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SEPTEMBER 1966 • 50¢

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"Many thanks to NRI for the Electronics training I received. I hold a First Class FCC License and am employed as a studio and master control engineer/technician with KXJB-TV." RONALD L. WOOD, Fargo, N. D.

"I am a Frequency Coordinator for the 11th Naval District. The course I completed was priceless in my work. I was a blue collar worker, now I am a white collar worker." JOHN J. JENKINS, San Diego, Calif.

"I am a Senior Engineering Aid at Litton Systems, in charge of checkout of magnetic recording devices for our computers. Without the help of NRI I would still be working in a factory." DAVID F. CONRAD, Reseda, Calif.

ELECTRONICS ILLUSTRATED

SEPTEMBER, 1966 A Fawcett Publication Vol. 9, No. 5

Special Bonus

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Special Construction Projects

Radio: CB • Amateur • SWL

Audio & Hi-Fi

Theory & Practice

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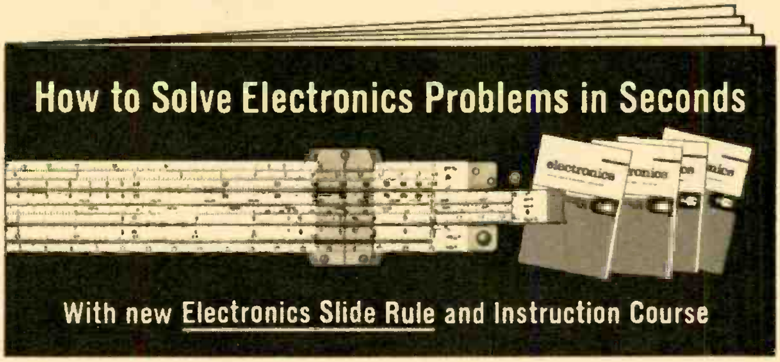
Why solve electronics problems the old-fashioned pencil and paper way?

This free booklet shows a faster way.



IT JUST DOESN'T MAKE SENSE! A complicated calculation can be solved by a computer in milliseconds. But a relatively simple problem in reactance is usually worked out the old-fashioned pencil-and-paper way... and takes one or two minutes.

Now there is a better way. You can solve many electronics problems in 20 seconds or less without doing any figuring at all. Our exclusive new, specially-designed electronics slide rule does the figuring for you.

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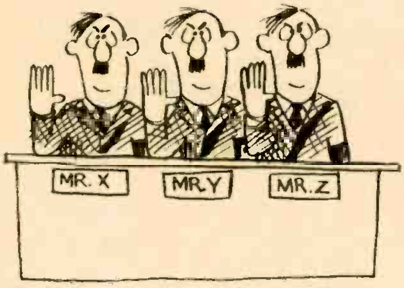
FEEDBACK

from our readers

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

● REVEALING



Thank you, gentlemen, for bringing out a story that I for one had never heard before—the one about how tape was discovered during World War II (THE DAY TAPE WAS BORN, July '66 EI). As you say, tape must have made it impossible to determine where Hitler really was in those days but I never knew it had played so important a role.

B.L.
New York, N.Y.

It did. And pinpointing Der Fuehrer's actual whereabouts was something on the order of looking at three monkeys and asking the real one to please stand up.

● SISTER EILEEN

I think this matter should be stopped. My 15-year-old son, whom you nicely ran a Swap Shop notice for, received this letter in the mail yesterday:

> Dear Sir:
> My name is Eileen and I am a student in college in Albany, N.Y. I am having a difficult time puting myself through college since I am able to work only a limited amount of time since I need time for my studies. So in writing you & others my request is for any donation you may have, that is of course without upseting any debts of your own. Thanking you ahead of time, I remain (my goal—a teacher)—
>
> Respectfully yours,
> Eileen ———
> Albany, N.Y.

I'm sure during these days and times with Federal Aid, scholarships someone wanting an education does not have to solicit donations through the mail such as this.

Mrs. A.W.
High Point, N.C.

He can say no, can't he? That Eileen must be a clever gal. Now if she could just learn speling . . .

● MR. ZIP

I would like to know if other countries of the world have Zip Code numbers and if they should be used in sending for QSL cards out of the U.S.

S.S.
Hyattsville, Md.

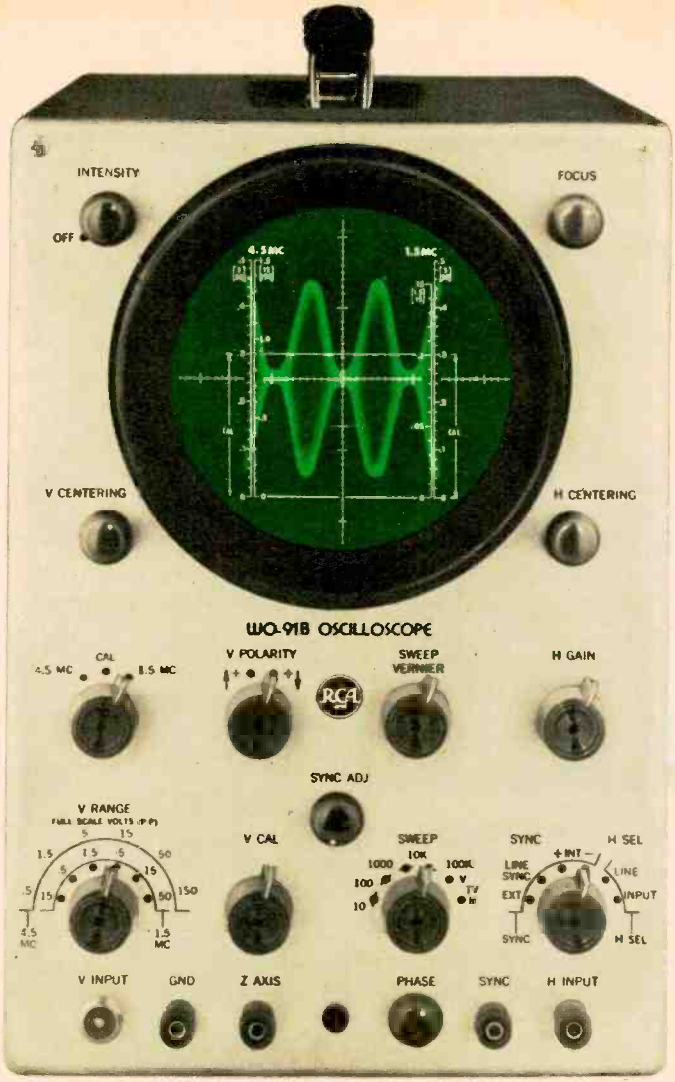
No. No.

● LAST RESORT

What do you do when the usual troubleshooting procedure (test tubes in troubled section, check resistors and capacitors in troubled section, etc.) does not show you where the trouble is? For example, all you get on the screen is a horizontal white line. The tubes test good, the vertical coil good and the resistors and capacitors in the vertical section good. Where would you go from here?

Thomas Garber
Wilkes-Barre, Pa.

To a movie.



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BROADSIDES

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

Rising star of solid-state electronics, the **field-effect transistor** is the subject of a 16-page booklet which pays particular attention to the FET's use in FM tuner front-ends. The bulletin is free for the asking from H.H. Scott, Inc., Powdermill Rd., Maynard, Mass. 01754.

The Microphone In Public Address Systems is the title of a booklet that promises to be of interest to jamboreeing CBers and anyone else who must use a mike to reach an audience. For your free copy, write Shure Bros. Inc., 222 Hartrey Ave., Evanston, Ill. 60602.

Whether ham rig, Science Fair project or electronic oddball performing tasks known only to its maker, gear of any sort is bound to take on an improved appearance when pilot lights are used. More importantly, **pilot lights** can help in taking the mystery out of what's going on inside a black box. Catalog L-178A—chocked full of pilot-light assemblies—well may list the kind of indicator you need. A free copy can be yours for the asking from Dialight Corp., 60 Stewart Ave., Brooklyn, N.Y. 11237.

What with intercoms, alarms and other gadgetry, small wonder that the homes of hobbyists sometimes get to resembling wire factories. A booklet now is available that explains the installation of a special **flat cable**—Scotch No. 700—that literally can be rolled on a wall, preferably just above the baseboard. Get your free copy from the 3M Co., 2501 Hudson Rd., St. Paul, Minn. 55119.

Many is the ham, CBer or other hobbyist who has had to make a coax T-connection or at least has had need to connect two pieces of coax at one time or another. Thing is, there's no way to mate coax unless you have the proper hardware. Catalog 6 lists 300 kinds of **coax connectors** that fill these needs and many others. A free copy may be had by writing Star-Tronics Inc., Moulton St., Georgetown, Mass. 01833.

Divided into two sections, Catalog SAC-25—a phonograph **cartridge replacement guide**—contains a total of 5,700 cross-referenced cartridge listings. The first section gives the proper Sonotone replacement for most cartridges, while the second section cross-references various makes of phonographs with the company's cartridges. A copy can be obtained by writing Sonotone Corp., Electronic Applications Div., Elmsford, N.Y. 10523

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- Checks alternator and generator's current and voltage outputs
- Finds open or shorted condensers
- Detects condition of point surfaces
- Checks ignition coil and distributor
- Finds poor or open ground connections
- Checks alternator diodes
- Checks headlights, pilot lamps, horns, starter relays, fuses, accessories
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- Determines battery charge/discharge rate
- Measures spark output & leakage
- Checks engine timing and power balance

Now you can always know your engine's efficiency — keep it in top shape yourself! The EICO 888 comes complete with a comprehensive Tune-up and Trouble-shooting Manual including RPM and Dwell angle for over 40 models of American and Foreign cars. **The Model 888 is an outstanding value factory-wired at $59.95.**

Model 460 Wideband Direct-Coupled 5" Oscilloscope. DC-4.5mc for color and B&W TV service and lab use. Push-pull DC vertical amp., bal. or unbal. input. Automatic sync limiter and amp. $89.95 kit, $129.50 wired.

New Model 712 Sentinel 12 Dual Conversion 5-watt CB Transceiver. Permits 12-channel crystal-controlled transmit and receive, plus 23-channel tunable receive. Incorporates adjustable squelch & noise limiter, & switches for 3.5 watt P.A. use, spotting, & Part 15 operation. Transistorized 12VDC & 117VAC dual power supply. $99.95 wired only.

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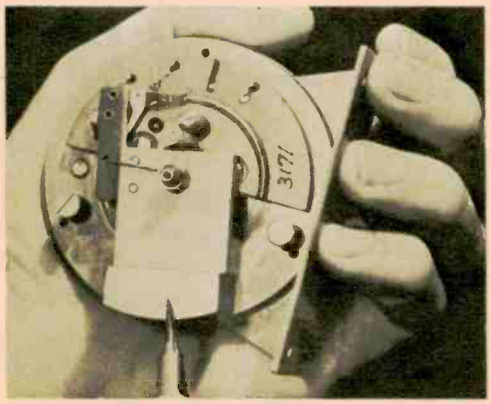
LASER SENTRY . . . Using a rifle scope (upper tube), the security guard in our photo is aligning the invisible and jam-proof beam of light from a laser intrusion detector—LID, for short. LID was developed by Raytheon's Bedford, Mass., Missile Systems Divison to provide an impenetrable fence of light around any location where protection and privacy are desired. Transmitter and receiver are identical in size and both are powered by flashlight batteries. With an effective range of roughly a mile, the LID system even works in light fog, rain or snow.

...electronics in the news



Pendulum Pot . . . Though it looks something like the back of a clock and is equipped with a pendulum, the gadget in the palm of the Litton Industries technician has nothing to do with measuring time. Verticals and horizontals are the sole subjects of its concern, for the unit in reality is a type of electronic level. Called a pendulum potentiometer, the gadget delivers an output voltage which corresponds to the tilt angle of its case. As our photo suggests, the device basically is a potentiometer whose wiper arm is attached to a weighted pendulum. Hermetically sealed, the novel voltage divider will indicate which way is up even underwater.

Master Pane . . . If the pattern on the pane of glass being held by the gal in our photo were a blueprint of a house the residents would be invisible electrons. Sound crazy? If it is, the people at Corning Glass Works haven't heard. The strange pane is a master negative printed on a special type of chemically strengthened glass that's just 0.09 in. thick. This particular blueprint is a plan for an IBM computer circuit board. Selected for its dimensional stability, transparency and shatter-resistance characteristics, the glass is ideal for this application. Reason is that photoplates easily can be remade in new configurations whenever changes are required.

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

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.

THE KIT FOR EVERYONE

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.

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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 trouble-shooting—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 trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

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.

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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, coils, hardware, tubing, punched metal chassis, Instruction Manuals, hook-up wire, solder, selenium rectifiers, 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 Radio and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to FCC Radio Amataur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

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- PRINTED CIRCUITRY

SERVICING LESSONS

You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs on the sets that you construct. You will learn symptoms and causes of trouble in home, portable and car radios. You will learn how to use the professional Signal Tracer, the unique Signal Injector and the dynamic Radio & Electronics Tester. While you are learning in this practical way, you will be able to do many a repair job for your friends and neighbors, and charge fees which will far exceed the price of the "Edu-Kit." Our Consultation Service will help you with any technical problems you may have.

FROM OUR MAIL BAG

J. Stataitis, 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, but like to work with Radio Kits, and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

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

PRINTED CIRCUITRY

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Instructive . . . Most any solder-gun-totin' hobbyist well knows that building a kit simultaneously can be a money-saving way of acquiring a piece of electronic gear and a rewarding way of finding out what makes it tick. The KT-630—a 7-tube, 30-watt (IHF) stereo amplifier kit—

is no exception. And when the project's done, four pairs of stereo inputs, DC on the heaters of its preamps, a concentric volume/balance control and 4-, 8- and 16-ohm output impedances are just a few of the amenities—usually reserved for more costly amplifiers—the builder can enjoy. Frequency response is within ± 1.5db from 20 to 60,000 cps. Kit (less cabinet), $39.95. Lafayette Radio Electronics Corp., 111 Jericho Tpke., Syosset, N.Y. 11791.

The E-V SEVEN was born in the eerie silence of an anechoic chamber — the world's largest devoted to high fidelity design. This vast sound absorbing room let E-V engineers get right down to basic engineering. Nothing disturbed their silence — or their concentration on the subtle differences that distinguish a great speaker.

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MARKETPLACE

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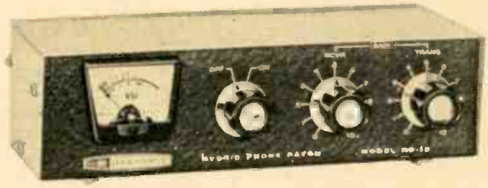

patch kit offers wire-strippin' hobbyists a chance to latch onto this accommodating piece of gear at a reasonable price. Designed to match high-impedance or 60-ohm microphone circuits and 3- to 16-ohm speaker circuits to 600-ohm telephone lines, the HD-15 is compatible with any rig in either push-to-talk or VOX operation. A panel-mounted VU meter and separate receiver-to-line and line-to-transmitter controls permit hams to adjust all audio levels precisely. Kit, $24.95. Heath Co., Benton Harbor, Mich. 49022.

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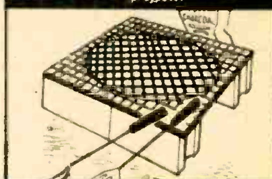

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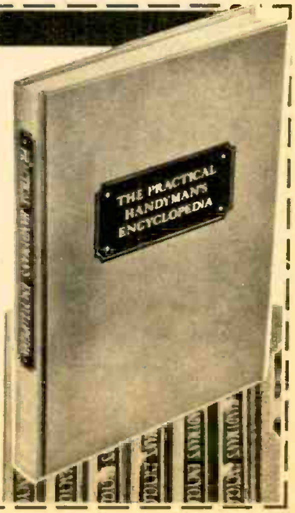

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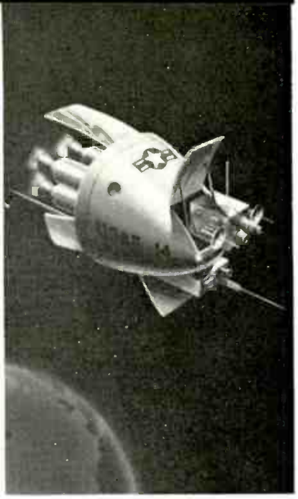

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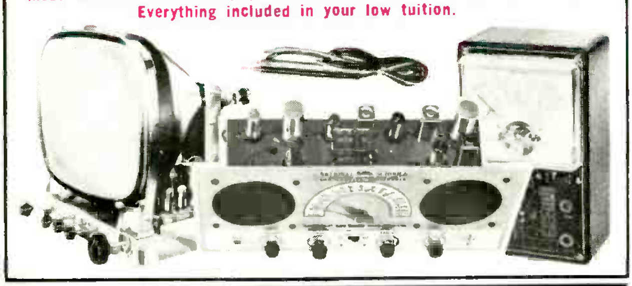

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BROWNIE Auto 27 camera, darkroom equipment. Looking for VHF FM receiver, CB transceiver. Peter Nagan, 816 Desnoyer St., Kaukauna, Wis. 54130.

MERCURY 203 tube testers. Need B&K analyzer. Monroe Marshburn, 607 S. Cumberland St., Wallace, N.C. 28466.

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[*Continued on page* 20]

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Continued from page 19

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HALLICRAFTERS S-107 communications receiver. Will swap for FM tuner or a stereo amplifier. William Hyland, 16 Ridgewood St., Waterbury, Conn. 06710.

HEATH 6-in. VTVM, model 2-B tape teleprinter. Want communications receiver or ham gear. Robert E. Proctor, 4600 Hartman Dr., Lawrence, Ind.

HEATH CB-1 transceiver, Alliance antenna rotator. Need oscilloscope and in-circuit capacitor checker. Sam W. Padgett, Rte. 3, Box 524D, Ft. Pierce, Fla. 33450.

KNIGHT R-55 receiver. Looking for CB rig. Dale K. Moseman, Rte. 1, Oakland, Neb. 68045.

KNIGHT Star Roamer receiver. Interested in test equipment, CB transceiver or Heath Twoer. Joseph H. Dangler, 625 2nd Ave., Long Branch, N.J. 07740.

KNIGHT lab kit, components. Will swap for Knight or Heath CB rigs or walkie-talkies. Alan Smith, Jasper, Tenn. 37347.

VARIABLE 1,000-V POWER SUPPLY. Want transmitting tubes, CB gear. George L. Whitmore, WA6IKV, 3240 Machado Ave., Santa Clara, Calif. 95051.

BC-659 FM transceivers, PE 120 power supply, other items. Interested in CB or test equipment. Harold M. Cohen, 22 Riggs Pl., South Orange, N.J.

ATWATER-KENT model 40 table radio, TDC 35-mm projector. Want Heath Sixer or Hallicrafters S-40 receiver. Theodore Nadeje, 5101-AA 39th Ave., Sunnyside 4, N.Y.

KNIGHT electronic lab. Will exchange for Ameco AC-1T transmitter or 6-meter beam. Ron Ackerman, Rte. 1, Box 312, Sawyer, Mich.

HALLICRAFTERS S-120 receiver. Want CB rig. Les Lussier, 81 S. Main St., Dolgerville, N.Y. 13329.

SURPLUS AN/ART 13 transmitter. Want test equipment. Larry Finley, WB6OFR, 197 Cherry Ave., Porterville, Calif. 93257.

NOAM-CORDER TR-300 tape recorder. Need walkie-talkies. Dale L. Walker, 477 Linden Dr., Rexburg, Idaho 83440.

TRANSISTOR tape recorder. Will trade for Lafayette 100-mw walkie-talkie. Ronald Rosenberg, 17 Beaumont Dr., Melville, N.Y.

WESTERN ELECTRIC milliammeters, 1890 Edison Lande battery. Will swap for books. James Minnig, Tracy, Minn. 56175.

SLOT RACING equipment. Will swap for CB rig or ham receiver. Frederick H. Story, 670 Carrol Ave., St. Paul, Minn. 55104.

KNIGHT Star Roamer, antique telegraph sounder. Make swap offer. Paul Cook, WN7CSK, 2943 N.E. 178th St., Seattle, Wash. 98155.

CAR RADIO. Make swap offer. Rickie Davis, 26850 Ames Lake Rd., Redmond, Wash. 98052.

RCA table-model color TV. Want RCA WV-98 Volt-Ohmyst or 20,000 ohms/volt VOM. William H. Ray, Jr., 36 Cortland St., West Hartford, Conn.

CROSLEY antique radio. Want T-60 transmitter. Steven T. Bryant, Star Rte., Central Bridge, N.Y. 12035.

TV CHASSIS. Will swap for CB transceiver, walkie-talkies or SW receiver. Jack Bergrin, 744 Williams Ave., Brooklyn, N.Y. 11207.

LAFAYETTE LA-55 amplifier, LT-80 FM tuner, other items. Will exchange for communications receiver. B.W. Keller, MR-71, Rochester, Minn. 55901.

ASSORTED components, car radio. Will swap for SW or test equipment. Richard Calliger, 6322 Blaine Pl., Spring Grove, Ill. 60081.

HEATH MI-10 marine depth finder. Interested in test equipment. Henry Kalscheuer, 801 Madison, Sauk City, Wis. 53583.

LAFAYETTE HE-15 CB transceiver. Will exchange for FM tuner or turntable. Norman Goldfarb, 3110 Brighton 7th St., Brooklyn, N.Y. 11235.

FORD AUTO RADIO (1955). Make swap offer. Wayne Johnson, 67 Hobart Ave., Bayonne, N.J. 07002.

[*Continued on page* 101]

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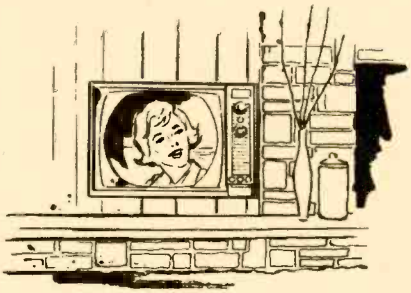
Build Your Own Heathkit® 21" Color TV And Save Up To $200!



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UNCLE TOM'S CORNER

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

By TOM KNEITEL, K2AES/KBG4303

★ *Crazy call-signs I've heard of but this is ridiculous! I keep hearing a ham in the 80-meter band with the call-sign X2BIG. Every night he's on 3580 kc CW and refuses to answer my call. I've called him until my fingers are numb. Has anyone else heard this one? Has anybody ever worked him? He's not in the ham Callbook.*

F.S.
Dallas, Tex.

You've stumbled on a Mexican government non-ham radio station which, for unknown reasons, has set up shop in the 80-meter band. I've heard him, too, sometimes on fone and working X2BIJ. The call X2BIG is legit, however—he's in Pueblo, Mexico.

★ *I have a bet on with a friend of mine. He says that you were once a one-man band on the boardwalk at Daytona Beach (Fla.). I say he's off his rocker. Who wins?*

Ephriam Wolf
Cocoa Beach, Fla.

You do. I've never been in Daytona Beach.

★ *I've seen stories of how the Navy operates a million-watt radio station on 14 kc, which is within range of human hearing. Can you hear this station without a radio receiver?*

William Norris
Miami, Fla.

No. Can you?

★ **Angry Mail Dept.** I'm still getting angry letters about the stand I took on police radar traps a few issues back. Those of you who wrote to defend use of these little spy devices presumably aren't offended by wire-taps, hidden cameras and other assorted sneaky ways for Big Brother to see what you're up to. It's a smelly kettle of fish at best and I defy anyone to prove that a marked patrol car on the road is any less effective in controlling speeders.

★ *Help! What can I do to eliminate TVI in reverse? There's a TV station tower right near my house and every time they go on the air my short-wave receivers flip with 60db of the most fantastic noises. The noise covers the entire spectrum, not just certain frequencies.*

"Duke" Kish, WA3AWH
Elizabeth, Pa.

Holy Barracuda! So forget short wave and enjoy Batman.

★ *Hey Daddy-O, bet it never occurred to anybody that our space program to put a man on the moon is called Project Apollo and Apollo was the Greek god of the sun. Did somebody goof?*

Drayton L. Buono
Circleville, Ohio

We think big.

★ *My name is Knox and I found out that there's a broadcasting station with the call-sign KNOX—my name. I then decided to try to QSL stations whose call-signs spell out words and names. So far I've gotten 11 such QSLs. Have you ever heard of this approach to the hobby?*

Ronnie Knox
Denver, Colo.

[*Continued on page* 26]

UNCLE TOM'S CORNER

Continued from page 24

No, I think you can claim that as your own personal contribution to the state of the art. Don't overlook the fact that many ship stations have call-signs which spell out words and names, including some we can't print here.

★ *I'm a traveling electrician, going from Maine to Miami. My problem is finding a good metal locator with a decent range that I can take with me. I don't care whether the unit is large or small. Any suggestions?*

James Jackson
Mill Spring, N.C.

I once owned a Chevy that located more hunks of metal on the road during a trip from Los Angeles to Pittsburgh than anything else I've ever come across. Track down this buggy and you'll have your transportation and metal-locating problems both solved.

★ *I claim to be the Messiah. Am writing to suggest that you do an article about me. Am available for interview. Please call or write.*

Morris Strauss
New York, N.Y.

So I'm writing. What are your office hours?

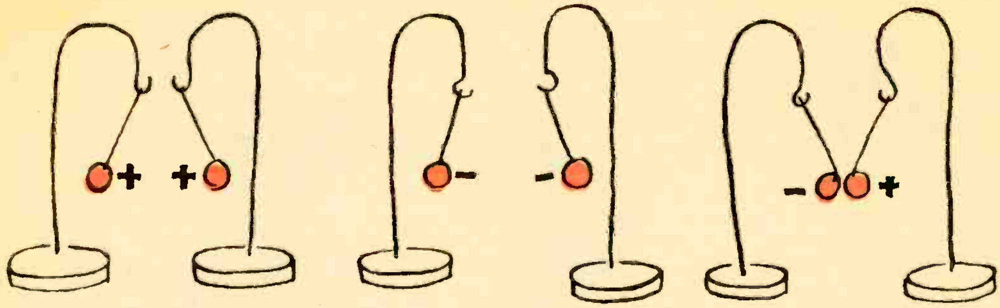
★ **Oscar Dept.** Awfully unsporting of the Project Oscar ham satellite people to thumb their noses at Technician operators. Oscar IV had its ham repeater operating on 144.1 mc which, while within the limits of the 2-meter ham band, is not part of the Technician portion of the band. Since the ARRL accepts Technicians as members they should have pressured the Oscar folks to locate the operating frequency fairly. Seems to me that the more stations taking advantage of Oscar, the better chances we will have to get future ones launched. Arbitrarily eliminating the major users of the 2-meter band looks like some more evidence of General-Technician snobbery.

★ *In answer to those pussy-cats who seem to think they have more cool than you and seem eager to trade boots, all I can say is, "Some cats got it. Some cats ain't."*

B.M.K.
Washington, D.C.

Purrrrrrrrr.


VOLUME
SQUELCH
hallicrafters
CB 20



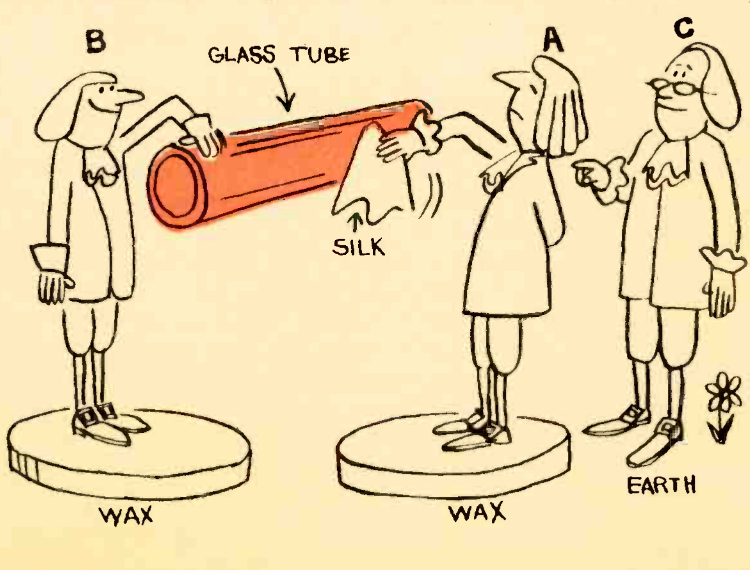
Pairs of pith balls charged from glass (at left) and from amber (center) repel one another, though two balls carrying dissimilar charges (right) attract one another. Ancients thought this indicated existence of two different kinds of electricity rather than two different aspects of the identical phenomenon.

sonably—that there were two different kinds of electricity: a resinous type produced by rubbing resinous material and a vitreous type produced by rubbing glass (see our drawings).

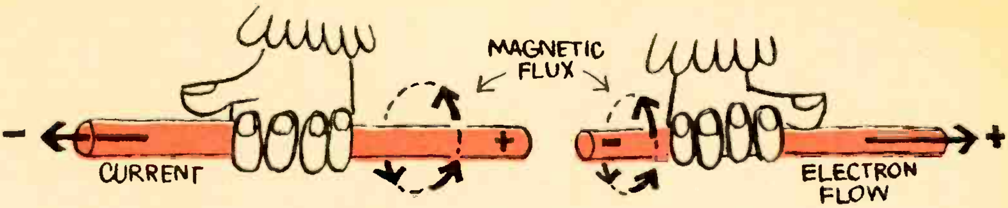
But Franklin shrewdly guessed there was only one kind of electrical fire. He reasoned an object charged with an over-quantity of electricity might display characteristics so opposite from those of an object with an under-quantity that an observer might think he was dealing with two different things rather than with different amounts of the same thing. Closest parallels are lightness and darkness, heat and cold. For though darkness to our senses seems to flood into a room when light is removed and cold seems to creep into iron as heat escapes, we know darkness simply is the absence of light and cold a measure of the absence of heat.

Franklin used the simple experiment (shown in our drawing below) to illustrate his theory, which he explained as follows: A, standing on insulating wax and rubbing the glass tube, "collects the Electrical Fire from himself into the Glass," thus giving it an over-supply. Since A's communication with the common stock of electricity in the earth is cut off by the wax, this leaves him with an under-supply. B, also standing on wax, touches the glass and receives some of the electrical fire collected from A, thus also giving him an over-supply.

Person C, standing on the earth and having a normal supply of the electrical fluid, sees both A and B as being charged, though oppositely, and capable of causing a spark if



Franklin was among the first to suspect that electrical fire existed in one rather than two forms, as the ancients had believed. Drawing illustrates experiment which led Franklin to label some charges positive, others negative. Ben had a 50/50 chance of being right, but subsequent theorizing suggests he was wrong.



Old Right Hand Rule for determining direction of circulating magnetic field around a wire states that fingers indicate direction when right hand grasps conductor with thumb pointing in direction of current flow—positive to negative. Newer, electron-flow concept would require substitution of left hand.

he touches either of them. When he touches A, the electrical fluid will flow from C's body to replenish the under-supply in the body of A. At the same instant C's own body will be replenished from the earth so that he remains in his uncharged state. If C touches B, the over-supply of electrical fire in the latter's body will flow through C's body into the earth.

"Hence," wrote Franklin, "have arisen new terms among us. We say B (and other bodies alike circumstanced) are electrised *positively;* A, *negatively:* or rather, B is electrised *plus* and A, *minus*. . . These we may use till your Philosophers give us better." (In fairness, let us note Franklin warned his idea was tentative and subject to correction.)

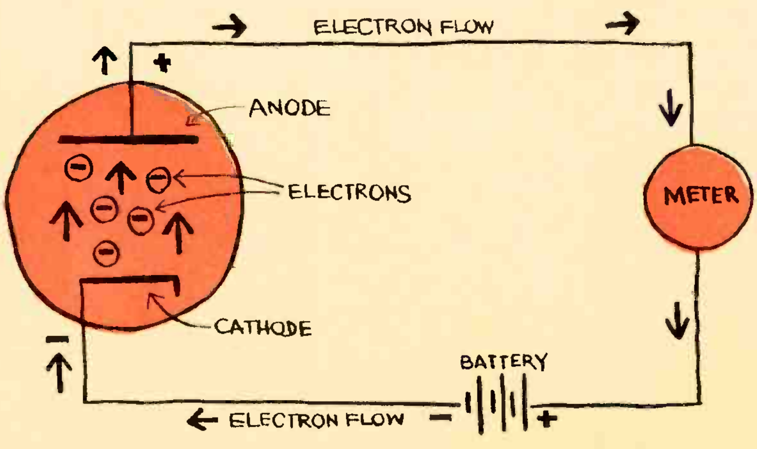
Where did he go wrong? Primarily in thinking the electrical fire moved *from A's body into the glass* when just the opposite was true. Something actually moved *from the glass into A's body*, and at the end of the 19th century Sir J. J. Thompson found that something consisted of very small, light pieces of negative electricity now known as *electrons*. These electrons constitute the mobile elements of electrical charge—in a conductor, at least.

Franklin reasoned the electric fluid would flow from where there was a surplus to where there was a deficiency, so he *guessed* current flowed from positive to negative. We know electrical surplus or deficiency actually is measured in negative electrons, so electron flow is from a negative to a positive (or less-negative) point.

But for a century and a half men experimented with electricity, laid down workable rules and laws regarding its behavior, generated it and put it to work—all without challenging Franklin's idea of current flow (our drawings above illustrate the old right-hand rule concept, which was part of their thinking). How could this happen?

It was possible because they were dealing with motors, generators, power transmission and lighting; and the actual direction of current flow is not important in these areas. So long as current is assumed to travel in one direction and all rules of electrical behavior are based consistently on this assumption, there's no problem.

But the advent of the vacuum tube made it difficult to defend Franklin's idea of current direction. Consider the diode in our drawing below. Here, inside a vacuum, is a



Discovered by Sir J.J. Thompson in 1897, the electron (which Thompson called a corpuscle) soon gave researchers reason to doubt Franklin's concept of current flow. Meter connected in series with vacuum tube, for example, indicated current flowing from negative to positive rather than in manner Ben had envisioned.

heated cathode emitting electrical particles and a charged anode intended to attract those particles. When current flows across the gap between cathode and anode, the meter will be deflected. If the positive battery terminal is connected to the cathode or pitcher element and the negative terminal to the anode or catcher element, no current flows.

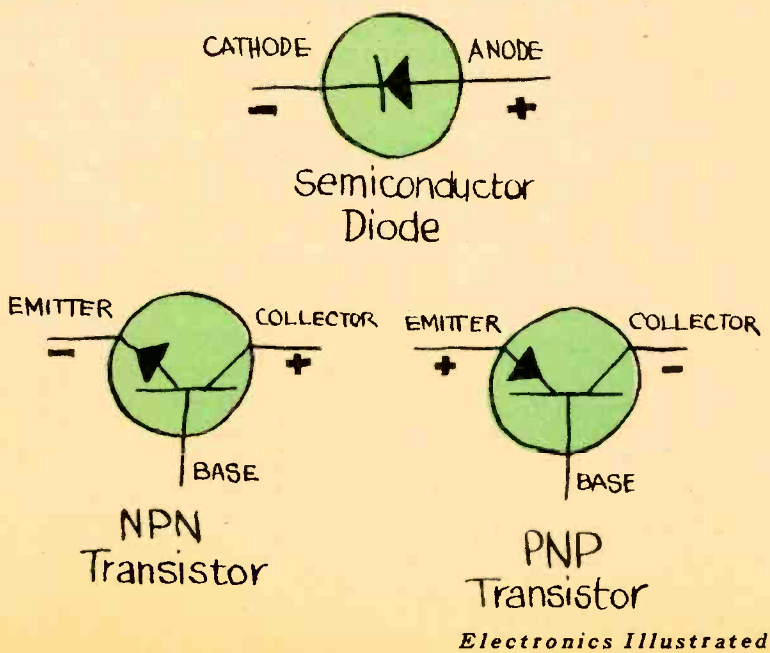
Thing is, it does flow when the terminals are connected as indicated. And this tells us three things: 1) emitted electrical particles must be negatively-charged to be attracted only by a positive anode; 2) movement of these particles constitutes a gap-bridging current from negative to positive *inside* the tube; 3) since direct current cannot flow in one direction in one part of a series circuit and in the opposite direction in another part, the electrons must move from negative to positive through the wires *outside* the tube.

Though the newer, electron-flow idea gradually is winning out over the traditional current-direction idea, one ideally should be familiar with both and able to translate from one to the other. For example, the arrows in the schematic symbols for a diode, a PNP transistor and NPN transistor (which we show below) all point in the direction of conventional current flow. (Remember the first two letters of PNP or NPN indicate the respective voltages applied to emitter and collector of that particular transistor in normal usage.) To translate these symbols to the electron-flow concept—and semi-conductor action is understood more easily in terms of electron movement—it only is necessary mentally to reverse the direction of the arrows.

Though electron flow is much more flexible and practical in dealing with modern circuits that well may include conductors, semiconductors and vacuum tubes all in a single device, many people still use Franklin's idea of current direction. Thing to remember is that when reading about current or conventional current one safely can assume that the writer is thinking of current as flowing from positive to negative. But if he speaks of electron flow, then negative-to-positive direction is intended.

But to return to our question, was Ben Franklin crazy? He wasn't, of course, though he sure has upset an awful lot of current carts since that error of his over two centuries ago. Actually, most people forgive Franklin everything when they learn of how, at his electricity parties, he used to impart opposite charges into a young man and a young woman and observe how much more zing the electric fire put into a kiss. You can't hold a piddling little error against a red-blooded experimenter like that!

Though old Ben never saw a modern-day diode or transistor (much less the symbols for them), they still reflect his ideas about current flow. Arrows in symbols for most common semiconductors all point from plus to minus rather than in the reverse direction as newer electron-flow theory argues they should.



The LISTENER

C. M. STANBURY II

ALMOST A QSL . . . A couple issues back EI ran a piece called HOW TO EAVESDROP ON REAL SPIES (May '66 EI). It answered all the pertinent questions except one—how would you get a QSL out of a spy? The question might not sound too bright since the answer obviously is that you can't . . . or can you?

Being the adventurous, soldier-of-fortune type, we decided to try. Now it happens that most of the currently-heard East German spy transmissions use, between messages, a musical interval signal which is identical with or at least similar to that used by Radio DDR. These transmissions currently are heard best on approximately 11550 kc at 1315-1345 EST but we logged a similar transmission on 2620 kc at 1635 EST. This done, we mailed a report to Radio DDR, carefully noting that the interval signal had been heard.

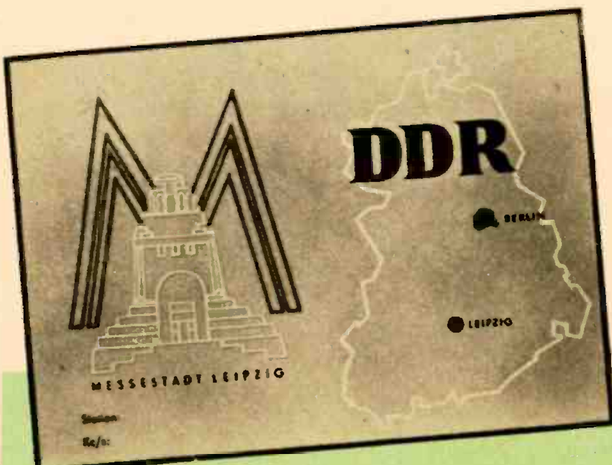
We frankly expected stony silence and nearly flipped when back came a DDR QSL. Yes, the card confirmed reception and specified the right time, too (see cuts showing the front of the card and half the back). But there was one trouble. Instead of 2620 they substituted one of their BCB frequencies (1043 kc), this being the one most commonly heard in North America.

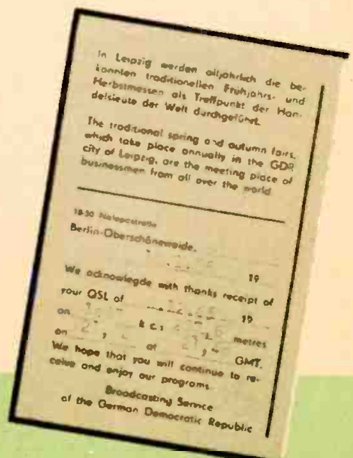
All this means the card we received really cannot be considered a valid QSL. But we intend to keep it in our collection just the same. And who knows? Next time we're stupid enough to try, we may score on all counts.

