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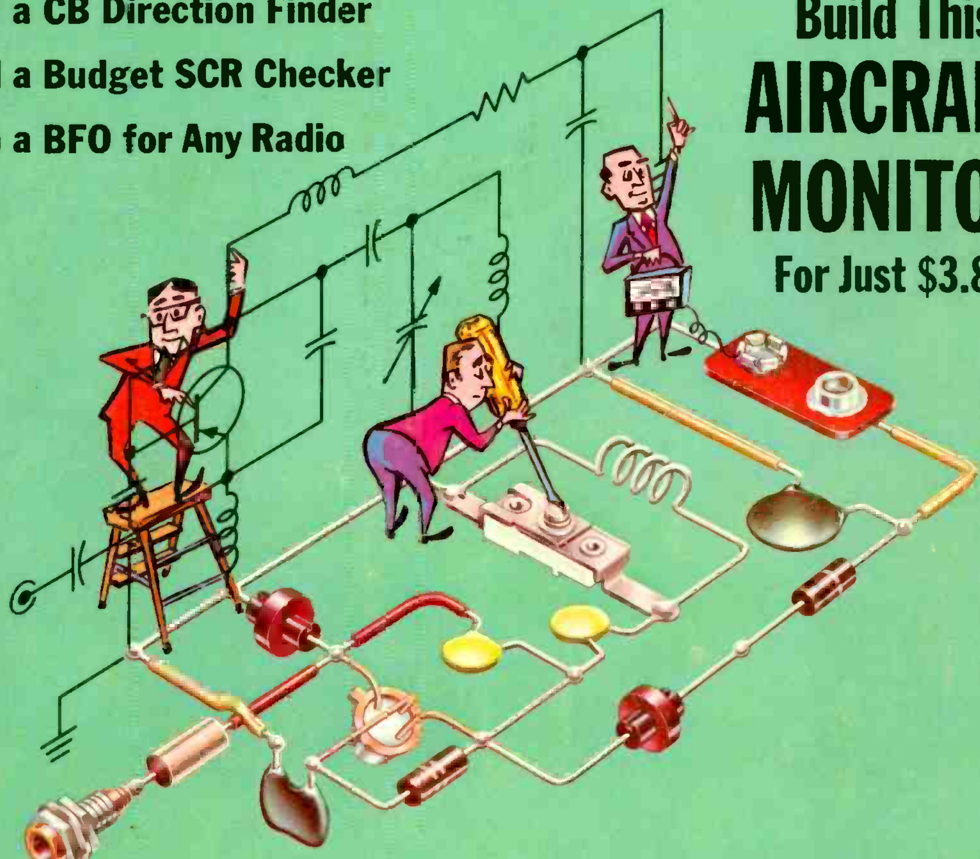

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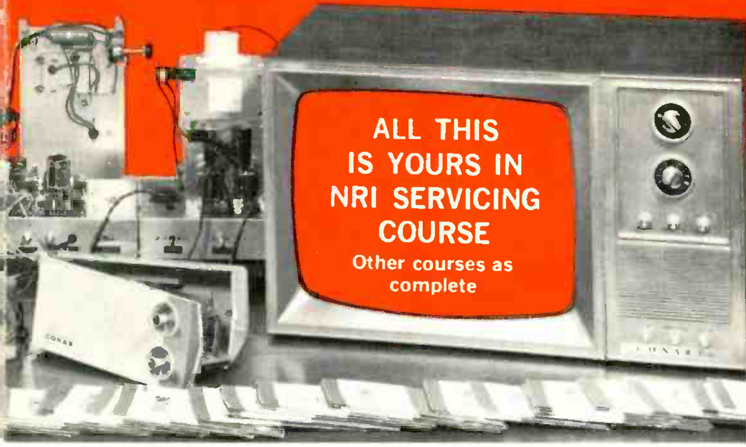

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RONALD L. WOOD, Fargo, N.D., holds a First Class FCC License and is employed as a studio and master control engineer/technician with station KXJB-TV. He wrote to NRI to say, "Many thanks to NRI for the Electronics training I have received."

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

CRAIG D. SPARKS, Cambridge, Mass., is a Communications technician for AT&T Long Lines Dept. "I was hired because of my NRI training. I was given credit for 18 months experience and my starting pay raised. They were impressed NRI trained me well enough to get a First Class FCC License."

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COVER: Schematic by Eugene J. Thompson. Figures by Edward Appleby

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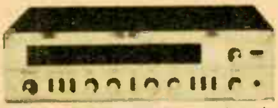

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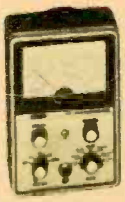

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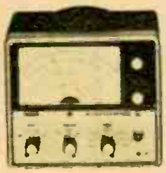
EICO 379 Solid-State Sine/Square Wave Generator $69.95 kit, $94.50 wired



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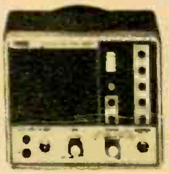

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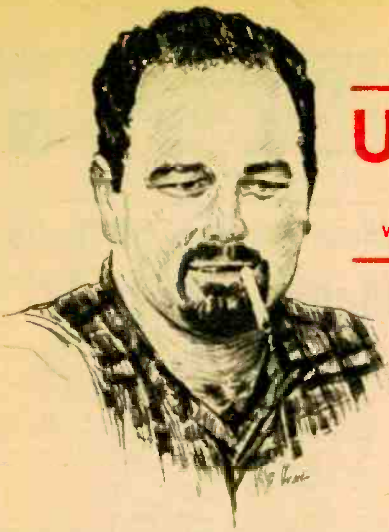


Uncle Tom's Corner

By Tom Kneitel, K2AES/KQD4552

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

★ *I bought a surplus Telefax set, Western Union Telegraph Co. Model 6500-A. Where might I obtain a schematic, operating instructions and the special fax paper the set uses?*

Robert R. Kissell
Osgood, Ind.

Send your question and a stamped, self-addressed envelope to Gordon E. White, 5716 N. King's Highway, Alexandria, Va. 22303. Gordon is a surplus expert for CQ magazine and probably can put you on the track of these goodies. This applies to the many folks who want similar data on other surplus gear.

★ *I've seen plenty of stories on how they're building miniature computers and calculating machines. I need something small which will multiply. What do you suggest?*

Carl Fredlin
Flushing, N.Y.

A rabbit.

★ *I keep reading that the high-speed train which runs between New York City and Washington has radio telephones aboard for passengers making calls. I've listened on all of the Washington and Baltimore mobile operator channels but I've yet to hear any calls from this supertrain. What's the scoop?*

Art Hardian
Dundale, Md.

The Metroliner doesn't use the regular mobile operator for its calls. They have been given six exclusive U.S. Government channels for their operation. Listen on 416.125, 416.175, 416.225, 416.875, 416.925 and 416.975 mc.

★ *Here in Oklahoma, where the wind comes sweeping down the plains, I've had a heck of a time keeping my 6-meter beam aloft. Seems like every time that breeze howls through town, the beam and mast bowl right over. Any suggestions?*

Alan MacRaye
Tulsa, Okla.

When I lived in Oklahoma City I picked up a few good tricks from local hams. One was to aim the beam into the wind so that it doesn't take the blast broadside. Another was to slip a broom handle inside the hollow masting to keep it from bending. A good set of guy wires added to this should keep you on the beam and vice versa.

★ *I'm an SWL who has been bitten by the ham radio bug. I'm a little short on funds and I'd like to know your opinions on using an Army ARC-5 Command Set for the ham bands.*

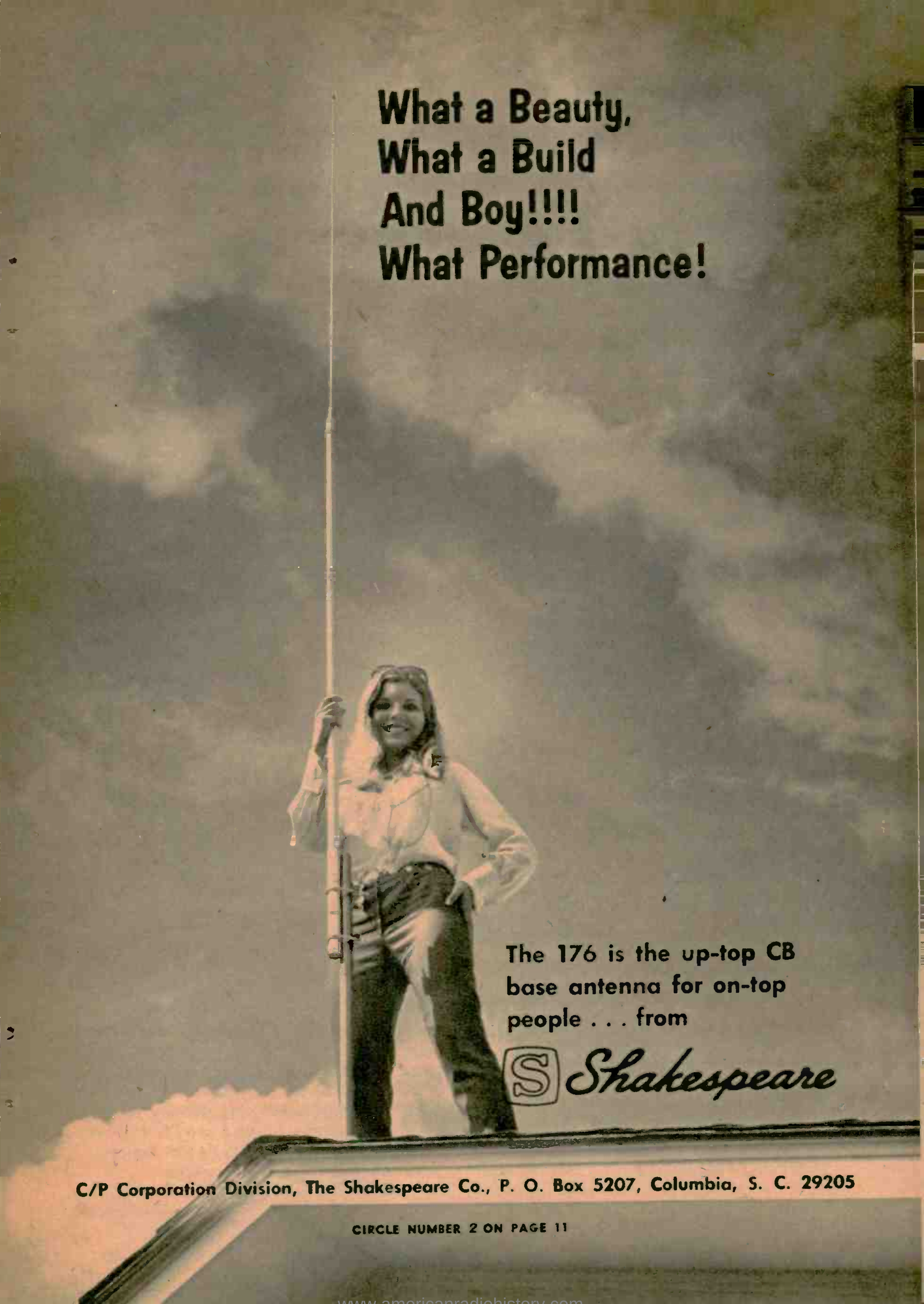
Pat Sullivan
Appleton, Wis.

For sheer guts, the ARC-5 can't be beaten. A few years back I rescued one from a rotting B-17 Flying Fortress which had been reposing in the Phillippine jungles for almost 20 years. Two new tubes and an hour's worth of minor patching and the set was going full blast; I've still got it.

★ *I recently purchased a group of five military 500 watt linears which I think will be useful to CB operators who want to increase their range. Every time I try to use one I find that the plate current becomes unstable after only a few minutes. This happens on all five units.*

R.J.M.
Hammond, Ind.

The FCC would just love to observe one of your little 500-watt CB demo sessions. As for the unstable plate current, maybe these rigs are trying to tell you something, like they're part chicken.


What a Beauty,
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What Performance!
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CIRCLE NUMBER 2 ON PAGE 11

Feedback from Our Readers

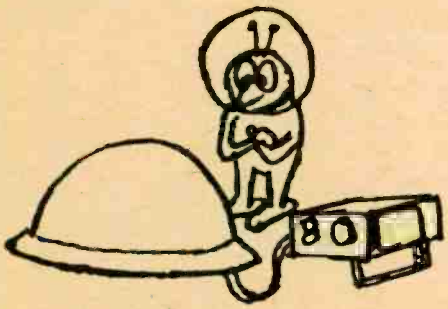
Write to: Letters Editor, Electronics Illustrated, 67 West 44th St., New York, N.Y. 10036

● FIXED FOR GOOD

Your ONE-STATION RADIO (July '70 EI) is an interesting solution to a problem I had. My kids were always tuning to another station when my back was turned so I sawed the shaft off the radio's tuning capacitor. Metal chips and filings got in the capacitor's plates and I now find myself with a set that receives nothing but memories of my favorite station.

Charles Osgood
Malverne, Ark.

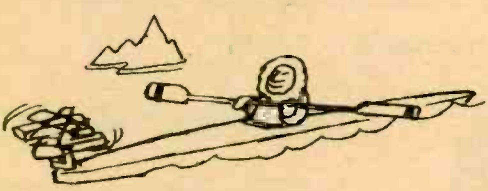
● UNEARTHLY ANTENNA



Your article, THOSE SPECIAL-APPLICATION TV ANTENNAS (July '70 EI), was out of this world! I had been wondering whether it was possible to get good reception without having the height and spread of the standard rig. I guess you just have to forget the looks when it comes to pulling in those distant TV stations.

Alan Mason
Rutland, Vt.

● SMALL TITANIC



I found your article, A RADAR FOR YOUR ROWBOAT (July '70 EI), fascinating. I own a kyack and I am planning to install a set just for kicks. I hope I am not mistaken for a submarine closing in for the attack but you can never tell when you might run into an iceberg in these waters.

John Sturgis
Fairbanks, Alaska

● APOLLO, PLEASE QSL

I was interested to learn from your Official World DX List that you consider outer space as a possible area for DX. With our efforts in space I can believe that there will be a lot of activity there. How do you go about getting a QSL card?

Dick Heindel
Mt. Vernon, Ohio

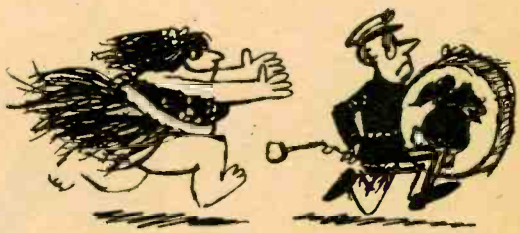
Any suggestions from you hams?

● MUSIC LOVER

STEREO '70 (July EI) seemed to make it clear that this year is going to be great for stereo gimmicks. Everybody seems to have lost sight of the goal—good music!

John Matthews
Chicago, Ill.

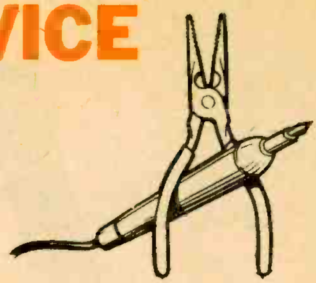
● LEATHERNECK DX



If you think that listening to the marine band (DXing THE Marine Band, March '70 EI) can be interesting, you should try listening to a real Marine Band. When some of these guys get going over here you really know that something is happening. Back home listening can be fun, but when you tune in here the action is guaranteed. How about doing an article on DXing military broadcasts? Some can be dull as a letter from your draft board, others make you feel that you have an inside line to the Pentagon.

SP5 Tom Sand
FPO, San Francisco

SERVICE TIPS

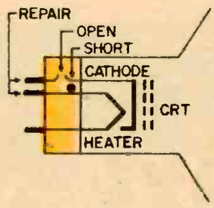


By
ART MARGOLIS

OLD radio finger-tricks work well on cheap tape recorders. Turn the volume all the way up and then touch the connections on the head with your finger. If this produces some hum or any kind of noise, the head probably is bad. If you don't get a response the amplifier, cable and selector switch become prime suspects.

—

If you install an isolation brightner on your weak picture tube and your brightness disappears altogether instead of improving, you have a heater-to-cathode short and an open cathode (see diagram). This is quite common. All is not lost. In fact, you can save the day quickly by reconnecting the cathode to one side of the heater with a piece of wire, right on the CRT socket.



—

When using an ignition-analyzer scope, if the patterns turn out as specified you're in good shape. Otherwise, double-check variations that seem to indicate defective spark plugs. For instance, some cars use resistance wire to suppress radio and TV interference. This will cause abnormal scope patterns, yet no trouble exists.

—

Motorboating without picture distortion on TVs was non-existent until recently. It has appeared in some of the newer sets. Don't check the filter. That's not it. It's the Compactron audio-output tube (such as a 12AE10) that is doing it.

—

A printed-circuit-board trick that is circulating among the pros is a procedure to remove solder from a connection during a desoldering operation. Take a piece of braid from shielded cable, put some soldering paste on it and use it between the soldering iron tip and the connection. It will sop up all the excess solder.

—

All electronic buffs are familiar with various tuner cleaners that are used also on volume controls, etc. Few realize that the chemical is excellent for cleaning and lubricating built-in TV antennas. Simply spray the ball joint and telescoping sections. This may cure erratic reception.

—

The commonest cause of electric skillet breakdown is improper washing. While the body can be immersed in water, the handle cannot. When the handle does get dunked the thermostat usually doesn't survive. If you can get a new part the repair is simple. ●

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9/70

Ham It Up. Model A-2516 amateur-band receiver offers AM, CW and SSB reception on frequencies ranging from 3.5 to 29.7 mc (80 through 10 meters). Dual-conversion circuitry provides crystal-controlled first local oscillator and solid-state VFO-type second oscillator. The latter can be used as VFO for a transmitter. The A-2516 includes AVC and ANL circuits, a calibrated S-meter, 500-ohm output terminals and mechanical IF filter. Sensitivity is 1.5 μV for 10db signal-to-noise ratio at 14 mc. $169.95. Allied Radio Corp., Chicago, Ill. 60680.

WHIPLASH. The Baton (Model ZS-7210A, shown at lower right) is a solid-state CB transceiver designed for portability and rugged use. Rig measures 9½ in. high by 2 in. in dia., weighs 1.5 lbs. and requires six penlight cells as power source. Both transmitter and receiver are crystal controlled; input power to final stage of transmitter is 100 mw. Audio output: 450 mw max. The Baton uses eight transistors and one diode; telescoping antenna reaches 59 in. when fully extended. $59.50. Toshiba America, Inc., New York, N.Y. 10022.

Electronic Marketplace

Pro Platter. Model SEL-100 automatic turntable offers speeds of 33⅓ and 45 rpm, synchronous 24-pole motor with belt drive, separate motor for record-change sequence and change cycle controlled by a photoelectric cell. The same spindle is used for both manual and automatic play. Speed accuracy: within 0.2 per cent; rumble/noise: -52db. $149.50. Sherwood Electronic Laboratories, Inc., Chicago. Ill. 60618.

