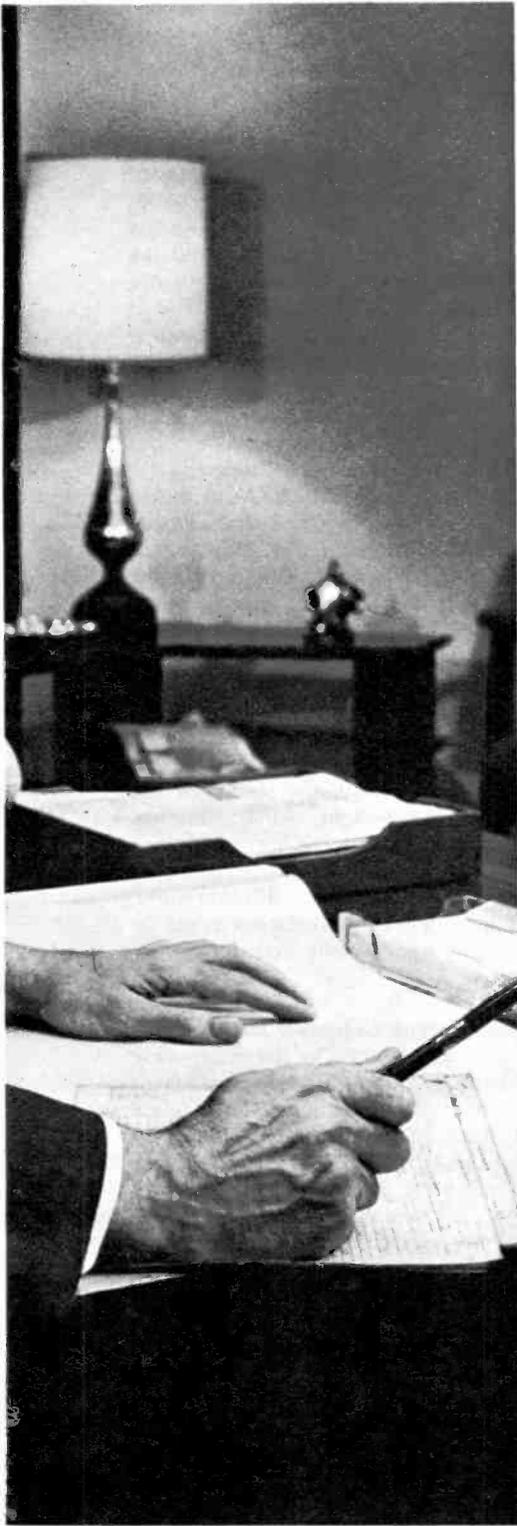
Rules to Remember. There is one basic rule to follow when you install a rotator: keep the antenna as close as possible to the rotator assembly. To increase antenna height, not only increase the length of the mast, but try to raise the rotator as well. Separation between the rotator and antenna should be a foot or less. This is because as the antenna rises farther from the rotator, it develops greater destructive leverage (i.e., bending moment) against the rotator. At a spacing of 1 ft. the bending moment is around 200 foot pounds; at 2 ft., it rises to 400 foot pounds and at 4 ft., it's nearly 800 foot pounds! It's true that with some towers the rotator is placed many feet below the beam. But a close look at these installations will reveal a bearing right under the antenna to provide support. [Continued on page 110]

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The Listener

By C. M. Stanbury II

Flying Pirate

WHEN British radio pirate Ronan O'Rahilly says he's going to take to the air, he means the cloud kind, not ether.

O'Rahilly has announced plans for a pirate TV station that will operate in the blue yonder of international airspace. O'Rahilly says he has bought two American Super Constellations and will start flying Caroline Television over the Irish Sea sometime this summer. Programs will be transmitted on a UHF channel.

O'Rahilly had been operating a seaborne pirate radio empire but he failed to attract enough international sponsors. British firms now are forbidden by the Marine Offenses Act to advertise on pirate stations. But with a high-flying color TV station covering all of Britain and Ireland, O'Rahilly feels it will be a different story. He may be right.

Caroline Television is keeping the location of its aircraft under wraps until it takes to the air. As O'Rahilly puts it this way: "If the government knew it would probably arrange a deal to close us down." Since the aircraft are of American manufacture, installation of TV equipment possibly could be accomplished on this continent. So there's an outside chance that North American UHF DXers may be able to log test transmissions from Caroline Television this spring. Since British and American video systems differ, only the sound signal would be receivable.

Wild Rumor Dept. The invasion of Czechoslovakia has triggered endless speculation about an eight-day wonder called Free Czech Radio. Most fanciful tale of all is that somehow FCR got hold of high-power mobile units which transmitted signals potent enough to reach North America. The story was first aired by R. Moscow which claimed the mobiles were smuggled in from West Germany. This same story, minus the German angle, was picked up by several U.S. publications.

To the best of our knowledge, no one has overcome the technical problems inherent in the design of high-power mobile units, including a really effective landmobile antenna system. Can you imagine a 200-ft. radio tower perched atop a moving truck?