Turning Tide . . . For years the SW-broadcast listener has played poor relation to the ham so far as communications receivers are concerned. But suddenly the SWBC devotee has begun to come into his own. Earlier this year (THE LISTENER, Mar. '66 EI) we took note of Hallicrafters' new S-200 receiver which, though priced for the novice, provides first-rate calibration of the broadcast bands. Now the R.L. Drake Co. is offering similar calibration in a receiver of communications quality—a unit with the needed sensitivity and, more importantly, the needed selectivity to cope with the crowded SWBC bands.

Drake's new double-conversion SW-4 offers a separate band for each of these 500-kc ranges: 6-6.5, 9.5-10, 11.5-12, 15-15.5, 17.5-18, 21.5-22 and 25.5-26 mc. All crystals are supplied and three additional crystal sockets are provided. This means that crystals can be added to cover any other 500-kc segment between 1.5 and 30 mc except those frequencies between 5 and 6 mc. Though the SW-4 primarily is for BC listeners rather than utility hunters (it has neither BFO nor other provisions for SSB reception), at $289 it nevertheless is an attractive offering.

[*Continued on page* 115]




In Leipzig werden alljährlich die bekannten traditionellen Frühjahrs- und Herbstmessen als Treffpunkt der Handelsleute der Welt durchgeführt.

The traditional spring and autumn fairs, which take place annually in the GDR city of Leipzig, are the meeting place of businessmen from all over the world

Berlin-Oberschöneweide.

19

We acknowlegde with thanks receipt of your QSL of

on 19

on kc, metres

at GMT.

We hope that you will continue to receive and enjoy our programs

Broadcasting Service
of the German Democratic Republic

Unexpected QSL from East Germany (the so-called Deutsche Demokratische Republik or DDR) confirmed reception of spy transmission but substituted another frequency. See text for details.

Why Fred got a better job . . .

I laughed when Fred Williams, my old high school buddy and fellow worker, told me he was taking a Cleveland Institute Home Study course in electronics. But when our boss made him Senior Electronic Technician, it made me stop and think. Sure I'm glad Fred got the break . . . but why him . . . and not me? What's he got that I don't. There was only one answer . . . his Cleveland Institute Diploma and his First Class FCC License!

After congratulating Fred on his promotion, I asked him what gives. "I'm going to turn $15 into $15,000," he said. "My tuition at Cleveland Institute was only $15 a month. But, my new job pays me $15 *a week* more . . . that's $780 more a year! In twenty years . . . even if I don't get another penny increase . . . I will have earned $15,600 more! It's that simple. I have a plan . . . and it works!"

What a return on his investment! Fred should have been elected most likely to succeed . . . he's on the right track. So am I *now*. I sent for my three *free* books a couple of months ago, and I'm well on my way to Fred's level. How about you? Will you be ready like Fred was when opportunity knocks? Take my advice and carefully read the important information on the opposite page. Then check your area of most interest on the postage-free reply card and drop it in the mail *today*. Find out how you can move up in electronics too.

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NEWS FOR VETERANS: New G. I. Bill may entitle you to Government-paid tuition for CIE courses if you had active duty in the Armed Forces after Jan. 31, 1955. Check box on reply card for full details.

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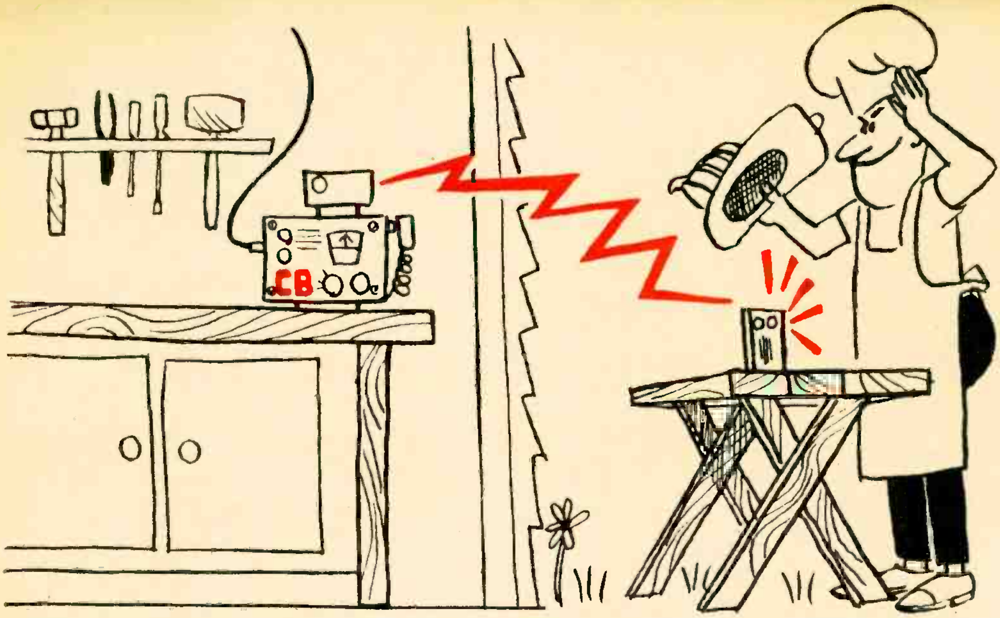


CB PAGER

It puts the Citizens Band on any broadcast radio anywhere in your home!

By HERB FRIEDMAN, KBI9457

SERIOUS Citizens Banders aren't known to be time wasters. They're quick to get messages across, then go on to other business. Seldom do they just sit and look at the rig, waiting for something to happen as would a short-wave listener.

But sometimes they *must* sit around waiting for a prearranged call to come through or to monitor a channel. More often than not there are other things waiting to be done around the house that could be taken care of during these idle moments.

This means that if they can't be within reasonable earshot of the rig you must crank the gain up so high that when the call finally does come through it rattles windows halfway across town.

The best way to be sure of hearing an incoming call *away* from the rig is with our Pager. It's a device that rebroadcasts incoming CB calls to you through any broadcast radio. It works this way: the Pager is a low-power broadcast-band oscillator. The CB transceiver's speaker output is fed to the Pager to modulate its oscillator, which is tuned to broadcast the call from the rig on an unused broadcast-band frequency.

To keep within FCC regulations and to insure privacy, the Pager's range is limited to about 100 ft. This is enough to cover the average home, backyard or your neighbor's home where you may be visiting. To keep distortion down the Pager has a built-in modulation meter. And the circuit is designed to

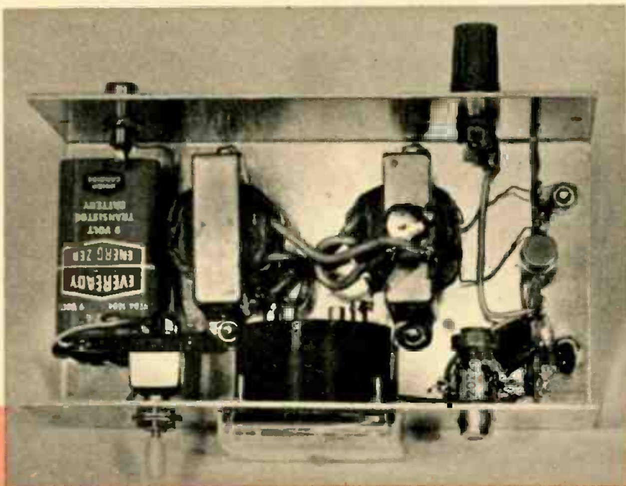
Pager is tuned to an unoccupied spot on the broadcast band by adjusting a front-panel-mounted coil. Radio becomes quiet when Pager is on frequency.

work from a flea-whisper signal.

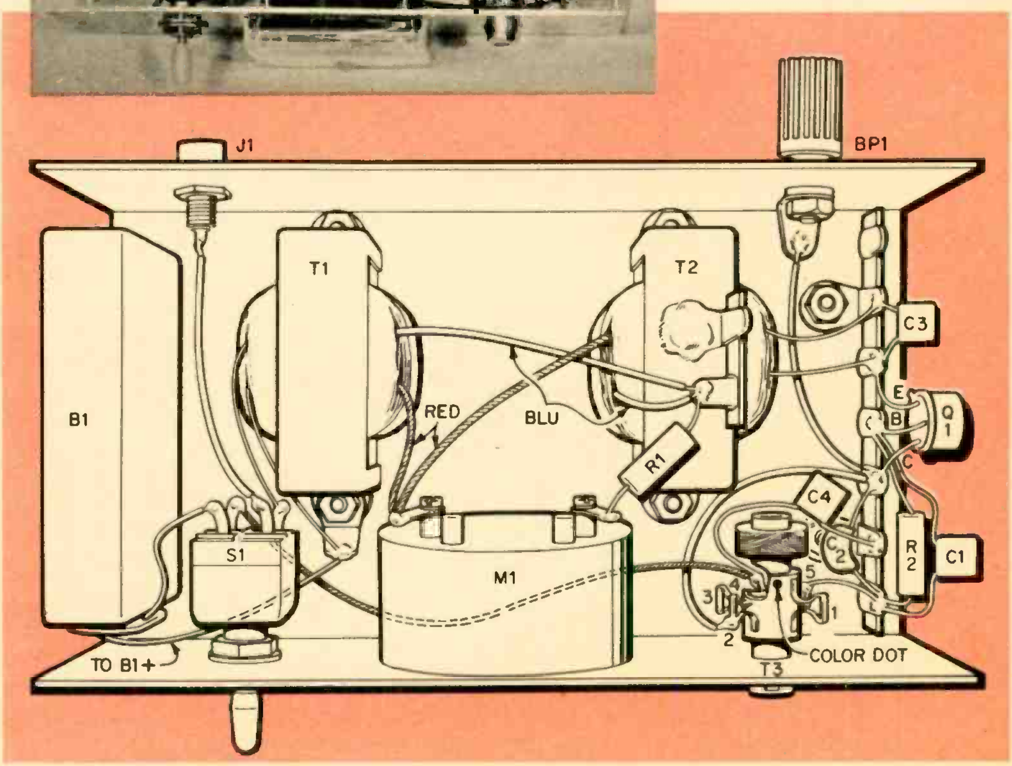
Construction. All component values are critical and substitutions must not be made. The Pager operates at the legal input power limit of 100 milliwatts. Do not attempt to increase the power or you will destroy transistor Q1 and possibly oscillator coil T3.

The circuit is built on the U-section of a 5¼ x 3 x 2⅛-in. Minibox. Modulation meter M1 is mounted dead center on the front panel (its hole can be cut with a standard 1½-in. chassis punch). To insure that there's enough room for T1 and T2, mount the 7-lug terminal strip (at the right in the pictorial) as close to the right edge of the cabinet as possible.

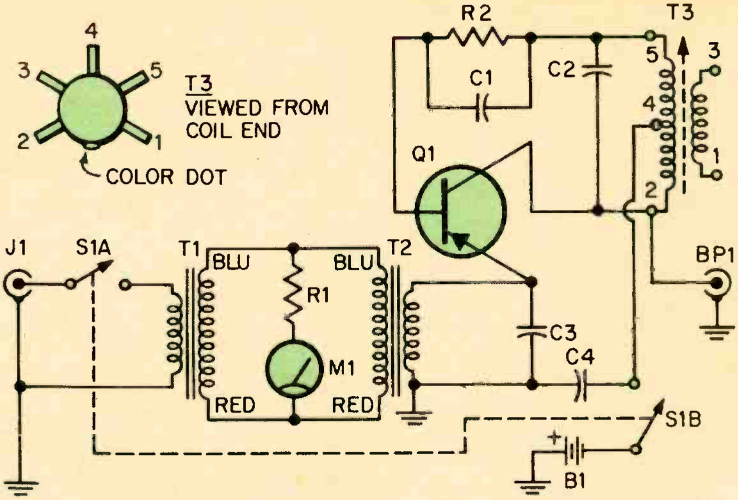
Since the components just fit into the cabinet, assemble the Pager in the following order. First (after all chassis holes are cut), mount the terminal strip at the right. Second, mount T3 on the front panel as shown, with the color dot facing up. Then connect all leads to T3. Connect the remaining components to the terminal strip before installing



Space is at a premium but you'll be able to fit everything in a 5¼ x 3 x 2⅛-in. Minibox if you proceed in this order: cut meter hole in center of cabinet; drill holes for switch, coil, transformers, terminal strip, binding post and jack; wire oscillator circuit on terminal strip at right, install coil, meter, transformers and other parts. Because of crowding around terminal strip at right and oscillator coil, use spaghetti on all leads. Heat sink Q1's leads to prevent heat damage to it when soldering.



Schematic of Pager. Incoming signal is stepped up by T1 to drive VU meter M1. (M1 indicates maximum safe modulation level.) Signal then is stepped down again by T2. T2's secondary is in Q1's emitter circuit so signal modulates RF carrier generated by Q1. When unit is turned off power is removed and signal from transceiver is prevented from being applied to T1 by open set of contacts of S1A.



PARTS LIST

B1—9 V battery (Burgess 2U6 or equiv. See text)
BP1—5-way insulated binding post
C1,C3,C4—.01 μf, 75 V (or higher) ceramic disc capacitor
C2—33 μμf, 500 V silvered mica capacitor (see text)
J1—Phono jack
M1—VU meter (Lafayette 99 R 5024)
Q1—PNP (AM converter) transistor (Lafayette 19 R 4213)
R1—5,600 ohm, ½ watt, 10% resistor
R2—2,200 ohm, ½ watt, 10% resistor
S1—DPST toggle or slide switch
T1,T2—Output transformer (50L6 tube); 3-4-ohm secondary (Lafayette 33 R 3701)
T3—Transistor oscillator coil (J.W. Miller 2022, Allied 60 U 974)
Misc.—K-tran alignment tool (Allied 50 U 015), 5¼ x 3 x 2⅛-in. Minibox, battery clip

CB PAGER

Q1. Since Q1's leads must be short, heat sink each when soldering.

All capacitors except C2 can be ceramic discs rated at 75 V or higher. But C2 must be a silvered-mica type. The specified value of 33μμf will produce an output between 1000 kc and 1600 kc. If you want to lower the output frequency, change C2 to 50 μμf. Install M1, then T1 and T2.

Battery B1 is a standard transistor-radio size. In intermittent service it will last several months. If you plan to use the Pager constantly, install a larger 9-V battery and mount it on the outside rear of the cabinet.

Tuneup. Connect an antenna no longer than 10 ft. to BP1. Temporarily connect the Pager via J1 to the voice-coil lugs on your transceiver's speaker. Make sure that if one of the voice-coil leads is grounded the ground lead from J1 is connected to this lug.

With the transceiver *off* and S1 *on*, place a radio near the Pager's antenna and tune the radio to a quiet spot between 1000 and 1600 kc. Then adjust T3's slug with the special alignment tool specified in the Parts List until you pick up the signal in the radio. You'll know the carrier's there by a sudden quieting of the radio.

Next, set S1 to *off*, turn the transceiver on and tune in an active channel. Turn the transceiver's volume way down and then turn S1 *on*. Slowly advance the transceiver's volume until M1 indicates 100 per cent modulation on speech *peaks*. If all is well you will hear the CB signal from the radio with very little distortion. If the sound is distorted move the radio away from the Pager's antenna.

Since the transceiver's output during normal listening is several times that required to modulate the Pager, both Q1 and M1 could be damaged if the Pager is left *on* during normal transceiver operation. Always make certain S1 is set to *off* before you turn up the transceiver's volume.

The level of the signal to the Pager should be adjusted on a moderate-level signal from the CB rig. If adjusted on a strong signal the weak signals hardly will be heard. If adjusted on a weak signal, a strong signal will cause overload and distortion.

BEGINNER'S CORNER

THE NIMBLE NEON

IT can cost as little as a thin dime, yet the neon lamp is one of the most sophisticated and useful parts you can buy for the money. It can be used to indicate, oscillate and regulate, to name just three applications. Let's see how this versatile lamp works then build an audio oscillator with one.

Look at Fig. 1. When the voltage on the electrodes is zero, a few electrons and positive ions are drifting around inside the lamp. They come from the neon gas which is always partly ionized (when an atom loses an electron it becomes an ion) by energy absorbed from outside light, cosmic rays or a radioactive substance put in the lamp during manufacture.

When we increase the voltage, to say, 10 V, as in Fig. 2, the positive ions and the electrons are attracted to the negative and positive electrodes, respectively. A small current flow starts. The current is in microamperes and usually is ignored.

Increase the voltage, as in Fig. 3, and electrons are accelerated with such force that they collide with other neon atoms. The collisions liberate additional electrons which in turn, further increase activity. The avalanche effect causes huge numbers of electrons and ions to form. Current suddenly soars and the lamp lights. This voltage is the lamp's *firing*, or breakdown, voltage. The ionized neon gas glows around the negative electrode.

Electrode spacing and gas pressure affect firing voltage, which typically is from 55 to 150 V, depending on the lamp. An NE-51, for example, fires at approximately 64 VDC. An NE-96 fires at about 150 VDC.

An important component in a neon circuit is a series resistor (Fig. 5A). Since neon lamps can conduct far more current than they can handle safely, the resistor is used to prevent lamp burn-out. In the case of an NE-2, the manufacturer recommends a 150,000-ohm resistor to limit the lamp's current to 0.5 ma.

If you lower the lamp's voltage it won't go off when voltage falls just below the firing point. There's a voltage range over which the lamp continues to maintain its fully ionized condition. The voltage must be lowered to the

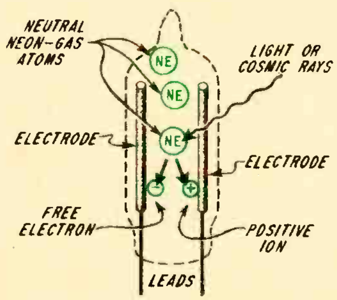


Fig. 1—Basically, a neon glow lamp is two electrodes in a glass envelope from which air has been removed and neon gas inserted. The lamp above is about twice the size of an NE-2. Assume no voltage is applied. Neon-gas atoms absorb energy from light and cosmic rays. This causes ionization of the gas—splitting of atoms into electrons and positive ions. Those lamps that are to be operated in the dark have a radioactive substance added to them to produce partial ionization.

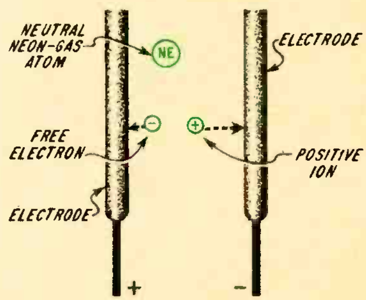


Fig. 2—Next thing we'll do is to apply a low DC voltage (say 10 V) to the electrodes. The result of this is that the electrode connected to the positive voltage source attracts free electrons. The electrode that is connected to the negative voltage source will attract the positive ions. A small current—measured in microamperes—starts to flow through the lamp and the external circuit. The current will continue to flow so long as gas is ionized. The lamp doesn't glow yet.

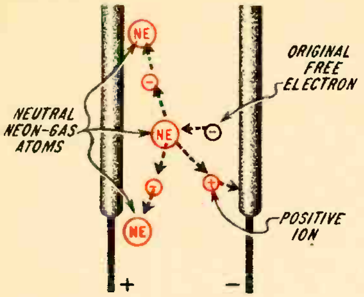


Fig. 3—We next raise the voltage on the electrodes. At what is called the firing voltage, the free electrons are accelerated and produce an avalanche effect. They strike the neutral gas atoms, causing more electrons to be released and accelerated. For each collision, a neon atom liberates two electrons and one positive ion. The positive ions are attracted to the negative electrode and electrons are attracted to the positive electrode. At this voltage (65 V for an NE-2), the lamp glows.

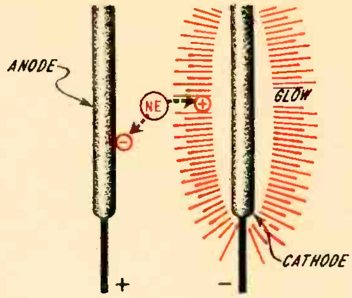


Fig. 4—Once the firing potential of the lamp has been reached, the lamp glows around the electrode connected to the negative side of the supply voltage. And the glowing electrode is considered the cathode of the lamp. Of course, if the applied voltage is AC both electrodes will glow because of the changing polarity. In larger lamps, the electrodes usually are a different shape. For example, in the NE-40 they're semicircular and together they have a diameter of about an inch.

THE NIMBLE NEON

extinguishing voltage. The NE-51 (64 V firing voltage) will not flick off until the voltage falls below 56 V. Reason for this is that the lamp requires a higher voltage to produce collisions and avalanche than to keep the gas in a continuously ionized state.

Several things affect neon-lamp performance; aging is one. New lamps may fire above or below rated voltage during the first 100 hours of operation. A quick way to age a lamp is to operate it at twice its rated current for 24 hours, followed by 24-hour operation in the circuit for which it is to be used.

A factor to be wary of is dark effect. Neon lamps usually need room light to start. Their operation, in fact, may become erratic if they're operated in the dark. A higher voltage might even be required to fire the lamp in the dark.

Here are some practical neon-lamp applications:

- Pilot Lamp. Add a power indicator to equipment by connecting the lamp and series resistor across a power transformer's primary.
- AC or DC? Only the negative electrode of the neon lamp lights when the voltage source is DC. Both electrodes glow on AC.
- Shock Hazard. The chassis of an AC/DC radio could be dangerous when removed for servicing. Touch one lamp lead to the chassis and grasp the other. If the bulb lights, reverse the wall plug.
- RF Indicator. Neon lamps glow in strong RF fields. Held near an antenna lead, the lamp will glow in the presence of RF. In a tube CB rig an NE-2, connected in series with a 1-megohm resistor from the plate of the final RF amplifier tube to ground, becomes an RF-output indicator.
- Strobe. To check speed of a record player, illuminate a strobe card on the turntable with a neon operated on 60-cps house

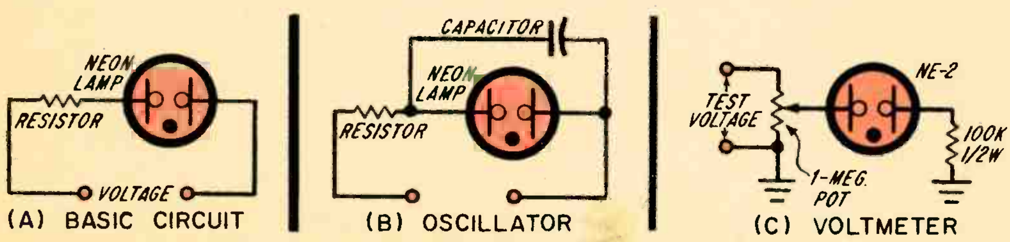
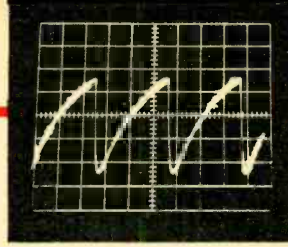


Fig. 5—Basic neon circuit (A) is lamp and resistor in series. In sawtooth oscillator (B), capacitor charges at rate determined by value of resistor. When capacitor's voltage reaches neon's firing voltage, lamp lights and discharges capacitor. Calibrate pot's scale (C) and you have a circuit that measures voltage.



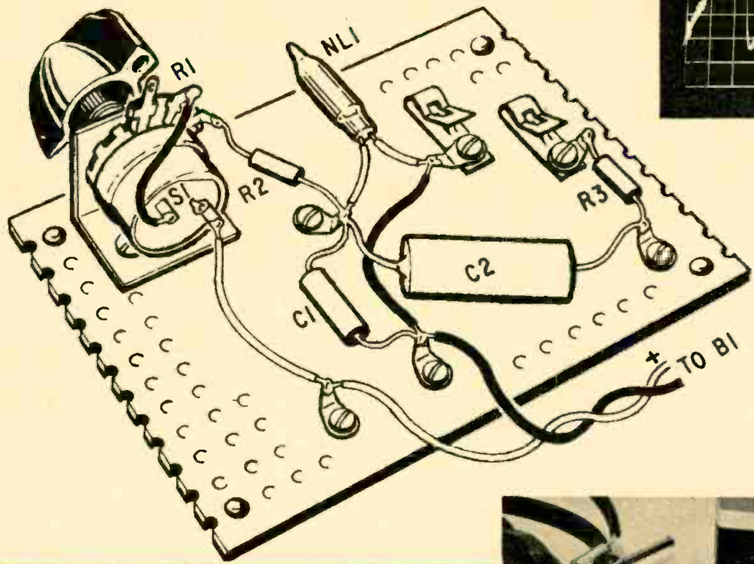


Fig. 6—Photo at upper right is of sawtooth waveform produced by oscillator. Pictorial above shows parts layout of oscillator. Board is 3½ x 5 in.

PARTS LIST

B1—90 V battery (RCA VS090 or equiv.)
C1—.005 μf, 600 V tubular capacitor
C2—.1 μf, 400 V tubular capacitor
NL1—NE-2 neon lamp
R1—500,000 ohm, audio taper potentiometer
R2—150,000 ohm, ½ watt, 10% resistor
R3—470,000 ohm, ½ watt, 10% resistor
S1—SPST switch on R1
Misc.—perforated circuit board, flea clips, fahnestock clips (2), NE-23 neon lamp (Allied 7 U 950), NE-40 neon lamp (Lafayette 32 R 6678)

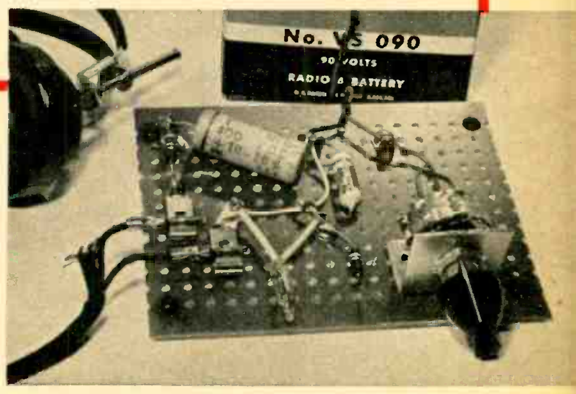


Fig. 8—Photo of our breadboarded audio oscillator. Build oscillator this way and you'll be able to change parts easily to experiment with circuit.

current. The lamp appears to glow continuously but actually it is flashing rapidly. If the speed is correct, the flashing light will cause the marks to appear to stand still.

● Simple Voltmeter. The circuit in Fig. 5C indicates DC or peak AC voltage—but with

[*Continued on page* 116]

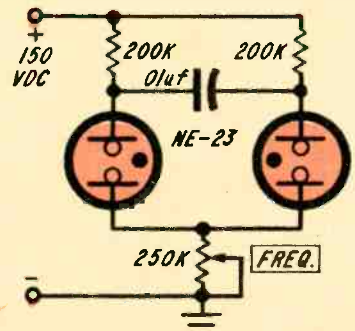


Fig. 7—Experimental multivibrator circuit using two NE-23 neon lamps. Take outputs from the lamp leads that are connected to the resistors.

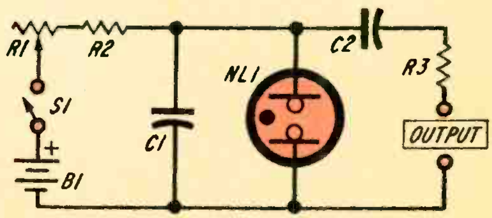


Fig. 9—Neon oscillator. Close S1 and voltage across C1 and NL1 increases at rate determined by R1,R2. C1 is discharged by NL1 when NL1 fires.

Notes from EI's DX CLUB

FROM Ronald E. Maples, K4DWU, comes word that he is planning a DXpedition to Navassa this year. Big question is whether he will be allowed to do so since the U.S. Coast Guard has permitted no one on this island (off the eastern tip of Cuba) in the past few years. Come next year, K4DWU has hopes for still another DXpedition, this one to Pitcairn Is. Interesting point is that there already is an active ham on Pitcairn—VR6TC, whom Marty Hartstein, WB6NWW, recently worked on 15 meters.

William Sparks (California) reports that the Burma Broadcasting System can be heard along the West Coast on 5040 kc with English programing at 0630-0800 PST. But sharp ears are required to pull this one out of the summer static.

Speaking of static, don't let the QRN keep you away from 60 meters for it continues to be a vital DX band. And if you haven't QSLed Honduras yet, try for the new missionary station, HRVC, on 4820 kc until 2230 EST sign-off. Station operates with 5 kw and has some English programing.

K.G. Scrimgeour (California) has logged R. Republik Indonesia's regional transmitter at Ambon. Station operates on 7140 kc, has strong signals as early as 0500 EST and can be identified readily by the sound of a clock striking and chimes on the hour.

Bob LaRose (New York) has bagged a rarely reported Peruvian, R. Sideral's 31-meter transmitter on approximately 9750 kc. Station is located in Pucallpa and is heard best evenings; Shangri-la is played during IDs. Off-band Peruvians also are popping up continually. Latest is OAX6U, R. Universidad, at Arequipa, which is found on 6235 kc at 2200 PST.

Will Cuban hams work Americans? Answer is yes, at least so far as CO8RA is concerned. J. Hartley Bowen III, WB2MNM, recently QSOed this island veteran who has been on the bands since 1935.

Irwin Belofsky (staff member of WRUL, R. New York World Wide) sends news that the FCC has granted WRUL a construction permit for its new transmitter site at Chatsworth, N.J. Installation will include two 250-kw, one 10-kw and two 100-kw transmitters plus the latest in curtain and rhombic antennas.

Anyone looking to log Mozambique the easy way should try for R. Clube de Mozambique's commercial service on 11780 kc around 2315 EST. This one is in English and Afrikaans (South African Dutch).

Propagation: Toward the middle of August formation of sporadic-E clouds in the ionosphere will begin to decrease. And since these clouds are responsible for short-skip openings in the FM, TV, 10-meter amateur and 11-meter CB bands, short-skip openings on these bands will have all but ended by the time September rolls around.

With the decrease in seasonal noise levels brought about by summer thunderstorm activity in the northern hemisphere, the broadcast band will begin to liven up. This means that BCB DX steadily will improve from late August or early September right on into the winter months.

Conditions in the short-wave bands also will continue to improve due to the increase in sun-spot activity. During daylight hours the 20-mc band will be good to fair and 15- and 17-mc will be good. There even is the possibility that normal ionospheric openings in the 10-meter amateur and the 11-meter CB band will occur toward the latter part of the forecast period.

At night, 6, 7, 9 and 11 mc will be open from various parts of the world.

7 Steps TO BETTER TAPES

By REID ETTA THERE she sits in a sealed carton. You tear away the cover, toss the instruction manual to one side, fight ten minutes to work your way through a mounatin of plastic foam. Finally—*your spanking-new tape recorder!*

Quickly now, and she's on the table. Ogles from adults and shrieks from children. And suddenly it hits you. The only thing sitting on top of the machine is an empty take-up reel (if you were lucky enough to get one with the recorder). And, unfortunately, no one yet has figured out how to record on thin air.

In order to capture those golden sounds forever, you obviously will need *recording tape*. But what kind? There are more varieties and prices of tape on the market than flies in a fruit market. Basically, however, we can reduce everything to two types: name-brand tape and white-box tape (which usually sells for several bucks less than the name-brand stuff). Since you know at least three tape buffs who swear by white-box tape, you naturally will be inclined to join the save-a-buck brigade. But will you really save? Or will you foul your recording heads and capstan, suffer through dropouts during your favorite symphony and make a mess out of a routine editing job?

Assuming reasonably good electronics (which most recorders have), the tape itself determines the final results of your recording efforts. And for recordings of highest fidelity the tape must be free from surface irregularities, which can cause signal drop-out. It must be free of oxide clumps, which cause excessive head wear (with resultant loss of high-frequency response). It must have oxide bound tightly to the base to avoid excess flake-off to foul the heads and capstan, resulting in uneven drive speed and microscopic tape lift-off from the heads. It must display practically no variation in recorded level from beginning to end of a reel so sections can be spliced together without noticeable changes in playback level. And it must have frequency and distortion characteristics which enable your recorder to deliver on its maximum capabilities.

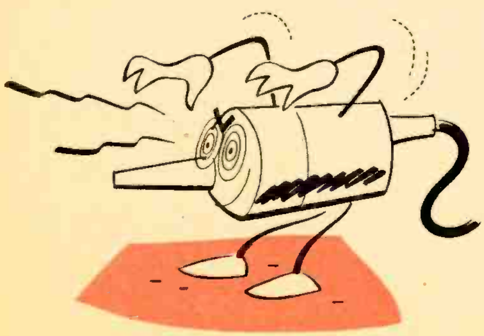
Sound like tough specifications? They are. And while you could start with white-box tape, as a general rule it simply isn't suited to quality music recordings. White-box tape, among other things, can be cut-down new or used computer tape; second-quality tape, i.e., tape which plain couldn't meet manufacturer's standards; or it even might be used tape. Or it could be cheaply-made tape with poor oxide adhesive and a surface like sandpaper. All things considered, tape by reputable manufacturers—Audio Devices, Kodak, 3-M, RCA and others—always is to be preferred for serious recording.

7 Steps to better tapes

Then there's the question of the material itself. Total recording time depends on the size of the reel and the thickness of the tape. Standard tape, such as Scotch 111, is 1.5-mil acetate. This means the base is made of acetate and the base plus oxide coating is 1½ thousandths (.0015) of an inch thick. Though such tape is suitable for average use, acetate deteriorates with age—and if permanence is important the somewhat more expensive heat- and humidity-resistant Mylar-base tape is a wiser choice.

When a standard reel offers insufficient recording time extended-play tape should be considered. For use of a thinner base means more tape can be wound on a given size reel. Extended-play tape can be purchased in both the +50% and +100% sizes, though the +100% tape is extremely thin and comparatively easily stretched or broken.

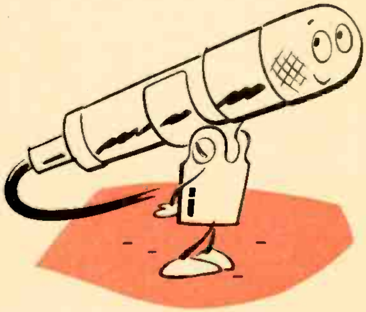
Having selected your tape, you slap a reel on the machine and away you go. The tape inventory builds and builds: Aunt Mini singing at sister's birthday party (not to mention Uncle Harold's tired sweet-sixteen jokes), 50 mi. of music off the tuner, three weeks' salary in prerecorded tapes. And then it happens. First the tapes seem to have a funny hiss. Later, the hiss grows louder and is anything but funny, no matter how defined. Head magnetization has struck again.



Except on those machines with built-in demagnetization, sharp-impulse overloads can (and do) magnetize the recording head, just as contact with a magnetized tool can magnetize a record or playback head. When tape passes over a magnetized head a hiss is superimposed, much as though you passed the tape over a weak magnet. Another symptom of a magnetized head is partial erasure of prerecorded high frequencies (this is what takes the sparkle out of prerecorded commercial tapes).

To avoid the magnetization problem, simply use a *head demagnetizer,* such as the Robbins HD-6, at periodic intervals—say once a week if the recorder gets moderate service. It takes just a second or so to hold a demagnetizer against a head but those few seconds can mean the difference between noise-full and noise-free listening.

Okay, you now are all set for the best in recording—or are you? If yours is a professional or semi-pro machine, there's good chance you didn't get a *microphone.* Then again, even if you did get a mike, chances



are your live recordings have nowhere near the fidelity you get from a tuner or from prerecorded tape. Microphones supplied with most recorders often are just fancy-cased versions of the cheapie models that come with budget recorders. And all leave a lot to be desired in the way of fidelity and convenience.

Quality recordings require quality microphones but you don't have necessarily to go for broke. Good mikes start at about $30, going up the ladder to $150 for broadcast quality. If you want to keep costs down, by all means consider the Electro-Voice 636 and the Shure 550S. Both exhibit a notably smooth quality that enhances the sound from budget recorders. A little better quality for medium-price recorders can be found in the AKG line, the Norelco D119ES, the Shure 556S and the Electro-Voice 676. And if you want your tapes to sound like a good-music station try a broadcast mike such as the Electro-Voice 666.

While you're concentrating on putting the highest of fi on tape, don't overlook dynamic range—the variations in speech and music levels. Sure, recorders are equipped with some sort of volume indicator: a flashing lamp or magic eye or a VU meter. But such devices give an accurate indication of recorded level only when feeding from one sound source. They tell you next to nothing when you're trying to blend such sources as tuner or phono with a mike or several mikes.

For optimum sound balance it's best to monitor while recording. Matter of fact, it's the only way to obtain precise balance. And while nearly all recorders provide for monitoring when recording from a tuner, phono or another tape recorder, silence descends when you use mikes (unless you're in the mood for the squeals of acoustic feedback). So your next step is to *monitoring headphones.*

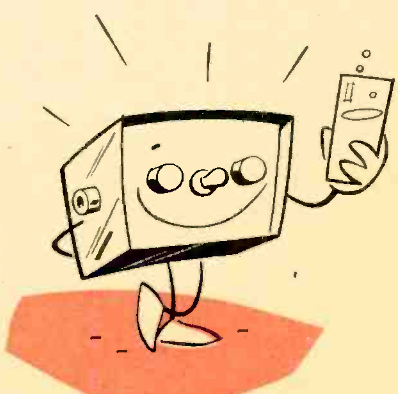
Inexpensive headphones, such as used for experimenter projects or ham radio, usually are unsuitable since their high distortion and poor low-frequency response do not give an accurate representation of what's being fed into the recorder. Just as you would use hi-fi phones, such as those made by Koss, Norelco and Telex (among others), with your amplifier, so you must use hi-fi phones with your recorder.

Thing to avoid is the impedance pitfall since this can have dire effects on any recording. Usually a recorder's headphone jack is in the speaker circuit and any of the low-impedance phones can be used. But it's just possible that your recorder's headphone jack is in a high-impedance circuit and that the loading caused by low-impedance phones, therefore, would alter the recorder's frequency response. When high-impedance phones are called for, use the crystal type, such as the Clevite-Brush BA-200B, which have a 90,000-ohm impedance. (If you're in doubt whether to use low- or high-impedance phones, best check with your dealer or manufacturer.)

Speaking of several sound sources, the average recorder, even if it sports both high- and low-level inputs, has but one volume control and only one sound source can be controlled at a given time. While some of the higher-price recorders have so-called mixing controls, usually only the mike and a high-level input, such as a tuner, can be mixed.

Yet best recordings of musical groups are made when several mikes are used to balance individual instruments or sections. While you sometimes can connect several mikes in parallel you still have only one volume control. For multiple mike setups or even for multiple high-level sound sources (tape recorder and amplified turntable, for example), a *mixer* —a device that accommodates several sound sources each with its own volume control—is required.

Two types are available to the hobbyist. The first is the passive mixer, such as Lafayette's audio mixer, which is nothing more than a small metal cabinet with two input jacks, two volume controls and an output plug to match the recorder's input jack. The

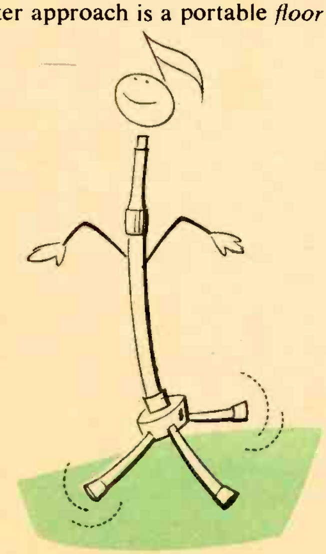


passive mixer will mix any two high-impedance sources into a single high-impedance input with individual control of each source. Most passive mixers have a slight loss in gain, however (generally on the order of 6 to 9db), and the Lafayette is no exception.

More flexible mixing can be obtained with an amplified mixer, which accommodates up to four inputs, either high- or low-level. A tube model such as the Bogen MX-6A provides nearly 60db mike gain. This means that even if you're mixing mikes, the mixer output can be connected to the recorder's high-level input, bypassing the noise of the recorder's mike preamplifier. If you want to save a buck there are the small transistor mixers (such as Lafayette's 99 R 4535) which mix four mike inputs and provide a small overall gain.