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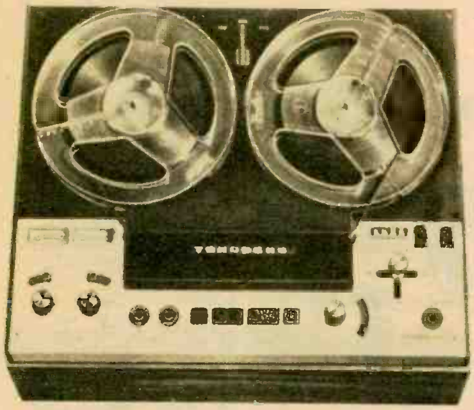
CIRCLE NUMBER 3 ON PAGE 11

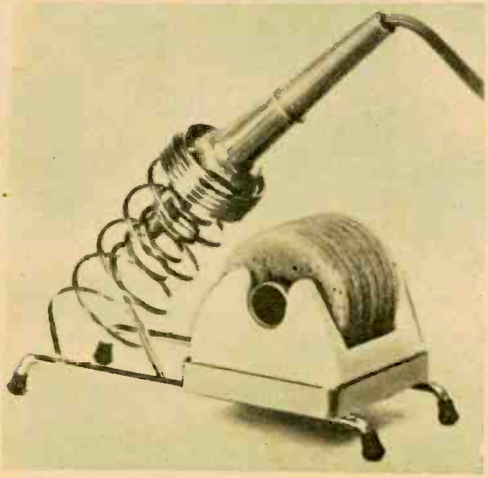
Electronic Marketplace

Tape's the Thing. Model 6000X stereo deck boasts four precision-gap, mumetal-screened heads with Cross Field design. Frequency response is 40-22,000 cps at 7½ ips, 40-18,000



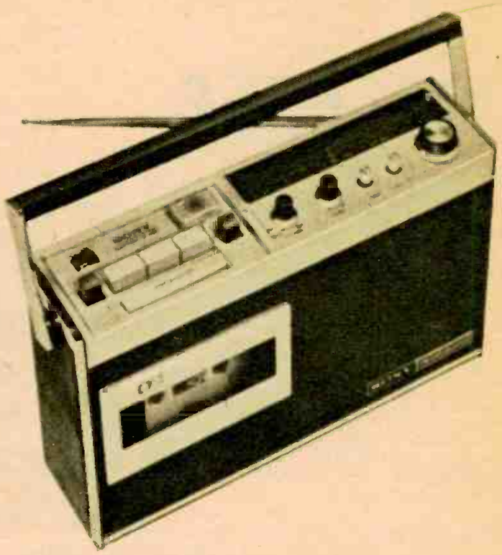
cps at 3¾ ips and 40-9,000 cps at 1⅞ ips. Rig has a single-level tape-transport control, hysteresis motor and sound-on-sound. Two or four tracks. $499. Tandberg of America, Inc., Pelham, N.Y. 10803.

Safe Soldering. Model TWH-444, a combination soldering-iron holder and rotary tip wiper prevents burns and keeps the tip free of oxidation and flux without detinning. The outer spiral



of the holder prevents the operator from touching the iron accidentally and the inner spiral holds the iron and serves as a heat sink to prevent overheating. $5.95. Plato Products, Inc., El Monte, Calif. 91734.

Hi-Ho Audio. A complete audio system, the Model 8000W offers cassette recording and AM-FM radio. It operates on 117 VAC or four D cells, has a built-in condenser recording mike



and a separate mike for VOX control. The recorder has an end-of-tape alarm which gives an audible warning at the end of the cassette. An optional nickel-cadmium battery pack is available. $145. Sony/Superscope, Sun Valley, Calif. 91352.

Accurate Turntable. Miracord's 770H automatic turntable features speed control and a built-in illuminated stroboscopic speed indicator that gives digital readouts of exact speed. It also has

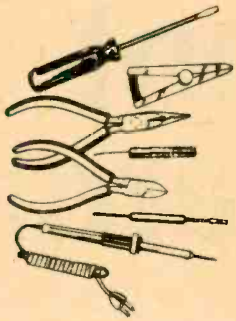
an ionic elapsed-time stylus-wear indicator to show the time the stylus has been used. The turntable has a Papst hystersis motor, pushbutton operation, stylus overhang screw for adjustment of height and silicon damped cueing. All the options combine to provide lowest possible stylus force. Speed precision is maintained without a strobe disk. $199.50. Benjamin Electronic Sound, Farmingdale, N.Y. 11735.

THE CALECTRO SUPERMARKET

EVERYTHING IN ELECTRONICS!

VARIABLE BALANCE STEREO HEAD PHONE

Unique "Sound Level" control on each earpiece permits adjustment. Frequency range 20 to 20,000 + cps. 6½ cord with stereo plug. Impedance 4 to 16 ohms.
Cat. No. Q4-132 $17.95 Net

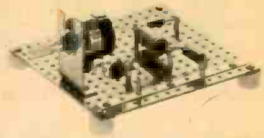


HOBBYIST'S SOLDERING AND TOOL KIT

Diagonals, long nose pliers, soldering iron and solder, solder aid tool, heat sink, and screwdriver. An ideal gift item.
Cat. No. H3-378 $7.95 Net

TAPE RECORDER MICROPHONE

Outstanding performance on music and speech for the price. Low impedance matches late model solid state recorders. Removable desk stand. 4½ cord with dual plugs that fit most models. Freq. Response 100-8k Hz. Output —77 dB. Impedance 200 ohms.
Cat. No. Q4-146 $4.95 Net



EXPERIMENTER'S CIRCUIT BOARD KIT

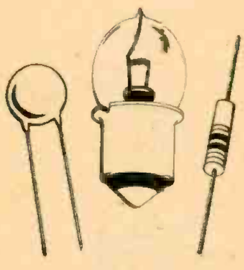
Contains a 3¾" x 4" perforated board, 15 terminals (No. J4-636) and 4 mounting feet w/screws. Build small circuits, hobby and science projects, etc.
Cat. No. J4-660 $.98 Net

AUDIO ADAPTORS

"Y" Audio Adaptor has a phono pin jack on one end and dual phono pin plugs on the other.
Cat. No. Q4-288 $.99 Net

TWO STATION WIRELESS INTERCOM

Just plug into any electrical outlet. Completely portable. Expand system anytime with additional units. Two unit system complete in display pack.
Cat. No. N4-110 $34.95 Net



MINIATURE LAMPS

Type PR2 • 2.5 volt • 0.50 amp •
Cat. No. E2-430 • Pkg. of 2 $.29 Net
Type PR3 • 3.6 volt • 0.50 amp •
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Attractively packaged 2 per pack, showing values, color codes and formulas.

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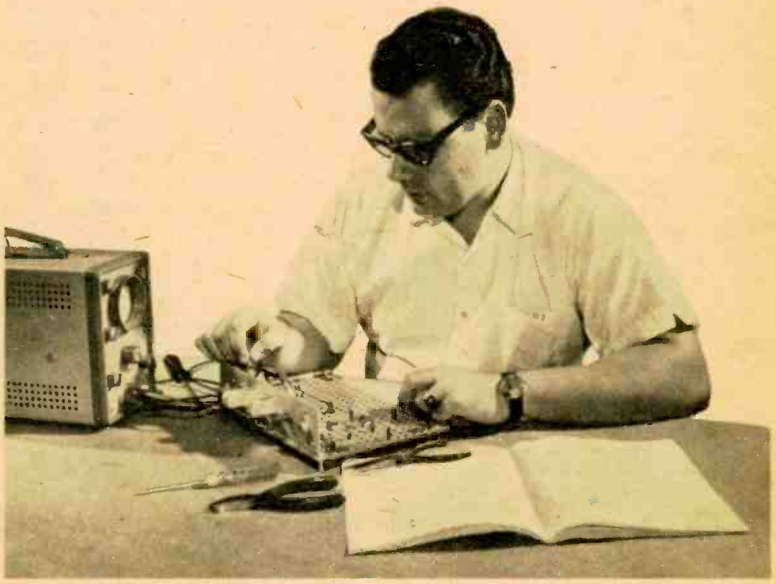
GC ELECTRONICS **CALECTRO** G-C ELECTRONICS
A DIVISION OF HYDROMETALS, INC.

CIRCLE NUMBER 4 ON PAGE 11

10 Reasons why RCA Home Training is your best investment for a rewarding career in electronics:



Performing transistor experiments on programmed breadboard — using oscilloscope

1 LEADER IN ELECTRONICS TRAINING

When you think of electronics, you immediately think of RCA...a name that stands for dependability, integrity and pioneering scientific advances. For over a half century, RCA Institutes, Inc., a service of Radio Corporation of America, has been a leader in technical training.

2 RCA AUTOTEXT TEACHES ELECTRONICS FASTER, EASIER, ALMOST AUTOMATICALLY

Beginner or refresher, AUTOTEXT, RCA Institutes' own method of programmed Home Training will help you learn electronics more quickly and with less effort, even if you've had trouble with conventional learning methods in the past.

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

RCA Institutes is doing something positive to help men with an interest in electronics to qualify for rewarding jobs in this fascinating field. Every year, literally thousands of high paying jobs in electronics go unfilled just because not enough men take the opportunity to train themselves for these openings.

4 WIDE CHOICE OF CAREER PROGRAMS

Start today on the electronics career of your choice. On the attached card is a list of "Career Programs", each of which starts with the amazing AUTOTEXT method of programmed instruction. Look the list over, pick the one best suited to you and check it off on the card.

5 SPECIALIZED ADVANCED TRAINING

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

6 PERSONAL SUPERVISION THROUGHOUT

All during your program of home study, your training is supervised by RCA Institutes experts who become personally involved in your efforts and help you over any "rough spots" that may develop.

7 VARIETY OF KITS YOURS TO KEEP

To give practical application to your studies, a variety of valuable RCA Institutes engineered kits are included in your program. Each kit is complete in itself. You never have to take apart one piece to build another. At no extra cost, they're yours to keep and use on the job.

8 FROM RCA INSTITUTES TRANSISTORIZED TV KIT, VALUABLE OSCILLOSCOPE

Those enrolled in RCA's television course or program receive complete transistorized TV Kit. All students receive a valuable oscilloscope—both at no extra cost and only from RCA Institutes.

9 CONVENIENT PAYMENT PLANS

RCA Institutes offers a unique tuition plan that lets you progress at your own pace. You only pay for lessons as you order them. You don't sign a contract obligating you to continue the course. There's no large down-payment to lose if you decide not to continue. However, if you desire, RCA Institutes also offers a convenient monthly payment plan.

10 RCA INSTITUTES GRADUATES GET TOP RECOGNITION

Thousands of graduates of RCA Institutes are now working for leaders in the electronics field; many others have their own profitable businesses. This record is proof of the high quality of RCA Institutes' training.

CLASSROOM TRAINING ALSO AVAILABLE

If you prefer, you can attend classes at RCA Institutes Resident School, one of the largest of its kind in New York City. Coeducational classroom and laboratory training, day and evening sessions, start four times a year. Simply check "Classroom Training" on the attached card for full information.

JOB PLACEMENT SERVICE, TOO!

Companies like IBM, Bell Telephone Labs, GE, RCA, Xerox, Honeywell, Grumman, Westinghouse, and major Radio and TV Networks have regularly employed graduates through RCA Institutes' own placement service.

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RCA INSTITUTES, DEPT. 234-009-0
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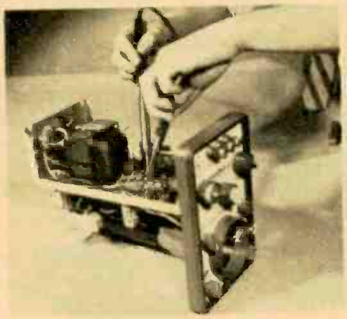
Accredited Member National Home Study Council

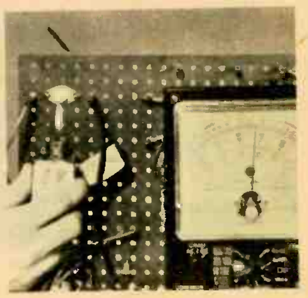
RCA

Construction of Multimeter.



Construction of Oscilloscope.

Temperature experiment with transistors.



Swap Shop

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

AMATEUR RADIO

EICO 720 transmitter with 730 modulator. Want Heathkit HX-20 transmitter. Kim Bailey, 7718 Loleta Ave., Citrus Hts., Calif. 95610.

WILL SWAP ham gear or test equipment for Scintillator Model III. Dan Williams, 4614 Broadmeadow Ct., Huntsville, Ala. 35810.

KNIGHT Span-Master II receiver and Ameco AC-1 Novice transmitter. Will swap for ham-band transceiver. Joe Magnan, Route 1, Pierz, Minn. 56364.

VIKING II transmitter with key. Want 2-meter equipment or best offer. Steve Farkas, 644 Derby Ave., Woodmere, N.Y. 11598.

ARC-5 Receivers covering 1.5 to 6 mc. Will swap for best offer. Harold Cohen, 256 East 37th St., Brooklyn, N.Y.

HALICRAFTERS SX-130 receiver. Will trade for Swan 500. Michael Moore, 918 Hunter Rd., Wilmette, Ill.

HEATH HW-30 2-meter transceiver. Will swap for good quality all-band SW receiver. Frank Magyar, Box 543, Stratford, Conn. 06497.

VANGUARD 407 2-meter converter, 7-11 mc output. Will trade for Heath HG-10B VFO. Richard McDuffie, 40 Webb St., Portland, Maine 04102.

LINEAR amp, 500 watt, 6-10 meter. Will swap for wide-scale VOM. Ralph Dean, Box 460, Siloam Springs, Ark. 72761.

SCANNER antenna, with 120 beam. Would like to trade for Garrard SL-65 turntable. Roger Ladewig, 14637 Center Ave., Harvey, Ill. 60426.

HAMMARLUND HQ-110 receiver. Will swap for other amateur-band receiver. Richard Rubin, Box 509, Monticello, N.Y. 12701.

HW-16 transceiver with matching Heath SWR meter. Want deal for stereo cassette recorder or deck. Darrell Frappier, 10409 Leann Dr., Clio, Mich. 48420.

AUDIO & HI-FI

ITT Minifon transistor wire recorder with mike, shoulder holster, etc. Works but needs belts. Want Star-Roamer or hi-fi equipment. Fred White, 883 Leighton St., Honolulu, Hawaii 96821.

HARMAN-KARDON 100-W amplifier; Knight KG-200 police radio (30-50 mc). Want 11-meter beam antenna or best offer. Frank White, R.R. 2, Paola, Kan. 66071.

EMPIRE 888 and 888TE phono cartridges, also Shure M3-D's. Swap for best offer. Jeffrey Moser, 205 Glendale Rd., Haverton, Pa. 19083.

TAPE PLAYER, Polaroid Swinger Camera. Will swap for best offer. K. Kovacs, 349 Spruce St., Hellertown, Pa. 18055.

TAPE RECORDER and accessories. Want Model 755 or 755A VFO or VF-I VFO. Alfred Boatman, Box 83, Cookeville, Tenn. 38501.

HARMAN-KARDON CA-65 PA amplifier. Want laser or best offer. Thomas Harris, 13039 Helen, Southgate, Mich. 48192.

VIKING RP-61 record/playback amplifier (for tape deck). Swap for Eico HF-12 amplifier or best offer. K. M. Bailey, Box 486, Rangely, Colo. 81648.

ZENITH (S-19373) AM/FM stereo amplifier, less speaker. Swap for Heath GR-54 & Q-multiplier. Randy Iliff, Rt. 2, Box 14, Rutledge, Mo. 63563.

CROWN tape recorder (CVA-5002). Want general-coverage receiver. Alper Pehivanzade, 3401 N. Columbus Blvd., Apt. 4B, Tucson, Ariz. 85716.

CITIZENS BAND

MIDLAND 13-110 walkie-talkie with crystals for 7 & 9. Also, Lafayette HE-210. Want 5-watt CB rig of equal value. Evan Luck, 21805 Pleasant Rd., Marengo, Ill. 60152.

LAFAYETTE Comstat 25-A CB transceiver, with Shure power mike and antenna. Will swap for Lafayette HA-600T or other SW rig of comparable value. Craig Holcomb, NPPSO, Box 108, FPO N.Y., N.Y. 09524.

HEATH GW-22A CB rig and GR-64 receiver. Need minor repairs. Want CB base station. G. Yee, 2117-A W. Lincoln Ave., Montbello, Calif. 90640.

RCA Mark VIII with channel 7 crystals and mike. Want novice equipment or SW receiver. John Leszek, Box 345, R.D. #3, Huntingdon, Pa. 16652.

KNIGHT walkie-talkies (pair of C-100s). Will swap for record—Relaxing Is Easy by Sam Vine on Epic label. H. Plouffe, 69 High St., Pittsfield, Mass. 01201.

REGENCY CB transceiver. Swap for CB rig having Canadian DOT approval number, such as Lafayette HB-600 or Sonar FS-23C. Paul Wayda, R.R. 1, Hannon, Ontario, Canada.

ANTIQUE ELECTRONICS

ATWATER KENT Model 84 radio (needs repairs), Hallicrafters S-120 SW receiver, DuMont VTVM. Swap for ham gear. Bruce Zuckerman, 3 Suburban Rd., Clark, N.J. 07066.

ATWATER KENT Model 20 (1924) and Model 60 (1927) radios. Horn speakers. Swap for ham gear or test equipment. Harry Reamer, 114 W. Linton St., Philadelphia, Pa. 19120.

ANTIQUE TUBES (24A, 80, 26, VX245 and others). Want tape recorder. Paul Maurice, 30 Elmwood St., Auburn, Mass. 01501.

ZENITH floor-model radio in working order, tunes BCB and 1.8 to 50 mc. Swap for best offer. Gilbert Hackbarth, Fair Oak Ct., Menomonee Falls, Wis. 53051.

RCA Radiola 17; 2 RCA 100-A speakers; Philco Super-Triodine (needs work). Want SW equipment, crystal calibrator, amplifier or tape recorder. Richard D'Aguila, 73 Kilbourne Ave., New Britain, Conn. 06053.

OTHER EQUIPMENT

ASSORTED electronic components (old and new). Want old ribbon mike like Shure 300, 315, 330, 333 or similar. V. F. Woychoski, Box 31, Qu'appele, Sask., Canada.

SIMPSON Volt-Amp meter and 450 surplus crystals. Want walkie-talkies or police monitor radio. Louis Devlin, 4901 E. Florence Ave., Bell, Calif. 90201.

RIDER radio & TV manuals (35, some going way back). Swap for best offer. Joseph Beck, 3810 Leila Ave., Tampa, Fla. 33616.

EICO 320 signal generator, AC/DC multimeter, oscilloscope. Swap for stereo tape recorder (or deck) or SW receiver. Angelo Ferraro, 10477 Cobourg, Montreal North-45G, Quebec, Canada.

HEATH 10-10 scope. Want Johnson Matchbox or best offer. R. Shideler, 3225-A Tecumseh Ave., So. Gate, Calif. 90280.

ELECTRIC race track (HO, over 200 pieces). Swap for best offer. W. Anchors, 4521 Meadowbrook Dr., Leavittsburg, Ohio 44430.

SAMS Photofact diagrams (60 sets). Swap for SW receiver. Daniel Seidler, 2644 W. 23 St., Chicago, Ill. 60608.

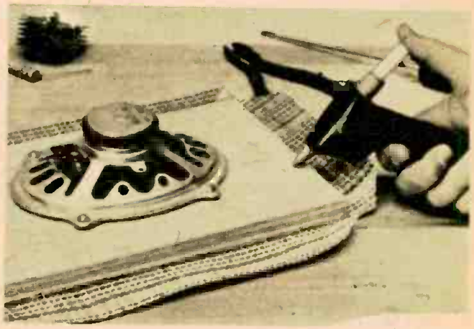
ASSORTED electronic components (transistors, diodes, etc.). Want Lafayette HA-132 or HE-210A walkie-talkie. Alan Hayes, 606 Clene Ave., Salisbury, Md. 21501.

TEST CARDS (350) for Hickok Model 123 tube tester. Cards are free to anyone paying postage on them. Clifford Earley, Rt. 3, Box 243L, Marion, N.C. 28752.

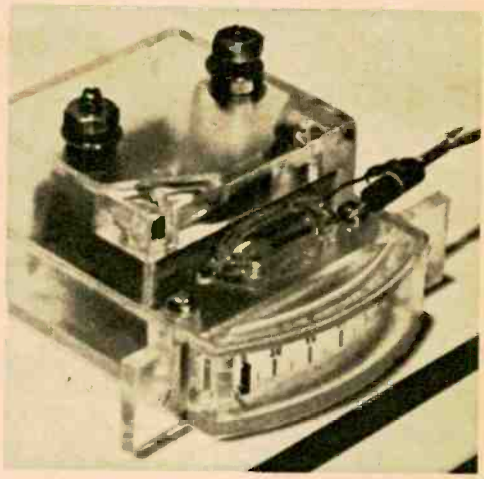
CIRCLE NUMBER 21 ON PAGE 11

CIRCLE NUMBER 24 ON PAGE 11

Tips



Plastic and fabric grille cloths are often difficult to attach to speaker boards. In the case of plastic grille cloth the problem develops because the material is stiff and will not bend sharply. Fabric grille cloth is tricky to work with because it's difficult to get the weave to remain straight. An effective way to attach grille cloth to speaker boards is with hot-melt glue applied with an electric glue gun. It works quite well. Since the glue sets quickly it's possible to make sharp bends and folds without the material creeping.