Austrian Radio. During a recent series of NATO meetings there were rumblings about a Russian threat to neutralist Austria. At first glance this seems farfetched but so did the Soviet invasion of Czechoslovakia. Austria is neutral by treaty. During World War II she became part of Nazi Germany and at the end of the conflict was occupied by both Soviet and Western forces. During the occupation, the BBC operated a radio relay base there and beamed transmissions into Communist-controlled eastern Europe.

One condition under which Austria was granted independence required that she become aloof from the cold war. This meant the end of the BBC relay. But during the Hungarian and more recent Czech crisis, Austrian-based monitors provided the West with much valuable information.

Official Austrian Radio (which can be described as dull by treaty) consists mostly of classical and semiclassical music interspersed with multilingual IDs, including English. Although beamed our way, the station is not heard particularly well in North America. At best it provides a fair DX test for novice SWLs. Try 6155, 9525 and 9770 kc during evening hours. Keep the Czech affair in mind, though! This otherwise dull station might be worth checking occasionally even by experienced SWLs.

Big Business. The Columbia Broadcasting System returned recently to the short-wave scene. Thirty years ago CBS operated short-wave station W2XE (which later carried Voice of America programs as WDSI) at Brentwood, Long Island. CBS now expects to add another 2½ million listeners by way of WNYW, R. New York Worldwide.

WNYW (formerly WRUL) itself has a long and controversial history, partly because of its involvement with three alleged CIA projects: R. Liberacion de Guatemala, R. Swan and R. Americas. Then there was the *secret-transmitter-site* bit.

After a disastrous fire in the spring of 1967 at WNYW's Scituate (Mass.) transmitter site, some people believed the station was moved to an undisclosed location. Others

[Continued on page 112]

Strobe Exposure Meter

Continued from page 74

cleaner or TV-tuner cleaner. All grease must be removed from SR1's body as any finger oil will provide a discharge path for C1. (It is SR1 which holds the meter indication.)

SR1 is a cheap *silicon* small-signal diode (the type sold for, say, 10 for a \$1) such as Lafayette's 19 T 6001 assortment for 89 cents. (Do not try to use expensive diodes—the one you get will probably not work in this circuit.) Use any diode in the package. If, when the unit is completed, the meter cannot hold a reading within $\frac{1}{2}$ f-stop for a full minute, try a different diode from the package. We tried several packages of diodes and found that each had at least three diodes which could hold within $\frac{1}{2}$ f-stop for at least a full minute; some held for as long as one hour.

Checkout and Diode Test. Set R3 and R4 to their approximate mid-position. Make certain all solder connections are good and that the wire short around Q1's leads is removed. Set S1 to the *on* position—battery connected to R5/R8, not to R9. The meter pointer may fly upscale or go in reverse off-scale (this is normal). Press and hold *reset* switch PB1 for at least one second and then adjust R8 so the meter pointer is over zero on the scale. Push PB1 again and check that the pointer stays on zero. A one- or two-meter scale division drift is acceptable.

Once again, push PB1 and fire your flash from 10 ft. away, directly at PC1. The meter should do something: it can either rise slightly or be driven completely off scale. If the meter doesn't rise try changing R3's and R4's adjustment. At some point, if the unit has no wiring errors, the pointer must rise. If you get a meter indication, keep your eye on the pointer. Under subdued lighting the pointer might crawl upscale about $\frac{1}{2}$ f-stop in 30 seconds. Under bright light it might drift up a full f-stop in one minute. If the pointer drifts downscale more than $\frac{1}{2}$ stop in 30 seconds try a new diode. If the pointer drifts downscale faster than one stop in 30 seconds SR1 is unusable or there is a lot of oil from your fingers on SR1's case. Normally, downward drift caused by SR1 will just about equal the ambient light upward drift and the pointer will stay almost rock steady for long time periods. (A slight two-scale unit upward drift per 30 seconds indicates an excellent diode.)

Meter Calibration. The scale in Fig. 4 can be copied or cemented directly on the meter scale. Allowing for the normal tolerance of M1 and R6, the scale will be close enough to put you well in the ball park—perhaps within $\frac{1}{3}$ f-stop accuracy. If it is off, simply add a correction mark on the scale.

Next, set R3 full clockwise for ASA 25, or counterclockwise for ASA 25 if you are using the expanded high-speed modification. Now find some spot in the house where you are absolutely sure, from previous experience, of your strobe's Kodachrome guide number (or any other color film whose guide number you are certain of).

Position the strobe so it is exactly 10 ft. from the meter, firing directly into PC1, not at an angle. Calculate what the 10-ft. f-stop is. For example, if your strobe's guide number for Kodachrome II is 56 the meter should be calibrated to indicate f-5.6 when the flash goes off (guide No./ft., $56/10=5.6$). Now remember, PB1 must be pressed immediately before each use.

Make certain the strobe is at *maximum* charge and fire the flash. If the meter indicates lower than the calculated f-stop, turn R4 clockwise in small increments and repeat the flash until you get the correct meter indication: in our example it would be f-5.6. If the test meter indication is too high turn R4 counterclockwise. Once you have the correct meter indication close the box; you now must calibrate R3.