And while you're mixing the sounds of that musical aggregation, you may wish to consider what best to do with the mike(s). Most recorder mikes, if supplied with a stand at all, have an inexpensive metal arrangement that just about keeps the mike from falling over when placed on a table. And the table stands supplied for some of the more costly mikes are no better. To record a musical or even a dramatic performer it often is necessary to prop a stack of books on a chair, stick the mike(s) on top of the tower and then trust someone doesn't upset the applecart by knocking down your house of cards.

A better approach is a portable *floor stand* like the pros use, a good example being the Atlas CS-33 Take-Apart Floor Stand. The CS-33 has removable legs which form a rigid triangular brace, yet it folds up small enough to be hidden away in a closet. When open, the three legs cover a wide base so, though light in weight, you can stick your best mike on it without fear of it being knocked over.

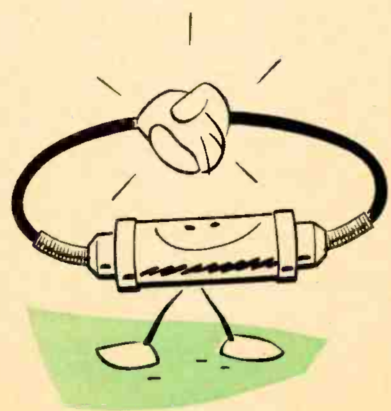


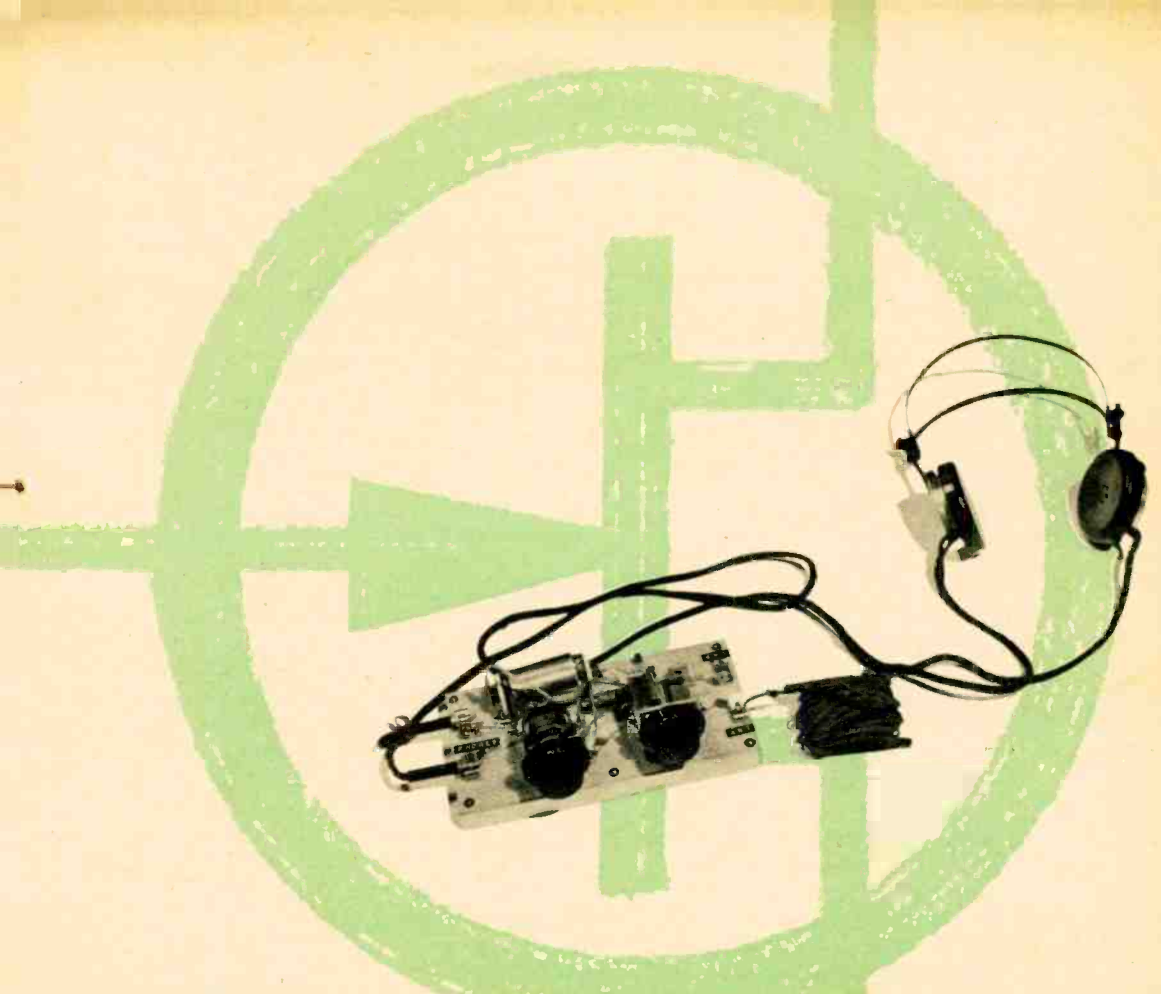
Though taping now should be as easy as listening there still is one giant step that can lead to the best in tape recording. That step—like the six that preceded it—is a step up, of course, this time to a microphone *matching transformer*.

Nearly all home recorders use high-impedance mikes and high-impedance mike inputs. While this arrangement is perfectly suitable for mike cable lengths up to 25 ft., beyond that the internal capacity of shielded mike cable attenuates the high frequencies. Further, the high-impedance cable itself is sensitive to hum pickup.

When long mike leads are needed, as they are when recording a high-school band or similar ensemble, it's best to use a low-impedance microphone rated at 50, 150 or 250 ohms. Impedances of this order permit cable lengths up to several hundred feet. Further, when the line finally reaches the recorder's high-impedance input all that's needed is a transformer, such as the Electro-Voice 502A, to match the low-impedance line to the high-impedance input.

Conversely, the matching transformer can be used to convert a high-impedance mike to a low-impedance output. One also is needed when you choose to use a low-impedance broadcast-type mike with your high-impedance recorder.





build a
1-FET Radio!

By
CHARLES
GREEN
W3IKH

THE term *solid-state* really is In nowadays. If electronic equipment isn't all-transistor it just ain't Boss. But, great as transistors are, they have shortcomings—one of which is low input impedance. In many applications this is of no consequence. But when it comes to tuned circuits (L-C) it creates problems.

A tuned circuit, of course, can be tapped down to match the input impedance of a transistor—but there's another rub. Since a transistor may draw current from a tuned circuit, the Q (selectivity) and the gain of the circuit will be lowered.

Enter a different and relatively new device called a field-effect transistor (FET). It has an extremely-high input impedance, on the order of megohms. Matter of fact, in many respects the FET and its circuit resemble a tube circuit. FETs operate at low voltages like conventional

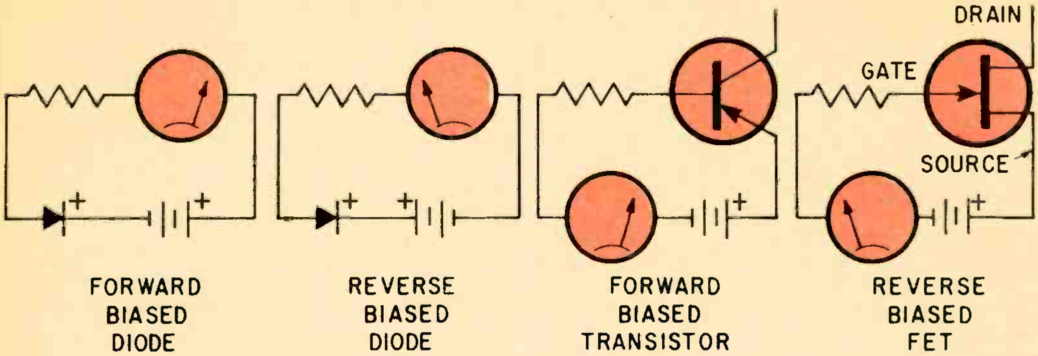
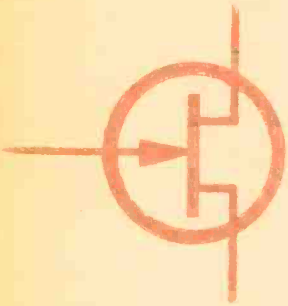


Fig. 1—Heavy current flows in forward-biased diode, meaning circuit resistance is low. Reverse-biased diode current is low so circuit resistance is high. Large current in transistor's forward-biased emitter-base junction means low impedance. Reverse-biased gate-source junction of FET means high input impedance.



transistors, don't load down circuits, and their internal noise is much lower than that of a conventional transistor.

A good way to become familiar with the high-input-impedance characteristics of the FET is with our FET regen radio. Its performance and operation are practically identical to those of a tube regen radio. The circuit uses only one FET, covers the broadcast band and produces good headphone volume. We breadboarded our radio but you could build it in any way you want.

But before we get to the radio itself, let's talk about the FET to see how it works and why its input impedance is so much higher than that of a conventional (bipolar) transistor.

How The FET Works. Take a look at Fig. 2, a pictorial representation of an FET and a basic circuit. The FET consists of a bar of N-type silicon (an impurity has been added to give it free electrons). At the ends of the bar are contacts. Because it supplies electrons, the contact at one end is called the *source*. It is analogous to a conventional transistor's emitter and a tube's cathode.

Because it collects electrons from the source, the contact at the other end of the bar is called the *drain*. It is analogous to a conventional transistor's collector and a tube's plate.

On the top and bottom of the bar at the center are pieces of P-type silicon which form PN junctions with the bar. The junctions are like the base-emitter and base-collector junctions in a conventional transistor. The P-type pieces of silicon form what is called a *gate*. The gate controls the flow of electrons from the source to the drain and is analogous to the base in a conventional transistor and the grid in a tube.

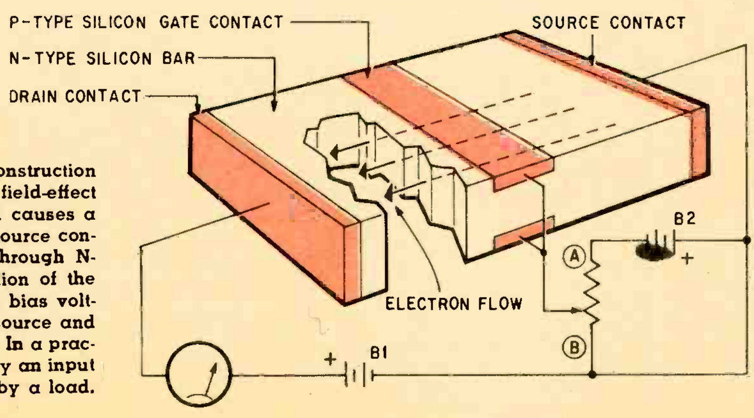


Fig. 2—Diagram shows construction of an N-channel junction field-effect transistor (JFET). Battery B1 causes a flow of electrons from the source contact to the drain contact through N-type silicon bar. The function of the potentiometer is to apply a bias voltage from B2 between the source and gate to control current flow. In a practical circuit B2 is replaced by an input signal and B1 is replaced by a load.

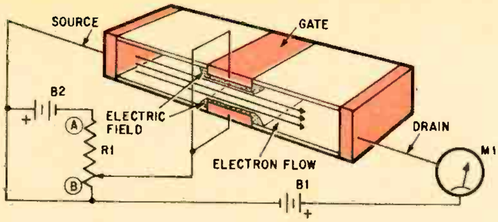


Fig. 3—A small negative voltage from B2 applied to gate causes electric field (gray dots) to narrow the channel through which the electrons flow.

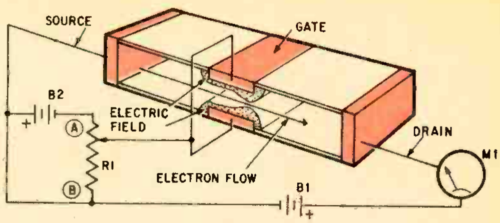


Fig. 4—A large negative voltage from B2 applied to gate increases size of electric field. Field narrows channel, further reducing electron flow.

Assume that the potentiometer's wiper is at *B* as shown in Fig. 2. The gate now is connected to the positive end of B2 and is at the same potential as the source. The gate in this situation does nothing and the bar appears simply as a resistance between source and drain. Because of the way B1 is connected and since the whole bar acts as a resistor, any point along the bar is more positive than another point closer to the source.

Electrons supplied to the source by the negative terminal of B1 flow through the bar to the drain, which is connected to B1's positive terminal. The current magnitude depends on the dimensions of the bar and the amount of impurity in it.

If the potentiometer's wiper is moved toward *A* the gate becomes negative with respect to the source. Therefore, the PN junction between the gate and the bar is reverse-biased (gate, P-type material, negative; bar, N-type material, positive).

To see illustrations of forward and reverse bias, look at Fig. 1. The diode at the left is forward-biased because its P-type silicon anode is positive with respect to its N-type-silicon cathode. The second diode from the left in Fig. 1 is reverse-biased because its anode is negative and its cathode is positive. In other words, for a solid-state diode to be forward-biased, the P-type semiconductor material always must be positive with respect to N-type semiconductor material.

(We're leading up to the reason why the FET has a high input impedance.) When a diode is reverse-biased, only a small leakage current flows in the circuit. All things being equal, when there's little current in a circuit it means the circuit resistance is high. When the diode is forward-biased, current flow is high. All things again being equal, this means circuit resistance is low.

Because the base-emitter circuit always is forward-biased in a conventional transistor, a large current flows. This is why the input

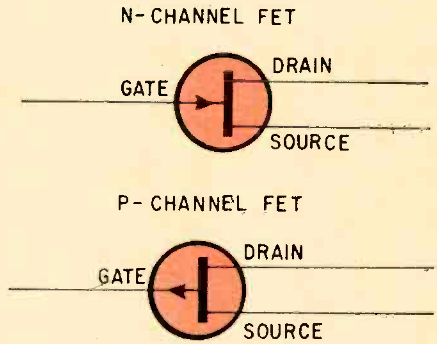


Fig. 5—Standard symbols for FETs. Arrow points toward vertical bar in N-channel FET. Arrow points away from vertical bar in a P-channel FET.

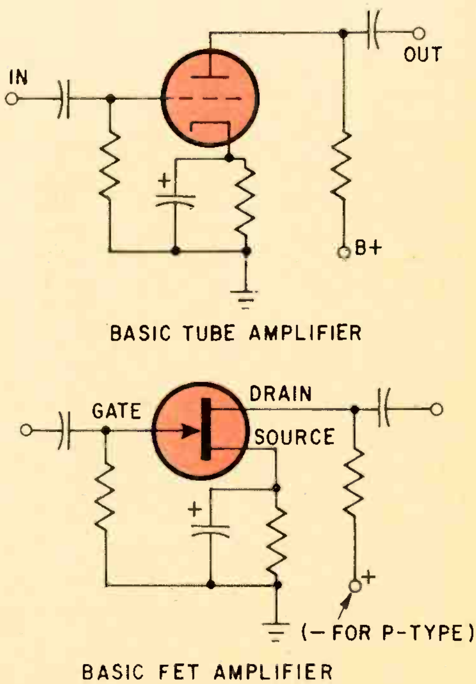


Fig. 6—Notice the similarity of a triode's and an N-channel FET's basic circuit. The drain and source can be interchanged in an FET's circuit.

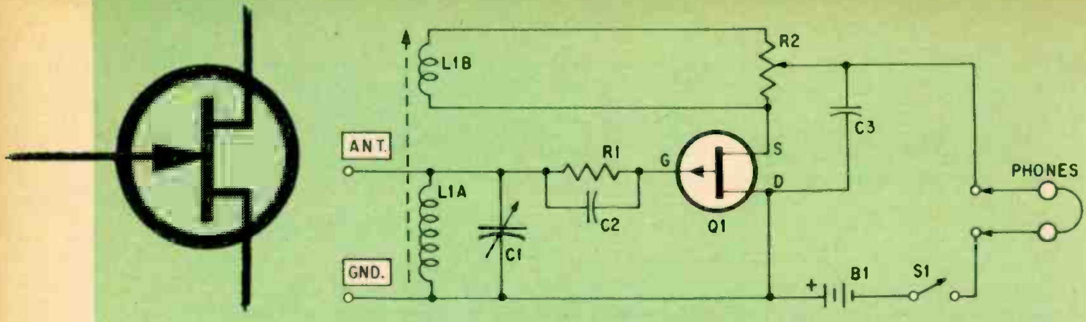


Fig. 7—Schematic of FET regen broadcast radio. Detector is a gate-leak (analogous to grid-leak) detector. To increase the receiver's sensitivity, the circuit is made regenerative by feeding some of signal back to gate via L1B.

impedance of a conventional transistor is low.

Since the source-gate junction of an N-channel FET is *always* reverse-biased (source positive, gate negative) as in Figs. 1 and 2, the current in this junction (or the input circuit) is low. Therefore, the resistance of the input circuit must be high.

How The FET Amplifies. We must be able to control a flow of electrons in order to amplify. Take a look at Fig. 3 and recall what we said about the silicon bar acting as a resistance. When the potentiometer's wiper arm is just above *B* electrons from B2's negative terminal appear at the gate. These electrons diffuse into the bar and their concentration is greater at the right side of the gate. Reason for this is that the bar gets progressively more positive as you go from source to drain. Therefore, more electrons are pulled into the bar at the more-positive right side of the gate.

These free electrons form an electric field (hence the term *field effect*) or a space-charge region. This region narrows the bar's channel through which the electrons pass when going from source to drain. The greater the negative voltage on the gate, the narrower the channel and the fewer the electrons that can pass.

When the potentiometer's wiper is moved nearer to *A*, as in Fig. 4, more electrons build up around the gate. This causes the space-charge region to increase in size and further limit the number of electrons going from source to drain. When the potentiometer's wiper is moved all the way to *A* we reach what is termed the pinch-off voltage and the channel in the bar is sealed. Electrons no longer can get to the drain.

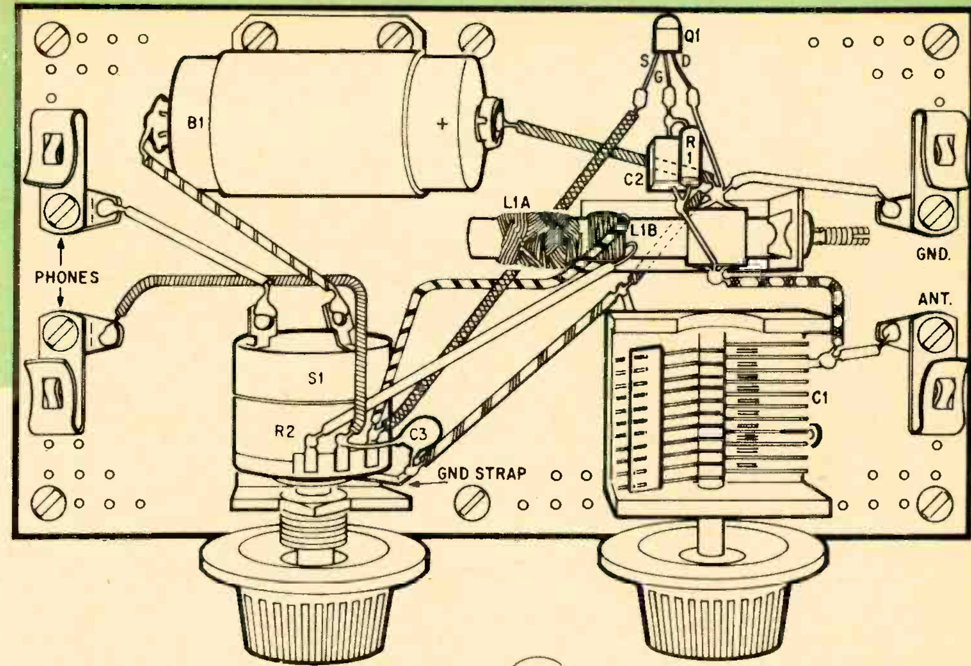
Now we have amplification since we can use a small voltage in the source-gate circuit to control a large current in the source-drain circuit. Install a load instead of a meter, replace B2 with an input signal, and we have a practical amplifying device.

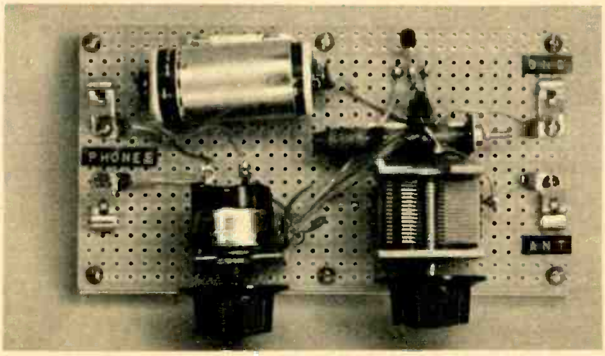
PARTS LIST

B1—12 V battery (Burgess PM8 or equiv.)
C1—10-365 $\mu\mu$f variable capacitor (Lafayette 32 R 1103 or equiv.)
C2—220 $\mu\mu$f, 500 V silvered mica or ceramic disc capacitor
C3—500$\mu\mu$f, 1,000 V ceramic disc capacitor
L1A—Ferrite antenna coil (Q approx. 250. J.W. Miller No. 6300. Lafayette 34 R 8705)
L1B—25 turns No. 28 enameled wire wound over L1A (see text)
Q1—2N3820 FET (Texas Instruments. Allied, $3.75 plus postage. Not listed in catalog)
R1—2.2 megohm, ½ watt, 10% resistor
R2—10,000 ohm, linear taper potentiometer with SPST switch
S1—SPST switch
Misc.—Perforated board, fahnestock clips, battery clips, knobs, flea clips, antenna wire, No. 28 enameled wire

FETs are available as either N or P types—just like NPN and PNP transistors. In the N-type FET, a positive voltage is connected to the drain and the gate is negatively biased—exactly like a tube. The gate is positively biased in P-type FETs and a negative voltage is connected to the drain. Both types have a high input impedance and differ only in the type of semiconductor material used.

How The Radio Works. Refer to Fig. 7. Signals from the antenna are tuned by L1A/C1 and fed through gate-leak resistor R1 to the FET's gate. By the way, notice the values of R1 and C2. (2.2 megohms and 220 $\mu\mu$f, respectively). They're about the same as they'd be in a tube receiver. This is because of the FET's high input impedance. The signals are detected in the source-gate circuit (which acts as a diode). The signal is fed to tickler coil L1B in the drain circuit and inductively coupled to L1A, then back to the gate circuit where it is amplified further. Regeneration is controlled by R2.





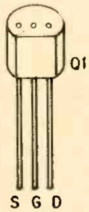


Fig. 9—Diagram above shows layout of radio on 3¾ x 6¾-in. perforated board. Because flea clips protrude from board's rear, put blocks of wood under board's edges. Use the diagram at left to identify FET's leads.

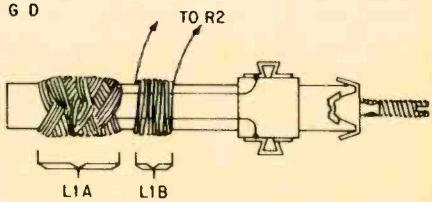


Fig. 8—Our radio was breadboarded on piece of perforated board to make it easy to experiment with circuit. Receiver can be put in small box.

Fig. 10—Feedback winding L1B is wound on form slightly to the right of existing winding. It is 25 scramble-wound turns of No. 28 enameled wire.

Construction. Details about building the receiver are covered in the captions for Figs. 8 and 9. Coil L1 is mounted with the bracket supplied with it. Before installing L1, scatter-wind 25 turns of No. 28 enameled wire around the form as shown in Fig. 10. Wind the wire in the same direction as the original winding.

Operation. In good locations, a 25-ft. indoor antenna is all you'll need. In weak-signal areas, a ground and outside antenna are required. For long antennas, you may have to insert a small capacitor in series with the antenna and the receiver. The value should be determined experimentally. Use phones of at least 2,000 ohms impedance. Crystal headphones can be used but you must connect a 2,000-ohm, ½-watt resistor across the headphone connectors.

Tune C1 for a station while simultaneously adjusting R2 until you hear a whistle (oscillation). Back off R2 until the whistle disappears and you hear the station. C1 then may have to be readjusted.

If you don't hear a whistle reverse L1B's connections and try again. Since the characteristics of FETs vary (as in conventional transistors), the number of turns for L1B may have to be increased or decreased for proper regeneration.

WANT AN OVERSEAS JOB

SAY YOU'RE as eager to travel as a hound with his tail on fire. Say you're ready to go anywhere from Barcelona to Baghdad at the drop of a passport. Thing is, you're short on the two essentials for leisurely foreign prowling: lots of free time and a bank roll big enough to split a kangaroo's pocket. Still, there is a way you can circle the globe and with plenty of style while you're at it. The ticket is a job that takes you places.

Scores of U.S. companies send men abroad each year to install and maintain electronic equipment in Europe, Africa, South America, Asia, the Arctic and Antarctica. For example, Bendix Field Engineering Corp. has a 50-man team at Tananarive, Malagasy, operating and maintaining a deep-space tracking station and other groups of electronics experts in the Canary Islands, Madrid, Mexico. Philco TechRep has 30 men in Wiesbaden, W. Germany, installing communications and radar stations for the Air Force. More than 75 TechReps are in S. Vietnam, others in Guantanamo and on shipboard in the Mediterranean. Upwards of 100 are scattered through 19 sites in the Alaskan Air Command's AN/FYQ-9 radar track data processing and display system (the men helped build it, now are operating it).

Other electronics experts working for U.S. companies are scattered over the globe. George Green works on the Atlantic missile range; Mike Shohat keeps Air Force electronics equipment in top shape at Hickam Air Force Base in Hawaii and elsewhere; Bob Kennedye recently helped put in a communications network for the Air Force in Panama; Jim Tosti spends part of his time aboard ships in the Atlantic during space shots, helping a Navy team keep in touch with globe-circling astronauts.

All these men are civilians, hired by U.S. companies with installation, maintenance and operations contracts abroad. But they're not the only globe-trotting technicians. The U.S. Government sends additional thousands of civilian employees to foreign posts each year. The Federal Aviation Agency, for example, installs and maintains navigation and communications equipment at stra-

tegic spots around the globe and helps underdeveloped countries enter the air age by setting up electronic networks.

Similarly, the Weather Bureau operates a world-wide weather-reporting system, just as the U.S. Information Agency plants powerful transmitting stations around the world to broadcast Voice of America programs. And the military services—Army, Navy and Air Force—hire thousands of civilian technical experts, both technicians and engineers, to help keep various communications, radar, computer, missile-control and other electronic installations in top operating condition.

If you can wield a voltmeter and a soldering iron well enough to qualify for one of these exciting jobs there's almost no place on earth you can't go—expenses paid—and make good money in the process.

Even if you aren't interested in travel for its own sake, there's another reason you might want an overseas job. Both private companies and government agencies operate electronic outposts in

IN ELECTRONICS?

By J. K. LOCKE

places hard to love for themselves alone: the steamy, insect-infested jungles of Southeast Asia; the bleak, sub-zero Greenland icecap. But they've discovered that large amounts of a mysterious substance called money can make technicians eager to go even where camels fear to tread. As an added enticement, they usually furnish everything a man needs in these remote outposts—food, room, ice cream, Ping-pong (well, almost everything!).

Since there are no expenses, a technician on such a job frequently can squirrel away as much as $1,000 a month. When he finishes his tour in a year of two he's got a man-size stack of cash to start a business, buy a house, go to college or invest in wine, women and song.

What does it take to land an overseas job in electronics? Answer: same thing it does in the States—know-how and experience. But you don't have to be a Ph.D. Listen to E. L. Walker, Director of Operations for Philco TechRep, which has contracts with the military to maintain electronic hardware around the world: "Right now, the bulk of our overseas effort is in advanced systems: scat-

WANT AN OVERSEAS JOB IN ELECTRONICS?

ter communications, telemetry, the more sophisticated radar. Experience in these fields is what we're looking for. Our educational requirements aren't too stiff, though. If a man has experience and can do the job, we don't require a lot of schooling."

"We want people with radio and computer experience," says J. P. Thatcher, an employment manager with the RCA Service Co., which hires technicians to work on Ballistic Missile Early Warning System (BMEWS) stations in Greenland and Alaska. "We also want experience in heavy ground tracking or search radar. The technician we hire would usually have had some schooling, too. He could have gone to one of the service schools, such as the Navy school at Treasure Island, or a good civilian technical school. What really counts is the experience he's gathered since."

To get a job with any government agency or as a civilian technician with the armed forces, you'll need Civil Service status. If you're in a large city there may be a Civil Service office listed in the phone book under U.S. Government. Call to see how you can qualify. (You won't have to take an exam; Civil Service ratings in electronics are assigned on the basis of experience.) Otherwise, check with your post office or write the U.S. Civil Service Commission, Washington, D.C. 20415. Once you have a Civil Service rating you can apply for jobs with government agencies and the armed forces.

In addition to training and experience—and in the case of the government, a Civil Service rating—you'll have to meet a few other standards, too. All overseas employers want proof that you're healthy (many give a rugged physical). Much of the equipment you'll be working on is classified so you almost certainly will have to get a security clearance to work either for the government or for private industry. If you travel for the government you will have to be at least 21. Some companies also have minimum age requirements. And, finally, if you still are of draft age you will have to get your draft board's permission in writing before you can leave the country.

As for moolah, you can make plenty. Get a job with ITT's Federal Electric Division on the DEW Line—the string of radar stations stretched across northern Canada—and you start at $237 a week, plus room and board. There are periodic reviews and you may get raises. If you work for RCA Service Co. on a BMEWS station your base salary, depending on qualifications and experience, will be $5,000-$7,000 a year. But there's a complex system of bonuses, depending on how long you stay, and plenty of overtime. Men now on the job average twice

FEDERAL DEPARTMENTS AND AGENCIES WITH INFORMATION ON OVERSEAS JOBS

GENERAL
Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402
Federal Jobs Overseas—10¢
Working for the U.S.A.—15¢

AIR FORCE
Civilian Personnel Officer
Air Force installation nearest your home

ARMY
Interchange and Recruitment Coordination Branch
Employee Management Division, OCP
Department of the Army
Washington, D.C. 20310

NAVY
ALASKAN AREA
Navy Overseas Employment Office
Headquarters, Thirteenth Naval District
Seattle, Wash. 98115

PACIFIC AREA
Navy Overseas Employment Office
Federal Office Building
San Francisco, Calif. 94102

ATLANTIC AREA
Navy Overseas Employment Office
Headquarters, Potomac River Naval Command
Washington, D.C. 20390

their base salaries: $10,000 to $15,000 a year.

Government technicians start with a base of about $4,500 and go up to more than twice that. But that's for stateside duty. In most foreign posts outside of Europe and Japan, you will get a differential—an extra 10 to 25 per cent to sweeten your paycheck.

Here's how it works. The Navy, for example, recently was looking for technicians to test and repair electronic equipment on Guam. Applicants were expected to have five years of experience, preferably part of it working on Navy gear. Pay ranged between $7,220 and $9,425, but a 25 per cent differential brought total annual income to almost $12,000. (The demand fluctuates constantly, of course, as jobs at various pay levels open up around the world. This one may or may not still be on the books when you read this.)

Base salaries and differentials where applicable are just part of the story. Overseas jobs frequently are loaded with extras. Naturally, the company pays your travel expenses and in many places you get free room and board. If you stay overseas 18 months your wages aren't subject to federal income tax. And Uncle Sam even will pay transportation costs for your family and ship your furniture and household goods to you at no charge. Further, unless you're going to the South Pole, Vietnam or some other equally uncharming spot, you usually can take your wife and children overseas. Thing is, it often is necessary that you go first to make housing and other arrangements before they arrive.

Overseas, you'll find that many U.S. military bases and other installations have houses for families, either free or at low rent. If not, you likely will get a housing allowance, in addition to your salary and differential. Some private companies pay a per diem (a fixed amount for living expenses); others don't.

Though assignments vary, it ordinarily is wise to prepare for being overseas for about two years. And you usually will want to stay 18 months or longer to get that income-tax rebate, anyway. If you like the duty you almost always can sign up for another stint, providing the project you're on isn't being scrapped. And once you finish foreign duty you usually can go to work for the company in one of its U.S. locations. Not all companies guarantee such employment but if your work has been satisfactory there hardly ever is trouble staying on the payroll. In government service you automatically are a career employee and can get assigned to another job elsewhere in the country or perhaps even in a different foreign post if openings are available.

Only distortion in this otherwise pretty picture is that landing on overseas job sometimes is a little like grabbing an eel in a bucket of warm butter. It

[*Continued on page* 114]

SIX U.S. COMPANIES YOU CAN WRITE FOR INFORMATION ON OVERSEAS JOBS

Mr. Kilhullen
Room 25-W
Federal Electric Corp.
International Telephone & Telegraph Co.
Industrial Park
Paramus, N.J.

Mr. E. L. Walker
Director of Operations
TechRep Division
Philco Corp.
Box 10
Fort Washington, Pa. 19034

Mr. J. P. Thatcher
Employment Manager
BMEWS Service Project
RCA Service Co.
1908 Bannard St.
Riverton, N.J.

Mr. D. P. Mulkeen
Assistant Industrial Relations Manager
Electronic Services Operation
Raytheon Co.
Burlington, Mass.

Director of Industrial Relations
Bendix Field Engineering Corp.
Owings Mills, Md.

Personnel Director
Clavier Corp.
87-46 123rd St.
Richmond Hills, N.Y. 11418

CONAR'S BUILD-IT-YOURSELF TREASURE FINDER

YOU can get rich with gold and silver and precious relics, say the ads. All you have to do is invest in a metal locator, known to the romantics as a treasure finder, and the wealth of the Indies can be yours!

Pirate treasure buried for centuries under wave-washed beaches, treasure chests filled to overflowing with pieces-of-eight, jewels to dazzle the eyes of Arab potentates, enough wealth for a lifetime of Cadillacs and girls to fill them. All this wealth can be yours, or so one might think, simply by walking along a beach with metal locator in hand and waiting till the beep in the headphones turns into a boop.

The modern metal locator is the kid brother of the Army's mine detector. A small box mounted near the handle of a pole contains two oscillators, a mixer and a headphone jack. At the other end of the pole is a large coil of wire (part of the tuned circuit of one oscillator) in the search head.

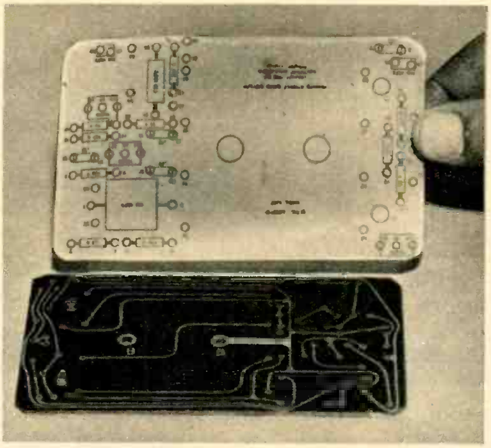
Operation is simple. One oscillator's frequency is adjusted to about 400 cps below the frequency of the oscillator in which the search head serves as tuning coil. The outputs of the two oscillators are fed to a mixer which produces a 400-cps difference frequency that is fed to the headphones. When the search head is brought near metal its inductance changes. This changes one oscillator's frequency, which causes the tone in the headphones to increase or decrease in pitch, depending on the type of metal.

While really sensitive metal locators cost several hundred dollars, many inexpensive models are available to the hobbyist. A typical low-cost model is one distributed by the Conar Division of the National Radio Institute (3939 Wisconsin Ave. N.W., Washington, D.C. 20016). The stock number is 100TUK and it sells for $49.95 with headphones, batteries and a general-purpose search head. Assembled, the price is $54.50. A small-object (No. 1AC) search head is available for $9.50 extra. A large-object search head (No. 2AC) is available for $21.50. The kit consists of a hollow aluminum pole, an assembled search head and the control box.

The control box has a printed-circuit (PC) board which is somewhat unusual. A PC board normally has the wiring etched on one side and the component layout printed on the other. Not so with Conar's treasure finder. There is no printed layout on the board. Instead, you stick an overlay—a template—on the board. The template contains numbered holes which line up with the predrilled holes in the board. You then push the component leads through the holes as described in the assembly manual. For example, a step might read *33k resistor through circle holes 21 and 22*.

We found the procedure of locating numbered holes to be cumbersome. Also, the holes were in poor register, thereby increasing the possibility of error. Luckily, there are few components so the two errors we made were noticed quickly. Particularly troublesome was the hole registration for the transistors—these had to be triple-checked.

Once the control box is assembled everything else goes together with a screwdriver in about 20 minutes. Allowing double time for extra-careful checks during control-box as-



To mount circuit-board parts, you first stick Conar's overlay on reverse side of board. Parts leads are pushed through holes in the template.

sembly, the kit took slightly over four hours to build. It probably would have taken three with a better template. (Our cover shows the control box with printed-circuit board inside, the headphones and reproductions of Spanish pieces of eight.)

Alignment and operation are easy. You plug in the headphones, turn on the power, keep the search head away from metal and adjust the tuning control (protruding from the control box) for a tone in the headphones.

The locator needs time to warm up. When we took it directly from car to beach the oscillators drifted so much we were unable to keep the tone steady. Only after leaving the unit in the sun for 15 minutes did the stability improve.

The locator's sensitivity depends on the size of the metal object and its depth below ground. With the general-purpose search head supplied, the smallest object we could locate was a half dollar buried about an inch under the sand. Water pipes could be spotted slightly over 2 ft. below the head.

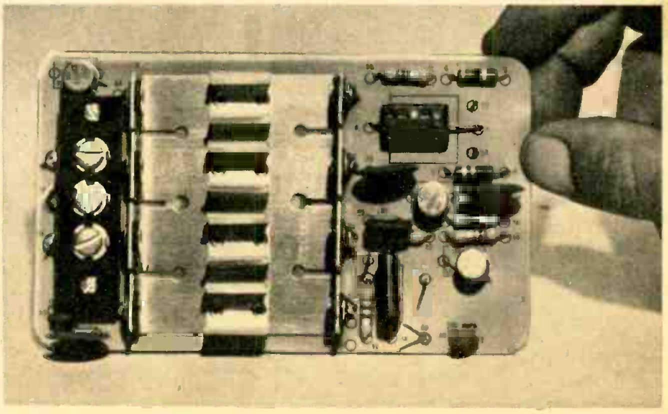
Did the electronic metalhound find pirate gold? No. On the other hand, Conar isn't one of those claiming quick riches from its product. Besides that, we doubt that Captain Kidd buried his bundle at Coney Island, anyway. Spent it, yes. And quickly. Buried it, no. However, the locator did turn out to be useful for locating sewer, water and electrical pipes. And we've got the best collection of bottle caps in town, not to mention half a sandwich wrapped in aluminum foil left over from a picnic. But then we never really did believe we'd find riches—only a lot of fun for the junior members of the family. That we did find.

When those lazy afternoons with nothing to do roll around you can use the metal locator to play a game that will keep the kids occupied for hours.

It's played this way: cut a square or circle of aluminum, about 3 in. in diameter or make up some real pirate's treasure by closely spacing three or four half dollars in an envelope. Bury it from 1 to 2 ft. in the sand. Then send the kids out to find the treasure. At this depth the metal locator's tone change when it's over the treasure will be slight so the one who locates the treasure will be showing real skill. If everyone fails, move the treasure a little closer to the surface.

The object is to keep the treasure deep enough to produce only a slight shift in the tone. If you don't bury it deep enough anyone will find it since its closeness to the surface will produce a drastic change in tone.

Assembled printed-circuit board goes into control box; note small number of components. The battery clips hold four penlite cells. The leads from the search head get connected to the three terminal-strip screws at the left. We experienced some difficulty in fitting component leads through holes in board (predrilled) because holes in the template and the board did not line up perfectly.



"He's a good worker. I'd promote him right now if he had more education in electronics."