Edgewise panel meters can be made even more useful if called on to serve also as pilot lights. The cost of doing this is only 22¢ each—the price of an NE-2 neon lamp (with wire leads) and a 100,000-ohm, ½-watt resistor. Connect the resistor in series with the lamp and cement the lamp and resistor to the meter in front of the movement, as shown. Epoxy cement holds the assembly securely. Connect the lamp and resistor across the 117-VAC line on the equipment side of the power switch. With the meter installed, the edges of the clear plastic face glow red when power is on. There will be no effect on meter operation.

Broadsides

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

IF YOU ARE shopping for mobile ham gear, you will also need a good antenna for your car. New-Tronics Corporation has a catalog of **amateur-radio antennas** designed for HF, VHF and UHF. The catalog also describes **SWR** bridges and mounting accessories. It can be obtained from New-Tronics Corp., 15800 Commerce Park Dr., Brookpark, Ohio 44142.

Lamps in your living room too bright? Or perhaps an electric drill must be slowed down for a special material. These and other power-control jobs are the bailiwick of **triacs, silicon controlled rectifiers** and **diacs.** Hundreds are listed in the RCA Thyristor Catalog THC-500. It's available for 30¢ from RCA Electronic Components, Commercial Engineering, Harrison, N.J. 07029.

Cornell-Dubilier is offering a new catalog in which you will find every conceivable type of **capacitor** as well as **relays, RF** and **power-line filters.** Also included are charts, theory and design information as well as application notes. Cornell-Dubilier, 150 Avenue L, Newark, N.J. 07101.

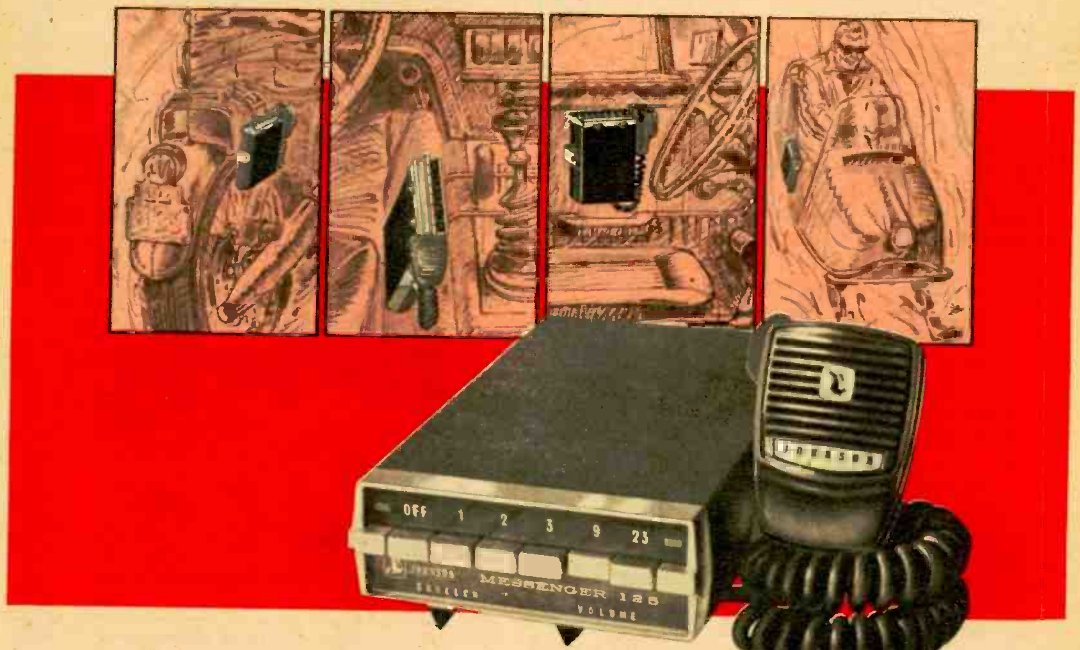
Need a conventional or special panel meter? Triplett's Catalog D-70 contains electrical specifications, and mechanical dimensions of many types. Included are **null meters, pyrometers and dynamometer-type wattmeters.** Also described are mirrored scales, illumination kits and custom faces. Available from the Marketing Dept., Triplett Corp., Bluffton, Ohio 45817.

Building a computer? Or perhaps you're looking for a way to switch antennas. A new listing of relays is available from the Magnecraft Co. Catalog 271 describes the new developments in **dry-reed, mercury-wetted, time-delay, coaxial and telephone-type relays.** You can get a copy by writing to Magnacraft at 5575 North Lynch Ave., Chicago, Ill. 60630.

You can't build anything without **hardware,** and Catalog 2570 of the Birnbach Co., offers loads of it. Included is fiberglass sleeving, heat shrinkable tubing, magnet wire, hookup and intercom wire. Standard items such as banana jacks and phoneplugs are also listed. The catalog is free from Birnbach Co., 177 Hanse Ave., Freeport, N.Y. 11520.

A 16-page illustrated catalog covers the Concord line of reel recorders, **cassettes,** receivers and speakers for 1970. If you have an eye for audio equipment which emphasizes styling as well as economy, you may be really turned on by this gear. Write for a free copy to Concord Electronics Corp., 1935 Armacost Ave., Los Angeles, Calif. 90025.

Try these installations with any <u>other</u> five watt unit!



At $99.95 the Messenger 125 fits anywhere ...including your budget.

Best of all, even with its mini-size and price, the Messenger 125 is *big* on performance. Its 5-watt transmitter, with high level class B modulation and speech compression, gives it all the "talk power" you'd expect from a full-size radio. Half-a-microvolt receiver sensitivity pulls in the weak ones. Automatic threshold noise limiting, IF clipping, and special AGC circuitry means less noise—better quieting. Full 2-watt audio lets you hear even in noisy vehicles. And the Messenger 125 looks great, too. Not a single knob—push-buttons select up to 5 channels, slide-levers adjust squelch and volume. Installs between bucket seats, in door pockets, on trail bikes—or over your shoulder with its optional rechargeable battery pack.

Dimensions: 1 9/16" High x 4 19/32" Wide x 7" Deep • 4-watts output at 13.8 VDC • FCC type accepted, DOC approved • All solid state—draws just 0.2 amperes on squelched stand-by • Optional portable pack available with re-chargeable battery, charger, antenna, and leather carrying case

E. F. JOHNSON CO.
WASECA, MINN. 56093

CIRCLE NUMBER 15 ON PAGE 11

$3.83 Aircraft Monitor

By WILLIAM F. SPLICHAL, Jr.

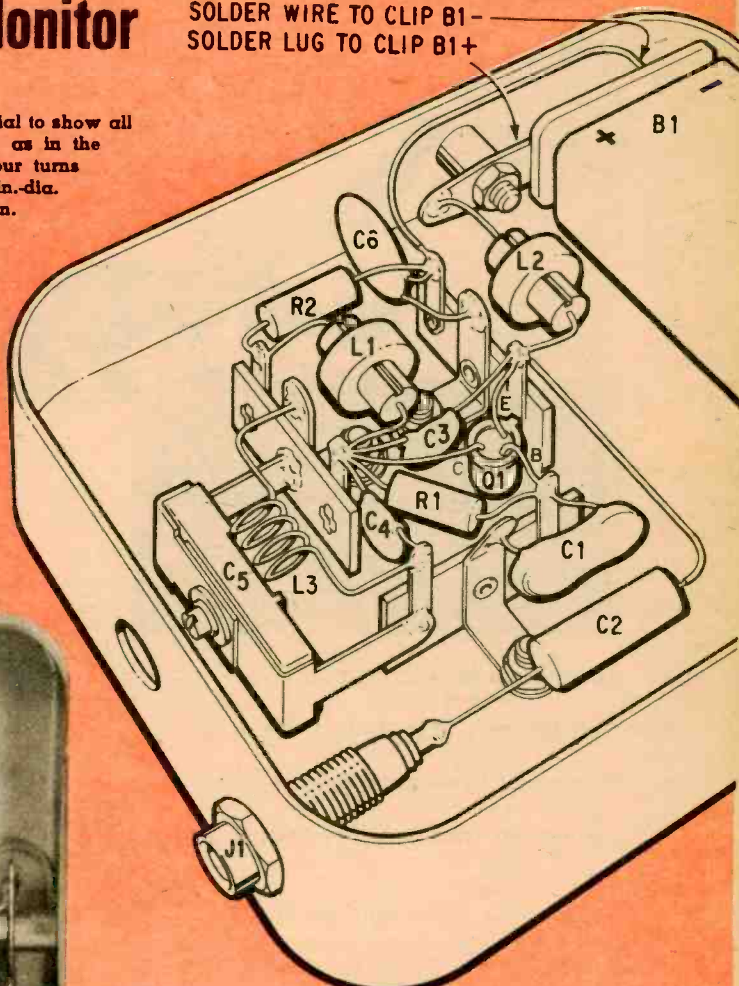
Tune in on the excitement of the jet set. It couldn't be easier using our low-cost one-transistor converter and any broadcast radio.

FLYING conditions are bad. It's Friday evening and, because of heavy traffic, arrivals and departures are delayed for hours. Planes circle in holding patterns while waiting to land. On the ground mammoth 747s and tiny Piper Cubs are lined up, anxiously waiting take-off clearance.

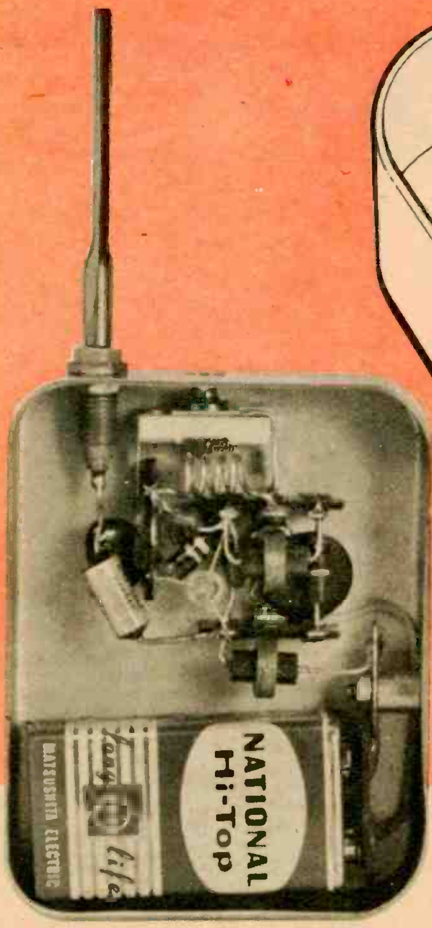
If you phone the airport or listen to news reports of traffic conditions you get only matter-of-fact information about delays. But when you can listen in on communications between the planes and control towers you discover the airport and surrounding sky are full of excitement. You'll hear planes notifying the control tower that they've passed the outer marker on their final approach. Or you'll hear a plane report passing over a check point some 50 mi. from the airport. The control tower will be telling pilots what altitude and heading to maintain and when to change. The tower will be giving take-off clearances. Then you may hear a pilot ask to have an airport attendant meet the plane with a wheelchair for a passenger who had one martini too many during the trip.

If it's action you want, you'll find it on the 108-136-mc aircraft band. With a dozen or so parts costing $3.83 (see the Parts List for prices) you can have a converter that enables you to listen to planes and control towers on any broadcast radio. You don't have to make a direct connection to the radio. We had good reception of airports and aircraft 20 mi. away by merely placing the converter next to the radio's

$3.83 Aircraft Monitor



Parts have been spread out in pictorial to show all connections; mount them compactly as in the photo. Output coil L3 consists of four turns of No. 18 wire. Wind it on a 3/16-in.-dia. drill bit. Its length must be 5/16 in.



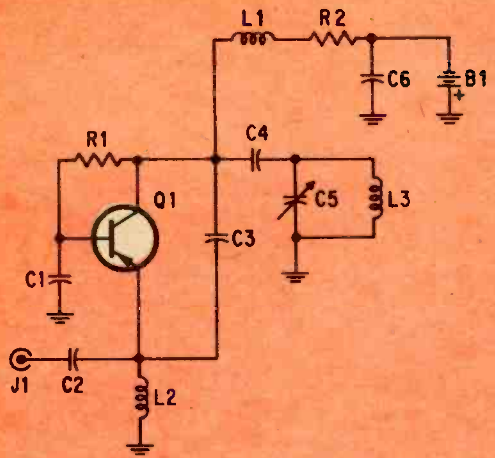
antenna coil. The converter easily can be constructed in an evening and you'll find many of the components in your junk box.

Construction

The converter is built in a small metal box which originally contained medicated throat lozenges (Sucrets). The parts layout, which is critical because of the operating frequency, is shown in the pictorial and photo. Prior to drilling the box we used steel wool to remove the manufacturer's printing. A small metal cuff-link box would also be a suitable container. If you plan to build the converter in some other small container, we recommend that it be metal to prevent detuning caused by hand capacitance.

Drill a ¼-in.-dia. hole in the side of the box directly above the screw on trimmer capacitor C5 to permit tuning. The lug of the capacitor which makes physical contact with the screw should be grounded. This will minimize detuning when a screwdriver touches the screw. The lead lengths of the components must be kept as short as possible to minimize stray-capacitance.

Mount antenna jack J1, two miniature



Aircraft-band signals are coupled by C2 to oscillator Q1. Q1, tuned by C5, beats with incoming signal and produces output in broadcast band.

PARTS LIST

B1—9 V battery (33¢)
Capacitors: 50 V or higher unless otherwise indicated
C1—270 $\mu\mu f$ disc (10¢)
C2—2 $\mu\mu f$, 5% silvered mica (18¢)
C3,C4—10 $\mu\mu f$ disc (10¢ ea.)
C5—4-40 $\mu\mu f$ trimmer capacitor (Arco 422, Allied 43 D 7079. Not listed in catalog, 23¢)
C6—.01 μf disc (10¢)
J1—Insulated tip jack (8¢)
L1,L2—120 μh video peaking coil (J. W. Miller 6153, Lafayette 34 E 88616, 72¢ ea.)
L3—Output coil: four turns No. 18 wire, 3/16-in. i.d. x 5/16-in. long
Q1—2N964 transistor (Motorola, 99¢)
R1—220,000 ohm, ½ watt, 10% resistor (9¢)
R2—1,000 ohm, ½ watt, 10% resistor (9¢)
Misc.—terminal strips, battery connector

three-lug (center lug grounded) terminal strips and the battery connector before you start wiring. The parts mount in layers and we suggest you install these first: C3,C6,R1 and C1. The parts are spread out somewhat in the pictorial for purposes of clarity. Study the photo carefully to see exactly where they go. The parts in our model occupy about a 1½-in.-sq. area.

The battery is clipped into a battery connector salvaged from a dead 9-V battery. Because an off-on switch was not incorporated (to minimize size and cost) the battery must be removed after each use.

Although not required, a miniature variable capacitor, such as a E. F. Johnson 160-130 (3-32 $\mu\mu f$) could be substituted for trimmer capacitor C5 to make tuning easier. Video peaking coils, obtainable from almost any old TV set can be used for L1 and L2 as the value of these chokes is not critical and can be between 100 and 200μh.

The output coil, L3, should be placed close to the side of the container and under a ¾-in.-dia. hole to permit coupling to a broadcast radio. To provide protection for the coil, cement a piece of plastic (1/32-in. thick 1¼-in. dia.) over the ¾-in hole.

An NPN germanium transistor capable of oscillating at 108-136 mc may be substituted for the PNP germanium transistor with no circuit changes other than reversing the polarity of the battery.

A 2-ft. whip antenna was made by removing the insulation from a length of No. 14 wire and soldering it into the end of a pin-tip plug.

Operation

To use the converter, install a 9-V battery and plug an antenna in J1. Bring the converter close to a broadcast radio so that L3 (behind the plastic cover) is close to the radio's antenna coil or loopstick. The converter may be taped to or held to the back of the radio with large rubber bands.

Turn on the radio and tune it between 700 and 1,000 kc until you hear a loud hiss. To check if it's the output of the converter you're hearing, bring your hand near the converter's antenna to slightly change the converter's oscillator frequency and the level of the hiss. Tune C5 slowly until you hear a plane or control tower.

Transmissions from aircraft and control towers are usually brief which means slow and careful tuning. The radio can then be tuned a very small amount for best reception. The converter may also be placed close to an auto antenna to convert the auto radio into an aircraft communications receiver.

How it Works

Transistor Q1 is the oscillator of the regenerative converter. The shunt-fed resonant circuit (inductor L3 and capacitor C5) is tuned to the desired frequency by C5. Capacitor C3 provides feedback for oscillation and capacitor C2 couples the signal from the antenna to the oscillator. RF choke L3, the converter's output coil, couples the output signal (in the broadcast band) to a broadcast radio.

Pomona Electronics Model 2900 HV test probe costs $19.95, has built-in meter and ±3 per cent accuracy. It measures up to 30 kv.

Basic Test Gear For Color TV Servicing

By ART MARGOLIS

Knowing how to buy and what to spend is half the service battle.

I AM involved in a rat race during the normal working day, managing a fair-size TV service business. Unfortunately, my duties are mostly administrative so when I wash up, regular soap will do. There is no dirt under my fingernails anymore.

Recently, when I realized I was no longer doing my thing—that is, fixing TV sets—I decided to do something about it. In a small store on property I own, I built a shop and equipped it for part-time color-TV service. This setup has no connection with my other shop. I buy my own components at a distributor and send in the sales tax to the state under a different number. This way I accept a few calls every evening and, besides enjoying myself, I pick up a nice little income on the side.

According to a recent survey undertaken by the Howard Sams Photofact people, there are approximately seven part-time TV servicemen to every 10 doing full-time work. Since most qualified TV servicemen have more business than they can handle, it's a good thing for the general public that the part-timers are pitching in. Otherwise, a severe crisis in service (even more critical than the current situation) probably would exist.

Besides my tube caddy, VTVM and wide-band scope, between $600 and $800 worth of test equipment gives me almost 100 per cent capability on color and b&w TV sets. If you're just starting, best thing is to get the *must* items first and then program your buying according to your pocketbook.

Color-Bar Generator. The first piece of *must* test equipment is a good color-bar generator. There are lots of good ones on the market, both assembled and in kit form. The important thing is the features an instrument offers. A generator should be able to display a dot pattern, a bar pattern and a gated color pattern. If you can obtain these three patterns you can perform an accurate convergence job. If your generator also can produce a single dot, a single crosshatch, horizontal bars, vertical bars and a test tone, so much the better. It makes your job that much easier.

Some color-bar generators are battery operated, some work on AC. Some are of fair size, others so small as to fit in a tube caddy. I personally prefer larger models which operate on AC. The smaller ones break clip leads easily and the batteries have to be replaced often.

High-Voltage Probe. Your next *must* item is a high-voltage probe. Due to the recent

Heathkit Model IG-28 color generator (below) costs $79.95 ($114.95 assembled) and offers 12 patterns plus a raster. Six patterns are in 9 x 9 format, six are in 3 x 3.

B&K Model 1245 color-bar generator (above) costs $139.95, has 5000-µV output. Patterns are bars, horiz. and vert. lines, crosshatch and dot.

Sencore Model CG18 color generator (above) costs $129.95. It has zener-regulated DC power supply as well as front-panel controls for the timer circuits.

outcry over X-rays, you're not going to take any chances. I set the high-voltage system in every color TV I service to its prescribed operating level, which is about 24.5 kv. The probe also is useful to determine the presence of high-voltage DC and is much better than the arc-over method.

The high-voltage accessory probe which accompanies a VTVM is usually accurate but I prefer a high-voltage probe that has a built-in meter and is self-contained. I own a neat job made by Pomona Electronics (see photo on first page). B&K and Eico also make a high-voltage probe.

Horizontal Cathode Monitor. Another *must* item that I use on a lot of color jobs is a 0-550 ma DC milliammeter which can monitor the horizontal-output tube's cathode current. A standard VOM does the job. But I also have a Seco Model HC-8 meter that has a test socket which places it automatically in series with the horizontal-output tube's cathode.

The Seco meter indicates the current drain and there's a list of common horizontal-output tubes which tells you what the current should be. By adjusting the efficiency coil with your diddle stick you put the current drain right on the nose to prevent premature output tube failure. Seco has a scoop on this piece (the HC-8 costs $34.50); there is nothing else like it so far as I know.