Since R3 is now calibrated for ASA 25 the next calibration is for ASA 50. Advance R3 and fire the flash. When the pointer indicates one f-stop more than it did for the ASA 25 indication, R3 is set for ASA 50; mark the panel accordingly. Similarly, calibrate R3 for ASA 100 (one more f-stop higher), ASA 200 (another stop) and ASA 400 (yet another stop). New reset R3 for ASA 25 (or your own color index) and check the meter scale. Firing the flash should give you the original f-stop, say f-5.6. Now move the flash toward the meter the correct distance for one stop higher; in our example it would be guide No./f-8 = 7 ft. Fire the flash: M1 should indicate f-8. If it's off, place a correction mark on the meter scale. Run several checks, moving the strobe in and out, to check all the meter-indicated f-stops. Room and wall effects might cause some errors but you can average them out by trying the meter in several locations.

The Battery Test. Finally, R9 must be

adjusted for the battery check. Set S1 to the *bat. test* position and adjust R9 so the pointer is at the *bat. check* mark, which is exactly at center scale. If at any time the meter pointer does not indicate center scale it is time to replace the battery.

Flashbulbs. Yes, you can use the meter with flashbulbs, but R3 might require a slight correction to get accurate indications. Simply run the 10-ft. test to determine the correction factor for R3. For example, suppose the guide number for a No. 5 bulb in your flash reflector is 110. At 10 ft. the exposure would be f-11. Set R3 to the 100 speed mark (close enough to 110). Then fire the flashbulb from 10 ft. away. The meter should indicate f-11. At the worst, it will be close. Then correct R3's setting until the meter indicates f-11 when the flash bulb goes off; mark the panel.

Direct or Bounce. In normal use, the meter is placed at the subject facing the flash, but you can modify the meter's orientation to whatever gives you the desired results. The meter can also be used for bounce-flash, and in this case place the meter at the subject position facing the camera.

In-Between Film Speeds. For in-between the calibrated film speeds, such as ASA 125, simply calculate the correction factor to be added to the meter's indication. For example, the correction factor for ASA 125 would be plus 1/3 f-stop. If you so desire, you can easily mark the in-between speeds on the panel.

Choosing an Antenna Rotator

Continued from page 103

With the added weight of a rotator, your mast may require guying. One rule-of-thumb is to add guy wires every 10 feet, this corresponds to the break in standard mast lengths. (However, a single 5-ft. section may need no guying at all.) Many rotators make the job of guying easier by supplying lugs that are cast in the metal housing.

Remember that the antenna lead must have plenty of slack. The antenna can then rotate without snagging the line. Usually you'll find a 2-ft. loop of twinlead held by stand-off insulators.

The control cable (four or more wires in a flat jacket) is taped every five feet or so as it runs down the mast.

Newest in CB Equipment

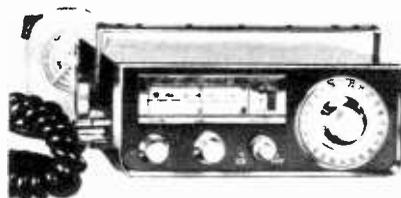
Continued from page 67

At first glance it resembles a miniaturized all-channel mobile transceiver. But a closer look reveals that the set also contains a VHF-FM receiver covering 150-174 mc. Thus the set doubles as a police and fire monitor. (Assuming your area is on high-band VHF and not the lower 30-50 mc band.)



Cobra 98, by B & K, has SWR meter.

For pin-point accuracy, you can plug two crystals into the Lafayette Rig for local police and fire channels. The boat owner may find this feature especially valuable, for by choosing a crystal for 162.55 mc he can hear the continuous VHF-FM marine weather forecasts now broadcast throughout much of the country.



Lafayette Telsat 150 includes VHF FM.

So much for our quickie bird's-eye view of the 1969 CB scene. Obviously there are many more rigs—old and new—which you will want to consider. This selection should, however, give you a better idea of what to look for.

As we go to press. . . . Courier Communications, Inc., has just announced a new 23-channel transceiver called the Royale. This CB rig features a Modulation Sampler circuit that boosts weak voice levels and reduces high voice inputs. Included are ceramic filter, built-in power supply and all crystals. Price is \$279.

The Ham Shack

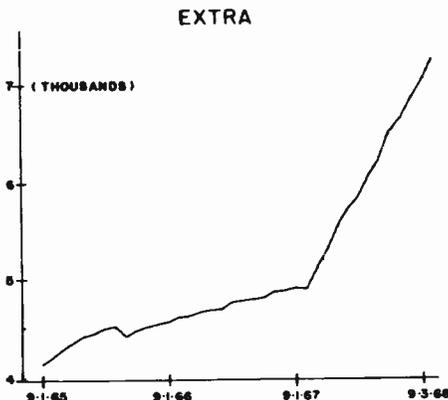
By Wayne Green
W2NSD/1



PERHAPS it's still a bit early to evaluate the impact of the Incentive Licensing regulations announced in late 1967 and effective as of November 1968. However, we can get some idea of what the response of amateurs was to the announced band changes.