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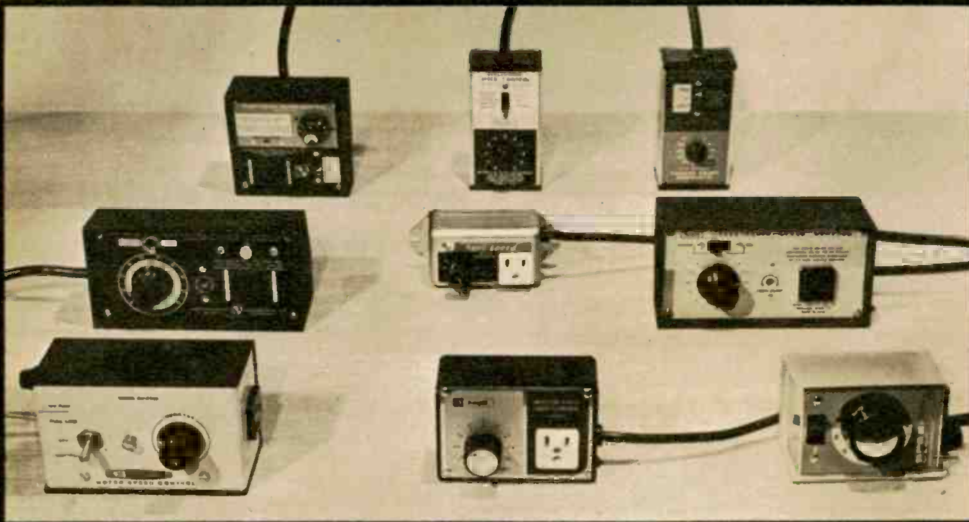


SCR SPEED CONTROLS

By BERT MANN LATEST CRAZE to reach the home workshop (and elsewhere) centers on the SCR motor speed control. And this is no mere fad for most everyone agrees that such controls are worth having. Tie your electric drill or saw to an SCR control and you'll drill and cut cleaner holes while also perhaps prolonging the life of bits and blades. Rig your soldering iron to an SCR control and you well may solder like someone who's spent 20 years building radio gear for the Army.

There's another side to the story. The SCR, with its infinitely-variable regulation of speed or heat, has become the biggest new selling point in such household appliances as blenders, food mixers, washers, dryers and so on. But this report is concerned only with SCR controls sold as separate products. As such, they have become so popular that nearly a dozen models are available.

With prices ranging from less than $10 to nearly $30, the question is what the extra dollars buy. To find out, EI purchased every model and type we could get our mittens on, then put them through a series of tests—everything from controlling the speed of the more-or-less standard ¼-in. electric drill to adjusting brilliance of room lights. The results were revealing.

Every speed control, it develops, does exactly the same thing, whether advertised as a motor control, motor and light control or motor and soldering-iron control. Heart of every SCR control is an *SCR*, short for silicon controlled rectifier. Basically, the SCR, connected in series with the appliance across the AC line, converts the line voltage to DC while simultaneously permitting the user to control the amount of DC fed to the appliance.

With a drill connected to the control, the user can adjust the SCR to deliver a tiny voltage, causing the drill to rotate at 200 rpm or so rather than at normal speed. With a soldering iron the user can set the heat so low it barely melts solder. Or with an incandescent lamp, illumination can be varied from full off to roughly 30% of normal brilliance.

This simple means of controlling supply voltage can be of extreme importance to most any hobbyist. For example, a 2,000-rpm electric drill is fine for steel, particularly when drilling small holes. Thing is, that same rpm could turn a carbide-tip masonry bit into molten metal while 200 to 300 rpm will make it last and last.

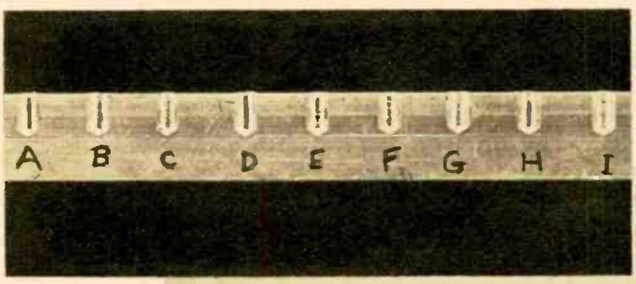
In the case of the saber or recipro-saw, normal speed is great for wood but a crawl will leave aluminum and sheet metal with a reasonably smooth rather than jagged edge. Or say you're repairing some electronic gear having a printed circuit. The old reliable soldering iron will melt not only solder but foil, too. Drop the heat with an SCR control to where the iron just manages to melt the solder and you'll be making repairs like a pro.

In fact, controlling lamp brilliance and soldering heat are but secondary applications. The primary purpose of SCRs is controlling motor speeds, though they cannot be used with all motors. Explanation is that since the SCR converts the AC line voltage to DC, an SCR control can be used only with a motor designed to work off DC. This ordinarily doesn't pose a serious problem since most hobbyist tools and appliances—hand drills and saws, modeler lathes, mixers and blenders—utilize universal motors (motors that operate on either AC or DC).

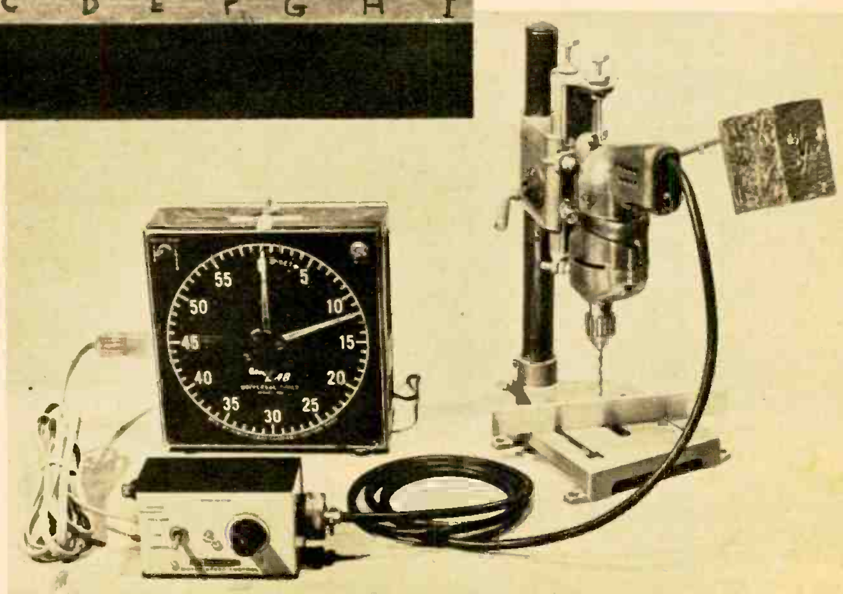
While there are other ways to control motor speed—a variable transformer (Variac) and a rheostat are two—none offers the big advantage of the SCR: high torque. Variacs and rheostats reduce the speed of a power tool by reducing applied voltage. However, should a heavy load cause the motor to slow, a Variac or rheostat drops the applied voltage even lower as the motor tries to regain speed by drawing more current. The SCR control, on the other hand, *increases* applied voltage as the motor speed falls. In a sense, it's a sort of feedback, for SCR motor controls are designed so they apply more voltage automatically as motor speed falls. And this, in effect, keeps motor speed reasonably constant regardless of load.

Since all SCR motor controls do the same thing, namely provide for control of the DC voltage fed to a tool, motor or appliance, the obvious questions are how do they compare in operation and wherein lies explanation for that $20 price difference?

With the exception of the Knight KG-201, all controls we tested performed exactly the same in all types of operation. Explanation presumably lies in the fact that all models



Setup used to test controls (below). Controls were preset to run ¼-in. weighted drill at 500 rpm; timer clocked drilling time. Cutaway view of specimen (left) reveals that all drills cut holes of identical path.



HOW SCR SPEED CONTROLS WORK

Heart of every speed control is an SCR or silicon controlled rectifier. Actually a special kind of silicon rectifier with a control element called a gate (in addition to the usual anode and cathode), the SCR can conduct only when a small positive voltage is applied to the gate at the same time that positive voltage appears at the anode. Once the SCR is driven into conduction by positive gate voltage current continues to flow until negative voltage appears at the anode during the next half-cycle. Even if the gate voltage is removed the SCR still will conduct.

Since the voltage applied to an SCR speed control is AC, current flows through the SCR only during positive half-cycles, which means the SCR is serving as a half-wave rectifier and delivering a DC output. Since the load—shown as a motor in Fig. 1—is connected in series with the SCR, the power it receives can be controlled simply by varying the amount or width of each DC pulse. Pulse width (the portion of the positive cycle during which the SCR conducts) is determined by the gate voltage.

As shown in Fig 2, the gate and anode voltages in most controls always are in phase; that is, peak anode voltage (and current) occurs simultaneously with peak gate voltage.

Note that if the SCR is turned on at peak gate voltage—which is the latest it can be turned on because the gate voltage then starts to go more negative—the SCR will conduct for exactly half the positive cycle. This means that the speed controls can limit current flow through the SCR and, therefore, the load from half to nearly the full positive cycle.

If the voltage applied to the gate is increased so the gate firing voltage is reached before the peak of the wave, as shown in Fig. 3, the anode will be turned on before the peak and the SCR will conduct for more than half the positive cycle. Theoretically, if the SCR could be turned on at the beginning of the positive cycle, current would flow for the full positive cycle. In reality, there is a minimum gate firing voltage that must be reached before the SCR can be turned on, so the SCR never can conduct for the full positive cycle. This delay is shown in Fig. 3 as a small break at the beginning of the cycle.

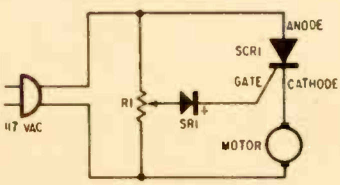


Fig. 1

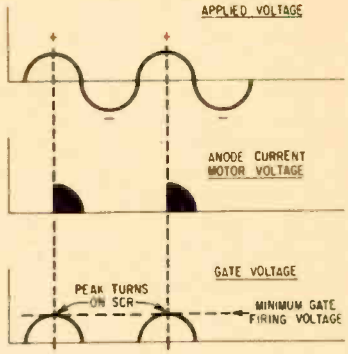


Fig. 2

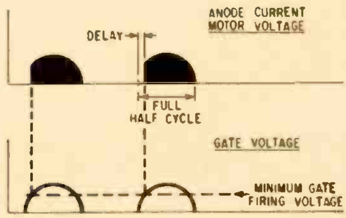


Fig. 3

SCR SPEED CONTROLS

(save the Knight) use a modification of the original General Electric SCR circuit (the Knight uses the original circuit) and have a minimum usable speed with a ¼-in. electric drill of 200 to 300 rpm. The Knight, in contrast, can be slowed to about 10 rpm while retaining high torque. And though 200 rpm is more than adequate for most cutting or drilling work (and the speed reduction is representative of the slower speeds obtained on saws, blenders, etc.), less than 200 rpm is useful for stirring paint or small quantities of cement or even for winding coils.

Except for the Knight, none of the controls proved useful for light control. Adjusted to produce a low light level on the order of a soft glow, they caused the lamps to pulse on and off. And when the controls were advanced ever so slightly in an effort to stop pulsing, the lamps immediately jumped to almost full SCR brilliance (and full SCR brilliance is only 30% of normal). The Knight control, however, provided for smooth adjustment of lamp brilliance from full off to 30% of normal.

All models checked out about equal when it came to controlling resistive heating elements such as those in soldering irons. And since all controls performed nearly the same (though they differ in the power-handling capacity), we concluded that the nearly-$20 difference between the lowest and highest priced models represents frills. Take the matter of fusing, for instance.

As it happens, all controls we tested are fused. The lower-cost, light-duty models utilize an internal, automatic-resetting circuit breaker that opens and closes until the overload is removed. Some models, both high- and low-cost, utilize an automobile-type fuse with an external fuseholder mounted on the cabinet. But de luxe controls have user-operated push-to-reset circuit breakers mounted on the front panel that serve no purpose other than to look impressive and jack up the price. One type of protection is as efficient as another, since all give adequate safeguard against long-term small overloads. However, all are useless against a short circuit since the SCR will blow faster than the protective device.

The most useless of useless features is a range extender or some similar fancy-sounding circuit. A range expander simply is a second speed-adjustment control (often a screwdriver adjustment mounted on the front panel) that is supposed to expand the adjustment range of the main speed-control knob. Depending on the current drawn by the motor, an SCR control starts a motor between ⅛ and ¼ of rotation from full *off* position. The range expander is supposed to trim the main control so the motor starts as soon as the control is cracked. In practice, however, the variation is so slight, usually an eighth of a turn, as to serve no practical purpose.

To sum up, except for the Knight, which offers superior low-speed performance, we uncovered only one important difference between the various models: power-handling capacity. And for general home use, a light-duty model with a 500- or 600-watt rating is adequate. Only if you have need to control appliances of over 600 watts is a high-current model required. Further, save for the Heath, the high-current versions are likely to pack plenty of unnecessary frills.

Also deserving mention is a special type of SCR motor control not discussed as yet. Specially designed to deliver extremely high torque, it is suited particularly for use with electric drills. Its secret lies in its full-wave operation, using both negative and positive current swings.

When connected to a ¼-in. drill and adjusted for minimum usable drill speed, it almost is impossible to stall the drill by hand (you *can* stall any other SCR-controlled drill). Even when the drill is slowed to 300 rpm, trying to stall it can result in a sprained wrist. Reason is that full-wave operation means more current to bring the drill up to speed.

So outstanding is this control that a drill used with it will display considerably more torque—even at the lowest speeds—than it would when connected directly to the AC supply.

There's a catch, of course. You have to build this one yourself—from EI plans (FULL-RANGE SCR SPEED CONTROL, Sept. '65 EI). The parts cost a little over $15.

A GUIDE TO CURRENT SCR MOTOR SPEED CONTROLS

Manufacturer or distributor	Model	Manufacturer's rating	Power switch	Special features*	Price
Electrotone Laboratories	Vari-speed	600 watts continuous	on speed knob	ISB	$8.95
Heath	GD-973A	15 amperes	3-way	F, pilot light	$17.50 (kit)
International Electronics	M10	7.5 amperes	3-way	ISB	$11.44
International Electronics	711	7.5 amperes	3-way	RE, ISB	$14.49
International Electronics	39	15 amperes	3-way	RE, PSB	$28.49
Knight-Kit KG-201	Allied Radio 83 Z 335	500 to 900 watts, depending on load	on speed knob	plastic case ISB	$9.95 (kit)
Lutron Electronics	Mark II	5 amperes	on/off	belt clip F	$11.95
Sears Roebuck	120-25100	7.5 amperes	3-way	ISB	$10.44
Sears Roebuck	120-25100	7.5 amperes	3-way	ISB, RE	$17.88
Electronics Illustrated	Full-Range Speed Control	(See text)			

** ISB—Internal circuit breaker (automatic reset); PSB—Panel-mounted circuit breaker; F—External fuse; RE—Range expander.*

THE HAM SHACK

BY
WAYNE GREEN
W2NSD/1

FRIEND-MAKING . . . Come one of those big pile-ups chasing rare DX, and you now and then will find me in there beating out my brains in the thick of it. But the great bulk of the time you'll hear me talking at length to my DX contacts. Hard to do? Not if you plan ahead.

Many fellows don't seem to be able to think of anything much to say once they establish contact with a DX station. After all, here is someone you don't know at all, in a place you probably know little better. What do you have in common to talk about, and how do you even find a subject? (You'd feel foolish reading off a list of topics for him to pick from for discussion.)

Solution actually is ridiculously simple. Talk with him about the one thing he's most interested in: *him*. Find out what he does, if he lives in or out of town and so on. Ask about his family. I've found it a fine conversational opening to suggest that I've been thinking seriously about visiting his country and I wonder what I might see and do there, whether I might drop in for a personal visit and a cup of tea (or coffee) and what the climate is like.

Of course, if you're impressionable—like me—this can be dangerous. For first thing you know you find yourself making more than vague plans for such a trip. But then again, this may not be half as bad as it seems on first consideration.

Elephantitis . . . Speaking of trips, I have one coming up. As this issue of EI goes to press I'll be off visiting some of the chaps I've been talking with on 20 meters for the last few months. Robby, 5Z4ERR, started it when he responded to my questions about Nairobi with an invitation to come visit, complete with a trip through a nearby game preserve. Then 5Z4JD and 5Z4IR put the pressure of their invitations on top of Robby's and I found myself seriously considering the incredible.

Red, 9U5ID, in Urundi suggested that if I were coming over to that part of Africa I perhaps could bring along some badly needed medicines for his mission. Red and Doc (WA2RAU) have been arranging to have emergency medicines flown to the Congo and Rwanda-Urundi for a couple of years now. And after all, Urundi is only about 500 miles from Nairobi . . . just a short drive through the African bush.

A few weeks later I contacted Red again as 9X5GG in Rwanda and he gave me the details on what roads to take and where I could stop at various missions overnight along the way from Nairobi. I found myself committed to adventure.

The more I talked with stations in Mozambique, Malawi, Zambia and South Africa, the more interested I became in the trip . . . and even the possibility of perhaps doing a bit of hunting. I've missed very few African movies for the last 40 years. But though I've popped off a few woodchucks and hedgehogs, I never once imagined that I might go after the big stuff. The capper came when 9J2BK in Zambia called me to say that so long as I was going to be over in his neck of the woods, why not continue on south a bit to Zambia where they have a serious problem with elephants? The government, it seems, is anxious to have the herds thinned, so mightn't I be interested in bagging an elephant? (I am.)

VHF Note . . . Many of us resist progress with great zest. I always have considered myself sort of progressive and usually one of the first on the block to get something new. Well, a few years back I decided to go first-class on 2-meter converters and I sprung the C-note for the 417A Tapetone converter. Last word and all that.

So there I was, sitting smugly on my New Hampshire mountain under a barrage of 2-meter colinear beams, quietly confident that if there were anything to hear I was hearing it. It was a happy life. Then one of those sneaky manufacturers of VHF transistor converters stormed my pinnacle with a little $16 printed-circuit converter half the size of a QSL card. Naturally, he challenged me to A-B it against my Sam Harris personally-tuned Tapetone.

Zounds! The signals were at least 3db better on the 16-buck converter. And when you

[*Continued on page* 117]

2 Meters on 2 Tubes

With this really basic receiver you can pull in a fascinating mixture of local OMs and Novices on the most popular VHF band.

By CLARE GREEN, W3IKI

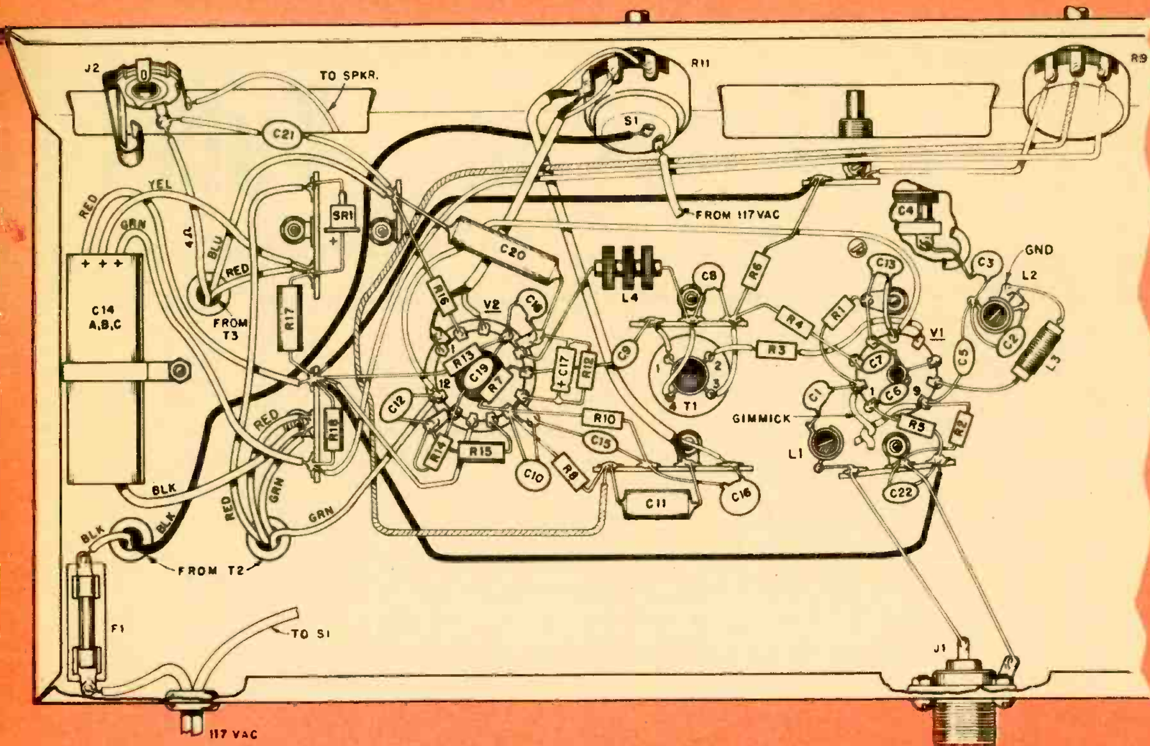
IT'S a busy, friendly world up on 2 meters. The high frequency, 144 to 148 mc, means mostly local contacts, though there are rare DX openings, when signals go halfway across the country.

Regulars on 2 get to know each other well. There's a lot of local rag-chewing and some hams call the band a big party line. Though in most areas 2 meters means phone operation, at times you can find a greater variation in hamming—and hams—than anywhere else in the spectrum. All hams—Generals, Novices, Technicians, everybody—can operate on 2 (it's the only band where Novices are permitted on phone) and practically anything that oscillates is allowed, including regular CW, modulated CW, unmodulated carriers, facsimile, TV, FM and RTTY.

You also will find a lot of 2-meter inhabitants who know their onions and who build their own equipment. Readymade rigs are relatively scarce when compared to 10-80 gear. That means a lot of home-brew equipment, which in turn means a fair level of technical competence because VHF circuitry can be quite tricky and critical.

Besides hams being hams, you also will find CAP stations and MARS nets on and at the edges of 2 meters.

With our cool 2-tuber it's an easy matter to listen in on the band. The receiver sports a superhet front-end followed by a superregenerative detector. Two stages of audio drive a speaker. Headphones can be plugged in to dig out those weak stations.



Because the receiver operates from 144 to 148 mc, placement of parts, especially around V1 at the right, is critical. And it also is important to install the parts exactly where shown around V2. For the purpose of making things as clear as possible, we have shown some parts smaller than their real-life size. Note the cutouts in the chassis near J2 and between R11 and R9. The cutout at the left is for the speaker frame; the cutout at the right is for the 2¾-in.-dia. pulley on the back of the slide-rule dial. Circle around T1 is ¾-in.-dia. hole in the chassis through which leads (soldered on coil's lugs before mounting) to T1 pass. As parts around V1 and V2 are quite close, use spaghetti on the leads to prevent shorts. Detailed sketches of coils L1 and T1 are shown on schematic on the last page of the article.

2 Meters on 2 Tubes

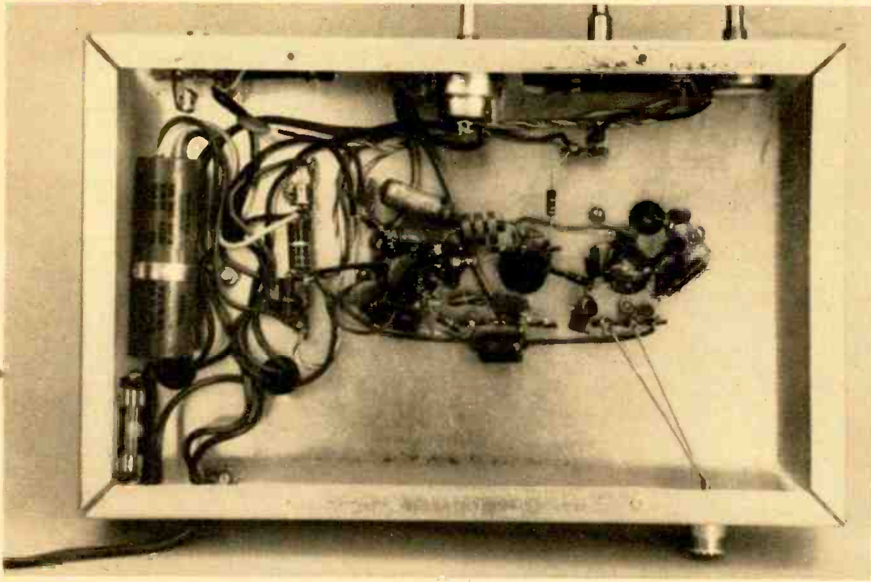
Construction. Our receiver is built on a 7x11x2-in. aluminum chassis. After cutting all holes, mount the components where shown in the photos and pictorial. Locate the position for T1's shield, then cut a ¾-in.-dia. hole in the chassis for the leads to the coil's lugs. Make cutouts on the front of the chassis to provide clearance for the dial's pulley and the speaker's frame.

Before mounting C4, make sure its shaft lines up with the dial pulley's hub. Always use lockwashers when mounting the terminal strips, fuse holder, potentiometers and output jack J2. Put rubber grommets in all chassis holes through which wires pass to prevent the insulation from being frayed.

The wiring and placement of parts in the front-end and detector circuits are critical. If leads are too long the receiver may tune out of the band or may not work at all. Use short, direct leads when installing all components. Slip spaghetti on all leads that cross or are near each other. Before mounting T1, solder leads to its lugs since it will be difficult to get to the lugs through the hole in the chassis after the coil is in place.

Alignment and Operation. Turn on the receiver and allow it to warm up a few minutes. If a signal generator is available, set it for an 8-mc modulated output and connect it to J1. With *volume* control R11 full clockwise, turn up *regen* control R9 until you hear the typical superregen hiss. Adjust T1 for maximum output. Set tuning capacitor C4 so the dial pointer is opposite 20 on the logging scale.

Set the signal generator for a 144-mc modulated output. Adjust L2 (starting with the iron core all the way *in*) until you hear the signal. Set the signal generator for 145 mc



Best place to start construction is around V1 at the right. Fit every part in carefully and keep leads short and direct. Then work your way left to T1,V2 and the power supply at the extreme left. Install controls, dial and speaker last. Just because there's a lot of empty space doesn't mean you can spread parts out. Keep them tight around the tube sockets. Use No. 14 buss wire to hook the antenna connector at lower right to terminal strip near V1.

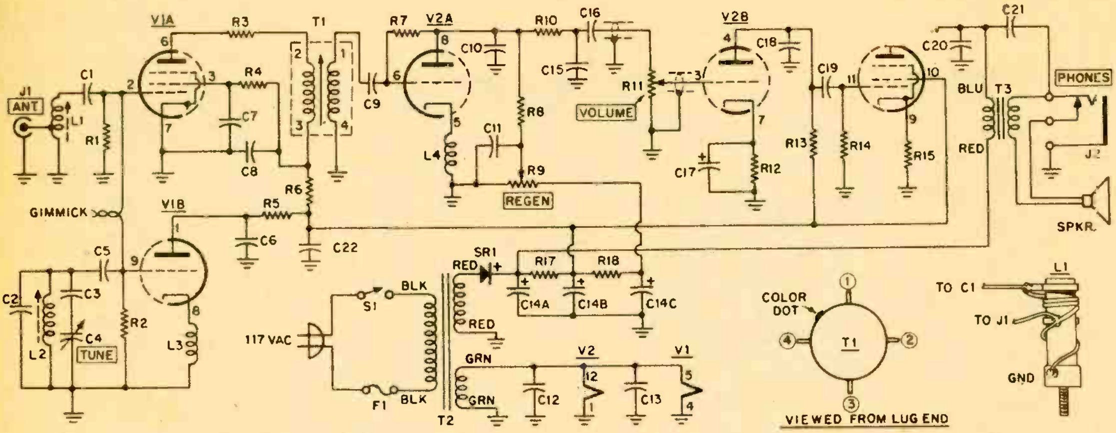
and tune C4 until you hear the signal. Adjust L1 for maximum signal amplitude while rocking C4 back and forth to keep the signal tuned in. Calibrate the rest of the dial with the signal generator. We used transfer type to mark the dial's scale at 1-mc intervals from 144 to 148 mc.

If you don't have a signal generator, set T1's slug-adjustment screw so it is ¼-in. out of the top of the form. Set L1's and L2's slug adjustment screws so they are ⅜ in. out of the form.

Wait until evening when the 2-meter band is most active and connect an antenna to J1. (The best antenna for this receiver is a high-gain multiple-element beam.) With the dial

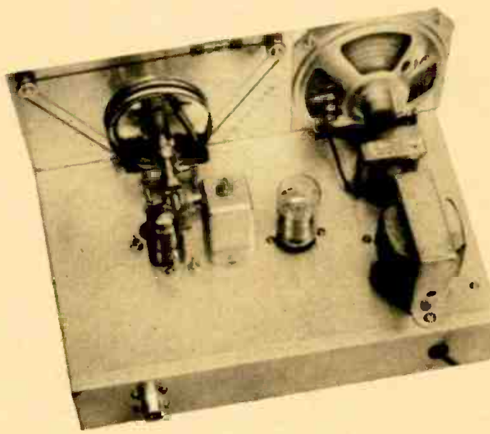
PARTS LIST

Capacitors: 1,000 V ceramic disc unless otherwise indicated
C1,C9—47 μμf C2,C3—4.7 μμf
C4—3-15 μμf variable capacitor (Bud MC-1850. Allied 13 Z 530; $1.82 plus postage. Not listed in catalog)
C5—10 μμf C6—500 μμf
C7,C8,C13,C15,C18,C22—.001 μf
C10—100 μμf C11—.25 μf, 200 V tubular
C12,C16,C19,C21—.005 μf
C14A,B,C—50/30/20 μf, 150 V electrolytic
C17—8 μf, 12 V electrolytic
C20—.05 μf, 400 V tubular
F1—1 A fuse and chassis-mount holder
GIMMICK—Capacitor made of two turns of hookup wire (see text)
J1—Chassis mount coax connector (Amphenol 83-1R)
J2—closed-circuit phone jack
L1,L2—0.1 μhy adjustable RF coil (J.W. Miller 20A107RB1. Lafayette 34 R 8944)
L3—1.72 μhy RF choke (J.W. Miller RFC-144. Lafayette 34 R 8973)
L4—1 mh 3-section RF choke (J.W. Miller 4652. Lafayette 34 R 8829)
Resistors: ½ watt, 10% unless otherwise indicated
R1—1 megohm R2—22,000 ohms
R3,R16—33 ohms R4—10,000 ohms
R5,R6,R12—4,700 ohms
R7—6.8 megohms R8,R10—120,000 ohms
R9—250,000 ohm linear-taper potentiometer
R11—1 megohm audio-taper potentiometer with SPST switch (S1)
R13,R14—220,000 ohms
R15—100 ohms, 2 watts
R17—1,800 ohms, 2 watts
R18—15,000 ohms, 1 watt
S1—SPST switch on R11
SPKR—4-in., 4-ohm speaker
SR1—Silicon rectifier; minimum ratings: 500 ma, 400 PIV
T1—1.7-5.5 mc RF coil (J.W. Miller B-5495-RF. Lafayette 34 R 8715. Shield for above, J.W. Miller S-33. Allied 62 Z 571; 51¢ plus postage. Not listed in catalog.)
T2—Power transformer; secondaries: 125 V @ 50 ma, 6.3 V @ 2 A (Allied 61 G 411 or equiv.)
T3—Output transformer; primary: 10,000 ohms. Secondary: 4 ohms. 5-watts. (Allied 61 U 448 or equiv.)
V1—6BL8 tube
V2—6AF11 compactron tube
Misc.—Slide-rule dial (J.W. Miller SL-16. Allied 60-090; $6 plus postage. Not listed in catalog), 7 x 11 x 2-in. aluminum chassis, 7 x 11-in. aluminum chassis bottom plate, 9-pin tube socket, compactron tube socket, terminal strips.



Receiver schematic. Signal from antenna and oscillator V1B go to grid of mixer V1A; 8-mc mixer output goes to superregen detector V2A. Audio is fed to audio amp V2B then to output pentode, V2C. Wind 1 turn of #22 solid wire on L1 between lower lug and base. Space wire to prevent a short.

2 Meters on 2 Tubes



Top view of chassis. Note cutouts in the front for slide-rule dial pulley and speaker frame. Install 7 x 11-in. aluminum plate in chassis bottom.

set to 40 on the logging scale (145 mc), adjust L2 until you hear signals. Adjust L1 for maximum volume.

Most 2-meter signals are polarized horizontally so vertical whip and ground-plane antennas will not be effective. However, you'll be able to get good results with a TV antenna. In normal operation, turn up *regen* control R9 until you hear a hissing, then tune for stations.

How it Works. Take a look at the schematic. Signals from the antenna are fed directly to L1, which is broadly tuned to 145 mc. The signals then go via C1 to the grid of mixer V1A. Oscillator V1B, whose output is coupled via the gimmick capacitor (two tight-wound turns of hookup wire) to V1A's grid, operates 8-mc below the incoming signal. The oscillator is tuned by C2/L2 and C3/C4.

The resultant 8-mc IF signal at V1A's plate is fed via T1 to the superregenerative detector, V2A. R9 controls regeneration.

The detected audio signal is connected via the low pass filter (R10/C15) to volume control R10 then to the grid of the first AF amplifier, V2B. The amplified audio is fed by C19 to power amplifier V2C. The signal is coupled by output transformer T1 to the speaker. When phones are plugged into J2, the speaker is automatically disconnected. B+ and the tube heater power are supplied by T2, SR1 and the filter circuit comprising R17, R18 and C14A,B,C

TUBE VOLTAGES

Pin	1	2	3	4	5	6	7	8	9	10	11	12
6BL8	80	—4.5	90	0	6.3**	100	0	0	—3.5	—	—	—
6AF11	0	150	0	58	0	—2*	—1.7	72	2.3	132	0	6.3**

Measured with a VTVM, ±20%. *R9 full clockwise. **AC

If the receiver doesn't work properly, first thing to do is measure voltages on tubes to turn up a wiring error or defective component. All voltages must be measured with a VTVM and not a VOM.

POCKET-SIZE FM STATIONS

By ARNIE RASMUSSEN

BOBCATS excepted, tails go with cats and cords go with mikes. Or they once did. But the so-called wireless broadcasters that the FCC permits on the standard AM band clearly can he cordless and now a new tailless mike has made its debut on the FM band. Transistorized, battery-powered and in some instances no larger than a pack of fags, the FM wireless mike also offers fidelity other less-sophisticated broadcasters can't muster. Fact is, the more expensive versions already are proving a boon to TV and nightclub entertainers and no one anywhere need tangle toes with mike cords these days.

FM wireless mikes hold high promise for the hobbyist, too, though like CB gear all must be type-approved. FCC regulations on radiation pretty much predetermine range so the various units generally vary little in this respect. On the other hand, fidelity and stability are inclined to improve with increasing price (our chart at the end of this article lists only those mikes selling for less than $100).

Actually, circuits for most popular-price FM mikes have much in common. In most units, a built-in microphone feeds a transistor amplifier and the output of this amplifier frequency-modulates an adjustable-frequency transistor oscillator operating in the 88-108 mc band. The modulated RF then is fed to a short antenna.

As might be expected, some units offer one or more bonus features. A jack, for example, sometimes is provided for an external microphone. Plugging in a mike disconnects the internal mike. Other units incorporate a built-in 1,000-cps oscillator. A push button disconnects the mike and simultaneously fires up the audio oscillator, which then modulates the carrier. Result is the unit transmits a distinctive signal that can be tuned in precisely on a receiver or tuner without attendant feedback howl.

To put any of these mikes to work, you tune an FM receiver to a quiet spot on the band and use an aligning tool (furnished with most of the units) to place the mike precisely on receiver frequency. Depending on the mike, you tune either for the sound of the built-in 1-kc oscillator or for the loudest feedback whistle. And that's all. You are ready for business.

As our drawing on the first page of this

POCKET-SIZE FM STATIONS

article suggests, waitresses or carhops can use these mikes to call orders into the kitchen so long as the cook is FM-radio equipped. Or a wireless mike and one or more large-speaker FM receivers placed near the audience and facing away from the stage or rostrum constitute a small, easily-set-up PA system. And an FM mike in the home will transmit the sound of a doorbell, a telephone, an intruder or a baby's slightest whimper to a transistor FM receiver in back yard, bath or basement.

When the output of the receiver is fed into the mike input of a tape recorder many new uses emerge. The combination is a natural for taking inventory or dictating notes while moving about. Disguise or conceal the microphone and you have a ready-made setup for surveillance. Even more ingenious is feeding the output of an FM car radio into a transistor tape recorder while a wide-ranging, freely-moving reporter conducts man-on-the-street interviews (the car in this instance normally would be parked).

As shown in Fig. 1, running the output of a variable-frequency sine-wave generator through an attenuator into the mike input of a wireless mike provides an FM test signal that, in connection with a scope, permits many useful checks of an FM receiver. Among them are overall frequency response, detector alignment, limiting action and de-emphasis characteristics.

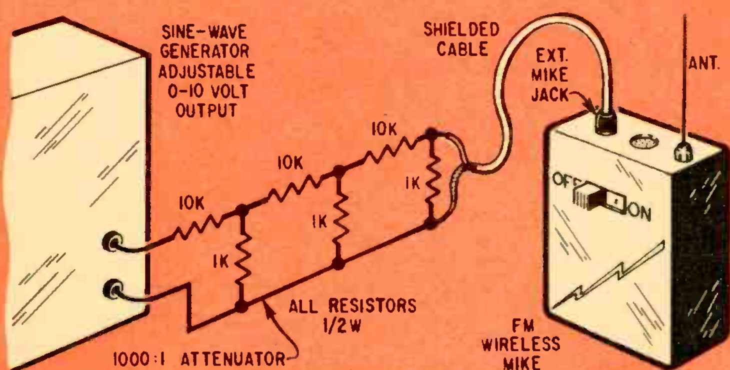
Finally, running the output of the receiver into a PA system permits a singer, actor or even a trapeze artist to move about freely and

Roughly the size of a cigarette pack, Kinematix IMP II is typical of popular-price FM wireless mikes. Unit covers 30-20,000 cps audio range.

still let his audience hear every sound he utters. Or a musical-instrument contact pickup can be plugged into the FM mike to give the most burly Beatle unlimited freedom of movement. Too, wireless mikes easily can move into an audience to relay questions and comments.

But doing any of these things well requires an understanding of the factors affecting FM wireless mike performance. Since it truly is a pocket-size FM station, an FM mike will perform satisfactorily only if the received signal strength always exceeds the minimum value necessary for good receiver quieting. Catch is, the FCC limits maximum radiated signal to 50 μv per meter at a distance of 50 ft. or more. Further, since the cord of an external mike acts as a radiating element, the FCC grants type approval only to micro-

Fig. 1—Simple attenuator permits use of ordinary AF generator with any FM mike equipped with external mike jack. Since most mikes cover full 88-108 mc FM band, addition of generator readily equips them for aligning most any FM tuner or receiver.



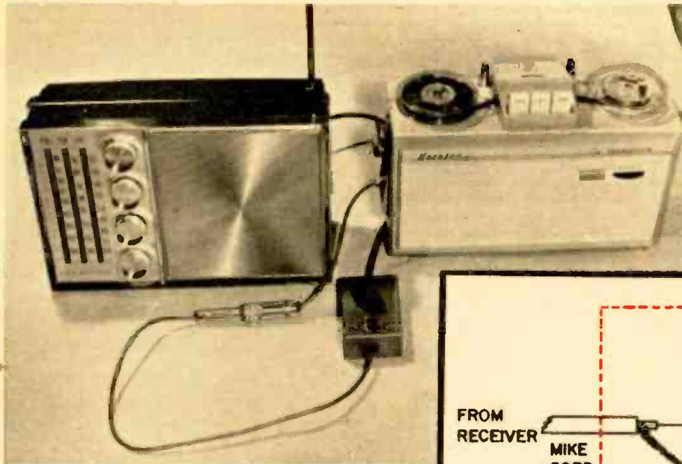
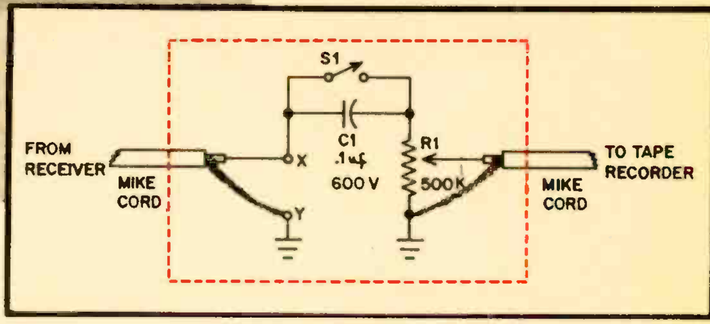


Fig. 2—Feeding output of associated FM receiver or tuner into tape recorder (photo at left) means anything picked up by an FM wireless mike automatically is preserved for playback later. Small box in photo houses universal coupling network (circuit below) which matches output of any tuner or receiver to any recorder or amplifier.



phones having specified cord lengths and used with external mike jacks, where provided.