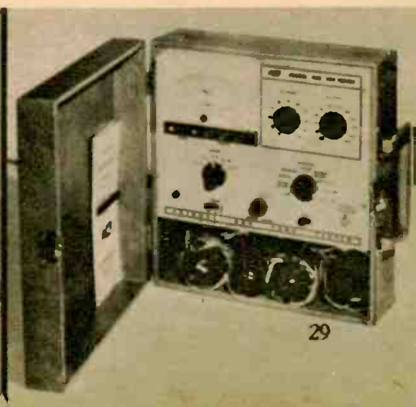
CRT Tester. Your next piece should be a good CRT rejuvenator/tester. There are lots of good ones on the market, all providing about the same level of performance. Their function is to determine the quality of a picture tube. This isn't as easy as it used to be due to the new color tubes and those strange electron guns and necks on new b&w models.

The CRT testers cannot give perfectly accurate tests on all types of picture tubes, nor do they reveal all types of failures. Basically, they all test the efficiency of the electron guns. Shadow mask troubles, intermittents, loose guns, etc., cannot be tested. Tests in-

Lectrotech Model CRT-100 picture-tube analyzer costs $89.50, comes with plug-in cables and chart.

Eico Model 633 CRT tester and rejuvenator costs $69.95 ($99.95 wired) and comes with cables and chart.

B&K Model 465 CRT tester costs $99.95, will test and rejuvenate both color and b&w CRTs in set.



Eico Model 435 wideband DC scope costs $119.95 ($169.95 assembled); the frequency response is flat out to 4.5 mc.

Sencore Model PS148 wideband oscilloscope/vectorscope costs $249.50, has 5-in. CRT. Must be used with a color-bar generator.

RCA Model WO-91C scope costs $269, offers choice of narrow- or wideband response. Newer version is the solid-state WO-505A.

clude cathode emission, permanent high- and low-resistance shorts and a prediction of cathode life. This is all valuable service information.

In addition, the CRT machines permit you to overheat the cathode (to weld it) and to apply a high B+ voltage to the control grids for rejuvenation purposes. This can extend the life of lots of color picture tubes.

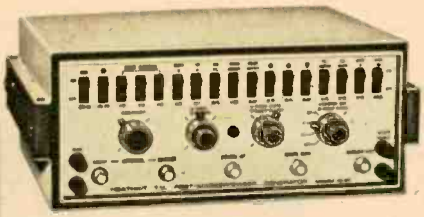
A CRT machine helps out on b&w mainly for rejuvenation purposes. On rare occasions it can be used to diagnose the condition of a picture tube, but usually a b&w diagnosis is accomplished by other means—visual checks and high voltage tests.

If you carry a color-bar generator, high-voltage probe, cathode-current meter and CRT tester along on house calls (plus a VTVM, degaussing coil, etc.) you can accomplish about eight out of 10 repairs right on the spot. This is your basic test setup.

Vectorscope. Another piece of test gear which can be used in the house but probably is better restricted to the service bench is the vectorscope. If you should want to use one in the house it's best to get a miniature version like the Lectrotech Model V5 ($179.50). It's self-contained and has a built-in color-bar generator. A vectorscope provides a good deal of service information and permits an on-the-spot touch-up of color alignment.

Oscilloscope. Found mostly on the service bench, there are lots of scopes for color TV service work. The B&K, Sencore and Lectro-

B&K Model 1077 TV Analyst (below) costs $379.95, offers complete range of test signals. Newer Model 1077-B costs $389.95. Has solid-state sweep-drive to test transistor sets.



Heathkit Model IG-57 (above) sweep-marker generator is now upgraded via Model IG-57A, costing $135 ($199 assembled). Unit comes with probes.

Sencore Model SM152 sweep and marker generator (below) costs $395, has solid-state circuitry providing linear sweep to 920 mc.

tech models are especially fine. If you purchase one of them you'll get a wideband, triggered scope that provides accurate peak-to-peak displays. They all provide convenient vectorscope access, and the B&K even has an intermittent analyzer.

As beautiful as these new scopes are, it's not absolutely essential to get one, except if you need the extra conveniences. Your old narrowband scope plus a second low-capacitance probe and a color-bar generator will do vectorscope duty fine. Simply inject the color signals into the TV (the second low-capacitance probe is for the horizontal input), and attach the vertical probe to the R-Y output and the horizontal probe to the B-Y output. Adjust the scope's gain controls and a vectorgram will appear.

Analyst. This piece of signal injection equipment is a *must* on the service bench. You can get by without it but you'll lose a lot of time, meaning many hours a week. The Analyst is useful for three types of repairs: it pinpoints the circuit that contains a faulty component when you have (1) high-voltage troubles, (2) vertical-sweep troubles and (3) loss of sound and picture.

The Analyst substitutes for these circuits. For instance, if there is no high voltage, you inject a horizontal-output drive signal obtained from the instrument into the ailing TV. Should the high voltage return, you've eliminated all of the circuits from the plate of the horizontal-output stage to the CRT as suspects. If you then inject a horizontal-output signal into the grid and the high voltage does not appear, you know the trouble lies somewhere between the grid input and the plate output. DC checks will then pinpoint the faulty component.

There are two instruments in this class. The most popular one is the B&K Analyst; not to be ignored is the Sencore Sweep Analyser. The Sencore unit only provides horizontal and vertical sweep signals. The B&K Analyst, however, has many other functions, including video and sound substitution in RF and IF stages, sync circuit substitution, color signal substitution, flyback testing and bias supplies. The Analyst also has a built-in color-bar generator, too. I wouldn't like starting work at the bench without one.

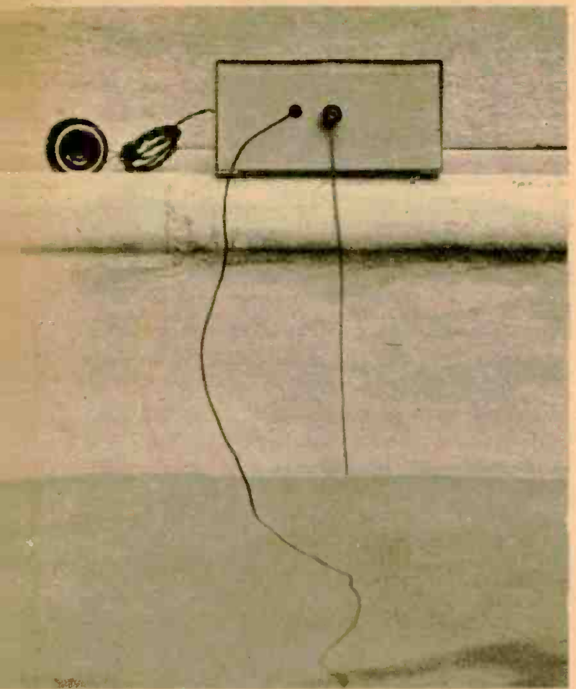
Alignment Equipment. These items of test gear fit nicely within a $600 to $800 budget. They give you almost a 100 per cent capability. The gap still remaining is the RF-IF color alignment jobs. If you know what the traps, coils and transformers are doing in the RF and IF stages, with the help of your vectorscope (in color stages) you can perform quite a few touch-up alignments.

However, you cannot perform a full-dress alignment according to factory service notes

[*Continued on page* 100]

BASIC TEST EQUIPMENT FOR COLOR TV SERVICING

Instrument Company	Color-Bar Generator	High-Voltage Probe	CRT Tester	Service Scope	Signal Injector	Alignment Generator
B & K Div. Dynascan Corp. 1801 W. Belle Plaine Chicago, Ill. 60613	1242 1245	HV-30	465	1450	1077-B	415
Eico Electronic Inst. Co., Inc. 283 Malta St. Brooklyn, N.Y. 11207	380 385	HVP-5	633	460 435 465		369
The Heath Co. Benton Harbor, Mich. 49022	IG-28	with VTVM		IO-18 IO-14		IG-52 IG-14 IG-57A
Lectrotech, Inc. 1221 W. Devon Ave. Chicago, Ill. 60626	V6-B		CRT-100	V5 TO-50	SCA-300	
RCA Electronic Components Harrison, N.J. 07029	WR-502A	with VTVM	WT-509A	WO-33A WO-91C WO-505A		WR-69A WR-70A WR-99A
Sencore Inc. 426 S. Westgate Dr. Addison, Ill. 60101	CG19 CG18 CG153		CR143	PS148	SS137	SM152



Intrusion Detector for Backyard Pools

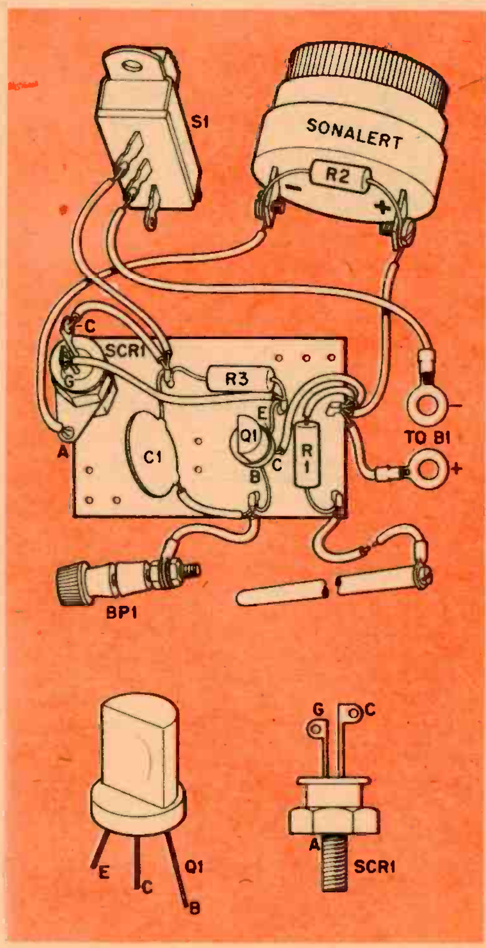
By STEVE DANIELS

SUMMER is here and for a lot of people that means filling up the backyard pool again. Though having a pool means great fun on hot days, it also means big risks, too. Like if someone should climb over your fence to cool off when you're not around. If the person, especially a child, can't swim and drowns you have a double tragedy on your hands. Yours is the responsibility for the accident.

Even though the person is on your property without your authorization you will be held liable for the accident. One way to avoid this situation is to stretch a net over the pool every time you go away from it. However, you could find yourself doing this several times a day. A better way to protect others and yourself is to install our intrusion detector. It will set you back about $12 if you need only one warning device (a Mallory Sonalert). Additional warning devices cost $5 each.

The detector is built in a box that you attach to the edge of a pool deck. Two wires come out of it. One hangs in the water and the other, a thin rod or piece of stiff wire, is positioned just over the surface of the water. When the water level is disturbed by someone falling in the pool, the water rises and touches the rod. This activates the circuit which sounds the alarm. The alarm device, a Mallory Sonalert, can be installed in the house. It produces a piercing sound and continues to do so until you go out to the pool to investigate and reset the circuit.

Take a look at the schematic. Connected to the lead marked *to water probe* is a wire that goes in the water. To binding post BP1 you connect the rod that remains above the water level. When the water level rises it completes the input circuit and applies a posi-



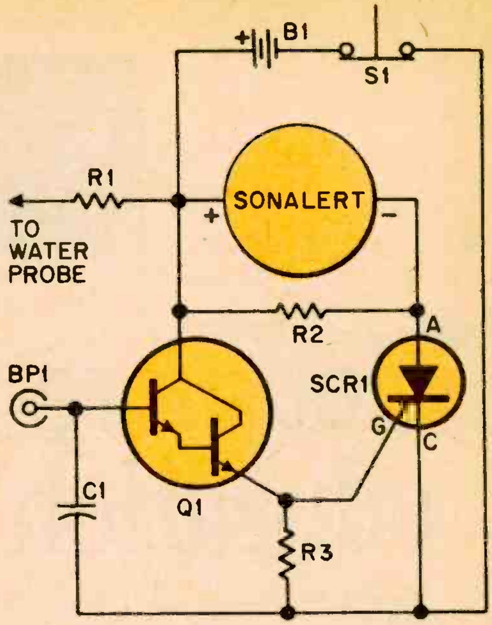
Only four parts go on circuit board. R2 could be there also, but we mounted it on back of Sonalert. Long lug on SCR1 is cathode; short lug is gate.

tive bias voltage from B1 (via R1 and the impurities in the water) to the base of Darlington amplifier Q1. This causes Q1 to conduct and apply a positive voltage to the gate of SCR1. This turns SCR1 on and current flows through it and the Sonalert. The SCR provides latching action as well so the circuit will not turn off until someone comes out and resets it by pressing S1. Because of the high gain of Q1, C1 is used to prevent the circuit from bring triggered on by spurious voltages.

Construction. Mount the semiconductors, resistors and capacitor C1 on a 1½ x 2½-in. piece of perforated board using flea clips or brass eyelets as tie points for the wires going to the switch, battery, Sonalert and probe wires. When the board is finished, decide where to mount it in the case with respect to the battery. As you can see in the photo of the inside of our model, the board is mounted in the right corner near the front of the cabinet. Mount the board with ½-in. long spacers so wires on the back of the board don't touch the cabinet.

Install a small rubber grommet and binding post BP1 on the front panel. Mount reset switch S1 and another grommet on the rear panel. If you use a slide switch as we did for S1, mount it and make connections to it so the circuit will open when S1 is pushed down. The battery is held in place by homebrew brackets. Because the current drain in the standby mode is so low, a power switch is unnecessary.

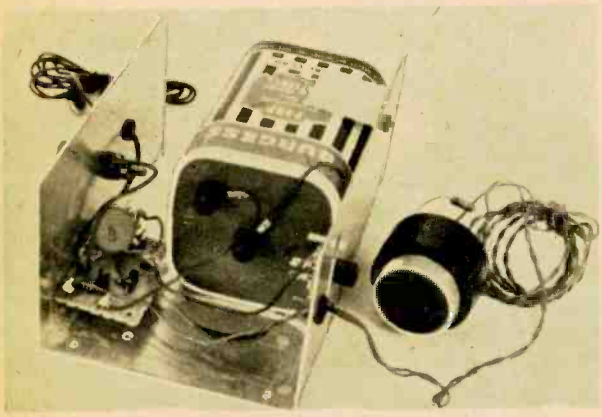
To finish up, connect the long water probe wire and the wires that go to the remotely-



When water completes circuit between probe and rod connected to BP1, positive voltage is applied to base of Darlington amplifier Q1. This turns Q1 on which turns SCR1 on. Sonalert then sounds.

installed Sonalert, connect the battery and close the box. The use of resistor R2 depends on the number of Sonalert devices you use. If you use only one, install R2 to provide an additional load to make SCR1 latch. If you use additional Sonalerts (connect them in parallel) R2 can be eliminated.

Drop the weighted water probe in the pool and adjust the rod in the binding post so that it is just above the highest swells produced by the wind. When the pool is in use just raise the rod. When you leave the pool lower the rod and relax knowing you'll be warned if someone falls in.



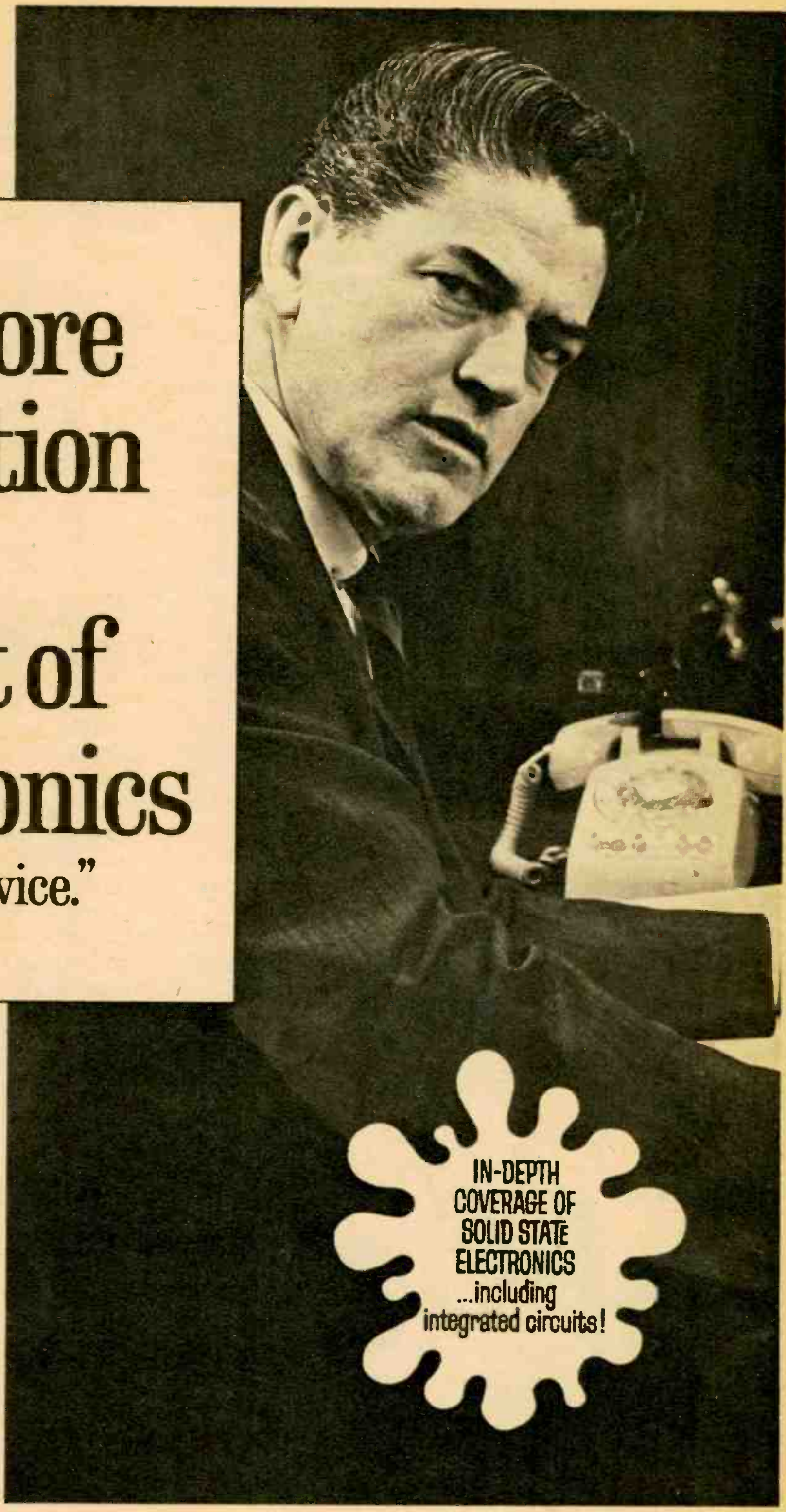
Inside of our model. Note where board is mounted in U-section of cabinet. Battery will last long time because of size and low current drain.

PARTS LIST

- B1—6 V battery
- BP1—Five-way binding post
- C1—.02 μf, 500 V disc capacitor
- Q1—2N5306 Darlington amplifier (GE, Newark Electronics Corp., 500 N. Pulaski Rd., Chicago, Ill. 60624. 41¢ plus postage. Minimum order, $5)
- R1,R2—270 ohm, ½ watt, 10% resistor
- R3—100 ohm, ½ watt, 10% resistor (see text)
- S1—Normally-closed spring-return slide or pushbutton switch
- SCR1—HEP-300 SCR (Motorola)
- SONALERT—Mallory Type SC628, 2.5 kc, 6-28 VDC. (Newark 64F300, $5.50 plus postage)
- Misc.—6 x 4 x 3-in. interlocking chassis box (LMB-141, Newark 91F1011), perforated board, flea clips

"Get more education or get out of electronics

...that's my advice."