Starting last November the bottom 25 kc in each of the four lower amateur bands was reserved exclusively for Extra Class licensees. This isn't a large piece of bandspread but unfortunately for the rank-and-file DX hunter, it's where 95% of the rare DXing has been happening. So the new allocations mean that if you're seriously interested in working DX you *must* have an Extra Class license.

The Extra Class ticket requires that you be able to send and receive Morse code at a speed of 20 wpm. Then there is a technical exam to pass that is about as difficult as those for First Class Commercial licenses. Some amateurs have been wondering why it's necessary to demonstrate a professional grade of competence. No one has an answer yet.



Curve shows growth of Extra Class licenses since 1965. Curve is sharp but the numbers small.

Others have been asking why CW proficiency is needed for the new Extra Class phone bands on 15 and 80 meters. They haven't been answered, either.

Undoubtedly there is no justification in history for even expecting a government agency to be fair or reasonable. This was one of the arguments brought up by many who were opposed to the Incentive Licensing proposals. Previous band allocations left quite a bit to be desired but that didn't mean that things couldn't be worse, as we have since discovered.

At first glance, the curve for Extras looks good. But let's look a little closer! Back in the beginning of 1966 there were about 4,000 Extra Class licensees out of 260,000 amateurs, which is 1.5%. Pretty skimpy when you consider that the Extra license was hardly new at this time. Also, add the pressure of three years of discussions about Incentive Licensing and the knowledge that the FCC was almost certainly going to allocate some bands to the Extras.

The number of Extras was growing at about 500 a year up until the announcement, in late 1967, of the new band allocations coming in 1968. Then the curve turned upward and about 2,000 new licenses were issued during 1968. This is 1,500 above the previous average, or about 1/2 of 1% of all licensed amateurs! The new regs obviously went over like a lead balloon.

Now that these band restrictions are no longer in the future, but are alive and kicking, the crowds at FCC offices have grown considerably. Will they last? Time will tell. At any rate, frequent updating of exam questions has had an unsettling effect on the fellow who goes into the exam with the questions and answers memorized instead of understood. Only about half of the applicants seem to be making it through the Extra Class exam.

Law 'n Order. The number of hams getting busted for serious infractions of the rules is at an all-time high. Perhaps it is the bad example set by CBers that has led to so much profanity on the ham bands. On the other hand it may be just a reflection of the general sickness that seems to have developed in our country—and the world. Bad language and intentionally interfering with another station are acts of vandalism and are not funny.

[Continued on page 112]

The Ham Shack

Continued from page 111

The schools in New York report vandalism up 22% in the last year. In Oklahoma City it is up 41%. Near Washington in Montgomery County, Maryland, it is up to 63%. Statistics are impossible to obtain for our bands, but anyone who is active will tell you that vandalism on the bands is growing apace with vandalism in the schools. A recent TV special documented the tremendous growth of vandalism in Vienna so we're obviously not alone.

It's unfortunate that once a ham license is issued it is so difficult to take it away. The FCC monitoring force is pathetically undermanned and they tend to leave amateur radio alone unless there are strong complaints. Their numbers have remained about the same during the last 20 years while the number of licensed radio operators has proliferated. They're glad to cooperate when needed, though, and if you hear an offender you should consider it your duty to put in a call to the nearest FCC office and get them busy with direction finders. They'll just warn him if his infractions are not too serious.

The ARRL Official Observer scheme is a good idea but since it has no teeth it has never gotten anywhere. I'd like to see some arrangement whereby licenses would be issued by our amateur radio clubs and then taken away by the same clubs if they were misused. I think a fellow would be a lot more careful of his behavior if he knew that local pals could put him off the air. Obviously a lot could go wrong with a system like this if it were not set up carefully. We often find that we just can't get along without government at the local level but this is what we are trying to do with regard to the FCC!

Vandalism on the ham bands—and the CB bands, for that matter—may be tied in with the rise in student unrest that we have been witnessing all over the world. It's primarily a youth movement, as 77% of those arrested for vandalism last year were 18 or under. Perhaps if we take more pride in our hobby and consider it our personal responsibility to preserve law and order on the bands we'll be able to have an effect. I think we should try.

Poor Stepchild. Amateur radio is a stepchild. It gets little attention or consideration

from Daddy FCC. We have no lobby in Washington so there's no pressure from Congress or a friendly senator to get Daddy's attention. When matters like the Incentive Licensing hassle come up, our problem is turned over to someone at a low level. No wonder the solutions we get don't seem to fit the problems.

If amateurs cared enough to insist on having representation in Washington our lot would be a great deal happier. Even if the manufacturers and distributors of ham equipment were to set up a lobby it would help fill the vacuum a little. Every other major user of radio frequencies has the intelligence to make sure of having a voice in Washington. We rely on the FCC and other government agencies not being so shortsighted as to kill off amateur radio, knowing that hams are a valuable national asset. We rely on this even though we have enough experience showing that our government runs largely on immediate emotion and seldom takes the time and trouble to predict the results of its hasty actions.