Interestingly enough, the FCC measures signal strength by placing a probing antenna 50 ft. from the microphone, then moving it in a circle until direct or reflected components of the radiated wave add in phase to produce a maximum reading. Of course, moving the antenna (or the mike) a few feet in any direction may cause the waves to arrive out of phase and buck each other, dropping the received signal to a fraction of the maximum value. But the FCC is interested only in that maximum!

While any FM receiver will yield results of some sort with such widely-fluctuating signals, maximum performance requires use of a receiver or tuner with good sensitivity, amplitude limiting, AGC and AFC. (Sensitivity insures maximum operating distance. Amplitude limiting and AGC provide noise quieting and nearly uniform audio output in spite of wide variations in received signal level. AFC compensates for frequency drift in receiver or transmitter.)

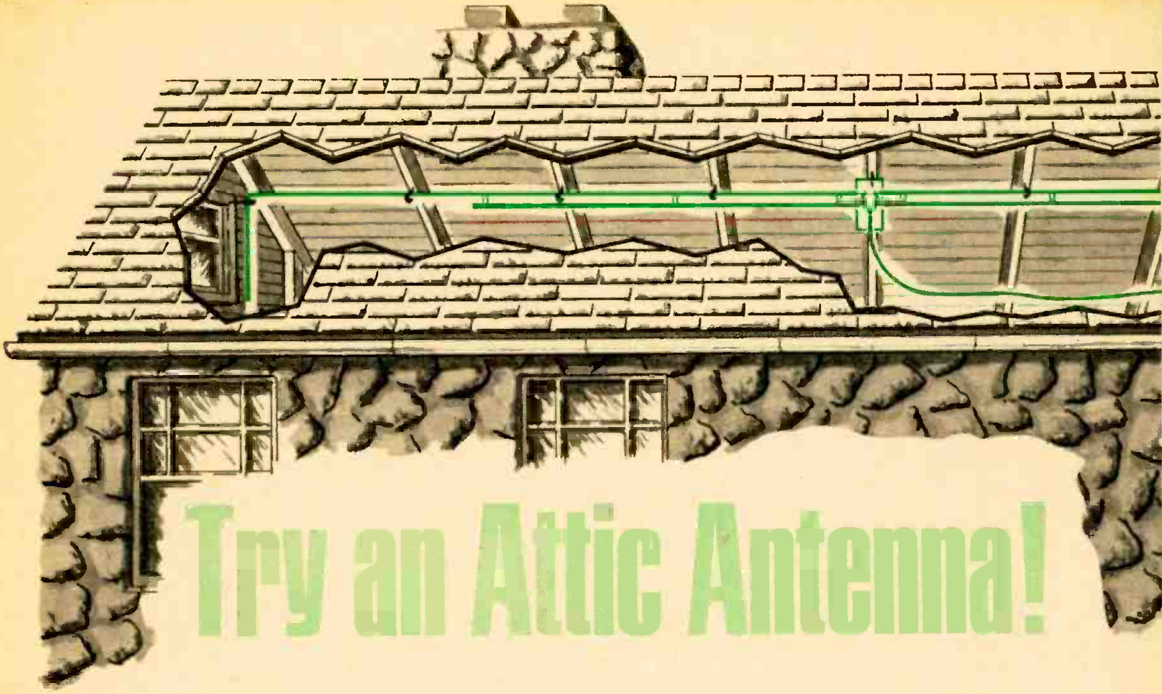
For transmitting up to 100 ft., a properly oriented rabbit-ears antenna near the receiver usually provides adequate signal pickup. But when the mikes must be used at greater dis-

[*Continued on page* 116]

FM WIRELESS MIKES PRICED UNDER $100

	BERGEN LABS WMT	CADRE C-50	FLEETWOOD 3002	ISCO WM-3A	KINEMATIX IMP II/M-222*
SIZE (less case)	1x3-1/8x4-1/8 in.	3-1/4x2-1/4x7/8 in.	5-3/4x1-5/16 in. dia.	2-9/16x2x1-3/16 in.	2-3/4x2-3/16x13/16 in.
WEIGHT (less case)	8.5 oz.	6 oz.	5 oz.	3.7 oz.	6 oz.
BATTERY	6.7-V mercury	8.4-V mercury	1.5-V penlite cell	9-V carbon	4.2-V mercury
BATTERY LIFE (approx.)	50 hrs.	300 hrs.	1,000 hrs.	30 hrs.	300 hrs.
FREQUENCY	88-108 mc	91.5-103.5 mc	88-108 mc	88-108 mc	88-108 mc
RANGE (approx.)	200 ft.	200 ft.	35 ft.	100 ft.	225 ft.
MICROPHONE TYPE	Dynamic	Dynamic; jack for external mike	Dynamic	Condenser	Dynamic; jack for external mike
RESPONSE	—	20-20,000 cps	40-20,000 cps	45-15,000 cps	30-20,000 cps
PRICE	$98	$49.50	$85	$22.70	$49.95

* *Kinematix IMP II/M-221 is identical to IMP II/M-222 except that it sells for $39.95 and has no built-in mike.*



Try an Attic Antenna!

It's invisible, solves space & weather problems and tunes all bands!

By LEN BUCKWALTER, KBA4480

THOUGH safe from the ravages of summer heat, winter winds, driving rain or pelting hail, this swinging skyhook manages to bring in the most-distant short-wave stations. The attic location also means that our multi-bander is hidden from the suspicious eyes of neighbors who think a receiving antenna can cause TVI. Along the way, it eliminates tree-climbing, erection of a tower and purchase of a 2-acre back yard.

Another important feature is that it *tunes* the short-wave bands, unlike many antennas that simply lie there. Take, for example, those that are described in the instruction manuals packed with communications receivers. You'd think after reading the descriptions that all it takes is a simple long-wire or compromise-length half-wave dipole to pull in stations.

Not so, unless the only stations you're after are 250 kilowatters like the BBC or the Voice of America. Use an antenna like one of those to try for Radio Pakistan or Outer Mongolia and you just might go to Helsinki before you could find them!

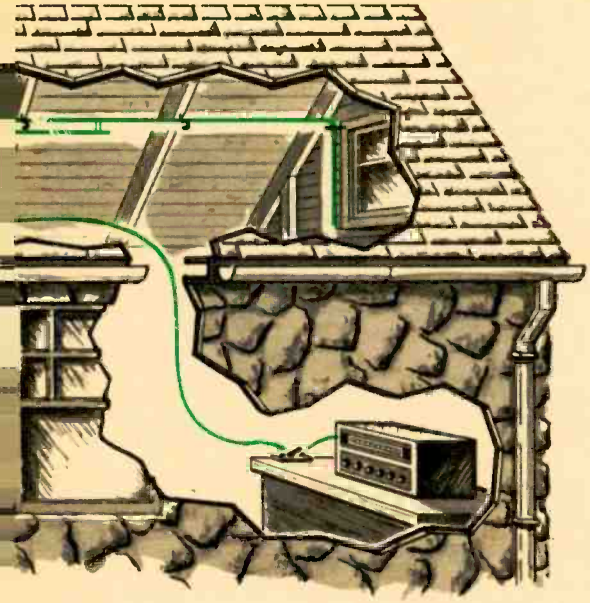
In addition to building up signal levels as a half-wave dipole at the higher frequencies —where it counts—our antenna becomes a conventional long-wire antenna at the flip of a switch.

How's through-the-roof reception? No different from that with an outdoor antenna. Radio signals don't know the difference between a fir stud, an asphalt shingle or a hole in the wall. So long as the roof isn't made of metal, doesn't contain insulation in foil-covered bags, and doesn't have a lot of electrical wiring, signals will pass through freely. The important factor is available space. But read on and you'll see that some of our dimensions can be juggled to fit the antenna into almost any attic—or even a silo.

The antenna is a multiple dipole. That is, it consists of separate tuned dipoles for four major short-wave bands. You can build the antenna for whatever bands you want. Our table shows several short-wave bands, their frequencies and half-wave dipole antenna lengths.

A novel feature is that all elements of our antenna are tied together at the center. This reduces the number of feedlines to just one, a coax cable, and eliminates bandswitching. The appropriate elements become active naturally and automatically on the frequency for which they're cut.

For those who raise eyebrows at the thought of the multiple connection to the cable and possible mismatching, rest assured. Despite the common connection, the dipoles are decoupled electrically from each other



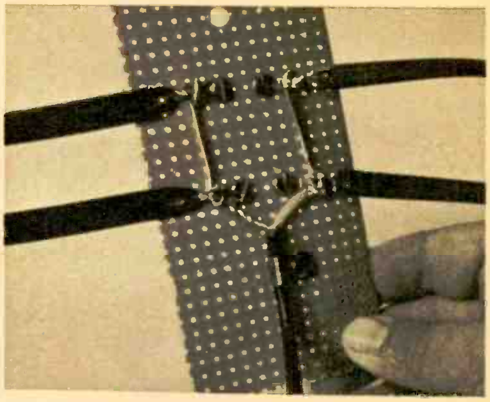
because of the different lengths. The result is that each dipole presents about a 70-ohm impedance to the 73-ohm coax cable.

To keep construction simple we've used a piece of 300-ohm TV twinlead for each *pair* of dipoles, or two bands. Both 19-meter and 16-meter dipoles, for example, are made from a single 31-ft. length of twinlead.

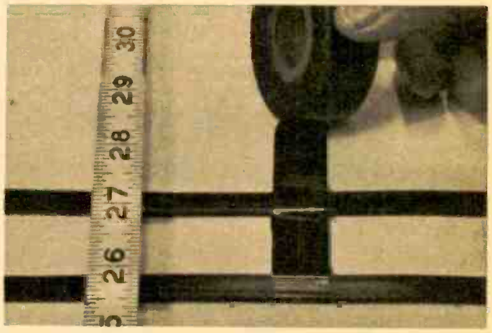
Building it. First, cut a length of twinlead to the 19-meter length (30 ft., 6 in.), then cut short one wire in the ribbon to the 16-meter length (26 ft., 4 in. that is, 25 in. shorter on each end). In similar fashion, cut another length of twinlead for 31 meters (48 ft., 6 in.) and cut one wire in the twinlead for 25 meters (39 ft., 6 in.).

Now to fit the antenna in your attic. If you have a ranch-type home with a long attic you might have room to include a 65-ft. dipole for 41 meters. Or, if you inhabit a bowling alley, there might be room for a real long 60-meter dipole (95 ft., 5 in.). But these are exceptional cases. Chances are, you'll have to switch to long-wire, rather than dipole operation, on these lower-frequency bands.

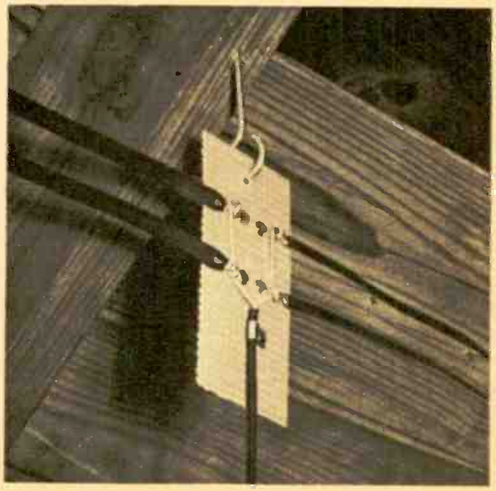
This explains the function of the knife switch shown at the receiver end of the coax in our diagram. Throwing it to *long-wire* means the coax shield is disconnected from ground and connected to the receiver's antenna terminal. The result is a long-wire antenna which picks up energy all along



Board at center where twinlead, coax join. Dipoles can be added for other bands so long as dimensions in diagram on last page are adhered to.



Tape wrapped between twinleads provides support and 1-in. spacing between each pair of dipoles. Space the twinlead with tape every 2 ft.

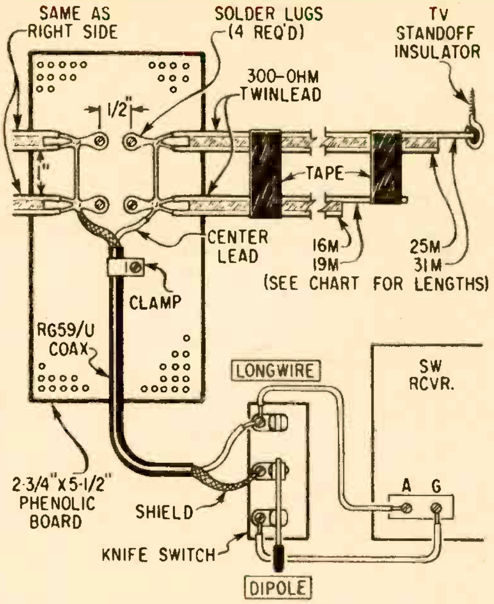


We suspended our board from rafter, which just happened to be in center of roof with a screw-in TV standoff. A home-brew hook will work, too.

TV standoff insulators support antenna at each end. Use standoffs between center board and the end supports wherever antenna arms might sag.

BILL OF MATERIALS

- 300-ohm twinlead, as required
- RG59/U coax cable, as required
- Twinlead stand-off insulators, as required
- SPDT knife switch
- Plastic electrical tape (Scotch No. 33 or equiv.)
- 2¾ x 5½-in. piece of phenolic, Bakelite or plastic board, solder lugs
- Cable clamp, 6-32 screws and nuts



Center-board dimensions. Each piece of twinlead contains two dipole antennas. Slit wire on the long dimension, then cut off the shorter antenna.

Try an Attic Antenna!

the coax, plus the combined dipole elements. In other words, the entire antenna installation becomes a conventional long-wire antenna.

Long-wire operation on the lower-frequency bands won't result in much loss in signal. It is the higher-frequency bands that need the benefit of a resonant half-wave dipole. Ample signal should be picked up at 41 and 49 meters with the antenna operating as a long-wire.

Thus, the longest attic dimension required for the antenna we show is about 95 feet for the 60-meter band. If you're tight for this amount of space, here are two possible solutions, the first based on the fact that a dipole antenna picks up most of the signal near its center. The ends are mainly for resonating the dipole on the frequency for which it's cut. It little disturbs the antenna if both ends drop straight down for about 20 per cent of the total length. For the 31-meter band this is about 10 ft., or 5 ft. at each end.

You might push this a little by zigzagging the ends slightly but don't overdo it. If a dipole is bent like a pretzel it will mismatch the line and develop an erratic pickup pattern. The second trick is to bring the dipole ends outside and down the sides of the house. In many attics this can be done through vents or windows.

Since a dipole is bidirectional, tending to be most sensitive in the two directions broadside to or facing the station, give a little [*Continued on page* 118]

Short-Wave Bands and Half-Wave Dipole Lengths

SW Band (meters)	Frequency (mc)	Length (ft-in.)
11	26.60-26.10	17-9
13	21.45-21.75	21-7
16	17.70-17.90	26-4
19	15.10-15.45	30-6
25	11.70-11.975	39-6
31	9.50-9.775	48-6
41	7.10-7.300	65-0
49	5.95-6.200	78-0
60	4.75-5.060	95-5

KIT EI REPORT

WHAT YOU CAN DO WITH KNIGHT'S KG-221 VHF RECEIVER

First build the kit. Then modify it —that's what!

A BIG world of fascinating listening awaits you in the VHF reaches of the radio spectrum. Once you've spent a few hours monitoring some of the bands, you may just put the old short-wave receiver back up on the shelf and give the TV set a well-deserved rest.

One of the best ways to break into VHF is with the $39.95 Knight-Kit KG-221 FM receiver which tunes from 152 to 174 mc. First we'll talk about the kit and then describe later how to modify it for operation from 88 to 176 mc.

The 152-174-mc band for which the receiver is designed will enable you to monitor police and fire calls, private mobile telephone conversations, Civil-Defense messages, U.S. Weather Bureau reports, taxis, railroads, public-utility vehicles as well as conservation and forestry-service communications. Modified, the receiver will tune the 88-108-mc FM broadcast band, the 108- to 136-mc aircraft band and the 2-meter (144 to 148 mc) ham band.

The KG-221 is not a difficult or time-consuming kit to put together. The circuit includes five tubes and one transistor. Because of the frequencies it tunes, the critical front-end is supplied completely assembled and aligned.

The Circuit

The front-end consists of a dual triode (12AT7) one section of which is a mixer; the other section is a Colpitts oscillator. You simply mount the assembly on the chassis and make four connections to it.

The mixer's output is amplified by two 10.7-mc IF stages (12BA6) and fed to a ratio detector (the solid state diodes are built in the ratio-detector transformer). From the detector, the audio signal is amplified by two triodes (12AX7A) and fed to a 6AQ5 power amplifier. The squelch circuit contains a single transistor. The transformer power supply is half-wave, solid state. Other features include vernier tuning, headphone jack (8 ohms) and a squelch control.

How did the kit go together? Without any hitches. The manual is profusely illustrated with large pictorials each of which covers only a few steps. This means uncrowded illustrations that are very easy to follow.

The few parts that went into the kit were logically packaged and all resistors came

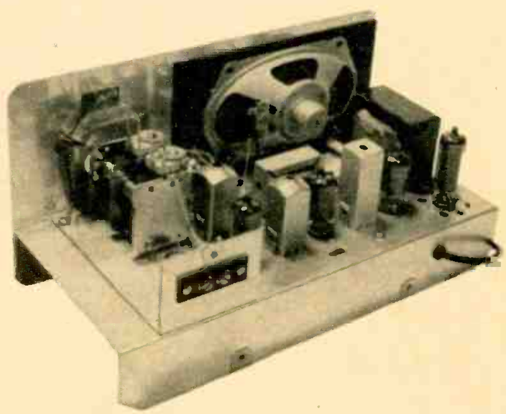


Fig. 1—Top-chassis view of receiver. Front-end is supplied wired and aligned. It's on the chassis on which the antenna terminal strip is also mounted.

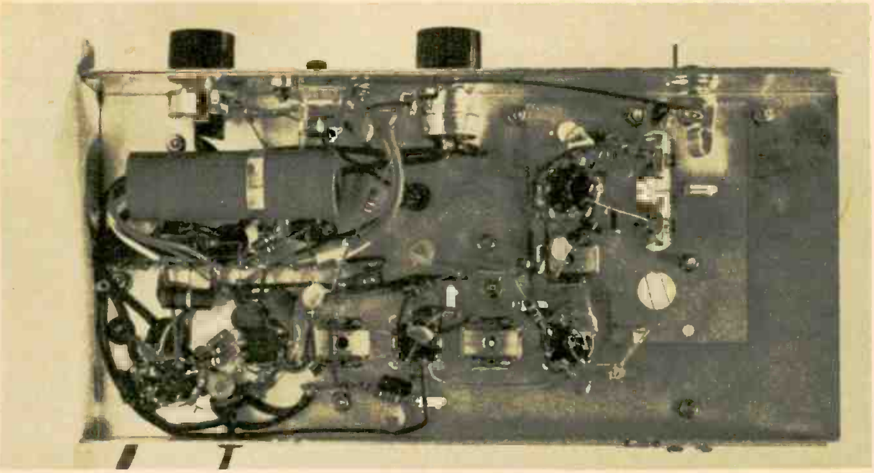


Fig. 2—Underside of chassis. Note how little crowding there is. Everything is wide open and there are no tight corners to work in. Front-end fits in large area at right. Large hole in front-end chassis can be used for wires added for modification of receiver for operation on other bands.

mounted on cardboard strips and identified. We completed construction in about 5 hours.

How it Worked

The KG-221's front-end and IF transformers are supplied pre-aligned, and well aligned they are. Sensitivity necessary to deliver an intelligible signal was 9 μv. Instrument alignment only improved the sensitivity to 8 μv. Either factory or instrument aligned, the receiver's squelch opens up the audio at the point where the signal strength is just strong enough to produce intelligibility—a good feature.

While the selectivity—the ability to reject interfering signals on adjacent frequencies—is not outstanding, it will be adequate most of the time.

Image rejection is about 8db—comparable to that of an inexpensive short-wave receiver. Considering that the band covered by the KG-221 is not going to be busy everywhere at the same time, image interference was not and will not be a problem.

Audio quality is exceptionally good though there is a tendency toward microphonic howling at high volume levels. However, this is common in inexpensive high-frequency receivers. Knight makes mention of the possibility of this happening in the instruction manual and suggests you use an external speaker, which can be plugged into the headphone jack, for high-volume listening.

Our on-the-air test revealed some distor-

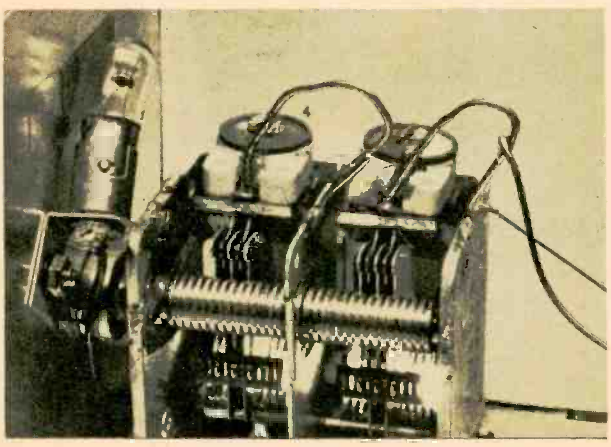


Fig. 3—View of tuning capacitor before modification. Coils weren't bent by accident. Knight shaped them this way during alignment procedure.

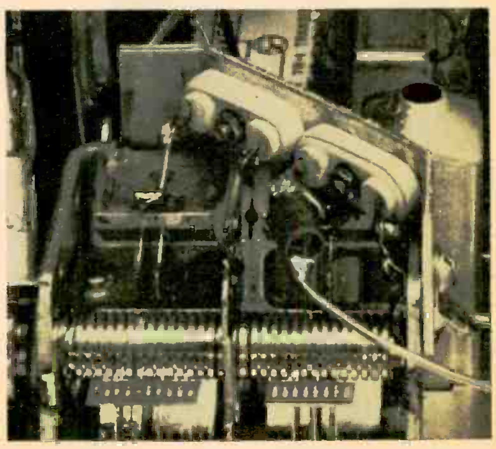


Fig. 4—View of tuning capacitor after modification. Coils were removed and bracket with two coil sockets was added. Note short connections.

KNIGHT'S KG-221 VHF RECEIVER

tion which we at first thought was caused by overload from a strong signal. We felt this was possible since the receiver lacks AGC. Curious, we did a little troubleshooting and found a defective ratio-detector transformer. We replaced the transformer and the problem was solved.

While Knight includes an instrument alignment procedure (which they do not recommend unless a repair results in changes to the factory alignment) it requires a special signal generator not generally found in even the best radio-TV service shops. We tried alignment with the type generator you'd find on a hobbyist's bench and found the receiver could be aligned easily using standard techniques.

But as we said, home alignment is not necessary since factory alignment is just about perfect. As Knight suggests, we recommend you don't realign the receiver unless absolutely necessary and then only if you've had experience with VHF-equipment alignment.

Weighing the few minor shortcomings against its really hot performance and remarkably good frequency stability after a 15-minute warmup, the KG-221 ranks as one of the best buys in Allied's catalog.

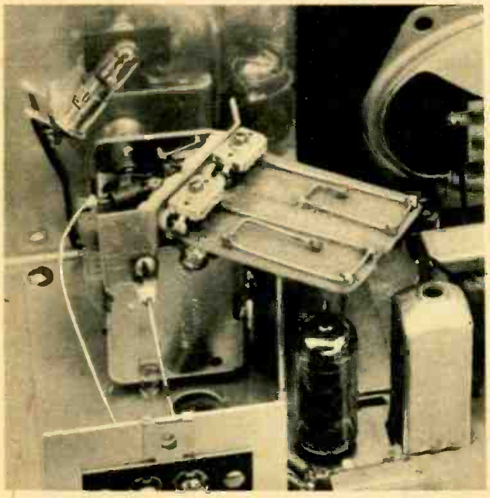


Fig. 5—View of the tuning capacitor with L1, the 88-108-mc coil, plugged in. Note the position and connections of leads from antenna terminal strip.

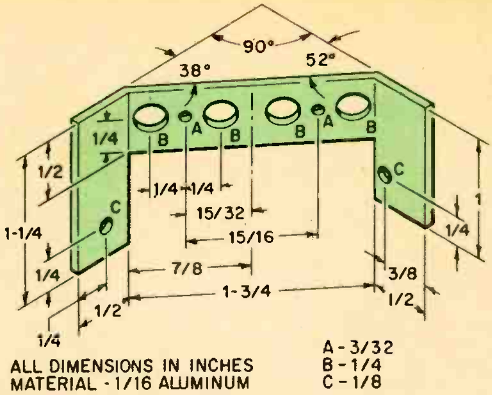


Fig. 6—Bracket for sockets for coils is made from a piece of 1/16-in.-thick scrap aluminum. Tab at right goes on back of the tuning capacitor.

Modifying the Receiver

While the KG-221 does a good job in covering 152 to 174 mc, hearing *signal 29, car 43, 10-4* may get pretty boring after a while. With our plug-in-coil conversion, you easily can extend the range of the KG-221 to receive FM and AM stations all the way from 88 to 176 mc in four bands.

The plug-in coils you use are built on four 1¾ x 2 5/16-in. pieces of perforated circuit board. You insert them from the rear of the receiver into a socket assembly on top of the tuning capacitor. A slide switch added at the rear of the chassis changes detectors for FM or AM reception on any band. The under-chassis circuit modification is not tricky.

Begin by carefuly unsoldering the coils and trimmer capacitors on top of the tuning capacitor (Fig. 3). Store them in case you want to convert the receiver back to its original design later on. Leave the antenna lead going to the mixer coil in place and unsolder the

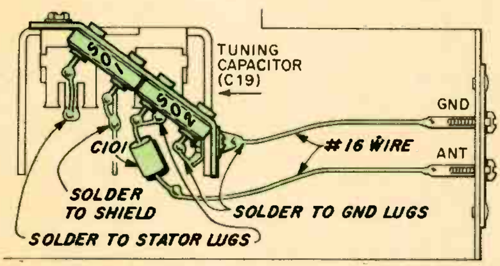
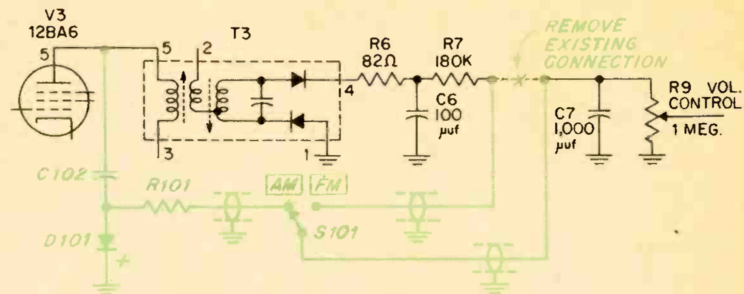


Fig. 7—Diagram of top of tuning capacitor shows the bracket mounted in place. Keep leads from sockets to tuning capacitor and C101's leads short.

Fig. 8—Schematic shows addition of AM detector circuit to receiver in color. When S101 is in FM position, output is taken from ratio detector. When S101 is in AM position, output is taken from diode detector D101. Use shielded wire from R101, R7, R9 to S101.



lead from the antenna terminal strip.

Cut the coil-socket bracket shown in Fig. 6 and bend the ends to fit the rear and side of the tuning capacitor. The bracket is mounted at an angle (Fig. 4) to enable you to plug the coils in easily and to keep the connections to the tuning capacitor short. Mount the two crystal sockets on the bracket as shown in Figs. 4 and 7 and position its mounting holes over the existing holes on the side and rear of the tuning capacitor.

Use a machine screw and nut to mount the bracket and the two ground lugs on the *rear* of the tuning capacitor (Figs. 4 and 7). Use a self-tapping screw to mount the bracket on the *side* of the tuning capacitor as it is difficult to fit in a machine screw and nut. Make sure the screws do not touch the capacitor's rotor or stator plates. We cut away a small length of the fiber tie strip on the rear set of rotor plates to provide clearance for the bracket's mounting screw.

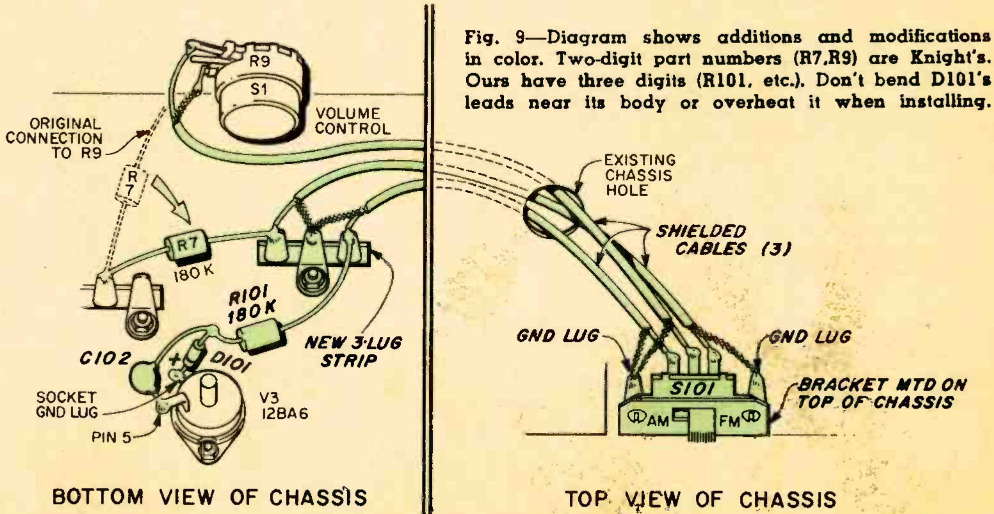
Refer to Fig. 7. Cut C101's leads as short as possible and solder C101 to SO2. Then solder the lead from the antenna terminal-strip lug to C101. Position C101 so it isn't touched by the rotor blades on the rear section of the tuning capacitor. Make sure all connections are as short as possible.

Make a small bracket for S101 (Fig. 9) and mount it on the rear of the chassis. Install a 3-lug terminal strip under the chassis near V3 as shown in Fig. 9. Unsolder the 180,000-ohm resistor (R7) at the volume control (R9) and connect it to the new 3-lug strip as shown. Connect the shielded wires and run them through the large hole in the front-end to switch S101 on top of the chassis as shown in Fig. 7.

The Coils

Cut the perforated circuit boards to the sizes shown in Fig. 10. Bend the #16 buss wire to shape before mounting on the boards then fit them in the flea clips. Cut the lead ends so they protrude about ⅛-in. beyond the edge of the board. Crimp the flea clips on the wire and apply solder to prevent the wires from coming out. Cut off the excess lengths of the flea clips and install the eight trimmer

Fig. 9—Diagram shows additions and modifications in color. Two-digit part numbers (R7,R9) are Knight's. Ours have three digits (R101, etc.). Don't bend D101's leads near its body or overheat it when installing.



KNIGHT'S KG-221 VHF RECEIVER

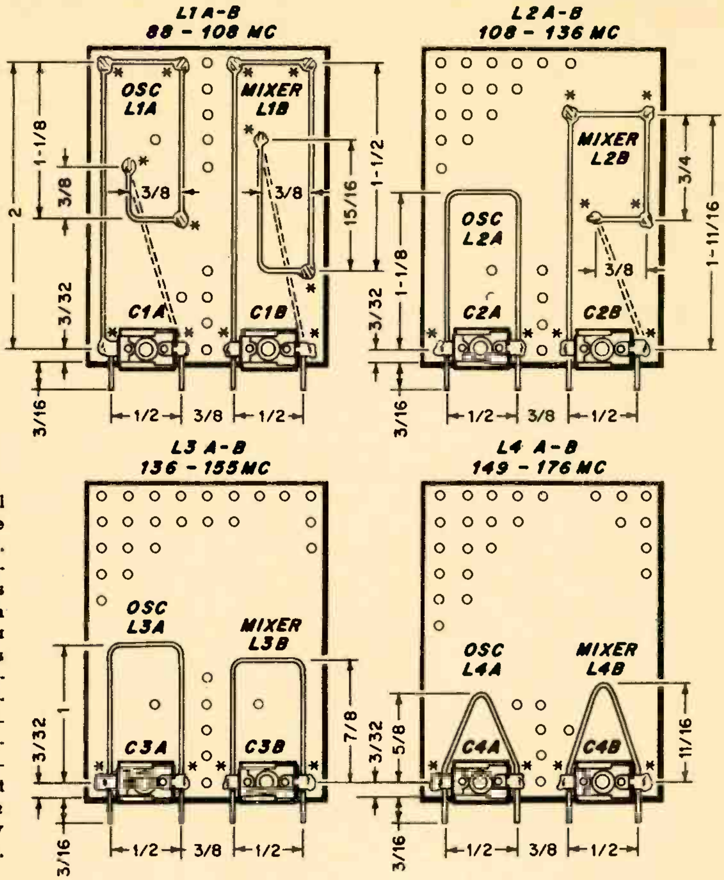


Fig. 10—Coil details. All pieces of perforated board are the same size—1¾ x 2 5/16-in. Dimensions are such that spacing between sides and ends of coils will line up with rows of holes. You can be a slight bit off on dimensions without worrying about performance as trimmer capacitors will compensate for coil-shape variations. But it is important that the spacing between the ends of the coils at the trimmers be exactly ½ in. so the coils will easily slip in and out of sockets.

NOTES
1. ALL DIMENSIONS IN INCHES
2. CAPACITORS SHOWN IN SMALLER SCALE FOR CLARITY
3. ALL BOARDS ARE 1-3/4 BY 2-5/16
4. BOARDS ARE PERFORATED BOARDS WITH 1/16 HOLES ON 3/16 CENTERS
5. 3/32 FROM BOTTOM EDGE OF BOARDS TO ℄ OF 1 ST ROW OF HOLES
6. USE 28 PUSH-IN TERMINALS WHERE INDICATED BY *

capacitors (C1A through C4B). Bend the wires so they slip in the sockets easily.

Tune Up

Connect a 16-in. length of wire to the antenna terminal and plug in a coil. Set up a signal generator (capable of going up to 176 mc) to produce a modulated output at the high end of the band for which you've installed a coil. Open the tuning capacitor's plates and loosely couple the generator's output to the antenna wire. Then adjust the *A* trimmer to pick up the signal. Tune up the *B* trimmer for maximum signal amplitude. Repeat this procedure for each coil.

PARTS LIST

C1A-C4B—0.9-7 μμf miniature trimmer capacitor (8 reqd.) Arco No. 400 (Allied 17 U 087 or equiv.)
C101—5 μμf, 500 V silvered-mica capacitor
C102—10 μμf, 1,000 V ceramic disc capacitor
D101—1N64A diode
Flea clips—(Vector type T28. Allied 40 U 879 or equiv.)
Perforated board—1/16-in. thick, 0.062-in.-dia.-holes spaced 0.18-in. center-to-center. (Vector 45B30, Allied 46 U 005 or equiv.)
R101—180,000 ohm, ½ watt, 10% resistor
S101—SPDT slide switch
SO1,SO2—Crystal socket: 0.05-in.-dia. pins spaced 0.486 in. (Allied 45 U 532 or equiv.)
Misc.—1/16-in. thick aluminum for bracket, shielded wire, No. 16 buss wire, 3-lug terminal strip, hardware.

CB CORNER
BY LEN BUCKWALTER KBA4480

The case of the FAKE MAYDAYS

THE DISTRESS CALL crackled in the ears of a shore-side CBer. Mayday . . . Mayday. . . , it wailed. Vessel . . . sinking . . . in . . . Yarmouth . . . harbor! In seconds the CBer had alerted the U.S. Coast Guard.

This was going to be CB's finest hour. The region around Cape Cod near Boston triggered into a rescue operation. The guys in the Guard soon had the distress signal spotted and plotted.

Chalk up a triumph for CB? Hardly. Boats, you see, just don't sink on dry land. And that's exactly where the distress call came from.

But the Coast Guard boys didn't lose their cool. They tricked the landlocked pirate at his own game. By transmitting back to the would-be vessel they managed to egg him on. Only it wasn't to a snug harbor, but the arms of local police, alerted earlier.

How serious was the ensuing case? If you ever get a yen to send a false distress signal, squelch it, but good. This 24-year-old CBer apparently was well-juiced at the time but it barely mattered. Coast Guard and FBI arranged his day in court anyway. Outcome: A one-year jail sentence. Even the judge got in his licks. For when the Coast Guard answers a false call, he explained at the trial, it could be shorthanded should the real thing come along.

Maybe it's pure coincidence, but this is the second case where a CBer received a jail term—and both happened in Boston. The first operator (guilty of a long history of obscenity) proved what can happen on a too-dynamic mike. He began serving time last March 21.

Frozen Juice . . . Tests by RCA on dry cells show that batteries stored at 9°C were in better condition at the end of five years than those stored at 40°C after one year (see our illustration). So don't let batteries waste away inside portable CB equipment when not in actual use. Keep them well-chilled inside a freezer, or a refrigerator at least. If neither is a frost-less type, protect cells against icing by placing them in a plastic bag.

Reason why shelf-life of cells is extended greatly under cold conditions is twofold. One is that there's less loss of essential moisture from the cell's innards. Also, local action—a discharge of electricity between the cell's chemicals, even while on the shelf—is reduced sharply.

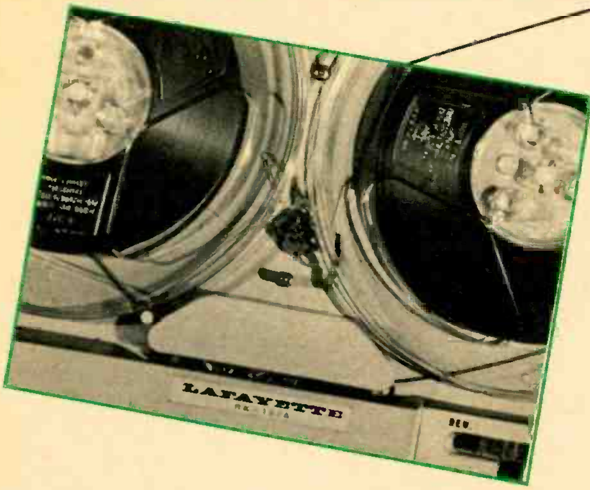
Chilly batteries last long, but don't use them in a walkie-talkie while fighting your way out of a blizzard. Tests also show that standard (zinc-carbon) cells virtually turn themselves off at -30°C—which, converted into Fahrenheit, is 22 degrees below zero. Mercury cells are even less efficient at low temperature. Warm up the cells, at least to above zero, or that keg-carrying St. Bernard never may show.

One-Man Band . . . Thousands of agitated CBers have written the FCC about what they think of certain rules. They express everything from nonplussed outrage to bitter com-

[*Continued on page* 118]

Dry cells last longer if stored in a refrigerator rather than on a shelf, according to tests by RCA. See text for tips on recommended temperatures.

Add Automatic Shutoff to your RECORDER



By IRVING KARMIN

ONE essential feature that often is missing from tape recorders is automatic shutoff. Manufacturers sometimes feel it's a frill and leave it off to keep the price down.

Add automatic shutoff to your recorder and you won't have to worry about what happens if you're not standing right over the machine when the tape ends or breaks. It's a simple, inexpensive accessory to add and will only take an hour or so.