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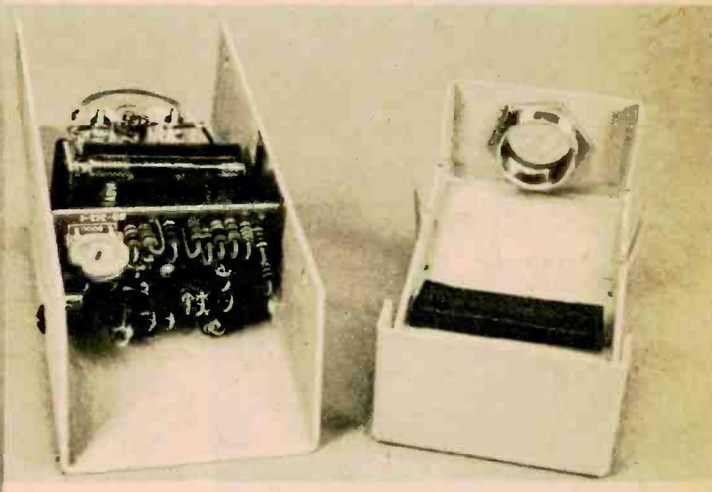
EI Kit Report

Thumb-Size Tach



Heathkit GD-69

DETERMINING the speed of a model plane's prop (or engines in model boats or wheels on model cars) might seem like an impossible task or, at worst, a dangerous one if you use a mechanical tachometer. But the job couldn't be easier with the $19.95 Heathkit Thumb Tach (1½x2½x5¾ in.).

This tach will tell you accurately the rpm of almost any rotating object within its two ranges, 0-5,000 rpm and 0-25,000 rpm. Heath specifies an accuracy of 3 per cent.

It took us about three hours to build the kit. Calibration took only about that many seconds. There are some resistors, six capacitors and six transistors that mount on a printed-circuit board.

Heart of the tach is a LSR (light-sensitive resistor) behind a lens at one end of the case as shown in the photo above (right). Changes in light intensity caused by the rotating object are reflected on the LSR, causing it to produce voltage variations that are fed to a Schmitt trigger. The rest of the circuit is designed so the pulse *width* at the output of a multivibrator will not vary as the pulse *frequency* changes. Meter-needle deflection is proportional only to the frequency of pulses striking the LSR.

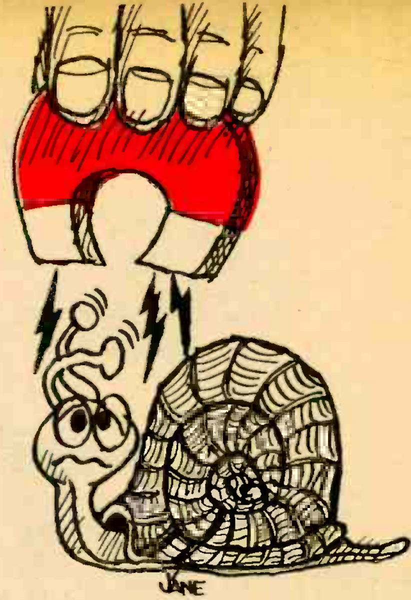
The meter's response is extremely rapid, yet the pointer has no overshoot; it jumps instantly to the rpm figure and doesn't wiggle there at all. Toward the lower end of the low scale, the pointer vibrates just slightly. However, this is noticeable only below about 1,500 rpm.

To calibrate the tach (for a double-pulse input as you'd get from a model-plane's prop) you point it at any lamp operated on 60-cycle house current. Then you rotate the calibration pot until the meter indicates 3,600-rpm. That's it. To calibrate the tach for single-impulse readings, you point it at a TV screen (with the set on) and again adjust for a 3,600-rpm indication.

For checking engines in model boats you would stick two pieces of reflective tape on the flywheel; the tach is then zeroed in on the tapes. Strips of tape may also be used on things such as power saws, drill-press chucks and other tools.

You must not try to check speed in a room with fluorescent lamps, because the ambient light will predominate over light variations from the rotating part.

Can Magnetism Turn You On?



Recent experiments show that animals will react to magnetism. Do you react, too?

By JORMA HYYPIA

THERE'S no force field like a sexy blond. She'll turn everybody on. But pity the poor slob who works in a lab or out in the field. He runs into few blonds. However, he *might* be surrounded by unusual gizmos designed to do special chores, and some just might turn him on.

For instance, powerful electromagnets, some supercooled (operating near absolute zero) to provide stronger magnetic fields at lower current strengths, seem to be turning people on, too. But how?

No poll has been taken to find out whether people are living better through magnetism but scientists now are convinced that living organisms do, indeed, react to magnetic forces.

Take Dr. Peter Neurath of the New England Medical Center Hospital in Boston, Mass., for example. Dr. Neurath has shown that if frog eggs are fertilized and then exposed to an intense magnetic field their embryonic development is impaired significantly. Whereas 52 per cent of the eggs receiving no magnetic radiation hatched, only 32 per cent of the exposed eggs did. Dr. Neurath thinks organic compounds which store iron may be at the bottom of it all. For instance, the magnetic field might attract these compounds away from vital areas in the embryo.

Dr. R. Mericle of Michigan State University has discovered that if barley seeds are subjected to high-power X-rays or magnetic fields up to 3,000 gauss growth inhibition results. Magnetically-susceptible trace elements in the plants, such as cobalt, manganese or iron, may be responsible.

Similar experiments have been done using snails, flatworms, fruit flies, etc. Problem is, what about people? As man ventures further and farther out into space and exposes himself to more dangerous environments, magnetic fields soon may become as much of a hazard as X-radiation and cosmic rays.

Sooner or later these biomagnetic problems will reach the consumer and the Federal Trade Commission; National Bureau of Standards; Health, Education & Welfare Dept. and so on could be debating whether you should be exposed to such and such or just how many gauss your kids can stand. Magnetic living may be living dangerously.

What scientists need are larger magnets which will permit experimentation with larger subjects. First mice, then cats and dogs and guinea pigs—and on up the scale to humans. By that time, magnets should be telling all. Anyone want to volunteer?

The Ham Story in Blighty

By SYLVIA MARGOLIS

THERE are 14,000 licensed radio amateurs in Great Britain, compared to something over a quarter million in the U.S. This means that one American in 700 is a licensed amateur, compared with one Briton in 5,000. Fact is, there are half as many amateurs in Los Angeles County as there are in the whole of the United Kingdom.

One reason for the difference is that there's no Novice license in Britain. Also, 14 is the minimum age at which you can become a ham. The most potent reason, though, is that the British qualifying exam is set up like a university exam—written essay answers are required.

The exam is stiff and lasts three hours under rigid conditions. It's in two parts. The first part has two compulsory questions on licensing regulations and interference suppression. In the second part you may answer any six out of eight questions. A typical brainbuster might read:

> Describe with circuit diagram a transmitter suitable for Morse code on the 3.5-mc band. State especially what precautions you would take to avoid harmonics and spurious radiation.

A passing mark is about 50 per cent. You also must be able to send and receive Morse code at 12 wpm. Then, providing you have U.K. nationality, you've got yourself a license. It costs about $7.20 a year (a mobile license costs $4 extra). You can also get a Class B license which entitles you to operate only phone on 2 meters and above. The code requirement is lifted for this ticket.

With regard to callsigns, all British prefixes start with G. The number following signifies little, except at what period the license was issued. Class B licenses have a G8 prefix, followed by three letters, i.e. G8AAA. The suffix A in this example (equivalent to the U.S. suffix FP) signifies that the operator is working from a different location than his

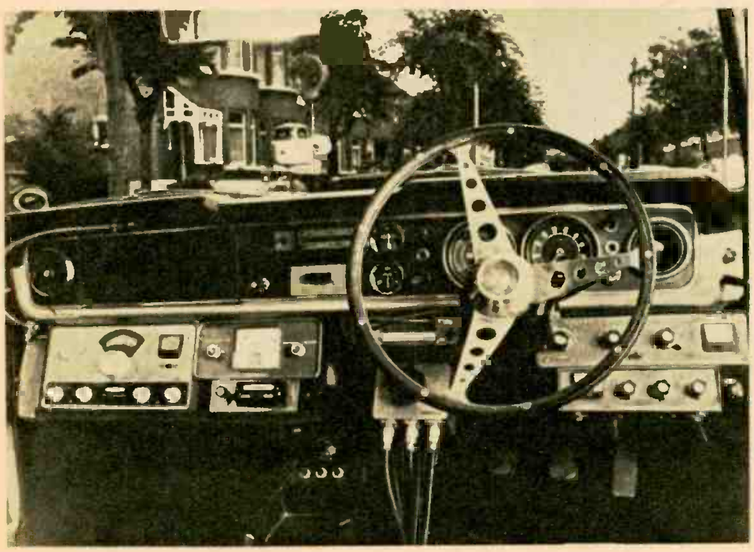
Wall-to-wall Collins is not what you usually run into in ham shacks in Britain, but lucky Jim Farlow, G3BXI, has an American wife. Maybe that has something to do with it? At any rate, American ham gear is considered a luxury.

home base. Mobile operation has the suffix M. Maritime mobile is rare but uses MM. Aeronautical mobile is not allowed.

While the G prefix alone signifies England, other areas in the U.K. are identified via a second letter: GM=Scotland, GW=Wales, GI=Northern Ireland, GD=Isle of Man, GC=Channel Islands and GB=exhibition station. Eire, or Southern Ireland, is independent of the British Crown and has a separate prefix, EI.

Visitors can obtain temporary licenses. They operate under the Reciprocal Licensing Agreement. Since the mid-60's international legislation has existed which allows amateurs to obtain temporary licenses abroad—an idea first inspired by Senator Barry Goldwater, K3UIG/K7UGA. Britain now has agreements with most foreign countries and grants temporary licenses to anyone who visits the U.K. These licenses have a G5 prefix.

Ham radio is administered by the Ministry of Posts and Telecommunications, now separate from the British Post Office. The department directly concerned with amateur radio is called the Radio Regulatory Department, and British hams maintain an amiable relationship with its officials, many of whom



Uh, where did you say the starter button was, Roderick? What could be the finest mobile installation in Britain belongs to Grahame Harding, G3WRU. Most of this gear is Heathkit built into Ford Cortina.

The Ham Story in Blighty

are themselves amateurs. Similar problems emerge in Britain as in other countries—mainly TVI and tracking down bootleggers.

There's more temptation to bootleg in Britain than in the U.S. due to the strictness of British regulations. Under no circumstances whatsoever may a non-licensed person speak through or otherwise operate an amateur station. This rule is never relaxed.

Also forbidden is phone patch and 3rd-party traffic, except in an emergency, and even then only when sanctioned by the police, the military or the Red Cross. While there is an elaborate and competent Radio Amateur Emergency Network set up to handle such contingencies, Britain is a small country where national or natural catastrophes rarely occur so there is seldom any communications breakdown sufficient to merit activating the Network.

The prohibition of 3rd-party traffic is a sticky wicket because American hams fail to understand why a British amateur refuses to pass on a message for them. Still, the majority of British amateurs, though they sometimes find this regulation frustrating, are agreed that phone-patch traffic—to the extent that it's practised in the U.S.—is an abuse of

British hams and SWLs pursue their hobby with as much passion as American blokes. Proof of pudding is number of electronics magazines in Blighty.

the privilege granted amateurs.

The British amateur may not use his station for business purposes nor can he be obscene on the air. Another divergence from U.S. practice, a British amateur may not discuss religion or politics on the air.

There is no Citizens Band service and little likelihood there ever will be. There's some argument among British hams as to whether the introduction of CB might divert the would-be bootlegger. However, taking a long view of how CB has evolved in the U.S., there is general agreement that the idea wouldn't work in Britain.

So **what's left? Well,** what's left is a healthy and enterprising amateur community led by the Radio Society of Great Britain. Founded in 1913, the RSGB is a few months older than the ARRL, a fact which it trumpets at every opportunity. The RSGB publishes a monthly journal, Radio Communication, and a wide range of technical books. Its massive Radio Communication Handbook is acknowledged (even by American amateurs!) to be the finest textbook of amateur radio obtainable today.

Another organization for hams is the Amateur Radio Mobile Society. International and voluntary, the ARMS is particularly helpful in furthering relations abroad. Founded in 1959 and run on a shoestring budget, it produces a lively monthly called Mobile News and issues the Mobile Century Award to those members who have worked 100 countries.

While the homebrew vs. commercial gear controversy was settled in the U.S. some years back, the battle still rages in Britain. Commercial gear has become popular in England but prohibitive import taxes make most of it much too expensive.

British manufacturers, led by KW Electronics (with their excellent KW line) supply most of the luxury home market and also a large export traffic into Europe. A typical new product is the KW Atlanta, an SSB transceiver covering 10 through 80 meters. It costs about $600 with power supply.

American gear is a status symbol, as much for its cost as for its quality. Collins, Drake and Swan lead the list. Heathkit is a favorite line because it is economical and allows the amateur the pleasure of building. Japanese equipment is cheapest among the imports but the English have a long memory and still view anything Japanese with suspicion.

[*Continued on page* 98]

EI Kit Report

Four Bar Generators for Color TV

THERE'S only one way to adjust the service controls correctly on a color TV set. That's with a color-bar/dot-pattern generator. Such an instrument produces four b&w patterns: horizontal lines, vertical lines, crosshatch (horizontal and vertical lines) and dots. Most important, it produces color bars (keyed rainbow) starting with red at the left, fading to blue at the center and going to green at the far right.

The crosshatch, line and dot patterns are for converging the three beams of a color picture tube. The color bars are for testing the set's color circuits. The sequence of color bars tells you not only whether the color is getting through but whether the hue (or tint) control is working correctly.

EI built and tested the four pattern-generator kits on the market and found that while prices are about the same, features, construction and performance variations among them were rather significant. The Eico, Heathkit and Knight-Kit sell for $79.95; the Conar (a division of National Radio Institute) sells for $83.50. The Conar, Eico and Heathkit also are available assembled; their prices are shown in the table on the last page of this article.

Features of the kits are comparable to those of other commercially made instruments but there are variations. All our generators put the video/color/sync signals on an RF carrier. The RF-output frequency of the Heathkit can be selected with a front-panel control for channels 2 through 6. For the Conar you specify a crystal for channel 2 or 3 when ordering. The Eico is supplied with a crystal for channel 3. The Knight-Kit has a coil on the rear panel that can be set for channel 3, 4 or 5.

The Heathkit and Knight-Kit also supply the video/color/sync signals without the RF carrier for aligning or servicing a set's chroma section directly. In the Heathkit the output cable can be switched to carry the video/color/sync signals; in the Knight-Kit video/color/sync signals are brought to two jacks on the front panel.

All four generators include color-gun killers; you clip colored leads to the CRT's grid wires. The gun killers on the Eico connect via a plug and socket to the picture tube. The socket fits only tubes with a large 12-pin Bakelite base. It doesn't work with the new small-diameter glass-base tubes.

The Heathkit and Knight-Kit include CRT grid jacks. Once the gun-killer connections are made, these jacks provide a convenient place to connect a scope probe for demodulator-circuit tests and adjustments.

The Heathkit produces a 3 × 3 crosshatch display which is three vertical and three horizontal lines. The lines are at top-center-bottom and left-center-right. This is ideal for convergence adjustments since you're more interested in areas across the center of the screen and near the top, bottom and sides. When you switch to dots, the 3 × 3 display puts just one in the center for easy checking of static convergence.

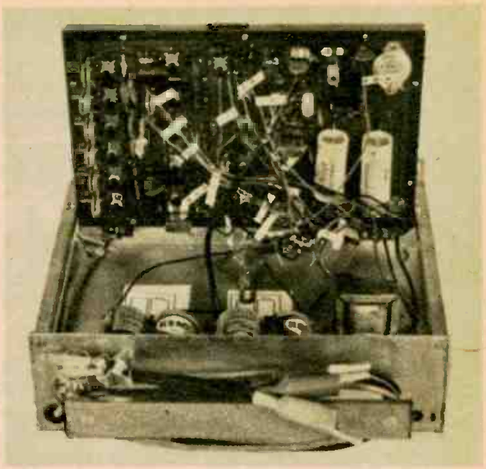
Four Bar Generators for Color TV

The Conar has a 1 × 1 display you can switch on to produce either one vertical line, one horizontal line, a single dot, or a vertical and horizontal line crossed at the center.

The Knight-Kit and Heathkit have a pattern for gray-scale adjustment. The Knight-Kit produces two groups of vertical bars graduated from black to white. If a dark gray bar has some tint of color, the set's screen adjustments need balancing. If a white bar looks tinted, you adjust the drive controls. The Heathkit gray-scale pattern is squares of light and dark gray.

A pattern (blank screen) for purity adjustments on the Knight-Kit and Heathkit saves switching away from a station and turning down contrast. The RF signal does away with snow, and you can use the gun killers to stop blue and green. Then you adjust the yoke and purity magnets for a red raster with no discoloring.

Construction. We built the Conar in about 20 hours, the Eico in seven hours, the Heathkit in 11 hours and the Knight-Kit in nine hours. Instructions for the Eico, Heathkit, and Knight-Kit are step-by-step. The Conar manual gives somewhat lengthy descriptions of steps in paragraph form. In some instances important information came too late. For example, the Knight-Kit manual tells you to connect 18 wires, one at a time. Then you're warned to route them away from the printed-circuit board along the chassis. Too bad if you've already positioned them elsewhere.

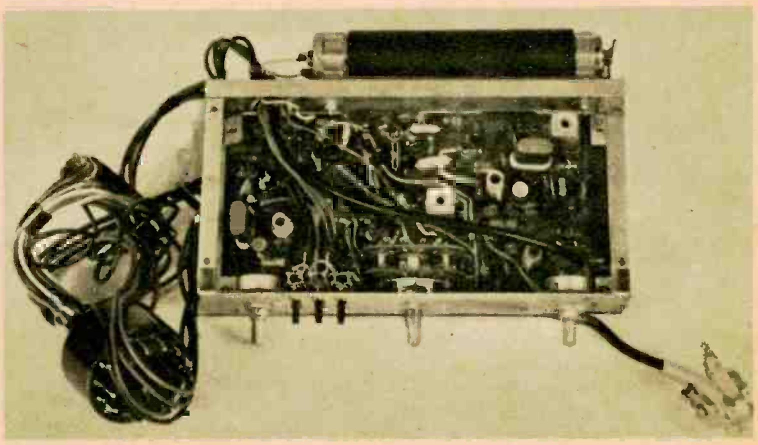


Printed-circuit board on Conar swings up on hinges for easy access to counter controls at left edge. Four D cells are mounted in bottom.

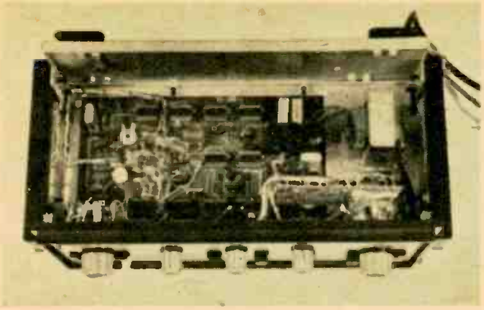
Will the kits work after you build them? Some did and some didn't. The Conar, for one, didn't. Reason was that a scope pattern in the construction manual was wrong. A call to Conar got us a corrected pattern. One thing may be a problem: adjusting the counters. You've got to use an oscilloscope. If you have one or can borrow one and know how to use it, the job won't be complicated.

Some of the adjustments are touchy and a few need resetting after the instrument ages an hour, a day, a week or whatever. Our Conar and Eico had to be readjusted often. All kits are sensitive to cold, too. Chill one, and it may take a long warmup time (some models up to an hour) to stabilize.

The counter adjustments on the Knight-



Eico was smallest generator. Components mount on printed-circuit board which has foil on both sides. Batteries are on back (top). To kill color guns, you plug large plug (lower left) in CRT's socket. Socket (not visible) is then fitted on the base of the CRT.



Counters are on printed-circuit board in Heathkit. They're connected to controls with supplied cable harness. There are two AC outlets on front panel.

Kit are conveniently located on the rear apron; you don't have to take apart the cabinet to reach them. On the Conar you just take the cover off (two screws), but you have to remove knobs and chassis of the Eico to reach the counter adjustments.

The Heathkit uses IC counters for which there are adjustments. The patterns produced wouldn't stabilize at first. Using a scope we found that one counter wasn't working. The cure was a new IC.

After we completed the generators we connected them to a color set to see how they worked. One thing was critical. If the TV set isn't tuned precisely to the generator's RF carrier, you may not get color, or patterns may not lock in. Before you start monkeying with the counters, try the set's fine tuning.