The result of this lack of lobbying power is that amateur radio had been one of the alltime losers in frequency allocations. Our ham bands would not be the crowded jungles they are today if we had had a lobby in the past to protect them. Our 20- and 40-meter bands used to be about three times the size they are today. Once frequencies are lost they are lost forever—when you put up absolutely no fight whatsoever to get them back. —

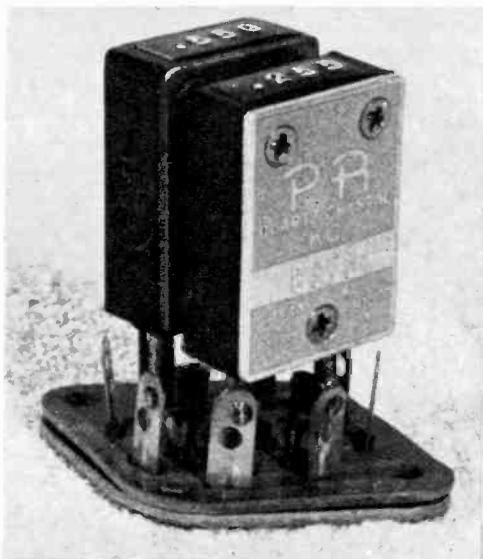
The Listener

Continued from page 108

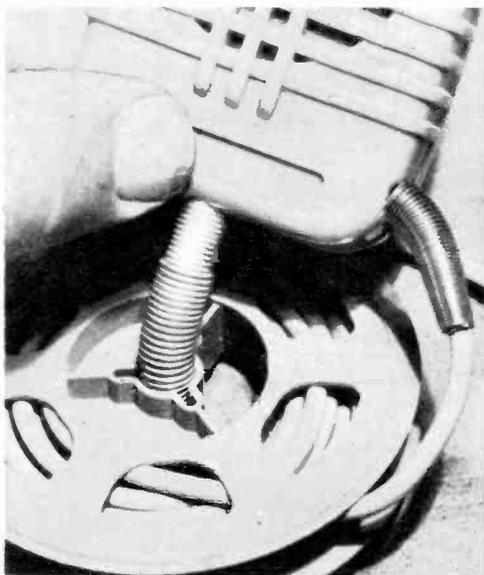
thought there was nothing secret about WNYW declaring it was located at Brentwood, Long Island. One club went so far as to use the supposed non-secrecy of the Brentwood site as ammunition in an unrelated Botswana controversy.

But subsequent backtracking revealed a letter from WNYW, available for all to see, which reads: "Sorry but cannot release information as to the location of our temporary transmitter site." *Not would not, but could not.* So it was WNYW itself that started the secrecy bit and one hardly expects to receive a hoax report from a station licensed by the FCC. But then, you wouldn't expect the FCC to allow one of its licensees to operate from a secret location, either. —

Tips



Hams who leave their transmitting crystals lying around to permit rapid frequency changes often end up wasting time trying to locate a particular crystal the moment it's wanted. To restore order, attach octal water sockets to the bench, shelf or wall. You can store up to two crystals in each.



A neat mike pedestal which ends cord tangle can be made quickly from a plastic 8mm film reel. Insert a short section of coil spring in the reel's center hole and mount the mike on the other end. (The mike and reel holes are almost the same size.) Wind the mike cord on the reel.

Toughest QSLs Of All

Continued from page 50

I guess verifying clandestine stations is as wild a DX chase as you can find. In January 1967 while investigating the famous BBC Botswana matter, I logged a BBC station on 7295 kc at 2300 EST. Other SWLs heard this one too and we all assumed it was BBC Francistown (Botswana). I reported my reception to BBC HQ and they replied: "Thank you for your interesting letter of 17th January and the details of the transmission you intercepted on 7.295 mc. We are quite certain that you did hear this transmission direct from Africa and it seems that under certain propagation conditions, it can produce a fairly substantial field strength in parts of North America."

However, a check of the BBC schedule for the date of my reception showed that none of the BBC's African relays—Francistown, Monrovia (both now defunct) or Ascension—were on 7295 kc at 2300. I later contacted the BBC about the location of the mysterious African station; they answered but refused to acknowledge my question. Despite the secrecy surrounding this station's location I consider this QSL, along with one for the BBC's official Francistown relay on 647 kc, the best in my collection. But the waiting and worrying goes on. Currently I'm sweating out some which may prove even tougher—like Free Czech Radio.

Hi-Fi Today

Continued from page 75

and placement of the 901 speakers. And it means that a whopping amount of amplifier power is required to make the Bose system reach normal listening levels. (The system seems to be far less efficient than the AR-3, which was once considered the lowest permissible extreme.) This approach is one reason why I'm less than enthusiastic about the Bose—a minority view these days, but one I'll stick by.

I'm willing to predict at this point that the JVC style of contouring is going to show up on more and more amplifiers. The feature probably will be overpromoted, exaggerated and generally misused—but it's still a valuable contribution.