The recorder to which we added automatic shutoff is a Lafayette Model RK-137A, an AC-powered tube job. Since there's little space underneath the deck plate, we mounted the switch between the reels. A small perforated circuit board installed inside the machine holds the four other parts.

There are three basic recorder designs, each of which requires a different circuit. The designs are: 1) AC powered, tube electronics; 2) AC powered, solid-state electronics, and 3) battery powered, solid-state electronics.

If your machine is the first type—AC powered, tube electronics, like the Lafayette RK-137A—use the circuit shown in Fig. 3.

If your machine is AC-powered with solid-state electronics, eliminate SR1 and C2 since low-voltage DC is available to operate the relay directly. However you may have to connect a resistor in series with the relay—it depends on the B+ voltage.

Relay RY1 is designed to operate on 6 VDC. Its coil's resistance is 335 ohms, which means at 6 V it will pull 0.018 A (18 ma). If the DC voltage used for the recorder's elec-

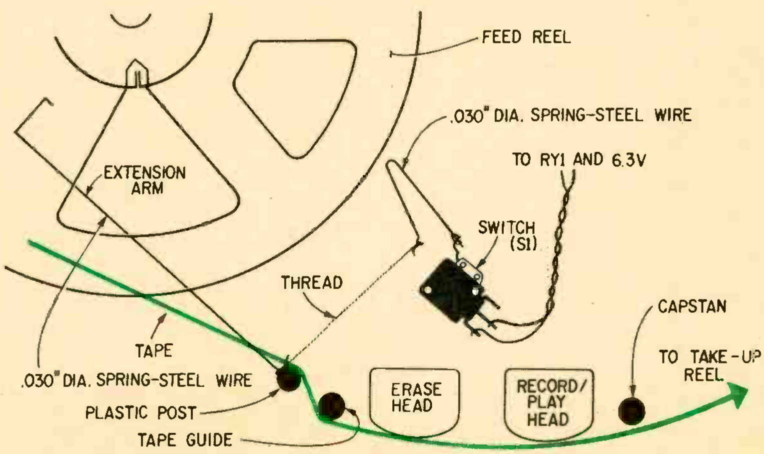


Fig. 1—Diagram shows where to install spring-steel extension arm and switch on top of deck. Switch and arm should be cemented to deck plate with epoxy. Note how tape is threaded over plastic post and around the existing tape guide post on machine.

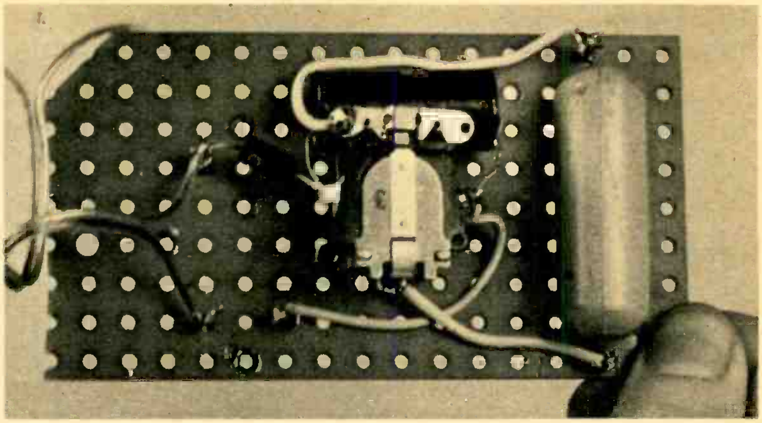


Fig. 2—We mounted relay and other parts on 4½ x 2½-in. piece of perforated circuit board. Leads at left go to 6.3-V filament winding on recorder's power transformer. Leads from switch get connected to lugs at bottom. Leads from motor(s) and 117 VAC can be connected directly to capacitor at right side of board.

tronics is, say, 12 V the resistor will have to drop the extra 6 V. To compute the resistor's value, use Ohm's Law: R = E/I. E is the voltage to be dropped (6 V). I is the current in amperes drawn by the relay (0.018A). Therefore R = 6/0.018, which equals 330 ohms. A 1-watt resistor will handle the power.

If your recorder is battery-powered simply connect the switch in series with one of the motor's leads.

Construction. First things to do are determine the best place to mount the switch and spring-steel extension arm. Remove the switch's actuator arm and cement (with epoxy) a piece of spring-steel wire (shaped as shown in Fig. 1) in its place.

Bend a length of spring-steel wire to the shape shown for the extension arm and put a ¾-in.-long by 3/16-in.-dia. plastic post on one end. Temporarily secure the extension arm and the switch on the deck plate with tape. Then connect the extension arm to the spring-steel wire on the switch with a piece of heavy thread.

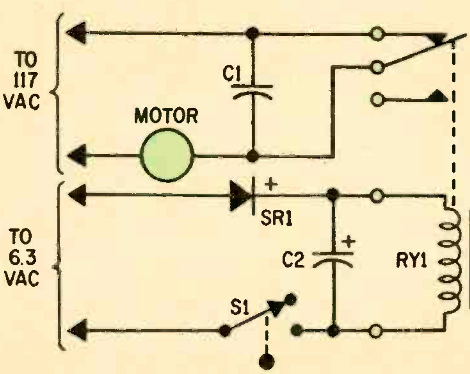


Fig. 3—Circuit for AC-powered tube recorder. When tape breaks, S1 closes and energizes RY1, whose contacts open, remove power from motor(s).

Put a tape on the machine as you would to make a recording and start the recorder. Simultaneously adjust the position of the extension arm and switch so the tension of the tape against the post actuates the switch.

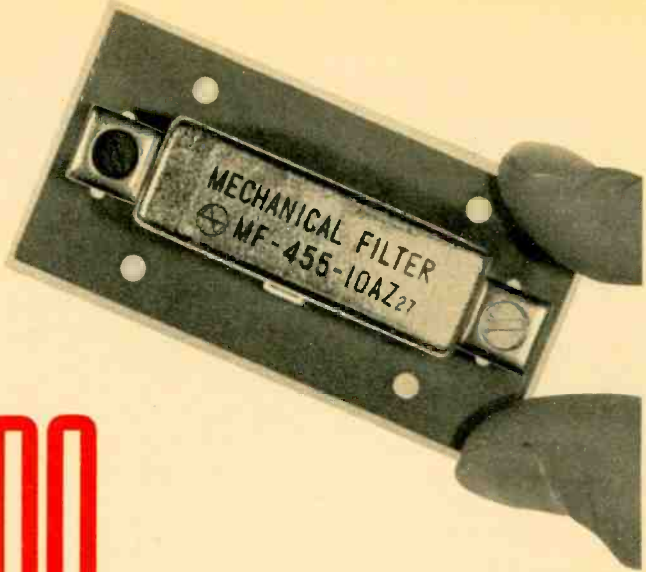
After you're satisfied with the mechanical operation, cement the extension arm and switch to the deck plate with epoxy. Install the circuit board in a convenient place inside the recorder. Break one of the leads going to the motor(s) and connect the leads to the *normally closed* relay contacts. Also be sure to connect the wires to the switch's *normally closed* contacts. Connect one wire from the switch to one side of the 6.3-V filament winding on the recorder's power transformer. Connect the other wire to one of the relay's coil lugs. Connect the relay's other coil lug to diode SR1 and capacitor C2.

Check for proper operation by pulling the post toward the front of tape recorder. The motor(s) should start. Thread a tape around the plastic post as shown in color in Fig. 1, turn the reels to put tension on tape to start the motor(s) and you're ready to go.

PARTS LIST

C1—.25 μf, 400 V tubular capacitor
C2—200 μf, 12 V electrolytic capacitor
RY1—SPDT relay; 6-VDC, 335-ohm coil (Potter and Brumfield RS5D. Lafayette 30 R 8598)
S1—SPDT subminiature snap switch. Cemco No. MAC-100-1. (Columbus Electric Mfg. Co., 621 N. Hamilton Rd., Columbus, Ohio 43219. $1.85 plus 20¢ postage)
SR1—Silicon rectifier; minimum ratings: 50 ma, 100 PIV.
Misc.—Perforated board, flea clips, .030-in.-dia. spring-steel wire, phono pickup wire (Belden No. 8429), 3/16-in.-dia. x 1-in.-long plastic rod.

FILTERS THAT REALLY DO



By LEN BUCKWALTER, K1ODH

REMEMBER when radio was mostly mechanical? You tickled a cat's whisker to receive, keyed a spark generator to transmit. But tubes and transistors changed all that. Now mention the word mechanical to an engineer and he's likely to say 23 skidoo. But the good old days are returning. Along with gas lamps and skirts above the knee, you well may see your next CB, ham or SWL rig packing a mechanical part to replace some pure electronics. For the most eye-opening, non-electronic improvement to come along in many a moon is the mechanical filter.

This nuts-'n'-bolts item hits squarely at the problem of receiver selectivity—or how to tune just one station at a time. Trouble is that many radio broadcasters don't have the squatters' rights of regular AM, FM and TV stations. These fat cats occupy fixed points in the band, ordinarily are surrounded by electronic picket fences called guard channels. Result is that even the lowly regen receiver, which tends to slobber all over the SW bands, can do a fair job of separating broadcast stations.

But get on your ham rig and work 20-meter CW when DX signals start to heat up the antenna. Or give a yell for help on CB some Saturday. Or if SWL is your dish of tea try to part Uncle Ivan in Moscow from Dr. Toru in Tokyo. Listening on these bands can be like eaves-dropping on a Chinese poker game. And many is the DX operator who has pin-pointed the interference problem with the remark: "We wuz clobbered by Q-R-Mary."

The mechanical filter changed much of that—at least for the affluent amateur who settled for nothing but the best. Introduced in a de luxe receiver by Collins Radio about ten years ago, the mechanical filter received a rousing reception. Bigshot brass-pounders claimed it was the greatest thing to happen to radio since Samuel F. B. Morse. Hams endlessly ranted on about incredible skirt selectivity and flat-top response. True, the fact that a mechanical filter went for about $100 limited it for years to high-price equipment. But the good news for the CBer, SWL and ham is that the bottom has dropped out of prices.

Just what is this mechanical upstart that makes even engineers slightly balmy? Truth to tell, it's little more than a tuning fork gone ritzy. Instead of the fork shape, however, this one looks like a flat metal disc. But the action is the same: twang metal and it begins to vibrate. And, like a violin string, the number of cycles per second (frequency) depends on physical size.

By way of comparison, the piano tuner's fork might resonate at 440 cps, an audio tone; the metal disc in a mechanical filter vibrates at 455 kc, a much higher radio frequency. Yet in each case mechanical vibration is used for good reason. The metal produces an extremely narrow and accurate frequency range. In effect, it forms a narrow slot through which all incoming signals must pass.

Result is that anything not precisely on filter frequency ends up in limbo.

The problem of getting receiver signals, which are electrical in form, through the filter's metal discs (several are used) is solved by placing transducers at the fore and aft sections. To run an electrical signal into the filter, the energy first is applied to a coil. This creates a magnetic field which moves a driving rod that, in turn, kicks the metal plates into motion. Since the plates are cut precisely for 455 kc, they respond only to 455-kc signals. Energy above or below this value—the interference—is rejected. In this fashion, a desired 455-kc signal rides through the filter as mechanical motion. What's more, the modulation, which lies at frequencies slightly above and below 455 kc, also pass through the discs with little untoward effect.

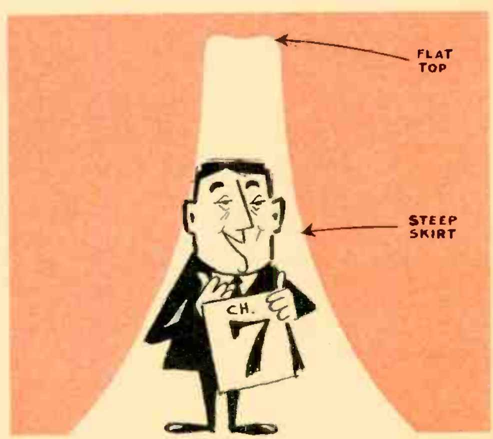
The filter next converts mechanical motion into electrical signals which are fed into the remainder of the receiver. This is accomplished by reversing the first step: the vibrating disc moves a rod which disturbs a coil's magnetic field. Result is induction of an electrical signal in the coil.

What this signal processing does to receiver selectivity is relatively easy to comprehend. The receiver's window to incoming signals approaches an ideal flat-top, steep-sided curve. And therein lies the mechanical filter's real magic, for it neatly avoids the problems of other selectivity devices like the crystal filter or Q-multiplier.

Cartoons are good at showing how a mechanical filter works. Perfect receiver would pass only one signal at a time—CB's channel 7, say—and reject others, particularly adjacent channels 6 and 8.

Since no receiver is perfect, selectivity curve normally has relatively gentle slope (called skirt). Result is that unwanted channels 6 and 8 easily can accompany desired signal through receiver.

Usual method of sharpening receiver selectivity calls for crystal filter or Q-multiplier. But both are so sharp that they chop off a portion of the desired signal—especially sibilant sounds.



Closest approach to idealized response of perfect receiver calls for mechanical filter. Combination of flat top and steep skirt permit only desired signal to pass; all others are rejected.

To be sure, the crystal filter also utilizes a vibrating medium (quartz) to squelch undesired signals. But without elaborate design, crystals are too sharp—even portions of the desired signal can be clipped. And as anyone who has operated a crystal filter well knows, there often is an annoying ring to the audio.

The Q-multiplier is the more electronic method for attaining selectivity. Simply an amplifier stage connected back on itself, it succeeds in canceling all interfering signals in the process of feedback. (The desired signal escapes this treatment and passes through the stage.) But Q-multiplier performance leaves much to be desired. Not only does it require manual tuning, it also tends to be excessively sharp during voice reception.

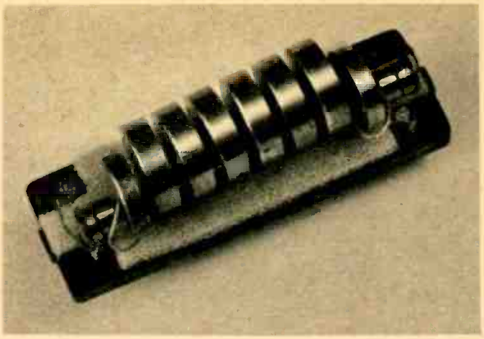
FILTERS THAT REALLY DO

The stable, accurate and well-shaped mechanical filter nimbly sidesteps these faults. Code signals piled layers deep seem to fall away, leaving desired signals free of QRM. Further, the filters can be made in different bandwidths to suit a particular application: a 500-cps model for copying CW, a 2.8-kc unit for single-sideband reception (it can slice away one sideband of an AM signal), a 6-kc filter for normal AM or voice reception.

But a mechanical filter for CB, SW or the cheap ham receiver? The prospect of so de luxe a device for equipment in the under-$500 class seemed ridiculous. Pooh-pooh said the In Group. What they didn't reckon with were two inexorable forces at work in the marketplace. One is spritely competition among manufacturers to make receivers work better under increasingly crowded conditions. The other: Made In Japan. Both seemed to set good old Yankee ingenuity to pressing forward. And, as we'll see, Collins was among the first to pull some rabbits out of the hat.

The first low-price mechanical filter arrived months ago in a CB transceiver by Lafayette Radio. This set, the Model HB-500, raised a few eyebrows. Not only did it boast a 5-watt, all-transistor circuit for less than $140, but it touted a mechanical filter to boot. Was Lafayette pulling our skirts?

Operating the rig for a few months provided the answer. Tuning evinces the distinctive, unmistakable feel that comes from having a mechanical filter in the circuit. As the dial is swung over the busy band stations don't slide into place, they kerchunk on frequency. Even strong adjacent-channel signals can't sneak through the steep-sided skirts of the mechanical filter.



Removing cover from Lafayette filter reveals unit's guts: six metal discs, two ceramic transducers.

Secret behind Lafayette's cost-busting filter is that designers left out all features needed principally by military and industrial users. CB, they figured, claims neither tough environment nor rigid performance specs of stricter applications. Thus the filter has no high-tensile, plated-steel casing (there's a simple metal cover instead). And since the filter probably won't be used in a jungle or at subzero temperatures, it's not sealed hermetically. Elaborate vibration damping also is eliminated.

The filter, too, doesn't need as many sections in CB service where straight AM (not single-sideband or code) is employed. This means that the cost of producing the filter is sliced to where it's about equal to that of a conventional crystal filter found in some CB equipment. But it outperforms the crystal filter due to the elusive steep-sided, flat-topped curve. It doesn't cut frequencies that make the voice understandable, and the fact that it's produced in Japan hurts the price not one iota.

"Will it perform as well as its high-priced American cousin?" we asked John Pereyo, a communications engineer with Lafayette Radio. He was confident as all get out. On selectivity, John boasted, "You call it, we'll do it!" He also stressed that the low price doesn't mean the materials used in the filter's construction are inferior and pointed out that the total device doesn't have to be extremely elaborate for CB. But the unit is quite capable of doing most anything a CBer would demand (an interfering signal removed a mere 8 kc from the desired channel easily can be knocked down a hefty 45 db, much more if necessary).

Lafayette apparently is confident, too, since a similar mechanical filter is installed in its more recent HB-600 rig. And indications are that the mechanical filter will appear in an increasing number of that company's line of communications equipment.

Not long after the first CB mechanical filter appeared, another producer, United Scientific Labs, decided to join the trend. Plunked between the stages of its Contact 23 rig is a mechanical filter which uses a ceramic-type transducer to convert electrical signals into mechanical action, then back again.

Where was Collins Radio? That grand old company with a gilded name in the communications field decided this was no time to be caught napping. In mid-1965 it took the industry by surprise by announcing its intention to enter the CB market with a mechanical filter. And it wasn't going to list at $65—the approximate price of one that goes into the high-priced Collins ham receiver. If CB makers would order in sufficient quantity, a suitable CB mechanical filter could price out at an incredibly low, under-$7 figure. (At this writing, Collins reports it's negotiating with more than a dozen CB manufacturers interested in the new low-price filter.)

So we asked a Collins man the burning question: "Will this cheap filter work as well as the super-duper model?" The answer came from Don Iacoboni, an engineer with the company. He explained that the CB unit really is no different from the expensive version, except that it's scaled down for the CB application. Since the filter is used only for voice work, it cannot be overly sharp. Thus the number of metal discs has been reduced from 7 or 9, down to 5. This gives the filter a shape factor of 3-to-1 (instead of 2-to-1) which, though not as good, is considered adequate for CB. What's more, plastic is used in packaging the filter to reduce the cost of materials and make the filter easier to assemble. Gone are hermetic seals and special shock absorbants not needed in CB service.

The Collins spokesman further points out that this new unit still uses the Collins idea of a magnetostrictive action to convert electrical signals into mechanical action. And here is where it differs from the imported units (which use ceramic elements to do the same thing). Argument is that the magnetostrictive approach makes for a more stable device, less affected by environment (though

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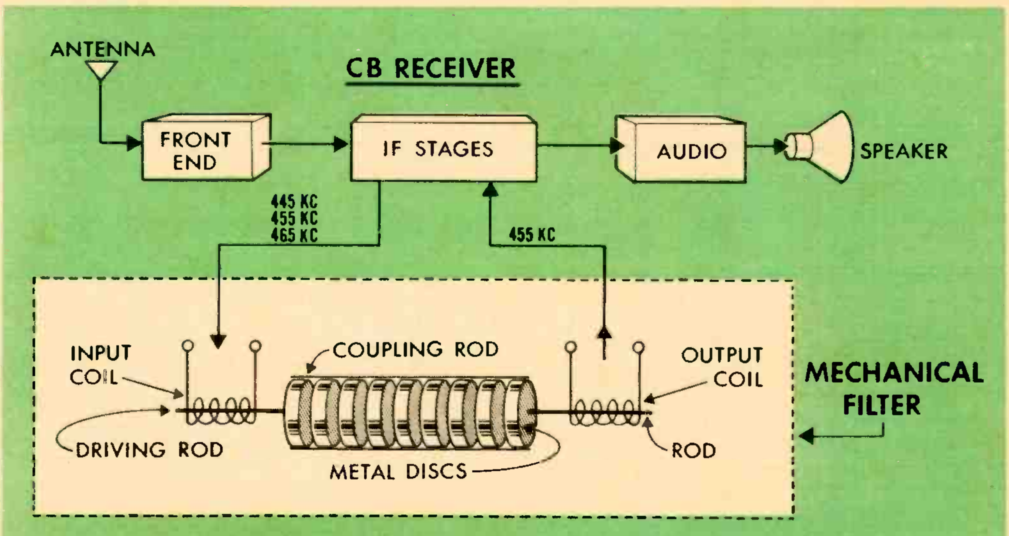
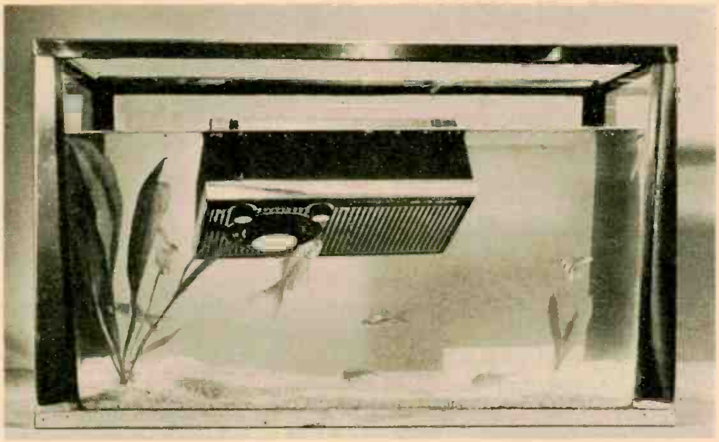
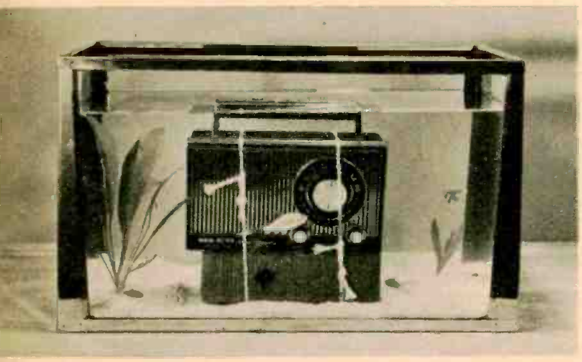


Collins mechanical filter relies on magnetostrictive action in rods and coils to convert energy from electrical to mechanical states. Only 455-kc IF gets through filter in this CB receiver.

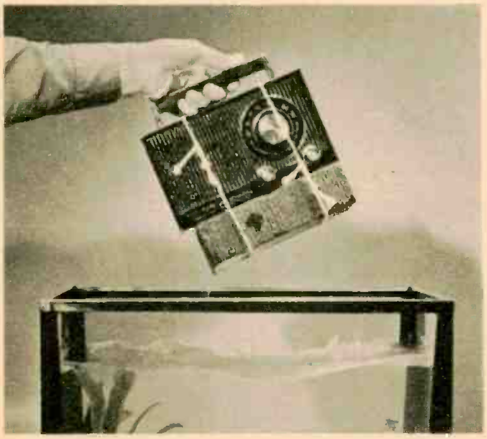




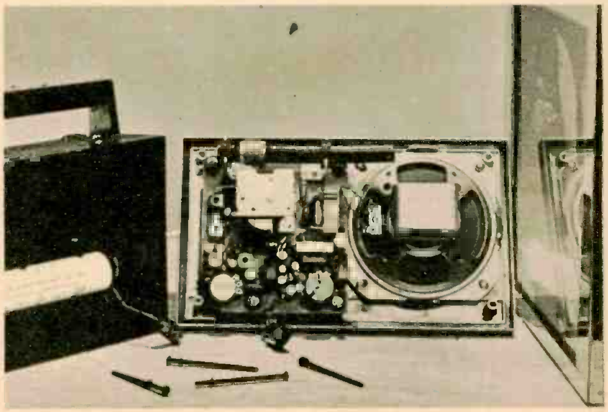
The Ivory people have nothing on this set—it floats, too! Radio isn't pressure-proof, however, and likely would flood if forced into deep water.

WORLD'S TOUGHEST RADIO?

Radio was turned on and tuned to a 24-hour station before it was placed in its aquarium bath. Brick served as weight to keep set under water.



Removed from tank after 12-hour soak, radio still was playing perfectly. Neoprene diaphragm covering speaker cone improves tone, keeps water out.



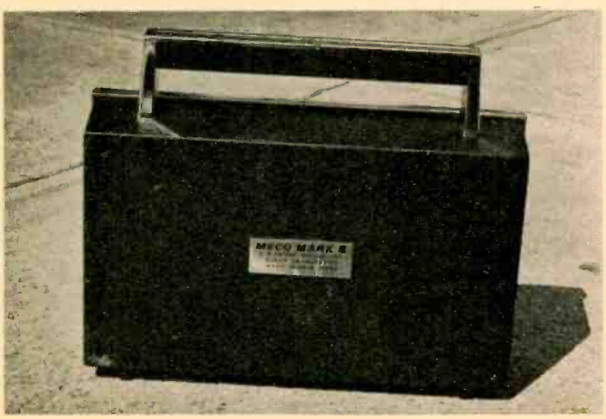
Interior of set proved bone-dry after its 12-hour dunking. Two-piece case houses batteries in one section, circuitry and 4-in. speaker in the other.

Shock test entailed repeatedly dropping the radio onto concrete from 3-ft. height. Set didn't mind the rough treatment a bit and kept right on playing.

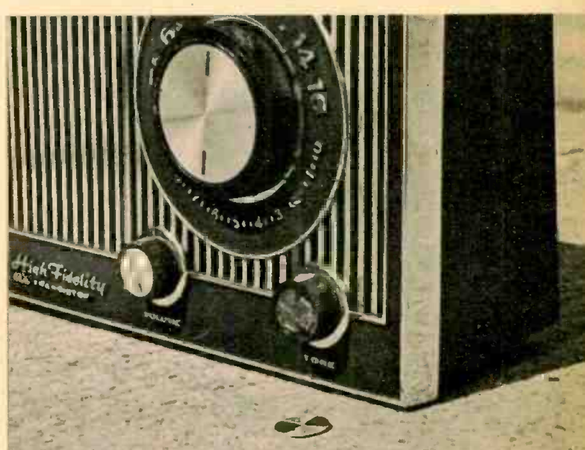
Combination zinc and plastic case ably protects circuitry from bangs and jars most every portable is heir to. Heavy components are shock mounted.

WATERPROOF, floatable, shock-resistant and humidity-proof says the Meco Corp. of its MK II radio, which just might be top dog of the unbustables. An eight-transistor AM portable made (of all places!) in Hong Kong, the MK II proved a solid performer with sensitivity, selectivity and audio quality all distinctly in the superior range. The unit is powered by four C-cells and, with a 1-watt-plus output, readily makes like a pint-size PA. Equally important, the set managed to pass our severe torture tests with all flags flying (see our photos).

The MK II is available for $29.95, postpaid, from Meco Corp., 2550 Murrell Rd., Santa Barbara, Calif. 93105.



Carrying handle (on rear section of case) also serves as direction finder. Handle points toward station when set is positioned for weakest signal.



Sole damage produced by stringent shock test was a few small dents in chrome trim and dropping out of decorative metal inset in tone-control knob.

GOOD READING

By Tim Cartwright

DAVID SARNOFF. By Eugene Lyons. Harper and Row, New York. 372 pages. $5.95

By any standards, David Sarnoff is one of the pivotal figures of electronics, and the barest facts of his biography add up to one of our century's great success stories. But don't approach this book in the hope of discovering just what manner of man he is or the real story behind the famous controversies he has figured in. The tone of the book is just a bit too deferential for those purposes, and the man is drawn in two (rather than three) dimensions—possibly because the author is a relative.

But what this book does have to offer is a long and panoramic view of electronics in this century. And when the big picture finally is sketched in, it becomes impossible to imagine what electronics would be like without Sarnoff's efforts, energy and genuine vision (our photo below was taken some 30-odd years ago before Sarnoff had demonstrated his dream of wireless pictures or TV). Though the book fails fully to flesh the personage it portrays, it does bring home the fact that his influence has touched the lives of all of us.

So by all means read this book. Someday, someone just may do a biography that uncovers some stones left untouched by this one. But until he does this will remain our best look at a most vital man in a most vital field.

Taken from the Sarnoff biography discussed above, our photo shows Sarnoff (left) and Guglielmo Marconi before a mammoth transmitter in New York.

TRANSISTORS: PRINCIPLES AND APPLICATIONS. By R. G. Hibberd. Hart Publishing, New York. 304 pages. $5.95

Books on transistors now are around in such quantity that it's hard to count them on a shelf, much less to tell good from bad with any ease. This book is one of the good ones. Manager of the R&D department at England's Texas Instruments Ltd., the author not only knows his stuff but talks about it clearly in idiomatic, non-stilted terms. Particularly interesting is a long, well-illustrated chapter on the making of transistors. If you've been looking for a good text on solid-statery, this is it.

DICTIONARY OF ELECTRONICS. By Harley Carter. Hart Publishing, New York. 410 pages. $2.65

Also of English origin is this dictionary of electronic terms. What really is appealing is that it offers both the esoteric things you'd expect as well as such everyday subjects as ghost images in television. Equally unusual is the excellent complement of illustrations. All in all, this definitely is a good bit above average and (in this paper-back version, at least) a bargain.

THE RADIO AMATEUR'S HANDBOOK, 43rd Edition. ARRL, Newington, Conn. 704 pages. $4

The biggest, most informative and definitely the best-printed edition yet and a must for practically everybody.

A DX GUIDE TO EUROPE

By ALEX BOWER

SOMEHOW Europe for the average SWL means tuning in transmissions from the BBC, ORTF Paris, Radio Sofia and such, chiefly because they ordinarily roll in like a Bat Radio. But European though they are, such stations never could quell the burning and yearning in the heart of a true DXer. Reason is that none *under ordinary circumstances* rightfully can be considered real DX. But don't let other peoples' mistakes fool you. There are DX treasures to be found just across the pond--you merely must know where to look for them!

Lest there be those who argue that the BBC and ORTF *are* DX, we best had define what DX means so far as Europe is concerned. No one would consider a local AM station DX and by the same token no one should consider as DX a station that regularly and readily is available for the tuning. Reason is that while DX once had something to do with distance, it since has come to mean any sort of truly rare or difficult reception. And in view of the fact that the BBC, ORTF and R. Sofia are like local BCB stations in that they can be heard every day (or close to it), none can be considered DX of 1966 vintage.

Schedules and frequencies of the true DX stations seldom are readily available to the average listener, a problem which frequently is one big headache for the general SWL. But the pure DXer couldn't care less about tuning in the same programs and same stations on an everyday basis. DX is his meat and he has learned that even the royal and rich fail to secure so rare a fare daily.

As most DXers are aware, there are many things which can place a station in the rare category. One is location, for entire countries oftentimes are difficult to hear. In Europe, five countries with SWBC facilities fall into this category. Tiny Luxembourg, for example, boasts Europe's leading commercial station. And the fact that R. Luxembourg *is* a commercial outlet makes it something of a rarity for most every other European broadcaster operates under government auspices. Significantly, R. Luxembourg claims so large an audience in France that Monsieur DeGaulle literally tried to buy control of it.

The station usually is available to North American SWLs only on 49 meters—6090 kc, to be exact. But since 49 meters is a relatively low band and the sunspot count is rising, a little effort will be required to log it. Best time is 2315 EST when the station presents taped religious programs and sometimes religious music.

Also on the wee side is Monaco, a principality blessed with two privately owned stations. Most easily heard is Trans World Radio, which is known better for its superpower Netherlands Antilles station, PJB at Bonaire. TWR often comes through on 7260 kc at 0130 EST when an hour of English tapes is aired.

Second station operating out of Monaco is R. Monte-Carlo. This one is a favorite with those hardy DXers who hunt European signals on the medium-wave broadcast band, since it operates on 1466 kc under the call 3AM2. This station recently added a million-watt-plus long-wave transmitter—the world's most powerful—on 218 kc. But for the average SWL, reception is not at all common. Best bet is 7130 kc at 0030 EST.

Still a third member of the tiny (and rare) nation group is Andorra. R. Andorra falls in the tough-to-log category, though it's easy by comparative standards. Its short-wave frequency is 5990 kc, sometimes 5995 kc, and both spots are loaded with QRM. It occasionally can be heard before its 1830 EST sign-off—sometimes as early as 1630—so long as Latin American signals haven't had a chance to build up. However, it's best to be prepared for a good many tries.

The European portion of Turkey (which EI's DX Club recognizes as a separate country) is the home of two experimental SWBC stations but to the best of our knowledge neither ever has been bagged in North America. However, there is fair chance of logging the station operated by the Technical University of Istanbul. It operates on 7018 kc and occasionally should be heard prior to its 1500 EST sign-off.

Most DXers also count the Azores as part of Europe, which makes Emisora Regional at Ponta Delgada another good DX bet. Try for this one on 4865 kc at 1700 EST or thereabouts. As it happens, 4865 kc is 60-meter territory and, under international radio law, broadcasting on this band is supposed to be limited to the tropics. Point is that this Portuguese government station is well north of the Tropic of Cancer, which fact makes it an even more interesting catch.

Though such super-tiny, super-DX spots as San Marino and Liechtenstein unfortunately are without SWBC facilities, certain normally non-rare countries also offer some interesting DX targets—clandestines being outstanding in this group. R. Espana Independiente, for example, a Communist operation generally rumored to be either in Czechoslovakia or Romania, last was observed on 17700 kc around 1800 EST. And a relative newcomer to the current clandestine scene is R. Euskadi which, while anti-Franco like R. Espana Independiente, is beamed specifically to Spain's Basque regions. Schedule is approximately 1500-1630 EST on 13228 and 15020 kc. This one also might be Communist-inspired, but there as yet is no evidence to that effect. For whatever it's worth, a French mailing address is announced (B.P. 59, Poste Centrale, Paris 16),

EI'S EUROPEAN DX DOZEN

FREQ (KC)	STATION	LOCATION	TIME (EST.)	REMARKS
7090	R. Tirana	Albania	From 2230	Broadcasts in Russian
7210	International Red Cross R.	Geneva, Switzerland	Irregular between 0100 and 0200	Very rare
9505	R. Beograde	Yugoslavia	1700 and 2330	Broadcasts in Russian and English
9675	Polskie R.	Warsaw, Poland	1800-2000	Spanish and Polish beamed to Latin America
11500	R. Free Russia R. Omega		About 1300	May use same transmitter
11697	"Peyk-e-Iran"	(clandestine)	Before 1340	May be located at Sofia, Bulgaria
11715	R. Tirana	Albania	1800-1815	Broadcasts in Spanish. QRM from R. Nacional de Espana
11717	R. Sofia	Bulgaria	From 1905	Beamed to Africa (see text)
11722	R. Athens	Greece	Before 1830	Best reception between 1745 and 1800 EST
11840	R. Polskie	Warsaw, Poland	1800-2000	Spanish and Polish beamed to Latin America
17700	R. Espana Independiente	(clandestine)	About 1300	Location unknown

which might be worth a try for anyone desirous of securing R. Euskadi's QSL.

Reports also once put another clandestine, Peyk-e-Iran, in E. Germany, though its real location apparently is either Tashkent (Uzbek S.S.R.) or Sofia, Bulgaria (see BIG TROUBLES ON 25, July '66 EI). Principal evidence is that when Peyk-e-Iran leaves 11697 around 1340 EST, Sofia invariably shows up on 11717 a few minutes later, beamed to Africa. Further, Sofia never has been heard to come on 11717 before the clandestine leaves the air, all of which strongly suggests that two are using the same transmitter.

For the most part, of course, R. Sofia cannot be considered DX. But under the above circumstances it becomes the best of DX. In fact, R. Sofia's transmission to Africa is itself a difficult logging in North America because it 1) has a weak signal on this continent and 2) suffers from severe QRM (from R. Canada on 11720 kc.) And therein lies excellent example of how most any European station, under certain circumstances, can become a worthwhile logging and take the form of true DX.

Speaking of true DX, our chart lists 12 rare transmissions from non-rare European countries. Only the most interesting have been included for it obviously would not be feasible to list them all. Short-wave listeners with a flair for DX will be interested particularly in the listings for Albania, Greece, Poland and Yugoslavia. While all are substantial nations, none save Albania has programs specifically beamed our way.

Matter of fact, such spots as Albania and Greece offer some *super* catches for DXers with ample digging power. Two of the best pulls are the Greek Forces Broadcasting station at Athens on 6045 kc (sign-off is at 1730 EST) and Albania's strictly regional R. Shkodra on 8215 kc (1500 sign-off). And these are but two, for even the world's greatest DXers always will be blessed with an untouched target or two in this, the farthest corner of Europe.

Best part about European DX, of course, is the Continent's fabulous QSL return. Except for stations of the clandestine variety (and R. Portugal), virtually no European SWBC station fails to verify a good report. DXers, in fact, should be able to confirm something over 95 per cent of their European SWBC reports. Or looking at it another way, Europe is a sure-fire test for every SWL. If you can't get that kind of return from your reports, there likely is something drastically wrong with your reporting method. For an address all you need is station name, city and country. And though most stations are government-owned, it still is a good idea to include return postage in the form of an International Reply coupon (IRC).

Tiny nations such as Andorra and Monaco make for proud entries in any European DX log book. QSL from Monaco's R. Monte-Carlo (above) depicts principality's flag and shows station's antenna against a picturesque Alpine backdrop.

HI-FI TODAY

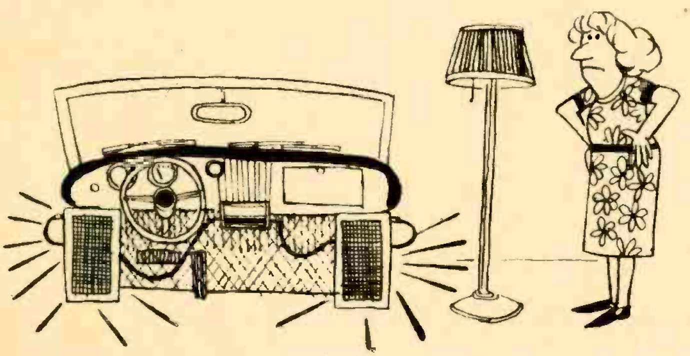
By John Milder

✓ *Cars, cartridges & cottages*

✓ *Receiver fever*

STEREO systems have become the biggest-selling new auto accessory since foxtails. Well, would you believe rumble seats? Fact is, recorders are threatening to catch air conditioners on the popularity list, original-equipment division. And when you add the machines installed over the past year in everything from month-old Cadillacs to vintage Volkswagens, you register an awful lot of dollars spent for stereo-on-the-road. The big thing, of course, is the tape-cartridge machine for cars. Mobile stereo-FM, though selling well, is a way-distant second to tape.

Roughly 25 manufacturers now are turning out stereo tape players for cars and a dozen other brand names (such as Sears and the auto manufacturers themselves) turn up on the various machines. Except for the Norelco, which uses a 1⅞-ips system all its own, the major machines are designed either for the Lear Jet 8-track or the Fidelipac 4-track cartridge (see Tapes For Touring, Nov. '65 EI). Two machines—the Kinematix and the Livingston—will accept both cartridges.



Betting on ultimate popularity favors the Lear Jet right now, since RCA's 8-track releases for the Lear Jet have been joined by new issues from Ampex. This latter company processes tapes for some 30 recording labels so the 8-track system currently boasts a big lead in recorded goodies.

There even is louder and louder talk about carrying the automobile cartridge-player into the house and hooking it up to the faithful hi-fi rig (the questionable practicality of which our cartoonist depicts in the illustration). The car cartridge, the seers are saying, is more convenient than any of the home-cartridge systems of the past few years. This being the case, there's no need to let all those cartridges lie on the back seat of your car when you're not on the road. Just get an extra cartridge machine for the living room or take the one out of your car into the house (and frustrate your friendly car-theft ring when they reach for the non-existent switch to turn the music on).