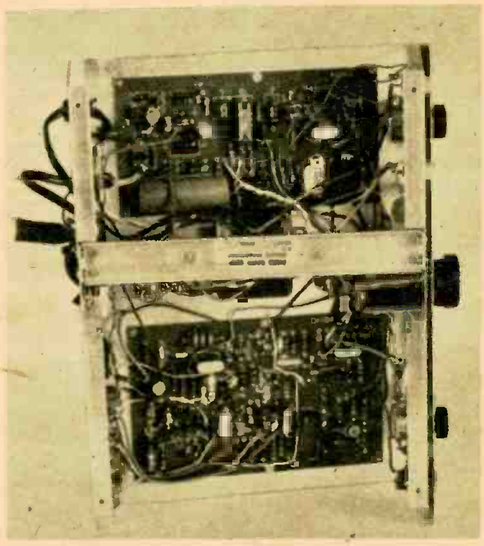
A 4.5-mc sound carrier is available from all kits but the Eico. It's a tuning aid, for one thing. With the 4.5-mc sound carrier switched on, you adjust the set's fine tuning to get rid of the interference pattern in the color bars. (The sound carrier doesn't produce sound from the TV set because the carrier isn't modulated.)

Producing steady patterns day after day proved to be a problem for the Conar and the Eico. If we hauled either one around much or left it in a cold truck or just let it sit around the shop a few days, we could bet on having to readjust the counters all over again.

Expect to invest some time learning how to use one of these generators. Adjusting a color set isn't something you undertake lightly. Be sure you have the set manufacturer's instructions that tell how.

COLOR-BAR/DOT-PATTERN GENERATOR FEATURES

Feature	Conar 680A	Eico 385	Heathkit IG-28	Knight-Kit KG-685
Power	Bat., AC	Bat.	AC	AC
RF channels	2 or 3	3	2-6	3,4,5
RF output (µv)	50,000	10,000	50,000	10,000
Separate video	no	no	yes	yes
RF level control	no	no	yes	yes
Video control	no	no	yes	yes
Color control	yes	no	yes	yes
4.5-mc carrier	yes	no	yes	yes
Timers	IC	xstr.	IC	xstr.
Center dot	yes	no	yes	no
Horiz. lines	14 or 1	7	10 or 3	14
Vert. lines	10 or 1	8	11 or 3	10
Crosshatch	14 X 10, 1 X 1	7 X 8	9 X 9, 3 X 3	14 X 9
Blank (purity)	no	no	yes	yes
Gray-scale pattern	no	no	yes	yes
Color display	10 bars	8 bars	10 or 3 bars	10 bars
Gun killers	yes	yes	yes	yes
Grid jacks	no	no	banana	pin
Price kit	$83.50	$79.95	$79.95	$79.95
Price wired	114.50	109.95	114.95	—



RF board is at top in Knight-Kit; timer board is at bottom. Generator has small work light on long wire and mirror which is stored under case.

Good Reading

By Tim Cartwright

RADIO HANDBOOK (18th Edition). By William I. Orr. Editors and Engineers, Ltd., New Augusta, Ind. 896 pages. $13.50

This monumental work, now in its 35th year, continues to be one of the most durable handbooks on radio communications. The expanded, updated 18th Edition preserves the winning ingredients; an intermediate technical level that shouldn't befuddle the beginner or insult the engineer, plus hundreds of practical circuits to illustrate the theory. The text mainly covers two-way radio principles in the HF and VHF bands (running from 3 to 300 mc); there is a strong orientation towards ham radio. Despite this specialization, the book is widely used by schools, students and government agencies as a basic reference.

After electronic fundamentals are covered, the book describes major communications systems (AM, FM, SSB, RTTY, etc.) used by hams, industry and military two-way radio. There is enough design information, including charts and tables, for the advanced hobbyist to turn out custom circuits on his own. Antennas are given a particularly comprehensive treatment to satisfy both the theory and nuts-'n'-bolts man.

This book must inevitably be compared to that other pillar on the reference shelf, The Radio Amateur's Handbook published by the ARRL. Both volumes cover the same general territory. Our recommendation: If you now have no handbook on communications, start with the ARRL publication (an unbelievable bargain at about $4), but add the Radio Handbook to your library as soon as your pocketbook permits. Many a misty bit of theory or construction technique has been cleared up by checking, comparing and browsing through both of these excellent publications.

SERVICING ELECTRONIC ORGANS. By Max H. Applebaum and Donald A. John. Tab Books, Blue Ridge Summit, Pa. 160 pages. $7.95

Rising sales indicate that the electronic organ is joining the piano and guitar as the nation's most popular musical instruments. This fact means an increased repair burden for the service technician. Here's a book which could help him prepare for the onslaught. The title, though, is a trifle misleading. Read understanding for servicing and you'll have a more precise description. Understanding, of course, is a prelude to good servicing and this is where the book does a creditable job. It gets right down to specific circuit functions and tracks signals through the resistors and capacitors and vacuum tubes.

The authors are practical men—though they speculate that Nero most likely played the organ, not the fiddle, while Rome burned. When they explained vibrato, for example, they don't use vague block diagrams, but actually show how it's done by Magnavox, Hammond, Gulbransen and others. This is the kind of gutsy information usually spread through the service manuals of manufacturers. You may not be able to service a wounded Wurlitzer using this volume, but it can provide an informative preview of what to expect when you actually confront organ circuits.

PRACTICAL SEMICONDUCTOR DATA BOOK FOR ELECTRONIC ENGINEERS AND TECHNICIANS. By John D. Lenk. Prentice-Hall. Englewood Cliffs, N.J. 260 pages. $10.95

Many of us have cut our technical teeth on the writings of John D. Lenk. His latest volume is more than just another data book amassed from technical bulletins and manuals. He boils down thousands of available semiconductors into a dozen basic types, then tells the reader how to test, operate and apply them.

The categories include FET and UJT transistors, photocells, controlled rectifiers, tuning diodes and ICs. Each device is allotted a theoretical description, then embellished with practical information that would interest a lab technician or advanced hobbyist. Many principles are illuminated by the author's helpful, interpretive remarks, rather than by complex math. Best example of this is a chapter on basic transistor design. In simple language, Mr. Lenk turns a dead transistor into a live amplifier with little more than Ohm's law.

And Make Note Of . . .

SERVICING THE SOLID-STATE CHASSIS. By Homer L. Davidson. Tab Books. 250 pages. $7.95

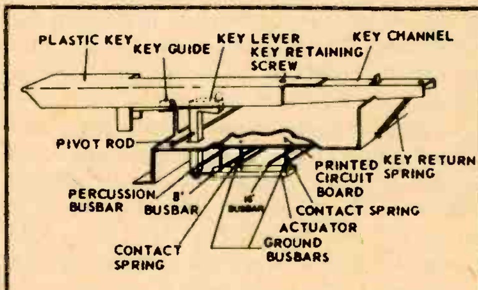
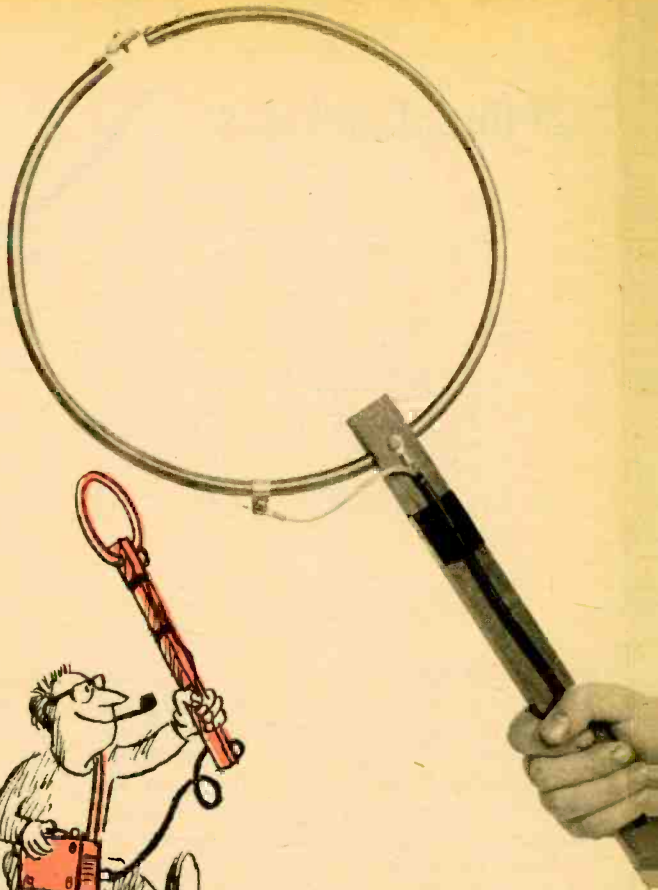


Fig. 4-10. Hammond keyswitch assembly (Courtesy Hammond)

Illustration from Servicing Electronic Organs by Max H. Applebaum and Donald A. John. Book is an introduction to operation, not a service manual.

CB Direction Finder



By HERB FRIEDMAN, KBI9457

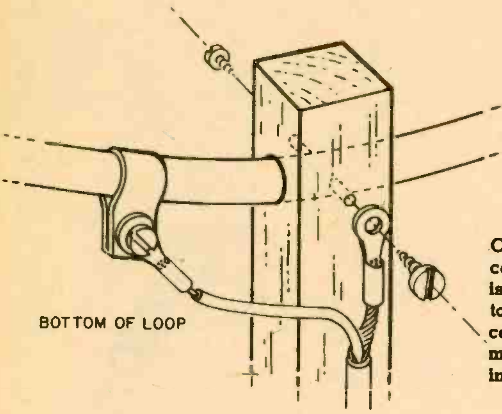
USING a ground-plane antenna to pinpoint some clown chopping the channel with dead carriers or finding a mariner lost in the fog is an exercise in futility. Reason for this is that the ground-plane is omnidirectional. And an omnidirectional antenna receives signals equally well from all directions.

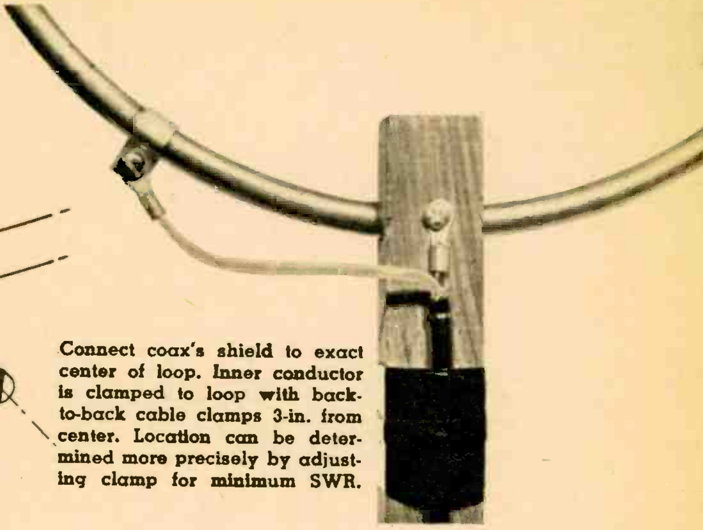
It takes a DF (direction-finder) loop antenna to tell you precisely which direction the received signal is coming from. The DF loop is least sensitive to signals coming from points along a line drawn perpendicular to its two flat side surfaces. Conversely, a line drawn parallel to these flat sides will point in the direction (both fore and aft) of greatest sensitivity. To get the bearing of a signal you can rotate the loop until the transceiver's S-meter indicates maximum signal strength. Or you can aim the loop 90° away (as a tennis racket would be held) for minimum sound from the speaker, or lowest S-meter indication. Take two fixes, plot them on a map, and the intersection of the lines is the location of the transmitter.

Construction

Cut a length of ⅜-in. copper *tubing* to 31 in. Note we said *tubing*, not *pipe*. Tubing has an o.d. of ⅜ in. Pipe has an i.d. of ⅜ in. You'll never be able to

CB Direction Finder





Connect coax's shield to exact center of loop. Inner conductor is clamped to loop with back-to-back cable clamps 3-in. from center. Location can be determined more precisely by adjusting clamp for minimum SWR.

bend pipe because it's much too heavy.

Using a 10-in. dinner plate or frying pan as a form, bend the tubing around it so it forms almost a complete circle. There will be a separation of about ¾ in. at the top of the loop. Using thumb and finger pressure, shape the coil into as good a circle as possible.

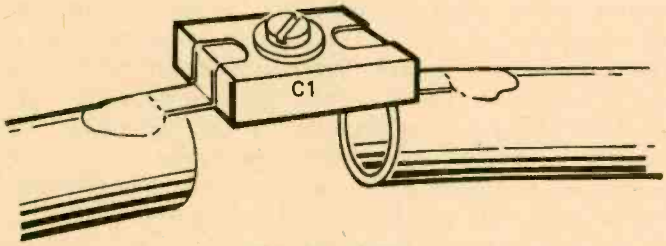
Next, locate the center (bottom) of the loop. Here's how to do it. Lay the loop on a piece of paper and make a mark on the paper at the outside edges of the loop. Fold the paper so the marks touch and crease the paper; the crease is the exact center. Position the loop on the paper so the sides of the loop touch the marks and the crease runs through the center of the gap at the top. The crease at the bottom will be at the center of the loop. Mark the loop with a grease pencil.

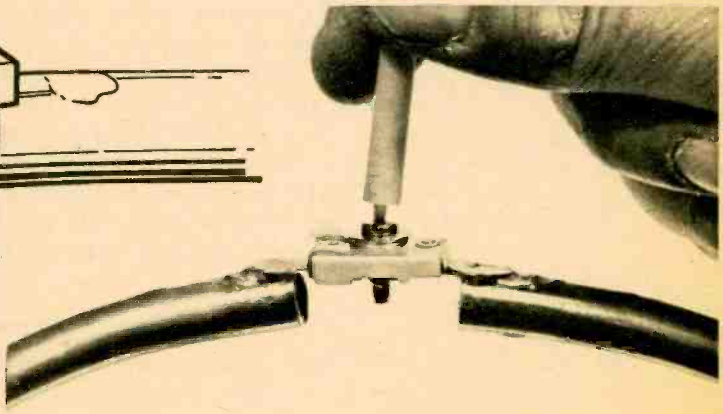
The DF's handle is made from a 36-in. length of 1 x 1-in. wood. About 1 in. below the top drill a 13/32-in. hole. Then drill a hole with a No. 28 bit through the adjacent side of the handle so it goes through the center of the larger hole.

Slide the loop into the handle and turn it until you see the center grease-pencil mark through the No. 28 hole. Then run in a No. 6 self-tapping screw in the hole to hold the loop in position. Another self-tapping screw will be installed later.

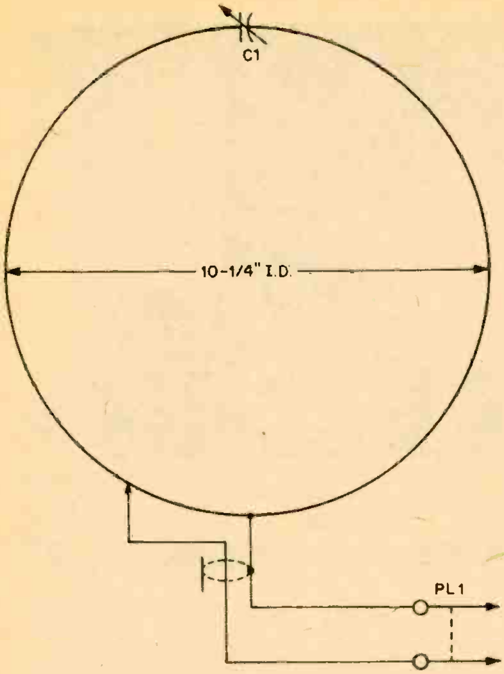
Bend out the solder lugs on trimmer capacitor C1 and tin them. Similarly, tin the ends of the loop at the gap, then solder C1 across the gap. Capacitor C1 has a range of 10-180 $\mu\mu$f (Lafayette 34 E 68311).

Prepare a convenient length of RG59/U coax—about 10 ft. should be adequate. Install a PL-259 connector on one end. Strip





The trimmer capacitor is soldered to ends of loop at top. Adjust the trimmer with a plastic alignment tool for maximum received signal strength, or for minimum SWR when transmitting.



Schematic of DF. Nominal inside diameter of our loop is 10¼ in. Shield of coax connects to exact center at bottom. Inside wire attaches 3-in. up.

away 4 in. of outer insulation from the other end and remove all but ½ in. of the shield. Unbraid the shield, twist the strands and solder them to a No. 6 solder lug. Using a No. 6 self-tapping screw, secure the shield's solder lug to the loop as shown.

Make a clamp from two ¼ in. cable clamps, attach the 4-in. inner conductor from the coax to the clamp and install the clamp on the loop so it is about 3 in. up from the center (bottom) of the loop (the shield's lug is the center). Secure the coax to the handle with tape.

Adjusting the DF

There are two ways to tune and match the DF. You can make a reasonably good adjustment by simply connecting the DF to your transceiver and adjusting C1 for *maximum* indication of a received signal as shown on the S-meter. Leave the coax's inner-conductor clamp at the 3-in. position.

A more precise way of tuning the loop is to use a transceiver and an SWR meter. Connect the transceiver to the SWR meter's input and connect the DF to the SWR meter's output. Next, key the transmitter but do not modulate.

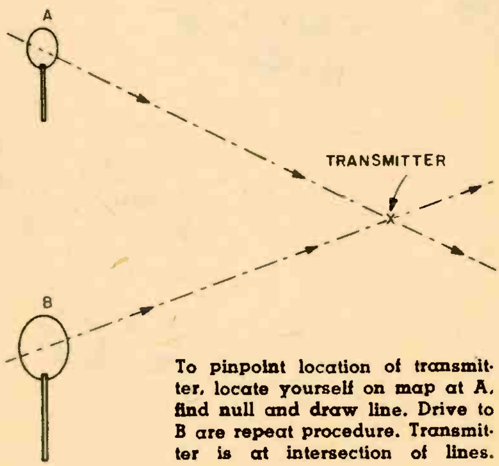
Using a plastic alignment tool, adjust C1 for the lowest possible SWR. You are simply interested in a *minimum* SWR. It could be 1.2: or 7.1. The actual SWR is of no importance at this time. Next, loosen the coax's inner-conductor clamp and shift it for *minimum* SWR. Again, do not be concerned with the actual SWR. When you have found a clamp position that produces lowest SWR, secure the clamp and cut off the excess inner conductor. The inner conductor should be a tight stretch to the clamp.

Finally, readjust C1; you will get an SWR well below 3:1. After you have made the adjustment put a drop of GE's RTV silicone rubber adhesive on C1's screw. It must be RTV which is an RF insulator. Other silicone rubber adhesives, such as Silastic, are almost dead shorts to RF and will cause the loop to be detuned.

Using the DF

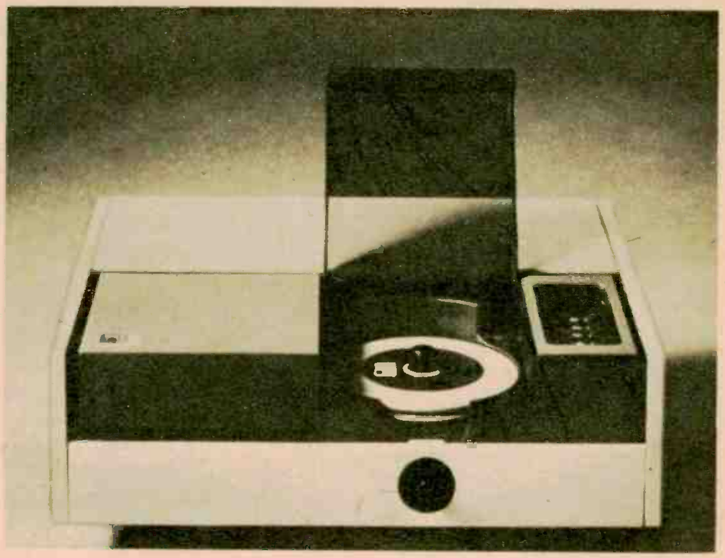
As we said earlier, you have a choice of two ways to use the DF. One is to aim the loop so its face is broadside to the signal source. This will provide a null indication on your rig's S-meter. The other way to use the DF is to aim the loop's edge at the signal source for peak indication.