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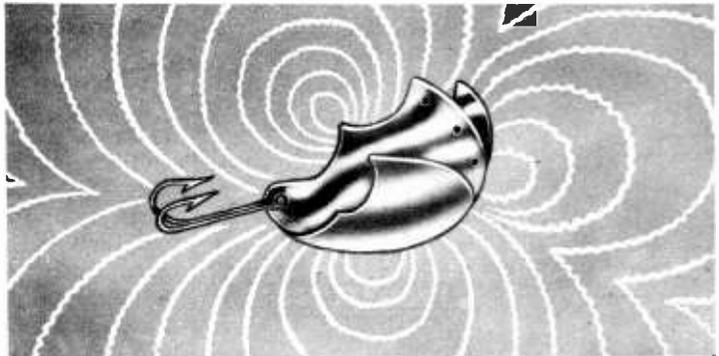
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Weird New Sonic Lure Caught Fish Like Crazy!

Think of it! My new vibrating lure gives loud, gurgling, splashing, bubbling sounds as you skitter it along the surface of the water! Sends out up to 200 vibrations every minute underneath that water! Looks completely unlike anything that a fresh water fish has seen before.

And has already used this weird sight and weird sound and weird sonic vibrations—in one of its very first Summer trials—to lure fish into attacking it so savagely that they actually knocked it out of the water. Hauled in trout, bass, muskie, walleye, and pike, even when other lures had caught little or no fish right next to it! Here's why—



THIS IS AN ARTIST'S CONCEPTION OF THE VIBRA-BAT LURE AND ITS SONIC EFFECT UNDER WATER! I believe it to be irresistible to fish! Try it entirely at our risk!

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At Cattail Lake, Illinois, on August 20, 1961. A hot summer day! A beautiful stream-fed pond—90 by 60 feet wide! Fishermen trying lures, flies, natural bait! But there is only an occasional strike. It looks like a wasted day!

Then, three die-hard friends try their luck with me! We cast from the edge of the water. At the end of our lines is an entirely different lure—a weird little metal monster that casts like a bullet and flutters back through the water like a drowning bat!

EXPERIENCED FISHERMEN SURPRISED

Almost at once that quiet water explodes into action! The first strike causes a shout of excitement! And then a second strike! A third, fourth,



Meet Lyman Walton, a direct descendant of Isaac Walton and co-inventor of the amazing VIBRA-BAT LURE.

sixth, seventh, eighth! Beautiful rainbows and browns still shimmering from the water—being pulled in at the rate of more than one every minute!

Now the water almost explodes with fish striking! Sometimes four and five trout savagely attack one lure at the same time! Fifty—seventy—ninety fish are caught and released! People along the shore stop to watch!

In one short hour, we have caught and released 120 fish! All with the very same weird little lure that can go to work for you next week, without risking a penny!

Why did this bat-shaped lure catch fish by the stringer-full—even after ordinary lures, and natural bait have caught little or nothing? For this simple reason—

Because this lure gives off unique gurgling, bubbling, splashing surface noises—plus up to 200 sonic vibrations every minute underneath that water—that fish find irresistible!

Navy Fish Biologist report about the sounds fish make between themselves in the water. Fish follow the propellers of a boat as though they were hypnotized by the sound!

Those gurgling, bubbling, splashing surface sounds and underneath vibrations—actually seem to call fish to them. Research showed me that lures, like fish, create Sonic Vibrations in the water by their movements! So I designed a lure that flutters through the water up to 200 times a minute! Wing-shaped—bat-like—jerk and fluttering madly through that water—sending out irresistible sonic waves—gurgling, splashing, bubbling surface sounds that travel through water in every direction at the rate of 4,760 feet every second, the actual speed of sound under water!

READ THESE FISHCATCHING ACHIEVEMENTS

No wonder this "VIBRA-BAT" lure caught a 10 pound 7½ ounce Northern on one of its first tests—only moments after it hit the water—hauled in six bass in sixty minutes in another test, all 2½ pounds or larger—pulled in perch by the dozens in a third test at Belmont Harbor, Illinois, even after live bait and lures had scarcely a strike, and continued to land so many fish, so quickly, that fishermen watched in amazement!

Tests show this revolutionary new lure hauls in trout, bass, muskie, walleye, pike, salmon and other fresh water fish even in hard fished waters—produces strikes even when other fishermen alongside it are going almost unrewarded!

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Perfect Color TV Picture

Continued from page 48

cents. "When you go to sleep how do you turn the lights out?"

"Easy man, easy, I just put all the bulbs in the closet."

Nothing's Too Good. I was surprised to see a Rolls Royce in front of the modest suburban home. Then I remembered as I glanced at the roof. I had installed the antenna there about five years ago. With a gigantic all-channel yagi, rotator, mast amplifier and four-set coupler, it was one of the most expensive antenna jobs I had ever done in a small home.

Shiny, capped teeth and a big smile greeted me at the door. It was my customer, a man with a mania for getting the best of everything. He led me to the TV room and turned on his \$1,500 Theater Model. Colors were weak and washed out, so I turned up the color saturation control. This knob varies the strength of the color subcarrier signal but it didn't help much now. I turned the contrast control. Like the one on a monochrome set it varies the strength of the b&w signal. It was working.