Having heard both the major car-cartridge systems over a home hi-fi rig, I predict that the take-it-into-the-house movement soon will come to a grinding halt. Sound of the auto cartridges on a wide-range audio system is discouraging, to say the least. There's no dynamic range, almost as little frequency range and a reasonable amount of distortion.

Things don't *have* to be this way, of course, though they likely will remain so. Reason is that it takes so little to achieve a spectacular kind of stereo in a car that few, if any, manufacturers will see any point in going beyond the bare minimum. The optimum tape-cartridge system for the home still is in the future. So leave all those plastic boxes on the back seat. (You have insurance, don't you?)

Aside from the upsurge of modular or compact systems over the past year or more, biggest trend in hi-fi is the swing to the complete stereo receiver as the focal point for a sound system. The popularity of separate amplifiers and tuners—not to mention separate

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ELECTRONIC SWAP SHOP

Continued from page 22

MAYFAIR tape recorder, UHF converters. Will trade for ham equipment. Ronald Green, 603 S. Pearl St., Knox, Ind. 46534.

BC-969A 15- to 150-kc receiver with manual. Will swap for Hallicrafters SW receiver. C.R. French, 460 Huron Ave., Louisville, Ky. 40209.

VISCOUNT transistor radio, Heath AR-3 and Q-multiplier, other items. Want tape recorder, record changer or CB equipment. Curtis Cook, Greenfield, Iowa. 50849.

GENERAL ELECTRIC variable power supply. Make swap offer. R.K. Wells, Bonnie Brae Lodge, Bernhards Bay, N.Y. 13028.

HEATH communications receiver. Will swap for anything of equal value. Joseph E. Pratt, 23-62A Steinway St., Long Island City, N.Y. 11105.

HARMONY electric guitar. Will exchange for SW receiver. Jim Vanderhoof, Jr., Rte. 1, Waverly, N.Y. 14892.

HALLICRAFTERS SW receiver. Will trade for Heath 2-meter transceiver or Novice transmitter. William S. Weir, Berea, Ky.

AMERICAN FLYER S-gauge model trains and accessories. Make swap offer. Dave LaCure, 1010 Fourth St., Aurora, Ill. 60505.

BOGEN stereo tape adaptor amplifier, Dactron stereo adaptor. Want Concord 330 tape recorder. Richard Bandelier, 1626 Wells St., Ft. Wayne, Ind. 46808.

PHILCO C-5009 auto radio, Motorola portable radio, old tubes. Interested in Novice gear. Joe Rock, Jr., Box 162, Knoxville, Md. 21758.

HALLICRAFTERS S-120 SW receiver. Will swap for antenna rotator, tape recorder of FM radio. C.F. Merchant. 2112 E. 218th Pl., Chicago Heights, Ill.

LAFAYETTE HE-43C, antenna, 6-V auto radio. Will exchange for 2-meter transmitter and receiver. Gregory Van de Berghe, 77-84 271 St., New Hyde Park, N.Y. 11043.

ADMIRAL 21-in. TV. Will swap for tube tester and caddy. Jim "Big Boy," 2609 99th Ave., Tampa, Fla. 33612.

TELEPHONES. Will trade for antique guns, swords, other war gear. Edward Wright, 8 Shire Ave., Fairfield, N.J. 07007.

HEATH Twoer, EMC 801 R/C bridge. Need oscilloscope. Larry Sobelman, 3028 W. 29 St., Brooklyn, N.Y. 11224.

HALLICRAFTERS S-120 SW receiver. Want Knight T-60 or Hallicrafters HT-40 Novice transmitter. Gregory Lazor, 972 Pierce Ave., Sharpsville, Pa. 16150.

KNIGHT Star Roamer. Interested in capstan-drive tape recorder. Doug Sprague, 2246 San Tomas Aquino, Campbell, Calif. 95008.

AC/DC portable radio, components. Want SW receiver or CB transceiver. Roger Coons, 73 Longwood Ave., Brookline. Mass. 02146.

TRIPLETT 3413 tube tester, Knight capacitor checker. Need 1946-1954 Sams Photofact, oscilloscope. Calvin D. Peterson, 622 S. 15th St., Bismarck, N.D. 58501.

SPEAKERS (10-in. and 12-in.), other components. Want ham transmitter or receiver. Greg Parks, 401 S. Pearl St., Knox, Ind. 46534.

ARC-5 2-meter transceiver, converter, 7-element beam. Make swap offer. Robert F. Voelker, 101-23 Lefferts Blvd., Richmond Hill, N.Y. 11419.

RCA Radiol A-33 antique radio. Want tape gear. Walter Banks, Box 36, Oxbow, Sask.

PACO V-70 VTVM, Boothco AM/FM radio. Want Hallicrafters S-27 communications receiver. Thomas P. Cheesborough, Box 804, Coconut Grove, Fla. 33133.

REFLECTING TELESCOPE (50 power). Will swap for stereo headphones. John Evans, 12444 Rte. 4, Mechanicsburg, Ohio 43044.

MODEL ROCKETS, assorted parts. Make swap offer. S.D. McGill, Rte. 2, Box 17, Liberal, Kan. 67901.

HALLICRAFTERS CB transceiver. Want Lafayette HE-20C. Warren J. Snyder, Rte. 2, Bainbridge, Ohio 45612.

AMPLIFIERS, speakers. Will exchange for Kalimar camera. B.B. Baker, Box 934, Reseda, Calif. 91336.

X-RAY machine, Q-multiplier. Make swap offer. John R. McGill, Rte. 2, Box 17, Liberal, Kan. 67901.

NOVICE 40-meter crystals. Will trade for 80-meter crystals. David Maynard, Canal Rd., Rte. 2, Box 391, Fairview, Pa. 16415.

SUTTON 23A UHF TV converter, test equipment. Want multi-match plate modulation transformer. William M. Socha, WA4YBM, Rte. 1, Box 420, Summerfield, Fla. 32691.

VIDICON TV camera. Will exchange for ham equipment. Burt Cohen, 3409 University Blvd., Kensington, Md. 20795.

JOHNSON Messenger I, base antenna. Will exchange for ham-band receiver. Kerry Brown, 234 Greenville St., Newnan, Ga. 30263.

ASSORTED components. Will swap for Ameco or Allied code course, CPO and key. Marc Pearce, 5922 Canehill, Lakewood, Calif. 90713.

KNIGHT C-11 CB transceiver, Knight C-100 transceivers, EICO 145A signal tracer. Want EICO 427 scope. J.F. Moses, 1637 Franklin Blvd., Linwood, N.J.

TRANSFORMER for Tesla coil. Want pre-1930 receivers. Gerald Lee Grulkey, 2801 Greenwood Dr., Richmond, Calif.

SP-200 receiver, DX-40 transmitter. Will exchange for hi-fi or VHF gear. Ronald Angert, 630 Ridgewood Rd., Maplewood, N.J.

KNIGHT capacitor checker. Will swap for anything of equal value. Fred Greenberg, 212 Woodside Ave., Hasbrouck Heights, N.J.

BROADCAST radios, tubes. Interested in ham and CB equipment. Finis Gream, WA9PVN, Box 144, Bluford, Ill. 62814.

AMPLIFIERS, other audio equipment. Will exchange for tape recorder or record changer. Alan Venooker, 210 Dryden Rd., Ithaca, N.Y.

RADIO CRAFTSMAN RC-10 AM/FM tuner. Will trade for 1-watt CB walkie-talkie. Kai Lanz, 5943 Glendora Ave., Dallas, Tex. 75230.

KNIGHT Star Roamer. Interested in Conar 500 receiver. Bill Bohart, 914 N. Cleveland, Little Rock, Ark. 72207.

CAMERAS, projectors, ham gear. Will swap for anything of equal value. Roland Kulish, WA5LTV, 5075 Heisig St., Beaumont, Tex. 77705.

COLLINS ART-13 transmitter. Make swap offer. Jimmy Freeman, 3217 Regina Dr., Wheaton, Md. 20906.

ADMIRAL TV. Want Novice transmitter or receiver. Rolf Nestingen, 4200 Xerxes Ave. N., Minneapolis, Minn. 55412.

X-RAY DIFFRACTION TUBE. Will exchange for CB rig or oscilloscope. Owen Phairis III, 403 Kimberly Dr., Syracuse, N.Y. 13219.

BACK ISSUES of QST, assorted components. Will trade for CB transceiver or test equipment. Bill Gruesbeck, 445 Seminary St., Roanoke, Ind. 46783.

STROMBERG-CARLSON BC-348M SWL receiver, 8-mm movie outfit. Will exchange for CB gear. Dan L. Priest, Rte. 1, Box 389G, Anderson, Ind. 46011.

APOLIC RA-11 transistor tape recorder, other items. Will swap for Knight Star Roamer. J.H. Yoakum, 411 Downing Rd., Scott City, Kan. 67871.

EMERSON BCB receiver, mono record changer. Want walkie-talkies, Q-multiplier. Gary Stratton, 420 S.E. 3rd Court, Deerfield Beach, Fla. 33441.

DC MILLIAMMETERS. Want AC voltmeters. M.J. Nederostek, 848 Walnut St., Allentown, Pa. 18102.

3JP1 CRT. Will exchange for Heath HD-11 Q-multiplier. Gary Bobileff, 876 Burr St., Fairfield, Conn. 06432.

BC-611 walkie-talkies. Will swap for antenna rotator or printing press. M.R. Dalessandro, K3IGO, 1917 Haywood St., Farrell, Pa.

HEATH DX-10 transmitter. Need VTVM, SWL receiver. Mark S. Fawler, Box 395, Carrott River, Sask.

JOHNSON Messenger II, Crosley Super 8. Want general-coverage receiver. Morrie Goldman, 8046 S. Euclid Ave., Chicago, Ill. 60617.

CROSLEY AM/FM police-band receiver. Will trade for Star Roamer or Lafayette HA-63. Samuel R. Chase. 1759 Stanton Pl., Long Beach, Calif. 90804.

ALLIANCE antenna rotors, tube tester. Want hi-fi equipment. Donald Drobery, 102 3rd Ave. S.W., Pocahontas, Iowa 50574.

LAFAYETTE HA-52 FM communications receiver. Want 30- to 50-mc FM communications receiver. Richard Southard, 1896 Rockville Dr., Baldwin, N.Y. 11512.

HALLICRAFTERS monitor radio, GP-150 ground plane antenna. Will swap for anything of equal value. William H. Short Jr., 909 W. Somerset St., Philadelphia, Pa. 19133.

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ELECTRONIC SWAP SHOP

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SILVERTONE receiver, Blonder Tongue HA-3 TV booster. Will trade for Q-multiplier, S-meter. Bill Forgotston, Box 8, Newellton, La. 71357.

ANTIQUE RCA receiver. Will exchange for VTVM, 2/6-meter converter. Tony Russomano, 9 School Rd., Whippany, N.J. 07981.

FICHTEL & SACHS 1-cylinder inboard motor. Will trade for communications or test equipment. Frank P. Gier, 1337 Cobblestone St., Dayton, Ohio 45432.

LAFAYETTE HA-70 walkie-talkies. Want high-speed key. Larry Schwartz, WN2UUD, 98 Havilands La., White Plains, N.Y. 10605.

RCA surplus CB transceivers. Will swap for anything of equal value. Larry Stabile, 201 Acre La., Hicksville, N.Y. 11801.

LAFAYETTE HA-60A walkie-talkie. Need ham or SWL receiver. Tim Stanis, 7142 Roland, St. Louis, Mo. 63121.

HEATH CB-1 transceiver, model trains. Want Heath Twoer. Rick Patterson, 5792 Thorndale Dr., Kent, Ohio 44240.

HO MODEL TRAIN. Will swap for test equipment or components. SP5 Robert Kaledas, Hq. Det., U.S.A.G., APO New York, N.Y. 09168.

TRANSMITTING TUBES. Will trade for test or hi-fi gear. C.W. Prescott, 87 Hayden St., Orange, Mass. 01364.

RELAYS, SOCKETS. Will trade for test equipment. Ernie Shuldhiess, Rte. 1, Box 97AA, Chaska, Minn. 55318.

HALLICRAFTERS S-120 SW receiver. Will swap for 150-mc FM receiver. Joseph J. Falcone, 640 77th St., Niagara Falls, N.Y. 14304.

LAFAYETTE KT-135 Explor-Air SW receiver. Looking for Lafayette mechanical filter, ham and SW gear. Dodd Sims, 915 E. Ave. L, Silsbee, Tex. 77656.

HALLICRAFTERS S-120 receiver. Want CB transceiver. Paul Petrun, 687 Middle Ave., Warminster, Pa. 18974.

KNIGHT Span Master. Interested in schematic diagram for adding bandspread to Scott 7697 marine receiver. Mike Adams, 2623 West 9th St., Panama City, Fla. 32401.

KNIGHT C22 CB rig. Looking for 30- to 50-mc receiver. Charles Davis, 3227 Northway Dr., Baltimore, Md. 21234.

OSCILLOSCOPE (14-in.). Will trade for smaller oscilloscope. Thomas Mayfield, Box 446, Yarnell, Ariz. 85362.

KNIGHT Star Roamer, Heath scope. Will trade for CB transceiver, stereo-FM tuner. Alfred Tetzlaff, 16 Rosemary Dr., N. Massapequa, N.Y. 11761.

ANTIQUE and surplus tubes. Looking for ham and CB equipment. Junior Gream, Bluford, Ill. 62814.

STEREO HEADPHONES. Looking for 2-speed turntable. Brad Roe, 14 Spring St., Manville, R.I. 02838.

WALKIE-TALKIES. Want VHF police receiver. Richard Luebke, 116 W. Fairway Dr., Hamilton, Ohio 45013.

LAFAYETTE HE-100A CB transceiver. Will trade for Knight Star Roamer or other SW receiver. Dan Merges, 953 S. Royal St., York, Pa. 17402.

LAFAYETTE HA-60A walkie-talkie, Philco 625 radio. Make swap offer. L. Greenfield, 2155 Paulding Ave., Bronx, N.Y. 10462.

DRAKE 2B receiver. Looking for Clegg 22er or Polycom 2-meter transceiver. William C. Collins, 357 N. Fulton Ave., Lindenhurst, N.Y. 11757.

GENERAL ELECTRIC 4ER6-4ET6 transceiver, other mobile gear. Want Johnson II CB transceiver. J.A. Cassin, 614 E. Fourth St., Eureka, Kan. 67045.

SILVERTONE AM receiver. Will swap for anything of equal value. Jim Rice, 479 Park Ave., Tyrone, Pa. 16668.

KNIGHT Star Roamer, EI's S-Niner preselector. Make swap offer. Ronald Topa, 65 Pentlow Ave., New Britain, Conn. 06053.

HEATH DX-40, 6-meter transceiver. Make swap offer. Jerry Moskowitz, 1060 Sheridan Ave., New York, N.Y. 10456.

UHF TUNERS. Will exchange for VTVM. Wayne Field, Hartsville, Mass. 02130.

LAFAYETTE HE-43C transceiver. Will trade for Novice ham gear. Michael Arcus, 705 E. Fifth St., Bloomsburg, Pa. 17815.

GRC-U5 Variac. Want electronic kits. Richard Lubrich Jr., Como-Allaire Rd., Belmar, N.J.

RADIO CITY 307 tube tester, Electro-Voice UHF converter. Want EICO 628 tube tester. C. Hacha, 615 W. Washington, Ft. Wayne, Ind. 46802.

KNIGHT C-100, Lafayette HE-83 walkie-talkies. Frank G. Krupansky, WB2VEE, Walker La., Box 163, Waretown, N.J. 08758.

BENDIX BC-639 UHF receiver, Hy-gain 6-meter halo. Want Minolta SR-1 35-mm camera. Dallas Williams, WAØMRG, 610 S. Loomis, Ft. Collins, Colo.

LAFAYETTE KT-135 SW receiver. Will trade for tape recorder. Mike Cummens, Hy G, Rte. 3, Waukesha, Wis. 53186.

LAFAYETTE HE-20C CB transceiver. Want guitar amplifier with reverb. James Gamache, 48 Wilmont St., Springfield, Mass. 01108.

TABLE RADIOS, other items. Will swap for oscilloscope or ham equipment. Wayne Kube, Box 333, Farwell, Tex. 79325.

HEWLETT-PACKARD 20C low-frequency oscillator, tubes. Looking for HQ-110, NC-270, NC-190. John Harding, 24 Bertram St., Beverly, Mass. 01915.

AIRLINE TV set. Will swap for CB transceiver. Bob Goettsche, 22439 Park, Dearborn, Mich.

BCB radios, RCA turntable. Need tape recorder, walkie-talkies. Thomas DiGiacomo, 1897 Calvin Blvd., Tonawanda, N.Y. 14151.

ASSORTED TUBES. Will exchange for other tubes. Richard Ashe II, 111 Oregon Ave., Dundee, Ill. 60118.

AUTO RADIO (Dodge '65). Will exchange for '62 Ford Falcon radio or aircraft receiver. Cris Hogan, 141 Philadelphia Ave., Massapequa Park, N.Y. 11762.

HEATH Q-multiplier, stamp collection. Want FM tuner or speakers. Robert Edison, 8223 Bay Parkway, Brooklyn, N.Y. 11214.

HEATH GR-81 SW receiver. Will trade for 190- to 550-kc Command receiver. Lance Batton, 1022 Redstone Pl., Haywood, Calif. 94545.

ASSORTED TUBES. Want Knight R-55A and crystals. Keith Botts, Box 24, Custer, Mont. 59024.

NATIONAL NC-88, Heath Q-multiplier. Need hi-fi gear, walkie-talkies. Harold Cable, 811 Ashley Lane, Hendersonville, N.C. 28739.

ASSORTED TUBES. Make swap offer. David Schroeder, 416 S. Fifth St., Coseyville, Ill. 62232.

LAFAYETTE HE-30 communications receiver. Will swap for 6-meter transceiver. Dennis Ardinger, K3VMZ, 401 Maplewood Dr., McMurray, Pa. 15317.

SURPLUS FIELD PHONE, tube checker. Want guitar, tape recorder, Novice transmitter. Joe Caruso, 4513 W. 66th Pl., Chicago, Ill. 60629.

CORNELL-DUBILIER vibrator inverter, Electro-Voice 727 microphone. Want stereo amp. Tom Krikorian, 15552 Arbor Pl., Southfield, Mich. 48075.

HALLICRAFTERS S-120 SW receiver, Novice code course. Want SX-140 and Q-multiplier. Harry Hammerling, WN6RPJ, 6833 Cerritos Ave., Long Beach, Calif. 90805.

LAFAYETTE HB-115A transceiver. Will exchange for Lafayette HA-230 or HE-30 communications receiver. Fred Keller Jr., 5069 Mathews St., Indianapolis, Ind. 46227.

UHF TV converter. Make swap offer. R.P. Mason Jr., 2007 Pembroke Rd., Greensboro, N.C. 27408.

TECHNICAL BOOKS. Will exchange for electronic gear. Ervin Ramos, Box 8, San Antonio, P.R. 00752.

HALLICRAFTERS SX-99 receiver. Will exchange for tape recorder. Neil C. Lundell, 829 Keniston Ave., Los Angeles, Calif. 90005.

ADMIRAL phono cartridge, other parts. Interested in tape recorder. Les Lieurance, 1106 Canby, Laramie, Wyo. 82070.

GILBERT 1000-power microscope, tape recorder. Want Novice gear. Gary Wells, 705 Weatherly Rd. S.E., Huntsville, Ala. 35803.

HEATH 5-in oscilloscope. Will exchange for Novice transmitter. Howard Fidel, 4385 Bedford Ave., Brooklyn, N.Y. 11229.

ARC 5 2-meter transmitter, Heath HR-10 receiver. Want ham or CB equipment. Paul Corriveau, K1ZTF, 24 Bridgeport Ave., Shelton, Conn. 06484.

KODAK Instamatic 100. Will trade for walkie-talkie. Patrick Hardin, 924 K St. N.W., Washington, D.C. 20001.

HEATH CB-1, Knight wireless phono. Will swap for CB transceiver and antenna. Rich Moburg, 3522 Scoville, Berwyn, Ill. 60403.

KNIGHT Span Master. Want Ameco AC-1T transmitter. Scott Baxter, 1503 E. Campbell Ave., Campbell, Calif. 95008.

ASSORTED OLD TUBES. Need CRT, power transformer. Len Scott, 661 18th St., Brandon, Man.

SURPLUS BC-652-A receiver. Want tape recorder. Steve Morrissey, 3910 Cassia, Boise, Idaho 83105.

EMC 502 signal generator, DM-28R dynamotor. Will swap for ham or test gear. Thomas A. Berry, Box 338, Lot 38, Niceville, Fla. 32578.

OPERADIO 14-in. speaker. Will swap for PA amplifier. Brian Thorstad, Benson Rd., Frederic, Wis. 54837.

LAFAYETTE HE-20C CB rig. Will swap for anything of equal value. William T. Bunner, Bell Run Rd., Fairmont, W. Va. 26554.

ARMSTRONG regenerative receiver and amplifier. Will swap for anything of equal value. A2C L.G. Baxter, CMR, Box 2727, 2036 Comm. Sq., Mt. Home AFB, Idaho 83648.

NEON-SIGN TRANSFORMER, Knight C-100 walkie-talkie. Want test equipment, tools. Brian Gamberg, Apt. 102, 2350 W. 39th, Vancouver 13, B.C.

KNIGHT Ocean Hopper, tape-recorder parts. Will swap for Star Roamer or telephones. Phil Oliver, 1634 E. Water St., Tucson, Ariz. 85719.

DEJUR-GRUNDIG dictating machine, Crestwood 400 tape recorder. Want NCX-5 Mark II transceiver, other ham equipment. Noa Spears, Box 844, Austin, Tex. 78767.

HOMEBREW 30-watt transmitter. Will swap for Heath Twoer, other ham gear. Mark Baugh, WN7EKQ, 4966 S. 2325 W., Roy, Utah 84067.

EDISON phonograph records. Will exchange for wide-band oscilloscope. Iver S. Olson, Box 337, Mendocino, Calif. 95460.

HALLICRAFTERS S-40, Heath Q-multiplier. Want National NC-155 receiver. Steve Jeske, Rte. 3, Box 173, Buffalo, Minn. 55313.

TRANSISTORS, other components. Want test equipment. W.M. Skelton, U.S. Naval Station, Box, 38, c/o F.P.O., San Francisco, Calif. 96610.

METERS, Philco receiver. Will trade for 5-in. oscilloscope. William C. Reichard, Box 329, Netcong, N.J. 07857.

U.S.L. TR-800 CB transceiver. Looking for 1-watt walkie-talkie. Dr. L.J. Wiley, 1726 W. 40th, Erie, Pa.

CODE PRACTICE OSCILLATOR, BCB radio. Need preselector. Richard Jenneman, Rte. 2, Box 104, Stanley, Wis. 54768.

KNIGHT Ocean Hopper. Will swap for FM tuner or tape recorder. Jim Guthrie, 3901 Orchard, Lincoln, Neb. 68503.

HEATH GR-64 SW receiver. Looking for Heath IT-11 capacitor checker. Steve Hawes, 20 Gray Terr., Bedford, Mass.

REGENCY Range Gain transceiver. Want Sony 4-203UW or micro TV. B. Aaron, 60 Richards Rd., Port Washington, N.Y. 11050.

KNIGHT R/C tester, RCA signal generator. Will swap for a 1-watt walkie-talkie. Mike Douthat, Rte. 1, New Hampton, Mo. 64471.

LAFAYETTE HB-115 CB transceiver, Heath QF-1 Q-multiplier. Interested in VHF and UHF ham gear. Mike Forsyth, 789 Colusa Ave., El Cerrito, Calif.

WINSTON portable radio. Want audio generator. Richard Matiasek, 1406 Wenonah, Berwyn, Ill. 60402.

WORKMAN BX 100K 12-V inverter. Will trade for signal tracer. Mike Ducy, 1525 N. Ellen, Decatur, Ill. 62526.

AMI 40-watt amplifier. Interested in oscilloscope or communications receiver. L. Swiderski, 283-B Spruce St. S., Timmins, Ont.

SONAR E CB transceiver. Will swap for 2-meter transmitter or transceiver. Gregory Lazor, 972 Pierce Ave., Sharpsville, Pa. 16150.

ASSORTED TUBES. Need tape recorder. R.W. Pemberton, 1708 Pin Oak Rd., Baltimore, Md. 21234.

STENOTYPE course and machine. Want 6-meter transceiver, 6-meter beam and rotator. Howard H. Halperin, WA9YNB, 9712 S. Merrion Ave., Chicago, Ill. 60617.

RIVERSIDE 61-6540 auto radio. Will trade for Novice ham equipment or oscilloscope. Joe Rock Jr., Box 162, Knoxville, Md. 21758.

HALLICRAFTERS S-38E and S-120. Will swap for other communications receiver. Emile G. Gallant, 1106 Bellevue St., St. Joseph, Mo. 64501.

RCA turntable, 5-watt amplifier. Will exchange for SLR camera. M.E. Anglin, 1336 Louisiana Ave., Akron, Ohio 44314.

HALLICRAFTERS S-119 Sky Buddy receiver. Want Heath Twoer or 10-watt guitar amplifier. Ken Ferguson, WN8QFY, 1020 S. East St., Fenton, Mich. 48430.

KNIGHT Span Master. Will swap for Heath Q-multiplier and Hallicrafters SX-71 schematic diagram. Joseph G. Renauer, 1147 W. Ann Arbor Trail, Plymouth, Mich. 48170.

KNIGHT Span Master, wireless broadcaster. Will trade for test equipment. Tom Jamrose, 505 139th St., Hammond, Ind.

CALRAD pocket VOM. Will swap for Supreme Publications Radio diagrams, Vol. 2, 1939. Gerald D. Crotinger, McCracken, Kan.

EICO signal generator, GDO, other items. Need sweep generator and DC scope. Garry Boross, 13 Fisher Ave., Nanuet, N.Y.

BC-348 surplus receiver. Will swap for 6-meter transceiver. Art Ruben, K3GEC, 67-04 Selfridge St., Forest Hills, N. Y. 11375.

LAFAYETTE Explor-Air receiver. Want Heath Twoer or Novice transmitter. Guy Slayden Jr., 106 E. Jackson St., Demopolis, Ala. 36732.

MAYFAIR tape recorder, other items. Want signal generator. Dean Sanderlin, 3332 Stonegate Rd., Waukegan, Ill. 60085.

NATIONAL 188 SW receiver. Will exchange for CB transceiver. Jack Lewis, 33 62 St., West New York, N.J.

HALLICRAFTERS SX-72, set of drums. Looking for Knight T-60 or T-150A transmitter. Paul Donahue, 1841 Richard St., Pomona, Calif. 91767.

HEATH CB-1 transceiver. Make swap offer. P. Hunley, Rte. 3, Concord, Tenn. 37720.

ANTIQUE Philco 2-band receiver. Will swap for 2-meter transceiver. Tom Leap, 11 Forgreen Rd., Camp Hill, Pa. 17011.

HAM equipment, assorted components. Want communications receivers, R/C equipment. Stan Putra, 1429 Lawndale, Racine, Wis. 53403.

WRL Globe Scout 680 transmitter, Hallicrafters S-76 receiver. Want stereo and photographic equipment. Cliff Eason, Box 242, Razorback Annex, University of Arkansas, Fayetteville, Ark.

SURPLUS transceiver. Need R/C equipment. Michael Zalsman, 5012 Lunt, Skokie, Ill. 60076.

AUTO RADIOS (12-volt). Will exchange for tape recorder or SWL gear. Don Ingram, Box 358, Wilder, Idaho. 83676.

ASSORTED components. Will trade for transistor radio. Ray Clem, 170 Ash Ave., Woodstock, Ill. 60098.

KNIGHT R-100. Will swap for Hammarlund HQ-110 or HQ-170. Ronald E. Sjostrom, Diamond H Ranch, Baldwin Creek, Box 93, Lander, Wyo. 82520.

RCA 3-RG-31 transistor radio, assorted components. Will exchange for Heath Sixer. Mike Bratcher, Rte. 1, Maysville, Okla. 73057.

SILVERTONE 1448 electric guitar and amplifier, Relco metal locator. Will trade for ham receiver and transmitter. A.O. Al Gattis, 112 W. Munson St., Denison, Tex.

HALLICRAFTERS S-38C, Imperial stereo amplifier. Want 152- to 174-mc receiver. Andy Andrus, 232 Katheryn, Mason, Mich. 48854.

SYLVANIA transistor radio, Gilbert erec-tronic set. Want tape recorder or ham gear. J.M. England, 4 Carlisle Pl., Pueblo, Colo. 81005.

CONN Coronet and Zenith portable stereo. Want ham-band receiver. Cliff Bond, 8379 San Benito, Dallas, Tex. 75218.

B&K 400 CRT tester and rejuvenator, EICO 944 flyback and yoke tester. Will trade for tape recorder. Donald L. Walker, Rte. 5, Box 117, Seneca, S.C. 29678.

EICO 722 VFO. Want Heath Twoer or Sixer. Marty Hartstein, WB6NWW, 5349 Abbeyfield St., Long Beach, Calif. 90815.

EICO VTVM. Want 1/32 road race set or walkie-talkie. R.F. Barnes, 187 Waveland St., Gurnee, Ill.

VM AM/FM stereo tuner. Will swap for HO model train equipment. William J. High, 2840 Eastlake E., Apt. 506, Seattle, Wash. 98102.

TUBES AND CRYSTALS. Will exchange for walkie-talkie or Novice gear. Steve Dale, Box 652, Globe, Ariz. 85501.

SOLID-STATE power supplies. Will trade for CB gear or sweep generator. John M. Blasko, 195 Harrison St., Johnson City, N.Y. 13790.

AUTO RADIOS (6-volt). Interested in 80-meter transmitter or Knight Star Roamer. Thomas McHenry, 508 2nd St. N.W., Independence, Iowa 50644.

KNIGHT T-60, Star Roamer, crystals. Need 6-meter transmitter, other ham gear. Jim Dickson, WA4WAG, 507 W. Main, Albertville, Ala. 35950.

ELECTRO-VOICE Slimair mike. Will swap for AM/FM radio. W. Fox, Box 914, Memphis, Tenn., 38101.

KNIGHT C-100 walkie-talkies, auto radio. Looking for KG-4000A walkie-talkies, test equipment. Joseph J. Berzak Jr., 4553 6th St. N.E., Columbia Heights, Minn. 55421.

[Continued on page 108]

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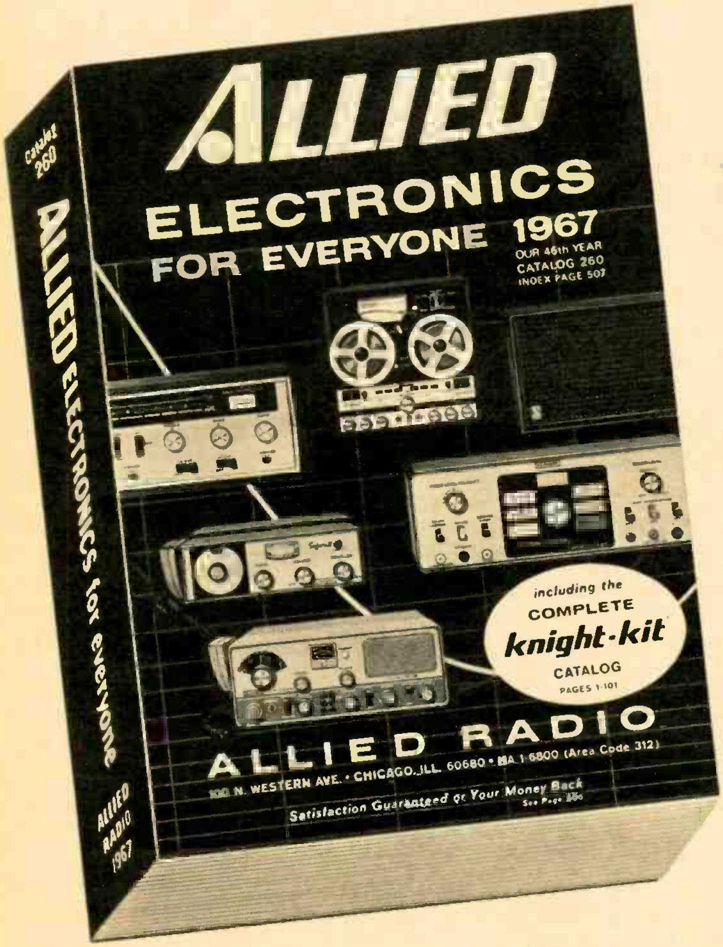

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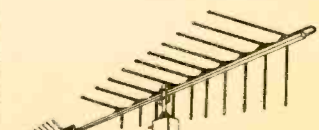

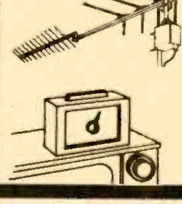

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ELECTRONIC SWAP SHOP

Continued from page 103

HALLICRAFTERS CB-7 transceiver, Zenith Trans-oceanic. Need test equipment, UHF receiver. Eugene Ostrowski, 1307 Minnesota Ave., S. Milwaukee, Wis. 53172.

OSBORN 100S walkie-talkies. Want ham equipment. Bruce Tiemann, WN2RUH, 304 Laurel Ave., Woodlynne, N.J. 08107.

KNIGHT KG-600B tube tester. Will trade for VTVM or signal tracer. Benny Bagasol, 859 Commercial Ave., Apt. 1, San Francisco, Calif. 94080.

78-rpm record albums. Will swap for CB equipment. Robert McGuire, Box 224, Lopex, Pa. 18628.

CBS 205C1, 205C2. Want sweep chassis or horizontal output transformer. Roger Mais, 3103 S. 11th St., Niles, Mich. 49120.

BC-453 receiver, ARC-5 transmitter. Will swap for anything of equal value. Bill Skeens, 1415 Barry Ave., Chicago, Ill.

KNIGHT R-100A receiver. Will trade for Heath Twoer or other 2-meter gear. Ronald E. Sjostrom, Baldwin Creek Rt., Box 93, Lander, Wyo.

GRUNOW 12G4-1 speaker, Revelation 4-power scope for rifle. Will swap for ham gear. Roger L. James, Rte. 1, Centertown, Ky. 42328.

KNIGHT R-100A receiver, 6-meter converter. Will exchange for CB transceiver. Dave Gillet, 3607 Woodlawn Terrace Pl., Honolulu, Hawaii 96822.

PHOTO-STAT copier, AM/FM tuner. Want CB gear, camera equipment. Calon, Box 464, Culver City. Calif. 90231.

HEATH CB-1 transceiver. Need Heath Twoer. Roger Attwell, WN7CYY, Rte. 4, Box 500, Everett, Wash. 98202.

HALLICRAFTERS S-119, Knight C-100 walkie-talkies. Need VHF transceiver or communications receiver. George Smith, 332 22nd St., Longview, Wash. 98632.

KNIGHT R-100A receiver, EICO HFT-94A tuner. Will swap for tape recorder. Vernon Hurst, 507 Circle Dr., Marietta, Okla. 73448.

LAFAYETTE HE-30 receiver. Will trade for Clegg 99er or Lafayette HE-45 transceivers. Robert Wilson, 19 Commercial St., Leipsic, Ohio 45856.

ARC-4, Knight T-60 transmitters. Need Heath Sixer or Twoer. Eric Liebler, K1UVR, 54 Kaynor Dr., Waterbury, Conn. 06708.

MAYFAIR F-111 tape recorder, tennis racket. Will swap for SW receiver. Stuart Golden, 4942 N. Lawndale Ave., Chicago, Ill. 60625.

NEON-SIGN TRANSFORMER. Need EICO 14F signal tracer. S. Rasmussen, 414 N. Second St., Silverton, Ore. 97381.

BOLEX 8-mm movie camera, Keystone projector. Will trade for Knight R-100A receiver and T-60 transmitter. L.E. Ingram, 45 Larry Dr., Decatur, Ill.

MOTOROLA walkie-talkies. Want 6-meter transmitter or other ham gear. Larry Freeman, 1 Rose Terr., Chatham, N.J. 07928.

LAFAYETTE Explor-Air receiver. Will swap for walkie-talkies. David Flory, 2601 Cheyenne, Wichita, Kan. 67216.

POLAROID 150, Yashica cameras. Want FM tuner, SW receiver. Harry Gursh, 2935 W. 5th St., Brooklyn, N.Y. 11224.

FANON FCB-9A walkie-talkie. Will swap for VTVM or SWR/power-bridge combination. David Bellask, 1159 E. 42 St., Brooklyn, N.Y. 11210.

HEATH HW-30 transceiver. Want 1-watt walkie-talkie or Electro-Voice 664 mike. Denis Weal, 4209 Kensington Rd., Baltimore, Md. 21229.

CB TRANSCEIVERS. Want 30- to 50- and 152- to 174-mc receivers, Cadre C-75. Tom Valovcin, 519 Wood Ave., Iselin, N.J. 08830.

SURPLUS transmitter and receiver, test equipment. Will swap for Collins or National communications receiver. Martin Hummel, WN3DUJ, Box 5742, Pikesville, Md. 21208.

KNIGHT R-55 communications receiver, Novice transmitter. Make swap offer. Mark Schiller, 1270 Lisbon Rd., Hartland, Wis.

LAFAYETTE HB-115A CB transceiver. Want SWL gear, musical instruments. Isaac K. Smith, Rte. 2, Box 45, Campbellsburg, Ky. 40011.

KNIGHT VHF receiver. Will swap for amplifier. Tom Colosimo, 3827 N. Prospect, Milwaukee, Wis. 53211.

RANGER bullhorns, handsets. Interested in Hallicrafters S-38, Heath VFI VFO. Jim Loring Jr., WA1BEB, Rte. 2, Gilead, Bethel, Me. 04217.

RCA tube tester, signal generators. Want Hallicrafters SX-140. Frank Vitale Jr., 8632 Riverside, Hollywood-Brookfield, Ill. 60513.

KODAK Auto-35F camera, Conar signal tracer. Need test equipment. Charles S. Alexander, 621 Mountainview Dr., Escondido, Calif. 92025.

MOTOROLA auto radio. Will swap for AC tape recorder. Rick Riccelli, 421 W. Newall, Flint, Mich. 48505.

HEATH GR-64 receiver, Q-multiplier. Want hamband receiver. Larry Schuldt, 200 4th Ave., S.E., Aitkin, Minn. 56431.

DELCO auto radio, Philco portable radio. Looking for 80-meter Novice transmitter. Mike Mayhew, 943 Thornapple, St. Clair, Mich. 48079.

ASSORTED TUBES, components. Want electronics books, magazines. P.J. LaRosa, 148 Smith St., Port Chester, N.Y. 10573.

JOHNSON CB transceiver. Interested in 27-mc linear amplifiers. S. Krzak, Pawtucket, R.I.

BUDD 46-in rack, 30-watt transmitter. Will exchange for Hammarlund receiver. Jim Bailey, Box 213, Grand Canyon, Ariz.

HALLICRAFTERS S-85, 35-mm cameras. Want portable typewriter and tape recorder. W.S. Markel, 212 Robin Rd., Waverly, Ohio 45690.

HALLICRAFTERS CRX-5 FM receiver, Heath GR-81 SWL receiver. Looking for 6- or 2-meter ham gear. William H. Short Jr., 909 W. Somerset St., Philadelphia, Pa. 19133.

ALCO chassis, punches, photographic gear. Need fone patch, 6-meter beam. Roland Kulish, 5075 Heisig, Beaumont, Tex. 77705.

DUMONT oscilloscope. Will exchange for hi-fi or ham gear. Bill Troyer, 423 N. 61st St., Kansas City, Kan.

HALLICRAFTERS S-38, 2-meter antenna. Will trade for 40-meter Novice crystals. Dale Putnam, WNØLRJ, Wray, Colo. 80758.

HEATH AR-2 receiver. Will swap for Lafayette HE-20D or HA-135. Dennis Crews, Woodridge La., Highland, Md. 20777.

ANTIQUE tubes. Will exchange for others. James F. Haning, 3207 Larry La., Austin, Tex. 78722.

AURORA HO motoring set, Lionel model train sets. Want Star Roamer receiver. Neil Steiner, 38984 Donald, Livonia, Mich. 48154.