When using the speaker for an indicator you'll find it will be easier to detect a null than a peak because a peak signal is often masked by the receiver's AVC. Remember that the received signal can be anywhere on a line passing through the face of the loop Therefore, to locate the transmitter precisely, you must move to a second location to get another fix. ◆



To pinpoint location of transmitter, locate yourself on map at A, find null and draw line. Drive to B are repeat procedure. Transmitter is at intersection of lines.

CARTRIDGE TV. This fall you'll be able to show pre-recorded color programs on your TV set with CBS's newest electronic video recording (EVR) system. (The first system could only play b&w programs.) The player, manufactured by Motorola, employs a flying-spot scanner that converts images on a seven-in. cartridge of film into an RF signal that carries audio and video information. The signal is fed to a TV set's antenna terminals.

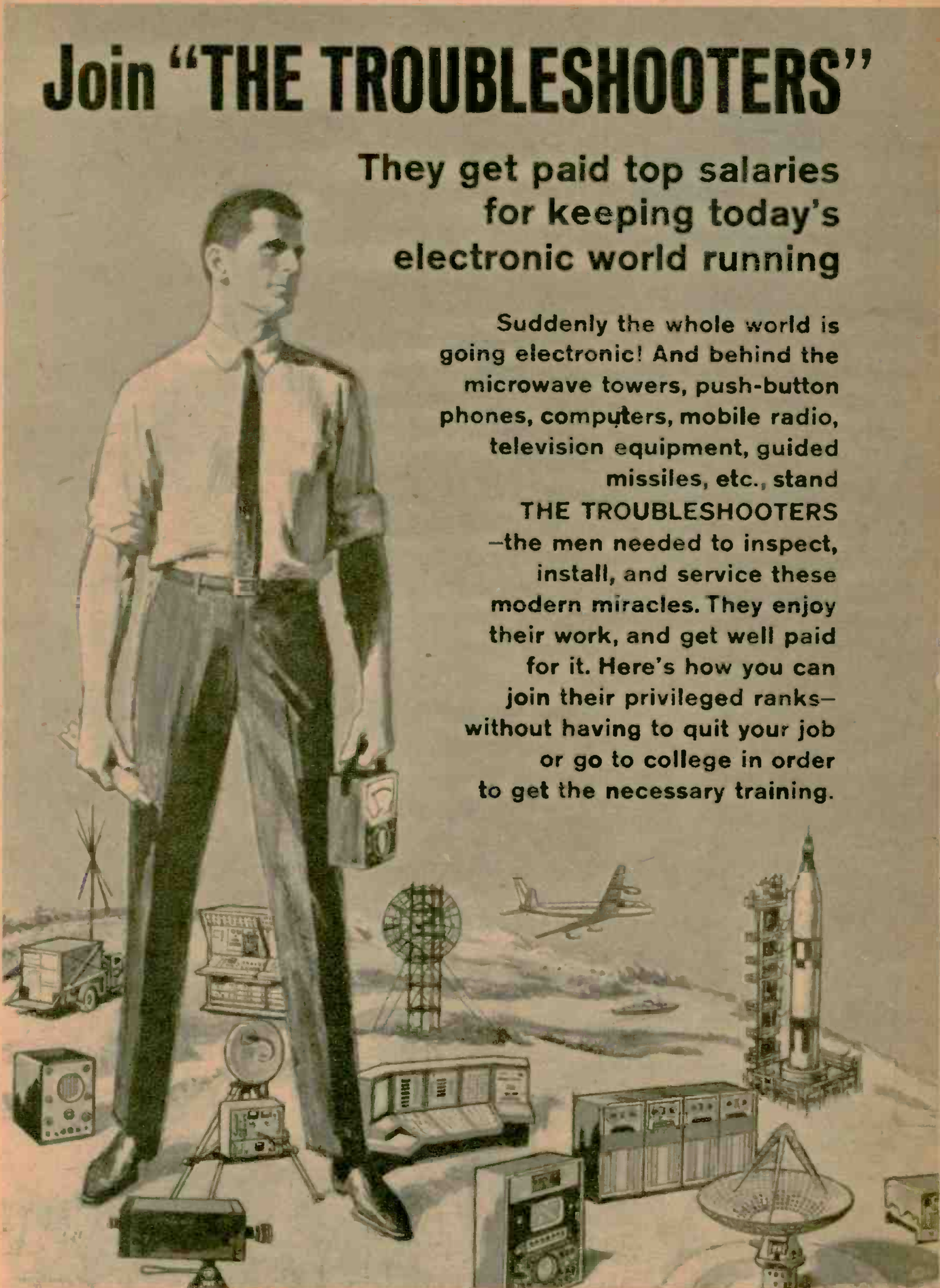


Electronics in the News

Inertial Guidance . . . Tell the inertial-navigation system on the new 747s the latitude and longitude of the plane's starting point and destination, and gyroscopes, accelerometers and a computer constantly calculate the flight path to be flown. The system navigates the plane without reference to external radio or radar signals. Designated Carousel IV by General Motors, the system provides the pilot with his exact position at any time and sends correcting signals to the autopilot to get the plane to its destination. The cockpit control/display unit (left photo) shows the latitude and longitude of N.Y. (top). Guidance system and computer are shown below.

Oriental Laser . . . The number of ideographic characters in the Chinese, Korean and Japanese languages is close to 10,000. When the U.S. government wished to publish in these languages, the work of typesetting had to be done by hand. RCA has developed a laser holographic memory in which all 10,000 characteris are stored on a three-in.-sq. glass plate. The characters are divided into sets. An operator uses a keyboard to activate a computer which designates a character to be set. This trains a laser beam on a portion of the glass illuminating all the characters in the set. A vidicon camera then selects the individual character and displays it on a CRT which is photographed for use in offset printing.

Guiding Light . . . Bell Telephone Labs has developed a way of using transparent pipes formed on glass plates that will enable scientists to control the light as if it were current in an electronic circuit. The lightguides are thin crystal strips which behave like mirrored walls in a tunnel and bend the laser light around sharp curves without dissipating much of the original beam. These lightguides will be used in developing a system to relay communications signals. Repeating lasers would be employed to amplify the signal along a route which could have a capacity 100 times greater than conventional microwave systems.


Join "THE TROUBLESHOOTERS"
They get paid top salaries
for keeping today's
electronic world running
Suddenly the whole world is going electronic! And behind the microwave towers, push-button phones, computers, mobile radio, television equipment, guided missiles, etc., stand THE TROUBLESHOOTERS —the men needed to inspect, install, and service these modern miracles. They enjoy their work, and get well paid for it. Here's how you can join their privileged ranks— without having to quit your job or go to college in order to get the necessary training.

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

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

Because they prevent expensive mistakes or delays, they get top pay—and a title to match. At Xerox and Philco, they're called Technical Representatives. At IBM they're Customer Engineers. In radio or TV, they're the Broadcast Engineers.

What do you need to break into the ranks of The Troubleshooters? You might think you need a college degree, but you don't. What you need is know-how—the kind a good TV service technician has—only lots more.

Think With Your Head, Not Your Hands

As one of The Troubleshooters, you'll have to be ready to tackle a wide variety of electronic problems. You may not be able to dismantle what you're working on—you must be able to take it apart "in your head." You'll have to know enough Electronics to understand the engineering specs, read the wiring diagrams, and calculate how the circuits should test at any given point.

Learning all this can be much simpler than you think. In fact, you can master it without setting foot in a classroom...and without giving up your job!

For over 30 years, the Cleveland Institute of Electronics has specialized in teaching Electronics at home. We've developed special techniques that make learning easy, even if you've had trouble studying before. Our AUTO-PROGRAMMED® lessons build your knowledge as easily and solidly as you'd build a brick wall—one brick at a time. And our instruction is personal. Your teacher not only grades your work, he analyzes it to make sure you are thinking correctly. And he returns it the same day received, while everything is fresh in your mind.

Always Up-To-Date

To keep up with the latest developments, our courses are constantly being revised. This year CIE students are getting new lessons in Laser Theory and Application, Microminiaturization, Single Sideband Techniques, Pulse Theory and Application, and Boolean Algebra.

In addition, there is complete material on the latest troubleshooting techniques including Tandem System, Localizing through Bracketing, Equal Likelihood and Half-Split Division, and In-circuit Transistor Checking. There are special lessons on servicing two-way mobile radio equipment, a lucrative field in which many of our students have set up their own businesses.

Your FCC License—or Your Money Back!

Two-way mobile work and many other types of troubleshooting call for a Government FCC License, and our training is designed to get it for you. But even if your work doesn't require a license, it's a good idea to get one. Your FCC License will be accepted anywhere as proof of good electronics training.

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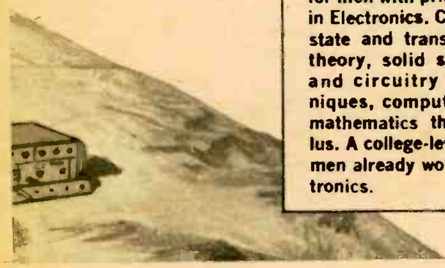

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☐ Electronic Communications ☐ Industrial Electronics ☐ Electronic Engineering

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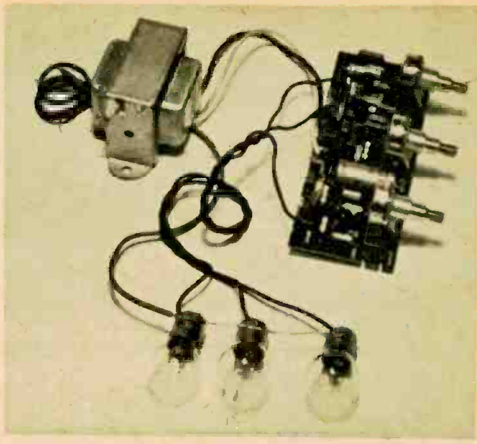
City ________ State ________ Zip ________

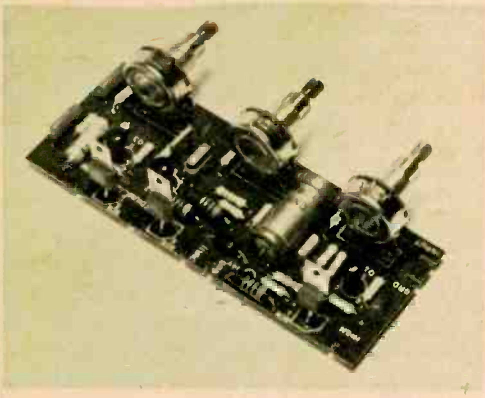
☐ Check here for G. I. Bill information.

EI-91

Cheapie Guts for Color Organs

Science Workshop LO-103





Above: basic electronics ready for cabinet. Transformer, bulbs are extra. Left: pots control signal to each channel. SCRs are at board's back edge.

BUILD one Model LO-103 basic color-organ kit, put a little bit of imagination into a cabinet design, then assemble everything with a few basic tools. What do you get? Mind-blowing psychedelic lighting, that's what!

The $12.95 Science Workshop (Box 393, Bethpage, N.Y. 11714) kit is a color organ in the full sense. Rather than just make lights blink on and off in step with program material (music), the kit's three filter-controlled SCR-regulated circuits change the intensity and pulsation of three lamps in step with the music's frequency and volume.

For example, a bass drum will pulse only, say, a red lamp with the intensity determined by the drum's volume. Trumpets joining in would light a green lamp. Violins fading in would sweep the blue lamp into operation. A full orchestra would produce a changing pattern of colors and brilliance.

The printed-circuit-board kit contains the basic electronics; the SCR controllers and their associated channel-level controls. The power transformer and bulbs are extra. Science Workshop sells a transformer for $2.95 and No. 93 automotive bulbs for about 50¢ each. Also available for $9.95 is the LO-103C power booster which increases the power-handling capability to 450 watts (117 V) per channel.

The kit is supplied with notably good pictorials. Total assembly time runs about one hour. Unfortunately, at least on our kit, the anti-run coating on the circuit-board foil was misplaced and was directly over the component holes. The foil area around each component hole had to be scraped clean with a knife.

The circuit board, transformer and bulbs are supposed to be mounted in a cabinet built by the user; a set of cabinet plans is included. To facilitate bulb changes three automotive bayonet sockets should be mounted in the cabinet. It was impossible to get these sockets (they are not supplied by Science Workshop) so we soldered the wires to the lamps.

A check showed that low-frequency lamp responded to about 20-100 cps. The medium-frequency lamp responded to about 100-1,000 cps and the high-frequency lamp handled everything over 1,000 cps. Full lamp intensity was obtained with a 0.4 V (rms) input signal; therefore, the unit would work successfully with a transistor radio.

The color organ's input circuit is a bridging design (high impedance) meaning it can be connected in parallel with a speaker without affecting the amplifier's performance. The three gain controls, one for each channel, assure correct operation regardless of the signal level fed to the input.

The Ham Shack

By Wayne Green
W2NSD/1

THE FCC has decided to get on a paying basis and has announced a new license-fee structure. The present fee of $4 for amateur licenses is to be raised to $9. Since the Commission has turned down one request after another to allow for enough delay in the proceeding to permit word to get around, the likelihood is that they intend to ram this one through over all objections. This stinks.

Okay, perhaps it does cost them $4 to give the license exam at the FCC offices. But it certainly doesn't cost them a fraction of that for the mail-order licenses or the renewals and that accounts for about 90 per cent of the action. If it takes five minutes to process a renewal I would be surprised. What other service do we get for our $4? Damned little. Since amateurs are largely self-monitoring, the FCC spends precious little time listening to the ham bands. Even those FCC office visits for new licenses could be avoided if they would set up an arrangement for the major clubs to administer license exams under a relatively foolproof system.

While other factors were at play also, it still remains that the decline in growth of amateur radio was coincidental with the levy of the $4 fee. If there is the slightest chance that the fee increase was responsible for the loss of amateurs it could prove to be one of the most damaging events in the history of amateur radio. Since 1963, when the fee was imposed, the FCC has discouraged thousands of youngsters from becoming hams—people who might have gone on to become engineers and technicians. A raise to $9 just might mean a loss of tens of thousands of skilled technicians at a time in history when the U.S. needs technical talent desperately.

A $9 fee especially can hurt the teen-ager who is going up for his first license. If there must be a tax on amateurs, I feel that it should be left at $4—maximum.

But why should amateurs be taxed? Why shouldn't those who use their FCC commercial licenses as a ticket to earn money pay the freight? Never has it been so obvious that the FCC has virtually no understanding of the value of the amateur service and little, if any, interest in it.

The fastest-growing mode of operation in amateur radio today is the use of FM repeaters. So what do we have? An FCC-proposed set of regulations that would just about stop this type of operation and most certainly would prevent its rapid growth.

In order to get these proposals into the regulations quickly, the Commission found it necessary to ignore the recommendations of the California Amateur Relay Council and brief RM-1542 filed by Ken Sessions K6MVH/1, editor of 73. The Commission was aware that an ARRL repeater group also was working on proposed regulations and they acted before the ARRL group could file their recommendations.

There are many areas of repressive restriction in proposed regulations but the worst and most damaging of all is the prohibition of multiple repeating. This would virtually prevent two repeaters from ever being tied together to extend the range of operations. Since no reasonable excuse is offered for this restriction it seems logical that the end in view is to discourage radio amateurs from experimenting and developing new techniques and services.

King Hussein of Jordan on 20 meters? Rumors started flying in early April. DX bulletins confirmed the rumors, along with reports of massive pileups of stations calling the King. Activity from Jordan has been negligible for many years, with Gus (W4BPD) being the only operator in recent years to manage to get on from there.

An American operator went over recently from Greece and was on the air for a little while from the palace in Amman. This seems to have interested the King and he was heard operating after that.

The more I thought about the problems King Hussein was having, the more I worried about it. Here was a chance to make a friend for amateur radio and help the hobby tremendously. I considered writing him a letter trying to explain the intricacies of operating. No, too complicated. Finally I decided to send him a cable offering to come over for a few days and help with the pileups and show him the techniques I had worked out. More about that in the next column.

Taking Care of a Cassette Recorder

By HOMER L. DAVIDSON

ON the audio scene, the cassette recorder is where the action is. Reasons these machines are coming on so strong are that they are easy to operate and the performance is rapidly coming up to that of moderate-price reel-to-reel recorders.

However, after hours of operation cassette recorders do develop maladies. Getting a recorder back in top shape (or keeping it that way) doesn't require the skills of a watchmaker or a computer troubleshooter. All that's needed is an understanding of how a recorder works, a logical approach to troubleshooting, a dozen or so routine checks and regular preventive maintenance.

After about 40 hours of operation heads should be cleaned with a tape-head cleaning cassette. You insert this cassette in the recorder, turn the machine on and after several seconds the tape will remove oxide deposits from the heads. To finish off the job use a Q-tip soaked in alcohol, as shown in the photo above. If a head is covered with a heavy layer of oxide, use a blunt plastic tool (such as an IF alignment tool) to scrape it away. Be careful not to scratch the head's surface.

Many recorders don't need lubrication but when a motor becomes noisy a drop of light oil on the bearings will clear up the condition. Check the capstan flywheel for dry bearings. These bearings should be cleaned with alcohol, then oiled. On flywheels that have a nylon end-bearing, clean and apply a light coat of Walsco Lubriplate grease.

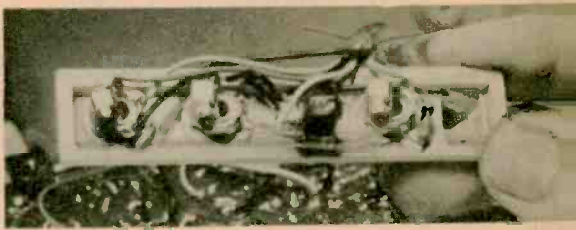
If speed is erratic or there is wow, check for an oily, hard or off-round pinch roller. It takes only a drop of oil on a capstan or pinch roller to cause speed problems.

If the recorder will not record or play, check the batteries. If the machine also is AC powered, see if it will work on AC. After checking the batteries inspect them for corrosion caused by leakage. Corroded contacts should be cleaned with a pocket knife, sandpaper or steel wool. Check the wires to the battery contacts; they may have been eaten away by corrosion or have become loose.

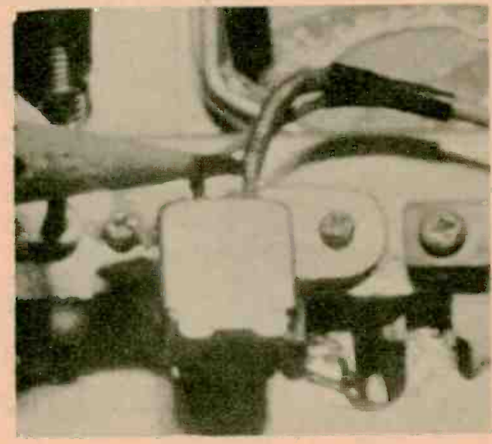
If the tape moves but there is no sound, look for a defective record/play head or amplifier. Remove the guts from the case and insert a prerecorded cassette. Turn the volume up full and listen for sound. Then touch the ungrounded wire from the head to the amplifier and listen for 60-cps hum. If you don't hear it you will have to troubleshoot the amplifier. If you hear hum and the machine will not play or record the head probably is defective.

An inoperative amplifier should be checked by injecting an audio signal from a probe-type signal injector or an audio signal generator. Start at the speaker and work back to the input, going from collector to

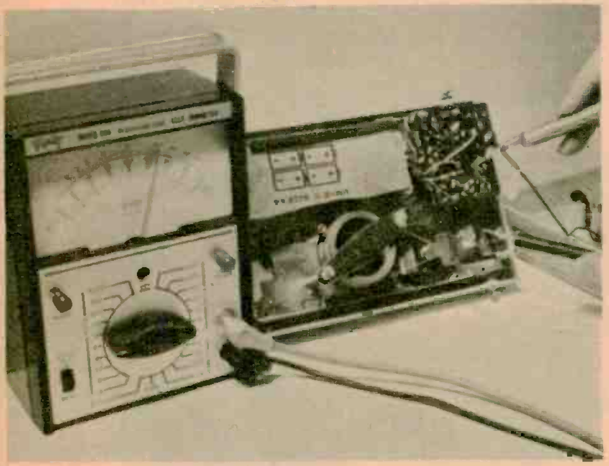
If motor doesn't turn and machine won't record or play, batteries may be bad. Test them with battery checker or measure voltage under load.