After I questioned the customer I discovered that colors never did come in well. He wouldn't even admit it to himself until he saw a neighbor's set with a better picture. This aggravated him.

Before opening the back of the TV to test the tubes I attached rabbit ears to the antenna terminals. He said, "It can't be the antenna, I have the best there is and you installed it." But the rabbit ears brought in a better color picture than did his fancy rig. He looked furious.

I began examining the antenna system. The elements were intact, the de luxe lead-in and special connections were still like the day they were installed. When I followed the lead-in to the basement, I saw it: the lead-in terminated at a transformer-type coupler. I disconnected it, went out to the truck and then installed a coupler of the resistive type.

A transformer coupler (Fig. 6) transfers TV signals with little loss compared to the resistive model. The transformer unit, however, may transfer only a narrow frequency band. So while the antenna was fine, the coupler was chopping off much of the color subcarrier.

I turned on the TV again and confirmed

my suspicion. The cheaper resistive coupler provided broader response and good color pictures. Fortunately, the antenna had enough gain in this installation (Fig. 7) to overcome resistive-coupler losses. But I did mention the possibility of his getting a log-periodic later on.

"How much is that new coupler?" he asked.

"A dollar ninety-nine."

"Too cheap."

"I could do it with an antenna distribution system that costs \$49.95, installed."

He brightened. "That's more like it, get it in as quick as you can."

90-Watt Combo Amp

Continued from page 56

and bright. The reverb channel was outstanding and had a crisp, rather than muddy, sound quality. The reverb was excellent even when the signal source was a singer.

The tremolo, with a rate of 2 to 10 cps and a modulation depth of up to 75 per cent, was satisfactory—with an exception. The tremolo oscillator didn't work when the rate control was set too close to the 10-cps (fast) rate. When turned farther, the control had no effect.

Measured Performance. Typical of musical-instrument amplifiers, the KG-387's test-instrument performance bears no relationship to the sound you hear. For example, the tone-control curves do not resemble those of standard tone controls because the positions of both bass and treble controls affect the mid-range response. In addition, the volume control is compensated so that approximately 10db of boost at 10 kc is applied at low volume levels. The bass and treble boost and cut vary between 5db and 10db depending on the setting of the volume control.

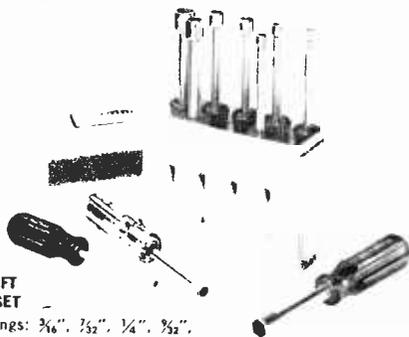
Hum level is notably low, probably due to a low-end roll-off which is some 8db down at 60 cps. The amplifier, which is rated by Allied at 30 watts rms, delivered 25-watt runs into a 4-ohm load (the impedance of the two parallel-connected speakers). We were unable to verify the 90-watt peak-music-power rating.

To tie it up, the KG 387 provides a notably solid, bright and clean sound with brilliant reverb.

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13½ Ways To Kill Interference

Continued from page 92

and how to cure them. You may not need all techniques. Try each in succession until noise is cut to a tolerable level.

13½. Get Away From It All

Admittedly, this last one is a little impractical—but tempting. One ham we worked lays claim to the world quietest QTH—near Quito, Ecuador, some 9,000 ft. above sea level on an Andean mountain top.

¡Que pacifique!

High Z for VOMs

Continued from page 99

sistance (2 megohms) from 10 megohms to obtain the value of the first resistor (R_A) in the attenuator (it is 8 megohms). Then subtract the next calculated resistance (500,000 ohms) from 2 megohms to get the next top resistance; it is 1.5 megohms. Continue on down the line. The last resistance R_F is 10,000 ohms.

If the resistor values are not available in the normal 5-per cent values, connect resistors in series to get the desired resistance.

One last point. To measure a negative voltage, such as an oscillator's grid voltage in a tube radio, reverse the probe connections to J1 and J2. In other words, the probe containing R1 should be connected to J2 and the other probe should be connected to J1.

Swap Shop

Continued from page 25

LAFAYETTE and Valiant walkie-talkies. Will swap for Heath GW-12A or Allied C-540 transceiver. Bill Clarke, 95 Highfield Ave., Port Washington, N.Y. 11050.

KNIGHT C-555 walkie-talkies. Want auto tape player or reverb. Charles Tang, 855 Victor Ave., No. 217, Inglewood, Calif. 90302.

RADIO SHACK Pacer 8-channel base. Will swap for a good short-wave receiver. David Hailey, 1013 Graybar La., Nashville, Tenn. 37204.

SONAR G transceiver. Will trade for a good general-coverage or ham-band receiver. Leonard Batch, 14-04 Bell Blvd., Bayside, N.Y. 11360.

MIDLAND 2-channel walkie-talkie with case and extra battery pack. Will swap for hi-fi tape recording accessories. Bob Mudroncik, 2110 Wespark Ave., Whiting, Ind. 46394.