EMERSON 3-band, Philco 2-band receivers. Will exchange for walkie-talkies. Bob Tallman, Rte. 1, Box 45, Freehold, N.Y. 12431.

HEATH GR-91 receiver. Will swap for Novice transmitter. Allan Freiberg, 5062 Elester Dr., San Jose, Calif.

AMERICAN FLYER model train, microscopes. Looking for tape-recording accessories. Ron Crown, 764 Merchants Rd., Rochester, N.Y. 14609.

LEECE-NEVILLE transistor ignition, EICO 221 VTVM. Want transceiver or typewriter. Lewis E. Belch, Box 183, Colerain, N.C. 27924.

HALLICRAFTERS S-120 receiver, tape recorder. Want CB or 2-meter transceiver. Ed Sawicki, 52 Park Ave., Garden City Park, N.Y. 11040.

JOHNSON Viking mobile transmitter. Will exchange for Regency AR-136. Jerry Scarlett, Box 364, Gladwater, Tex. 75647.

S-METER, Novice crystals. Will trade for transistor radio. T. Cinquini, 6917 Chester Ave., Philadelphia, Pa.

ARC5 receiver, Heath QF-1 Q-multiplier. Make swap offer. U. Niedrins, 366 Williams St., N. Dighton, Mass. 02764.

LAFAYETTE KT-135. Want telephone gear, electronic strobe. Joshua A. Socolof, 88-45 62 Dr., Rego Park, N.Y. 11374.

AUTO RADIO. Need VOM. Clarence H. Legendre, 3297 Cartwright, Beaumont, Tex. 77701.

EICO 147A signal tracer, Electro-Voice 729SR mike. Want Lafayette HE-75 or HA-150. Joe Patton, Box 615, Warsaw, Va.

LIONEL model train, TV components. Need ham gear. Bill Campbell, 10843 Dunaway, Dallas, Tex. 75228.

HALLICRAFTERS S-119. Need 2-meter Novice gear. Richard Wynne, 147-43 8th Ave., Whitestone, N.Y. 11357.

HALLICRAFTERS S-120 SW receiver, RCA CB transceiver. Will swap for anything of equal value. Dave Noel, Glasco, Kan. 67445.

OLD TUBES. Want ham and CB gear. Pat Gream, Bluford, Ill. 62814.

RCA 45-rpm record changer. Will exchange for CB gear. Rex Allen Thompson, Rte. 1, Box 125, Culberson, N.C. 28903.

JOHNSON Viking Adventurer. Want 6-meter transmitter. Henry S. Tannenbaum, WB2NFA, 26 Cranberry La., Plainview, N.Y. 11803.

ASSORTED tubes, filament transformer. Will swap for SWL receiver. William Davis Jr., 802 E. Washington Ave., Jonesboro, Ark. 72401.

WESTINGHOUSE portable SW receiver. Want Heath Sixer or Twoer. Steve Sorton, 62 Isabella Ave., Newark, N.J. 07106.

LAFAYETTE portable radio, Hallicrafters S-38. Want Sony miniature TV or Minox camera. Chris Bloch, 350 First Ave., New York, N.Y. 10010.

LAFAYETTE KT-320 receiver. Will exchange for Heath Twoer. Jules Sherer, 29 Shady La., Bound Brook, N.J. 08805.

ELECTRO-VOICE and Shure mikes, EICO 526 VOM. Want Globe VF-10 VFO, RME 602 transmitter. Richard Skoba, 50 N. 8th St., Kenilworth, N.J. 07033.

KNIGHT KG-221 UHF FM receiver. Will exchange for 30- to 50-mc receiver. Thornton Cockram, Rte. 2, Bassett, Va. 24055.

BOLAND & BOYCE picture-tube tester, other test equipment. Want tape recorder, phonograph records. James W. Grimmette, Mod. 11 CN, Bruno, W.Va. 25611.

OLD TUBES, EICO signal generator. Interested in walkie-talkies or tape recorder. Henry St. Clair, 171 E. New St., Mountville, Pa. 17554.

ASSORTED COMPONENTS, model-airplane engine. Will swap for portable tape recorder or SW receiver. Keith Marskman, Rte. 2, Melbourne, Ont.

TELECTRO SR122 stereo tape recorder. Will trade for Heath DX-60. Mel Granick, 220-42 137th Rd., Laurelton, N.Y. 11413.

NOVICE transmitter, other items. Want tape recorder. Michael Sutton, 83 Maple St., Rouses Point, N.Y.

EICO signal generator, Knight G-30 GDO. Need ham gear. Mike Forsyth, WB6SAJ, 789 Colusa Ave., El Cerrito, Calif.

ATWATER-KENT 35 radio. Make swap offer. Jeff Walker, 3630 Brisban St., Harrisburg, Pa. 17111.

HEATH Twoer and Sixer, Zenith Transoceanic. Will trade for communications receiver. John Raifsnider, WA8OKA, Rte. 1, White Pigeon, Mich. 49099.

SNOOPERSCOPE. Will exchange for EE-8 field telephone. Terry Thompson, 1628 Skylark Dr., Carthage, Mo. 64836.

HALLICRAFTERS S-38C, Knight T-60. Want 6-meter transceiver. Joseph S. Newbrough Jr., WA5MYY, 932 Louisiana, New Orleans, La.

KNIGHT Ocean Hopper, Hallicrafters SX-99. Will swap for Heath Sixer or Twoer. Kalman Smilowitz, WB2TPN, 86-70 Francis Lewis Bldg., Jamaica, N.Y. 11427.

BAUSCH & LOMB lenses, guitar. Looking for communications receiver. John E. Kalpus, 2016 Barcelona Dr., Muncie, Ind. 47304.

ROBINS 4-track stereo tape heads. Want Nortronics 4-track heads. Fred Reimann, 3 N. Pine, Mt. Prospect, Ill.

KNIGHT C-100 walkie-talkie. Need crystal calibrator. Edward Kuester, 1729 Eloise Dr., Muskegon, Mich. 49444.

LAFAYETTE HE-100 walkie-talkie, Rad-Tek radiological survey meter. Want EICO 730 modulator, 1-watt walkie-talkie. Kipling Vandenberg, 85 Salzburg Rd., Bay City, Mich.

HEATH GW-11A. Will swap for Heath 1MW-13 VTVM or 10W-12 oscilloscope. Bruce Pierce, 5536 N. Ryland, Temple City, Calif. 91780.

KNIGHT Star Roamer. Want Lafayette HA-230 or 30- to 50-mc FM receiver. Frank Hardesty, 1907 Cloverdale Ave., Baton Rouge, La. 70808.

RCAF Marconi transmitter. Want Knight Ocean Hopper and Ameco AC-1 transmitter. James Hodgson, 1242 Cameo Dr., Ottawa 5, Ont.

EMERSON transistor radio, other items. Want semi-automatic key (bug). Larry Schwartz, WN2UUD, 98 Havilands La., White Plains, N.Y. 10605.

KNIGHT Star Roamer, other items. Will swap for Zenith Transoceanic or Realtone portable. Carl Zablotny, 1041 Auburn Ave., Cleveland, Ohio 44113.

REED SWITCHES. Need test equipment, CB transceiver. Edwin L. Bond, Rte. 1, Box 4015, Issaquah, Wash.

EICO HF89 stereo amplifier, Lafayette KT600 preamp. Looking for Pacer CB transceivers. TSG Joseph A. Scibona, Hq 5 AF Box 709, APO San Francisco, Calif. 96525.

KNIGHT C-540 CB transceivers. Will swap for stereo gear. C.A. Rennie Jr., Box 673, Victorville, Calif.

OLD TUBES. Want Q-multiplier, test gear. Michael L. Dale, Box 634, Butler, Ala. 36904.

POLARIS Autologger. Looking for transistor TV or stereo tape recorder. R.J. Newman, Favourable Lake, Ont.

KNIGHT stereo amplifier. Will trade for Fisher K-10 reverberation unit or Knight KG-620 VTVM. N.S. Cheney, 544 W. Monroe, Petersburg, Ill. 62675.

HALLICRAFTERS S-118, code practice course. Make swap offer. Lee Stewart, WB2UHH, Rte. 2, Canisteo, N.Y. 14823.

EICO 324 signal generator, other items. Want movie camera or refracting telescope. John D. Martin, Wyaconda, Mo. 63474.

SURPLUS LS-10-A amplifier. Will swap for anything of equal value. Norm Bussiere, 34 6th St., Auburn, Me. 04210.

HEATH GR-91, QF-1. Looking for Heath HW-29A, all-band VFO and transmitter. Bill Cotter, 1005 Lane Allen Rd., Lexington, Ky. 40504.

DOPPLER radar transmitter and receiver. Need Heath Twoer. John Abt, Rte. 1, Box 1746, Meadow Vista, Calif. 95722.

EMERSON hi-fi, HO model train set. Interested in communications receiver. Jeff Meyers, 8502 Temple Rd., Philadelphia, Pa. 19150.

EICO 460K oscilloscope. Will trade for Novice ham gear or CB transceiver. Ralph Stallsworth Jr., 3506 Moffat Rd., Toledo, Ohio 43615.

CRTs. Looking for Novice or SWL gear. Duane Meakin, 23791 Piper, East Detroit, Mich. 48021.

LAFAYETTE wireless broadcaster and mike. Want Ameco AC-1T transmitter. Alan Spitz, 99 Gregory Ave., Passaic, N.J. 07055.

HALLICRAFTERS S-38 receiver. Need CB transceiver, Heath Twoer. David Lampel, 420 W. 160 St., New York, N.Y. 10032.

HEATH Q-multiplier, 35-mm projector. Want Hallicrafters S-40 receiver. Theodore Nadeje, 5101-AA 39th Ave., Sunnyside, N.Y. 11104.

HEATH GW-21s. Want 12-channel CB rig. George Tarrazi, 8606 5th Ave., Brooklyn, N.Y. 11209.

MAYFAIR tape recorder. Will exchange for AC tape recorder. Micheal Pollard, 5907 Sheriff Rd., Washington, D.C. 20027.

AC/DC SW receiver, walkie-talkie. Will swap for ham-band receiver. Donald Kirstine, 102 E. Main, Pierce, Nebr. 68767.

AMERICAN FLYER 00-gauge trains, Science-Fair items. Will trade for ham or CB gear. Scott Oskow, 1419 Mace Ave., New York, N.Y. 10469.

HEATH Q-multiplier. Will swap for anything of equal value. Gary Fritz, 2414 Garland St., Lakewood, Colo. 80215.

UNDERWOOD communications typewriter. Will trade for Heath Twoer, Sixer or GDO. Duane O. Mason, Box 331, Groton, Mass. 01450.

KNIGHT Span Master. Will exchange for RAX 1 or BC-946/R-24 receivers. Carl Ervin, 7521 S. Prairie, Chicago, Ill. 60619.

TRANSMITTER (4 to 5.3 mc.). Want Geiger counter. Max Miller, 21313 Evalyn Ave., Torrance, Calif.

SPACEPHONE walkie-talkie. Will swap for Knight LC-1 CPO. Bruce P. Cox, Box 116, Oxford, N.C. 27565.

LAFAYETTE HE-90 CB rig. Will exchange for Novice transmitter. Dave Grossman, 39 Joan Ct., Elmont, N.Y. 11003.

ANTIQUE radio equipment. Will swap for anything of equal value. Winfred O. Moore, 417 10th St., Aurora, Nebr.

GONSET G-11, EICO 726 CB rigs. Will exchange for Knight T-60, Heath HR-10. Bruce Kirkpatrick, 5633 W. 18th St., Topeka, Kan. 66604.

RME DB-20 preselector, EICO 720 transmitter. Want CW monitor, ham-band receiver. A.M. Colby, WA8PWF, Box 309, Saugatuck, Mich. 49453.

KNIGHT R-100A receiver, Heath transmitter. Will trade for 23-channel CB rig. Bobby R. Harris, Rte. 3, Box 181, Double Springs, Ala. 35553.

HY-GAIN all-band antenna, Heath Q-multiplier. Looking for VOM and crystal calibrator. Frank McBrayer, 104 Franklin St., Lawrenceburg, Ky. 40342.

HEATH VTVM, Garrard record player. Will swap for Star Roamer or CB gear. Jack Burns, 425 Elm St., Oak Hill, Ohio 45656.

HEATH AT-1 transmitter. Need SW receiver. Aristotle Bouras, 1753 Cottage Grove Ave., San Mateo, Calif. 94401.

[Continued on page 110]

ELECTRONIC SWAP SHOP

Continued from page 109

RELCO 12T metal detector. Make swap offer. Gary Denman, Rte. 3, Box 164, Grapeland, Tex. 75844.

GLOBE STAR CB transceiver. Want Hammarlund SW receiver. James H. Gunderson, 1007 W. Church St., Marshalltown, Iowa 50158.

GUITAR, test equipment. Need CB transceiver. John Arnold, Box 84, Bluffs, Ill. 62621.

KNIGHT KG-220 30- to 50-mc. FM receiver. Will swap for AM/FM tuner. Gordon Broussard, Box 65, Winnie, Tex.

WESTINGHOUSE 14-in. TV set. Want Heath R-55A receiver or other ham gear. Dan Case, 434 E. 7th St., Marysville, Ohio 43040.

COIN COLLECTION. Need Hammarlund HQ-180 receiver. Walter V. Jandro, 473 Success Ave., Bridgeport 10, Conn.

KNIGHT Ocean Hopper, Heath Q-multiplier. Want antique SW receiver. E. Armstrong, 1300 E. 8th, Apt. N-1, Odessa, Tex.

ATWATER-KENT model 60 receiver. Will swap for anything of equal value. John L. Waggaman IV, 306 W. Adams Ave., Fairfield, Iowa 52556.

GLOBE CHIEF 90-A, EICO 425 modulator. Will trade for CB transceiver. Dee France, 16247 Denley St., Hacienda Heights, Calif. 91745.

ATWATER-KENT model 37-C receiver, Knight Ocean Hopper. Will swap for other SW receiver. Ken Roberts, Rm. 225, Halloran House, 23 Curl Dr., Columbus, Ohio 43210.

GE advanced electronics lab AM transmitter. Need SW receiver. Carl McCormick, 1502 Debra, Bossier City, La. 71010.

TELECTRO tape recorder, code records. Will trade for CB transceiver or ham receiver. Glenn Ungarten, 1618 Larkspur Dr., Mountainside, N.J.

ACROSOUND and Heath hi-fi gear. Will swap for walkie-talkies or SW receiver. Harry E. Sprenkle, 44 Hitchner Ave., Bridgeton, N.J. 08302.

MAGNETIC REED SWITCHES. Will trade for back issues of electronics magazines. Thomas King, 910 Harvey Rd., Pullman, Wash.

HEATH oscilloscope. Make swap offer. James Doughty, 1½ Webber Pl., Texarkana, Ark.

HEATH Q-multiplier, CB receive crystals. Will swap for anything of equal value. Kay W. Hargis, 2620 W. 5800 S., Roy, Utah 84067.

UNUSUAL QSL CARDS. Will swap for others. Nick, Box 1102, Owensboro, Ky. 42301.

HEATH GR-64 SW receiver. Want walkie-talkie or VHF communications receiver. Mike Thede, 17972 N. Shore Dr., Spring Lake, Mich. 49456.

EICO 221 VTVM, hi-fi equipment. Make swap offer. Nicholas J. Denaro, 170 Wellington Rd., Elmont, N.Y.

AIRCRAFT RECEIVER, TV transformer. Want plate transformer with 1800-VCT, 400-ma. secondary. Dan Thiemann, 10917 Valley St., Omaha, Nebr. 68144.

GLOBE SD-75A transmitter. Need EICO 460 oscilloscope or other test equipment. Don Hirsch, 5027 N.E. 87th, Portland, Ore. 97220.

JUKE-BOX AMPLIFIER. Will swap for tube tester. Glenn Ray Wise, Box 101, Irvine, Ky. 40336.

HEATH HX-11 Novice transmitter. Will exchange for Heath HG-10 VFO or Heath Twoer. Tom Peterson, 719 Hoyt St., Warren, Ohio.

COAX (RG8A/U, RG9 and RG11). Make swap offer. David Bogart, 305 Walnut, El Campo, Tex. 77437.

REGENCY AR-132 aircraft monitor. Will trade for walkie-talkies. Dennis Atteberry, 721 E. Glen Ave., Peoria Heights, Ill.

LSA-3 linear amplifier. Make swap offer. Frank J Strauss, 4457 Howard, Western Springs, Ill. 60555.

BUD 19-in. relay rack, Knight capacitor checker. Make swap offer. R. Smucker, Rte. 3, Box 42, Huntington, Pa. 16652.

B&K 500 tube tester, Heath oscilloscope. Want tube checker for 4- and 5-pin tubes. Jean McCarty, Augusta, Ill. 62311.

SENCOR PS-103 power supply. Looking for Novice-band crystals, low-power transmitter. Hewey E. Smith Jr., Box 615, Sundance, Wyo.

LAFAYETTE KT-320 communications receiver. Want test equipment or tape deck. Robert Kafka, 1 Valley Ct., Huntington, N.Y. 11743.

[*Continued on page* 112]

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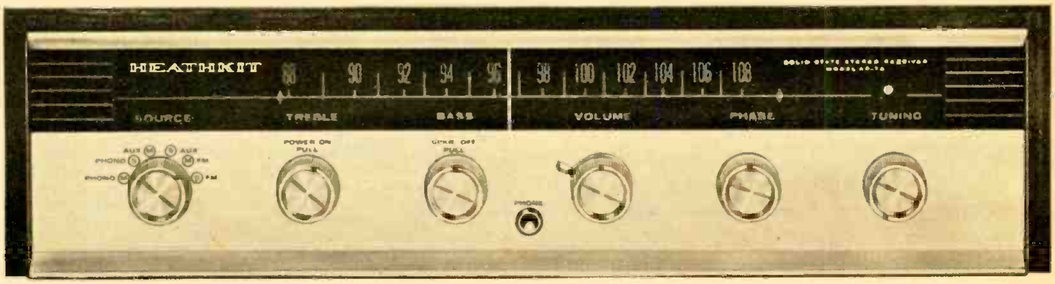

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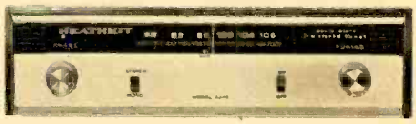

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Hi-Fi Today

Continued from page 100

preamps and power amplifiers—has dropped sharply and practically every manufacturer of hi-fi electronics will feature a receiver or two in the near future.

What happened? Well, there's the transistor, of course, which has made it far easier to put a lot of complex electronics on a single chassis. But equally important is the fact that the receiver just plain makes sense. If there no longer is a big performance advantage in separate amps and tuners (and there definitely isn't in most cases), why should the average buyer choose a whole shelf-full of electronics? Separate amplifiers, tuners and what-have-you will be around for as long as anyone can predict but the receiver—and the modular system in particular—are riding the wave of the future.

My vote for the most unexpected product of the year goes to Fisher's new R-200-B tuner, which combines FM with *three* AM bands to bring in long-wave and short-wave transmissions as well as the usual tuner fare. The tuner apparently originally was designed with Fisher's European export market in mind but it is of interest to plenty of people in this country, as well.

To make the most of various transmission and reception conditions, it offers a choice of normal, broad or sharp bandwidths. (Fisher claims that reception will be of high-fidelity quality most of the time.) Upshot is that if you can't get to those European music festivals you now have a way of bringing *them* to *you*.

For some time now, many tape recorders have been offering automatic reversing on playback, usually via a subsonic triggering signal on the tape. And Ampex, for about a year now, has had automatic-reversing signals on all of its commercial tape releases. But very few tape machines (the Concertone is the only one I can think of at this writing) specifically offer automatic reversing during *recording*.

It seems to me that the extra expense of a second recording head needed for reversing while taping would be considered money well spent by many a tape buff. Accordingly, here's hoping that more manufacturers take the plunge in the near future.

ELECTRONIC SWAP SHOP

Continued from page 110

LINCOLN 5-watt CB transceiver. Need Jim Lansing 075 tweeter and crossover network. P.L. Meeks, 4641 Janssen, Corpus Christi, Tex. 78411.

MIDLAND walkie-talkie. Want AC tape recorder. Mark Underkofler, 7318 Conser Dr., Overland Park, Kan. 66204.

AUTO RADIOS, model trains. Will trade for SW receiver. Bruce Karsk, North Bend, Nebr.

KNIGHT R-55A receiver, Q-multiplier. Will exchange for VHF ham gear. Dock Brown Jr., 67 157th S.E., Bellevue, Wash. 98004.

RECEIVING TUBES, other items. Will swap for 100-kc. crystal calibrator or preamplifier. Douglas Smales, Box 625, Woodward, Okla. 73801.

MOTOROLA FM mobile transmitter. Will trade for oscilloscope. J. Delson, 8698 Hollyhock Dr., Cincinnati, Ohio 45231.

KNIGHT Star Roamer. Will swap for equipment of equal value. Sam Barrett, WN5OSX, Box 427, Watonga, Okla. 73772.

VIKING Challenger, Lafayette HE-74 VFO. Want 2-meter transceiver, VTVM. C.R. McCormack, Marshfield Rd., Lawtons, N.Y. 14091.

ATWATER-KENT 55C receiver. Will exchange for Knight T-60, R55A or other ham gear. Joe Rock Jr., Box 162, Knoxville, Md. 21758.

EICO 214 VTVM, Superior Instrument 76 capacitor/resistor bridge and signal tracer. Will trade for Knight Star Roamer. W.L. George, Box 14322, Orlando, Fla. 32807.

STROMBERG-CARLSON PA amplifier, Polaroid 80A camera. Make swap offer. Richard Beatie, 1904 E. 114 Ave., Tampa, Fla. 33612.

HEATH AA-32 stereo amplifier, two-band Novice transmitter. Want 6-meter transmitter or Heath Twoer. R.W. Yerbury, 3186 Hillsdale Dr., Granger, Utah 84119.

GUITAR (steel-string). Will swap for Conar 500 receiver. Roger Critchlow Jr., 58 Oakwood Ave., Upper Montclair, N.J. 07043.

HEWLETT-PACKARD AC-4As, Berkley 705A plug-in decade units. Need surplus signal generator, CV-253 tuning unit for APR-4. J.B. Harker Jr., Box 2991, Kirkland AFB, N.M.

HO MODEL EQUIPMENT. Will exchange for ham gear. Blair P. Smith, 3 Ardmore Dr., Brentwood, N.Y.

SECO tube tester, miscroscope. Looking for oscilloscope, CB transceiver. Randy Schuster, Rte. 4, Box 178, Tucumcari, N.M.

CROSLEY RADIO, other receivers. Will trade for BC-696, BC-496 or T-22 surplus transmitters. Earl Cooper, Box 382, Wood River, Nebr. 68883.

LLOYD tape recorder. Make swap offer. Bruce Blechman, 2288 Mott Ave., Far Rockaway, N.Y. 11691.

HEATH Sixer, VOM. Want low-band ham gear. Benjamin Gross, 4923 Laurel Canyon Blvd., North Hollywood, Calif. 91607.

BROADCAST RADIO, model airplane motors. Want Knight Star Roamer. Alexander Sacco, 8 Curry Ct., Metairie, La.

BROADCAST RADIO (sun-powered), R/C model airplane. Want Novice transmitter or receiver. Al Nazzaro, Box 85, Rocky Point, N.Y. 11778.

ASSORTED RADIOS, components. Will trade for Canadian CB rig. Peter Poil, Box 297, Coronach, Sask.

KNIGHT Space Spanner receiver. Want Knight 400A tube checker or RF signal generator. M. Miller, 4622 Ridgelane, Fort Wayne, Ind. 46804.

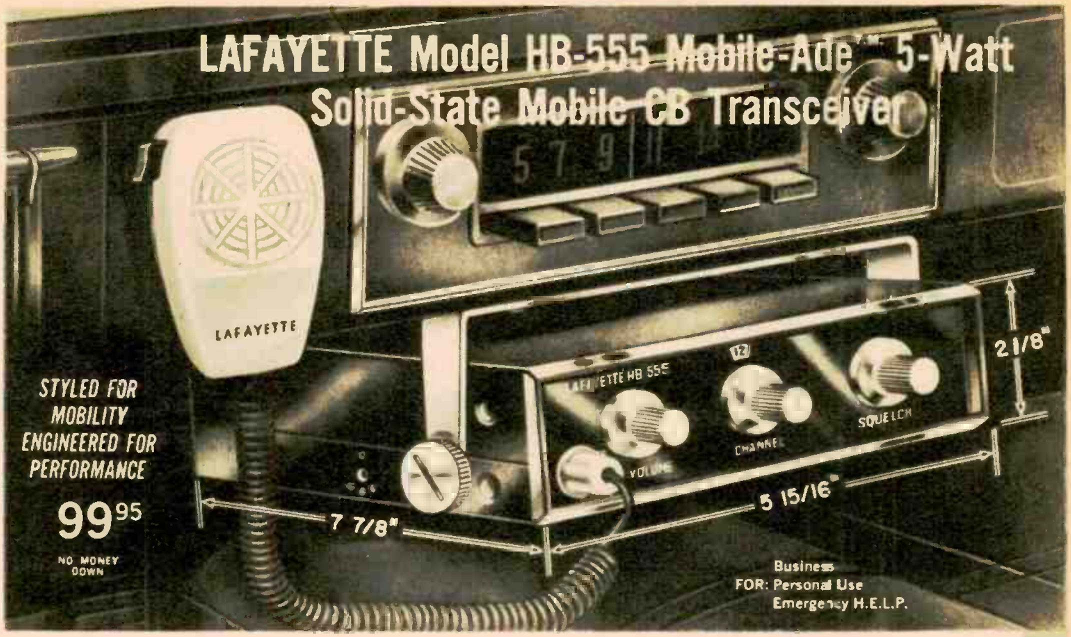
KELLOGG relays, assorted components. Will trade for 8- or 35-mm camera and projector. M.D. Johnson, Box 271, Alliance, Nebr. 69301.

HALLICRAFTERS S-120 receiver. Will swap for anything of equal value. Greg Pickrell, Rte. 2, Ruthven, Iowa 51358.

LAFAYETTE D-200 voltage regulator Heath EK-2, GR-81. Will swap for Heath Twoer, other ham gear. Larry Schwartz, WN2UUD, 98 Havilands La., White Plains, N.Y. 10605.

HALLICRAFTERS SX-100 SW receiver. Will trade for 60-watt transmitter and receiver or mobile ham station. Stephen R. Gibbs, 730 Montview Dr., Escondido, Calif. 92025.

[*Continued on page* 121]



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Overseas Job In Electronics

Continued from page 57

can be done but you've got to know what you're doing. Companies want men with proven performance records in the field. That usually means experience in specific areas—communications, data processing, radar, countermeasures. There are jobs for technical assistants with relatively little experience but they're harder to find. And you seldom can count on instant Istanbul even after you've landed a job. Reason is most companies want to put you through one to six months of training in the U.S. before shipping you out.

For government service, cracking the market from outside is even tougher. Employees already on the payroll usually get first chance at these plums. Says William F. Coakley of the Army's employee management division.

"In filling all positions overseas, we give first priority to career employees of the Department of the Army and then to career employees of other federal agencies. If we fail to locate a suitable candidate from these sources we go to the appropriate Civil Service registers."

Harold S. Alexander, personnel staffing specialist of the Federal Aviation Agency, puts it this way: "The jobs we have overseas usually require experience in one of the FAA's major program areas. As a result, two years of FAA experience is preferred before overseas assignments."

Best way to land an overseas job with the government undoubtedly is to take a stateside job with an agency that has overseas operations and go after the foreign post from within. Matter of fact, unless you're blessed with badly needed skills it's almost the only way. If you want to work for industry, your chances of getting a direct assignment overseas are better. To start, you might write a few of the large companies that hire overseas personnel on a more or less regular basis. But don't bother scattering scores of letters to big electronic firms all over the country. Reason is that many with widespread foreign operations don't hire for overseas posts in this country at all.

"We staff our operations in the 102 countries where we operate with nationals of the host country insofar as possible," says IBM's D. J. Scherer. Many other companies follow the same policy.

Good way to find out who's hiring is to watch the classified section of your newspaper or of a big-city paper near your home. You'll find ads from individual companies and from employment agencies seeking technical men for overseas posts. Both are good bets.

It's best to stick to papers near where you live. Most firms want personal interviews before they hire and you may not be able to travel across the country on the chance you'll get a job. But some companies—RCA, for example—have recruiting teams roaming the country.

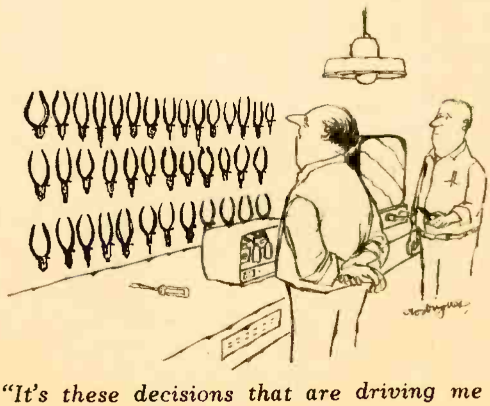
"We have nationwide recruiting," says J. P. Thatcher, "so we're usually in some city near your home town at least once a quarter." The classified section of your paper likely will announce the arrival of such teams.

Newspapers, in fact, are full of opportunities. For example, a recent Sunday edition of the New York Times carried four large ads by major companies recruiting overseas personnel. It also had employment agency ads such as these, culled from the same issue:

> Electronic Tech, overseas. $7200+bonus. First FCC necessary.
>
> Field—Japan or Turkey. Degree not necessary. Long term assignment. Communciations, install and check-out. $7,000+bonus+per diem.
>
> Technicians to $12,000. Overseas assignment in maintenance, calibration of electronic test equipment.

Tough to get an overseas job in electronics? Sure. But impossible? By no means.

Simply decide what you want and go after it. It could be the beginning of a long, adventure-filled career, combining the excitement of electronics with the pleasure of world travel.



"It's these decisions that are driving me crazy. . . ."

The Listener

Continued from page 33

FM DX '66 . . . It no longer rates as news but the fact is worth noting that distant radio listeners addicted to the 88- through 108-mc FM band have been given a real boost by ye olde Federal Communications Commission. That venerable body finally has compelled broadcasters to stop duplicating AM transmissions on FM, which ruling comes as good news for DXers on several counts. First, DRLs who like their targets interesting as well as elusive now will find much more variety on this heretofore ultra-staid VHF band. For example, did you know that George (Hound Dog) Lorenz holds court nightly on WBLK, 93.7 mc, from Buffalo, N.Y.? ('Tis wild, he is!)

Also on the plus side is the fact that many stations which for financial reasons were useless appendages of an AM operation hopefully now will be forced out of business. Only purpose of these transmitters was to hold down an FM frequency for the licensee on the off chance that the future might produce some unforeseen jackpot. DXers will be delighted to see these dog-in-the-manger calls go and all of the unnecessary QRM with them.

Finally, reporting an FM catch now is far more certain to bring an FM QSL. Reason is that when programs were simulcast on both bands the station always could harbor doubts as to the authenticity of a report. But split operation removes this headache once and for all. End result is that FM DXing well may be in for a real spurt.

As you read this, skip still will occur from time to time on the FM band. Caused by formation of an abnormal (sporadic) E layer, skip can be responsible for FM reception at distances between 500 and 1,500 mi. However, it is quite unpredictable and can occur at any hour of the day or night.

The phenomenon called trop also currently is moving toward a peak and can result in reception at distances up to 500 mi. Despite the drop in distance, many experienced DXers consider trop the greater challenge because weaker signals often are involved (skip is more a matter of luck). Trop begins in earnest around sunset and can last up until 2 a.m. And the longer it lasts the better it gets.

Pocket-Size FM Stations

Continued from page 75

tances, a vertically mounted half-wave dipole generally is better. A long length of twin-lead run over or around the working area and serving as an antenna makes for more uniform signal pickup in a fixed location. And for difficult installations the outputs from two antennas located several feet apart can be combined to feed the tuner. (Rarely will direct and reflected signals simultaneously be cancelling each other at both antennas.)

The universal coupler shown between the receiver and tape recorder in Fig. 2 is capable of coupling any type of receiver or tuner to any kind of recorder (or amplifier). When different DC voltages are present at the input and output of the coupler, as sometimes is the case with transistor equipment, slide switch S1 can be opened to provide capacity coupling instead of direct coupling. Potentiometer R1 is adjusted to avoid overloading of the input stage of the recorder or amplifier.

Input of the coupler can be plugged into the earphone jack of a receiver if a resistor equal in value to the nominal load impedance is soldered across points X and Y in the coupler. However, this arrangement does have two drawbacks: 1) you cannot monitor reception and 2) any distortion present in the receiver's audio system will degrade performance.

Taking audio from a multiplex jack on a tuner or receiver yields maximum fidelity. Reason is that broadcast FM stations employ a pre-emphasis network to boost high frequencies and a corresponding de-emphasis network therefore is incorporated in FM tuners and receivers to restore normal response. Most popular-price wireless mikes have no pre-emphasis, though, so audio from a mike signal taken off *after* a receiver's de-emphasis network suffers from a gradual roll-off of high frequencies.

Though we have touched on a goodly number of applications, other uses of these cordless FM pocketables seem limited only by the imagination. For example, an FM receiver can be worked through the coupling unit into the mike input of a ham transmitter. The wireless mike then will work the VOX perfectly and other hams won't be able to tell whether you are using your regular or your wireless mike. More importantly, they have no way of knowing whether you are 3 or 30 ft. from your rig.

Properly and intelligently used, these FM wireless mikes are capable of excellent performance in many places where a trailing mike cord simply is out of the question. Just don't attempt to turn a couple of FM mikes and receivers into a full-fledged two-way communications system. The FCC specifically forbids it.

The Nimble Neon

Continued from page 43

two limitations. It indicates voltage only in excess of the neon's firing voltage. And AC frequency cannot be higher than about 20 kc (that's as fast as a neon can operate). The potentiometer must be calibrated against known voltages. Simply turn the pot until the neon lights, then read the voltage from the potentiometer's calibrated dial. The circuit can be used to measure up to about 500 V.

Fig. 5B is a neon-lamp oscillator. When voltage is applied the capacitor starts to charge. When the voltage across the capacitor reaches the lamp's firing voltage, the lamp lights. The lamp's low resistance quickly discharges the capacitor. The sawtooth waveform produced by this circuit is shown in Fig. 6. The upward slope represents the charging of the capacitor. The plunge downward occurs when the neon fires.

A practical circuit, a relaxation audio oscillator, is shown in Fig. 9. Important circuit values are R2 and C1, whose time constant provides an audio tone of about 1300 cps. The tone can be lowered a few hundred cycles with R1, which inserts additional resistance in the circuit.

Capacitor C2 and R3 prevent the load from shorting the oscillator. The load can be 1,000- to 3,000-ohm headphones or may be fed to an audio amplifier for testing purposes. Connect a key in place of S1 and you have a code-practice oscillator.

If you turn R1 clockwise much beyond half rotation the tone may stop. To start the oscillator, simply turn power switch off, then on.

Look through parts catalogs and you'll see a wide range of wattages and bulb sizes and suggested series resistors. The big $2.70 NE-40, for example, has a 3-watt rating. It could be used when greater light is needed. Also listed are aged and high-brightness neons for other applications.—*H. B. Morris*

Filters That Really Do

Continued from page 93

this benefit may not be too important in the usual CB application where tolerances simply aren't critical). Another advantage of the Collins model: it needs no matching devices (transformers and the like) to make it work in a tube or transistor circuit.

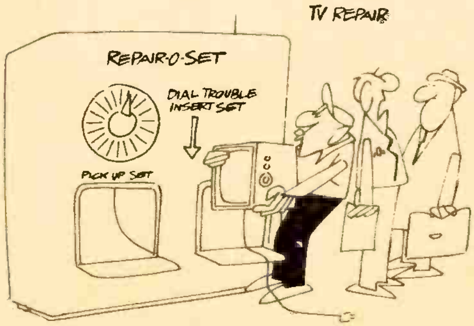
So the mechanical filter quickly is shedding its reputation as a gem-like device for use only where costs are not counted. Offering a formidable set of advantages over its close competitors—the crystal filter and Q-multiplier, it seems headed for a role as work-horse component in the coming crop of communications equipment. Fact is, with mechanical filters coming on stronger and stronger, you soon may hear CBers and SWLs joining in with hams in their tech talk. All will be arguing steep skirts and flat tops right along with S-units and db.

The Ham Shack

Continued from page 68

consider—and I did—that this roughly was equivalent to increasing my 336-element beam to 672 elements or doubling the power of every station on the band, you perhaps can understand Wayne's waxing enthusiasm.

By way of answering the slide-rule contingent, I know there theoretically shouldn't be quite that much difference between a carefully tuned 417A converter with a selected 417A and a transistor converter. Answer is that darned few 417A converters are working at optimum at any time and those that are don't stay that way long. And if you won't give me that point, let's discuss price.



"In my day we did it all by hand."

Try An Attic Antenna

Continued from page 78

thought to orientation. As one sage said about extremely long dipoles and the problem of directionality—simple, just turn the house. Until someone markets a suitable house rotor, there'll have to be some compromise. If Europe, say, is to the east or west of your location, a north-south running attic would provide the best orientation. But short-wave signals also have an affinity for taking the short hop over the poles—which suggests an east-west antenna. Again, it's a matter of compromise.

Other installation details are shown in the photographs. TV standoffs and friction tape support the elements and eliminate sag. During installation try to avoid close proximity to masses of metal which will reduce antenna efficiency. Such things as rain gutters just outside the roof, plumbing, electrical wiring in attic walls, floor and ceiling will affect performance adversely.

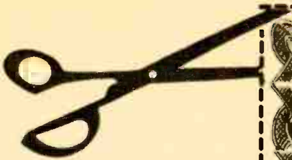
CB Corner

Continued from page 87

plaint. But the effect usually is feeble. FCC officials explain that comments must contain constructive argument if they are to carry weight. Rebuffed CBers have replied that it almost takes a Philadelphia lawyer just to launch a protest.

This didn't bother George Nims Raybin. A CB operator in the New York City area, Raybin felt oppressed by one rule that didn't seem to make sense. It's the one that divides channels among units of the same and different call-signs. Raybin feels there are times when it is impossible legally to contact a station and communicate for what actually are perfectly legal reasons. It happens when the other station is monitoring a channel reserved exclusively for units of the same station (channels 1-8, 15-22).

Raybin's solution, as argued in his petition to the FCC, is to allow a station to call another channel for the *sole purpose* of asking it to move to one of the inter-station frequencies. Communications then can proceed as usual. Raybin believes his idea actually supports present law. CBers, he feels, now are driven to illegal methods to reach other stations outside the inter-station band.



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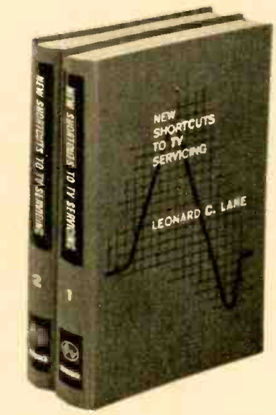

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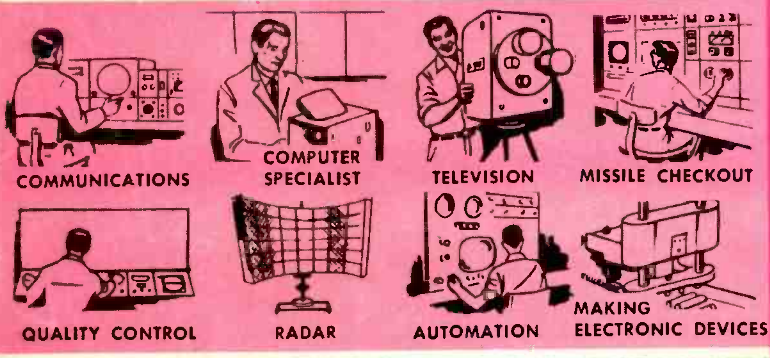

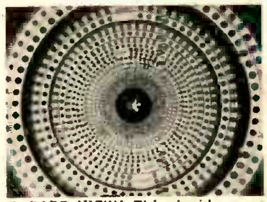

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