LAFAYETTE HB-115A transceiver. Will swap for 23-channel transceiver. Robert Landrich, 100 Beach St., Jersey City, N.J. 07307.

CONTACT 23 transceiver, 2 mikes. Will swap for combo-type electronic organ. Lanny Windham, Rt. 4, Box 198, Gordo, Ala. 35466.

LAFAYETTE HB-555 transceiver. Will swap for good 3-5 watt walkie-talkie or best offer. Edward Stone, 9613, Briston Ave., Silver Spring, Md. 20901.

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Master Matcher

Continued from page 62

install L1 exactly as shown. Connect the ring terminal nearest the collar to J2's frame (ground) with a piece of No. 20 solid wire bent into a U-shape as shown. If you make a straight connection from L1 to J2 you may not be able to adjust L1.

Capacitor C1's tuning shaft must be insulated from the shaft protruding through the cabinet with an insulated shaft coupling or a 1/4-in.-dia. plastic rod. If you use a rod, cement both C1's shaft and the tuning shaft to the rod with a silicone rubber adhesive such as GE's RTV.

A knob, such as is used on a miniature volume control, can be screwed on L1's slug-adjustment screw to facilitate L1's adjustment. Otherwise, use a small screwdriver to adjust L1.

Checkout and Adjustment. Figures 3 and 4 show the two possible ways of spreading L1's windings. The normal or starting winding is the one in which the wire is stretched almost the entire length of the form.

Connect an SWR meter between your transceiver and J1; connect the antenna transmission line to J2. Set C1 full counterclockwise and turn L1's slug-adjustment screw full counterclockwise. Put the transceiver in the transmit mode and note the SWR; most likely it will be astronomical, but this is normal. Adjust L1 to the point where the SWR can no longer be reduced, then adjust C1 for even further SWR indication. Finally, alternately adjust C1 and L1 in very small increments until the SWR is negligible. With most antennas it should fall to a rock-bottom 1:1. If you cannot get it lower than a 2:1, release the transmit button and squeeze L1's ring terminal near the collar to the center of the form, or even closer, as shown in Fig. 4. Then repeat the C1 and L1 adjustments; this time you should be able to get the SWR almost to 1:1. If you still don't, squeeze L1's ring terminal again and repeat the adjustments to C1 and L1.

In the event the SWR changes from day to day even though C1's and L1's adjustments have not been changed, check the antenna system for loose connections or moisture in the transmission line or loading coil (if the antenna has one). It should not be necessary to readjust the Matcher if no changes are made to the antenna system. ●

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You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur License. You will learn 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. Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the low price you pay. The Signal Tracer alone is worth more than the price of the kit.

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You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment. Many thousands of individuals of all ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice troubleshooting—all in a closely integrated program designed to provide an easily-learned, thorough and interesting background in radio. You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and troubleshooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

Included in the "Edu-Kit" course are Receiver, Transmitter, Code Oscillator, Signal Tracer, Square Wave Generator and Signal Injector Circuits. These are not unprofessional "breadboard" experiments, but genuine radio circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

THE "EDU-KIT" IS COMPLETE

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

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

Progressive "Edu-Kits" Inc., 1186 Broadway, Dept. 601AE, Newlett, N. Y. 11557

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FROM OUR MAIL BAG

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

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

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

PRINTED CIRCUITRY

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

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

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

CIRCLE NUMBER 10 ON PAGE 11

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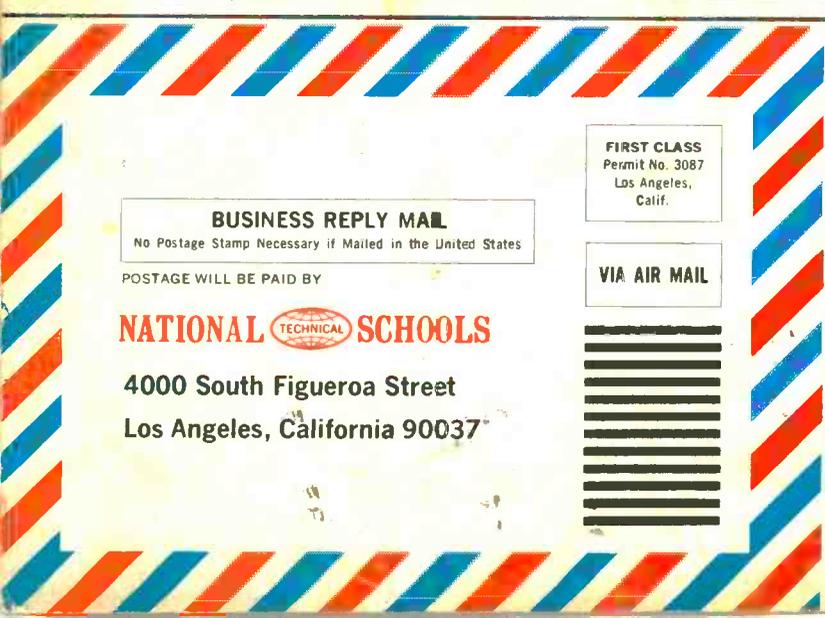


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