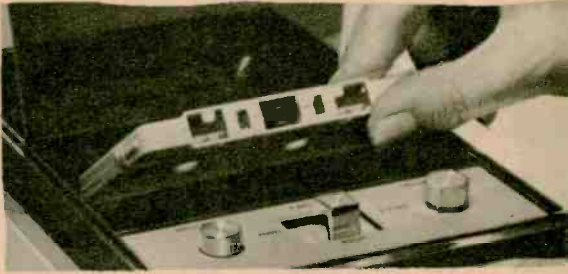
Loud hum can be caused by bad mike connections or broken wires. Check for possible poor contact on the jacks at the input terminal board.



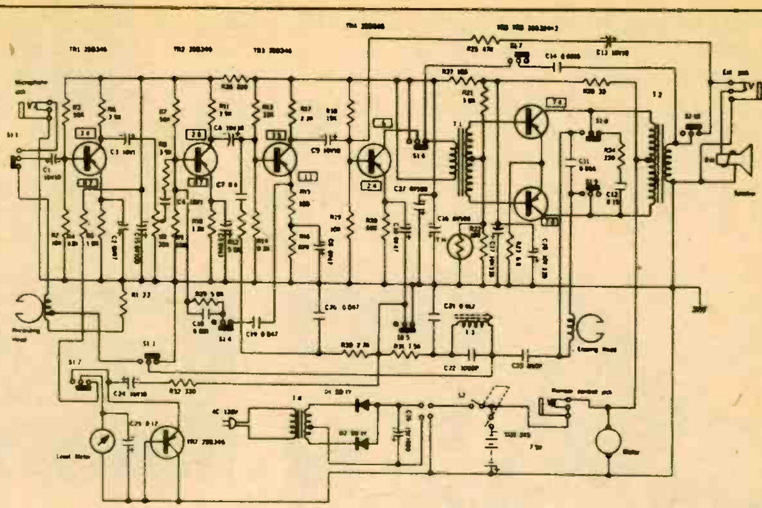
If machine won't record or play, check for broken wires at head. The screws at left and right of the head are for height and azimuth adjustments.



Troubleshoot amplifier with meter set to low voltage range. Lowest range on this Triplett Model 600 solid-state volt-ohmmeter is 0.4 V full scale.



Quickest way to clean record/play and erase heads thoroughly is with cassette with special head-cleaning tape. Do it at least once a week.



Schematic of typical cassette-recorder amplifier. Circuit has seven transistors, AC erase, battery/record-level meter and operates on batteries or AC. Fortunately, this schematic shows voltages on all transistors, which makes troubleshooting easy.

Taking Care of a Cassette Recorder

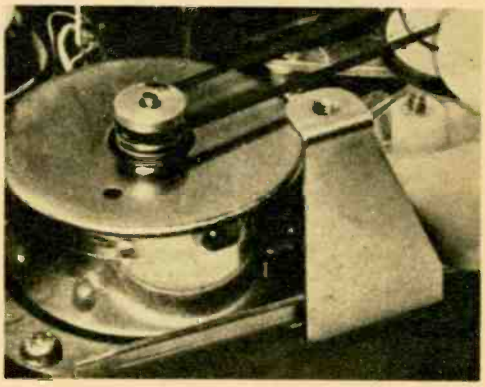
base of each transistor. When the signal appears you've located the defective stage.

If you still can't find the trouble make voltage measurements at the collector, base and emitter of each transistor, comparing the voltages with those in the machine's service notes or schematic. If collector voltage is too high a transistor is not conducting or is open. Also check for an open emitter resistor. Low voltage at both collector and base means a defective transistor.

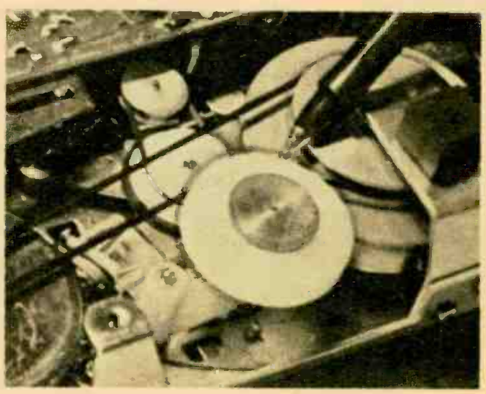
Hum generally is caused by a poor or broken connection in the tape-head or mike cable. Make a continuity check to be sure the shield or ground lead is not broken.

Hearing two recordings at the same time (crosstalk) means incomplete erase or incorrect head alignment. A defective erase head or oscillator may be the cause. When recordings on adjacent tracks play at the same time, an adjustment of head height should be made, using the screws at the rear or at each side of the head. On a mono machine the adjustment is not difficult. On lower-price recorders there may be only one screw at one side of the head for height adjustment.

In stereo machines you must use a prerecorded test tape and a VTVM to make precise head-height and azimuth adjustments. Generally speaking, what you do is connect the VTVM to the output jack or the speaker terminals. Then adjust azimuth and height for maximum VTVM indication.



If batteries are good and motor doesn't turn, check resistance of the motor. Most cassette-recorder motors are sealed and don't require oiling.



If speed is slow or erratic check to see if rubber drive belt is stretched. Also look for oil that may have gotten on the belts, idlers and pulleys.

24-HOUR SHORT-WAVE SCHEDULE

EI presents an updated Fourth Edition of its famous tabulation of English language short-wave broadcasts for 24 hours of the day—from 100 countries. Keep it near your receiver to help you tune in the world.

ABBREVIATIONS USED IN THIS SCHEDULE

B.C.—Broadcasting Co. (Corp.)
Br.—British
B.S.—Broadcasting Serv. (System, Station)
E.—East
Is.—Island(s)
N.—North
N.Z.—New Zealand
Neth.—Netherlands
R.—Radio (Radiodiffusion, Radiodifusora)
S.—South
Terr.—Territory
TV—Television
V.—Voice (of, of the)
W.—West
*—Beamed to North America
+—Beamed to western U.S.
#—Beamed to eastern U.S.

All times listed are Eastern Standard Time. To convert, subtract 1 hour for Central Standard Time, 2 hours for Mountain Standard Time and 3 hours for Pacific Standard Time. Schedules are daily, except when noted parenthetically, i.e., (1)—Sunday transmission, (2)—Monday transmission, etc. All frequencies are in kilocycles.

TIME (EST)	FREQ.	STATION (CALL)	LOCATION
12 MIDN.	4,855	R. Clube Mozambique	Lorenco Marques, Mozambique
	4,976	R. Uganda	Kampala, Uganda
	6,050	R. Clube Mozambique	Lorenco Marques, Mozambique
	6,145*	Deutsche Welle, DMQ9	Cologne, W. Germany
	7,115*	Thai National B. S.	Bangkok, Thailand
	9,545*	Deutsche Welle, DMQ6	Cologne, W. Germany
	9,720+	Swiss B. C.	Berne, Switzerland
	11,715+	Swiss B. C.	Berne, Switzerland
	11,730+	R. Nederland Relay	Bonaire, Neth. Antilles
	11,910*	Thai National B. S., HSK9	Bangkok, Thailand
12:15 A.M.	5,954	R. Casino, TIQ	Puerto Limon, Costa Rica
	7,155	Office R. TV Francaise	Paris, France
12:30 A.M.	4,967	Kuwait B. S.	Kuwait
	6,090	R. TV Kaduna	Kaduna, Nigeria
	11,850+	R. Moscow	Moscow, USSR
	17,750	Kuwait B. S.	Kuwait
	17,825	R. Sweden	Stockholm, Sweden
12:45 A.M.	6,125	United Nations R.	Greenville, USA
	11,890	R.V. Gospel, ETLF	Addis Ababa, Ethiopia
	11,920	R. Brazzaville	Brazzaville, Congo Rep.
	15,115	V. Andes, HCJB	Quito, Ecuador
1 A.M.	3,316	R. Sierra Leone	Freetown, Sierra Leone
	6,080	R. New Zealand, ZL7	Wellington, N. Z.
	7,195	R. Uganda	Kampala, Uganda
	9,540	R. New Zealand, ZL2	Wellington, N. Z.
	11,945	Sudan Interior Mission, ELWA	Monrovia, Liberia
1:15 A.M.	9,650	BBC Relay	Cyprus
	9,690	Deutsche Welle Relay	Kigali, Rwanda
	11,905	Deutsche Welle Relay	Kigali, Rwanda
1:30 A.M.	3,255	Liberian B. C., ELBC	Monrovia, Liberia
	7,275	V. Nigeria	Lagos, Nigeria
	7,290	Trans World R.	Monte Carlo, Monaco
	15,115	V. Andes, HCJB	Quito, Ecuador
1:45 A.M.	3,230	R. Fiji, VRH8	Suva, Fiji
	6,175	V. Malaysia	Kuala Lumpur, Malaysia
	17,850	R. Bucharest	Bucharest, Rumania
2 A.M.	6,010	R. Warsaw	Warsaw, Poland
	6,055	R. Prague	Prague, Czechoslovakia
	6,165	Swiss B. C.	Berne, Switzerland
	9,505*	R. Japan	Tokyo, Japan
2:15 A.M.	5,990	Canadian B. C., CKNA	Montreal, Canada
	9,625	Canadian B. C., CKLO	Montreal, Canada
	11,710	R. Australia	Melbourne, Australia
2:30 A.M.	3,925	Australian B. C., VLK3	Port Moresby, Papua Terr.
	4,890	Australian B. C., VLT4	Port Moresby, Papua Terr.
	6,165	Swiss B. C.	Berne, Switzerland
	9,540	R. New Zealand ZL2	Wellington, N. Z.
	9,560	R. Australia	Melbourne, Australia
	17,880	R. Portugal	Lisbon, Portugal
	21,495	R. Portugal	Lisbon, Portugal
2:45 A.M.	3,995	Solomon Is. B. S., VQ04	Honiara, Solomon Is.
	6,050	V. Andes, HCJB	Quito, Ecuador
	6,080	R. New Zealand, ZL7	Wellington, N. Z.
	6,175	V. Malaysia	Kuala Lumpur, Malaysia
	7,290	Trans World R.	Monte Carlo, Monaco
	9,505	R. Prague	Prague, Czechoslovakia
	11,730	R. Nederland Relay	Bonaire, Neth. Antilles
	11,800	R. Prague	Prague, Czechoslovakia
	11,900	V. Malaysia	Kuala Lumpur, Malaysia
3 A.M.	6,540	R. Pyongyang	Pyongyang, N. Korea
	7,135	R. Pakistan	Karachi, Pakistan
	9,645	R. Pakistan	Karachi, Pakistan
	15,520	R. Pyongyang	Pyongyang, N. Korea
	17,815	R. RSA	Johannesburg, South Africa
	21,545	R. RSA	Johannesburg, South Africa
3:15 A.M.	3,995	Solomon Is. B. S., VQ04	Honiara, Solomon Is.
	4,890	Australian B. C., VLT4	Port Moresby, Papua Terr.
	7,165	V. America Relay	Okinawa
	15,165	R. Denmark, OZF7	Copenhagen, Denmark
	15,345(1)	R. Norway, LKU	Oslo, Norway
	21,655(1)	R. Norway, LKC	Oslo, Norway
	25,900(1)	R. Norway, LLA	Oslo, Norway
3:30 A.M.	3,322	R. Bougainville, VL9BA	Kieta, Bougainville
	15,345	V. America Relay	Tinang, Philippines
	17,880	R. Portugal	Lisbon, Portugal
	21,495	R. Portugal	Lisbon, Portugal
3:45 A.M.	5,990	Canadian B. C., CKNA	Montreal, Canada
	7,205	R. Australia	Melbourne, Australia
	9,625	Canadian B. C., CKLO	Montreal, Canada
4 A.M.	3,230	R. Fiji, VRH8	Suva, Fiji
	3,385	R. Rabaul, VL9BR	Rabaul, New Britain Is.
	4,912	R. Tarawa, VSZ2	Tarawa, Gilbert & Ellice Is.
	5,980	R. Demerara, ZFY	Georgetown, Guyana
	9,670	V. Freedom	Saigon, S. Vietnam
	11,890	Far East B. C., DZE9	Manila, Philippines
4:15 A.M.	11,750	BBC Relay	Tebrau, Malaysia
	11,770	V. Indonesia, 8FC22	Djakarta, Indonesia
	17,880	BBC Relay	Tebrau, Malaysia

TIME (EST)	FREQ.	STATION (CALL)	LOCATION
4:30 A.M.	7,165	V. America Relay	Okinawa
	15,155	V. America Relay	Poro, Philippines
4:45 A.M.	4,985	V. Malaysia	Penang, Malaysia
	7,295	V. Malaysia	Penang, Malaysia
	11,795	Deutsche Welle, DMQ11	Cologne, W. Germany
	11,875	R. Japan	Tokyo, Japan
	15,265	Deutsche Welle	Cologne, W. Germany
5 A.M.	6,030	V. Prairies, CFVP	Calgary Canada
	6,170	Philippine B. S.	Manila, Philippines
	9,505*	R. Japan	Tokyo, Japan
	15,220	R. RSA	Johannesburg, South Africa
	17,815	R. RSA	Johannesburg, South Africa
	21,545	R. RSA	Johannesburg, South Africa
5:15 A.M.	9,520*(1,7)	R. Denmark, OZF5	Copenhagen, Denmark
	9,570	R. Australia	Melbourne, Australia
	11,880	R. Australia	Melbourne, Australia
	15,305	Swiss B. C.	Berne, Switzerland
	17,840	Deutsche Welle, DMQ17	Cologne, W. Germany
5:30 A.M.	6,080	R. New Zealand, ZL7	Wellington, N. Z.
	7,115	Thai National B. S.	Bangkok, Thailand
	9,520	R. New Zealand, ZL18	Wellington, N. Z.
	11,910	Thai National B. S., HSK9	Bangkok, Thailand
5:45 A.M.	7,165	V. America Relay	Okinawa
	9,560	R. Pakistan	Karachi, Pakistan
	11,672	R. Pakistan	Karachi, Pakistan
	11,785	Deutsche Welle Relay	Kigali, Rwanda
	15,155	V. America Relay	Poro, Philippines
	15,345	V. America Relay	Tinang, Philippines
6 A.M.	3,335	R. Wewak, VL9CD	Wewak, New Guinea Terr.
	6,105	V. Indonesia, 8FB63	Djakarta, Indonesia
	6,170	Philippine B. S.	Manila, Philippines
	9,505*	R. Japan	Tokyo, Japan
	9,585	V. Indonesia, 8FB22	Djakarta, Indonesia
	9,770	V. Evangelique, 4VEH	Cap Haitien, Haiti
	11,810	R. Bucharest	Bucharest, Rumania
	15,380	R. Bucharest	Bucharest, Rumania
	17,830	R. Ceylon	Colombo, Ceylon
6:15 A.M.	3,335	R. Wewak, VL9CD	Wewak, New Guinea Terr.
	3,925	Australian B. C., VLK3	Port Moresby, Papua Terr.
	6,155	Far East Network	Tokyo, Japan
	7,115	Thai National B. S.	Bangkok, Thailand
	9,615	R. Pyongyang	Pyongyang, N. Korea
	11,750	BBC Relay	Tebrau, Malaysia
	15,315#	R. Sweden	Stockholm, Sweden
6:30 A.M.	4,920	Australian B. C., VLM4	Brisbane, Australia
	7,105	V. America Relay	Colombo, Ceylon
	9,580*	R. Australia	Melbourne, Australia
	11,820*	Trans World R.	Bonaire, Neth. Antilles
	11,835	V. America Relay	Colombo, Ceylon
6:45 A.M.	5,047	R. Republik Indonesia	Djogjakarta, Indonesia
	7,160	R. Malaysia Sarawak	Kuching, Sarawak
7 A.M.	4,985	V. Malaysia	Penang, Malaysia
	5,055	R. Singapore	Singapore
	7,160	R. Malaysia Sarawak	Kuching, Sarawak
	7,295	V. Malaysia	Penang, Malaysia
	9,580*	R. Australia	Melbourne, Australia
	9,660	V. Malaysia	Kuala Lumpur, Malaysia
	11,710*	R. Australia	Melbourne, Australia
	11,925	R. Tashkent	Tashkent, USSR
	17,700	R. Berlin International	Berlin, E. Germany
	21,590	R. Berlin International	Berlin, E. Germany
7:15 A.M.	6,030	V. Prairies, CFVP	Calgary, Canada
	7,240(1)	R. Norway, LLR	Oslo, Norway
	9,625*	Canadian B. C., CKLO	Montreal, Canada
	11,720	Canadian B. C., CHSB	Montreal, Canada
	11,820*	Trans World R.	Bonaire, Neth. Antilles
	15,325	Canadian B. C.,	Montreal, Canada
	15,410	Deutsche Welle Relay	Kigali, Rwanda
	17,765	Deutsche Welle Relay	Kigali, Rwanda
	17,825(1)	R. Norway, LLN	Oslo, Norway
	25,900(1)	R. Norway, LLA	Oslo, Norway

TIME (EST)	FREQ.	STATION (CALL)	LOCATION
7:30 A.M.	7,155	R. Amman	Amman, Jordan
	9,540	R. Ulan Bator	Ulan Bator, Mongolia
	9,755	R. Vietnam	Saigon, S. Vietnam
	9,770	V. Evangelique, 4VEH	Cap Haitien, Haiti
	11,715	V. America Relay	Tinang, Philippines
	15,105	R. Sweden	Stockholm, Sweden
	15,155	V. America Relay	Poro, Philippines
7:45 A.M.	6,130	R. Nationale Lao	Vientiane, Laos
	6,140	Australian B. C., VLW6	Perth, Australia
	7,540	R. Ulan Bator	Ulan Bator, Mongolia
	9,540	R. Ulan Bator	Ulan Bator, Mongolia
	9,755	R. Vietnam	Saigon, S. Vietnam
	9,770	V. Evangelique, 4VEH	Cap Haitien, Haiti
	11,920	Far East B.C., DZF2	Manila, Philippines
	15,095	R. Peking	Peking, China
	15,440	Far East B.C., DZF8	Manila, Philippines
8 A.M.	6,140	Australian B. C., VLW6	Kabul, Afghanistan
	6,155	Far East Network	Tokyo, Japan
	6,160	Canadian B. C., CKZU	Vancouver, Canada
	9,770	V. Evangelique, 4VEH	Cap Haitien, Haiti
	11,750	BBC Relay	Tebrau, Malaysia
	11,940	R. Bucharest	Bucharest, Rumania
	15,250	R. Bucharest	Bucharest, Rumania
	17,880	BBC Relay	Tebrau, Malaysia
8:15 A.M.	7,105	V. America Relay	Colombo, Ceylon
	7,155	R. Amman	Amman, Jordan
	11,810	All India R.	New Delhi, India
	11,835	V. America Relay	Colombo, Ceylon
	15,105	Windward Is. B.S.	St. George's, Grenada
	15,150	R.V. Gospel, ETLF	Addis Ababa, Ethiopia
	15,315	R.V. Gospel, ETLF	Addis Ababa, Ethiopia
8:30 A.M.	17,895	R. Portugal	Lisbon, Portugal
	21,495	R. Portugal	Lisbon, Portugal
8:45 A.M.	5,010	Br. Forces B. S.	Singapore
	11,920	V. Andes, HCJB	Quito, Ecuador
	15,135	Swiss B. C.	Berne, Switzerland
	15,255	V. Andes, HCJB	Quito, Ecuador
	17,845	Swiss B. C.	Berne, Switzerland
	21,520	Swiss B. C.	Berne, Switzerland
9 A.M.	4,775	R. Afghanistan	Kabul, Afghnaistan
	4,950	R. Malaysia	Kuching, Sarawak
	6,020	R. Nederland	Hilversum, Neth.
	11,945	R. Singapore	Singapore
	17,810	R. Nederland	Hilversum, Neth.
	21,480	R. Nederland	Hilversum, Neth.
9:15 A.M.	6,130	R. Ghana	Accra, Ghana
	15,315#	R. Sweden	Stockholm, Sweden
	17,825#(1)	R. Norway, LLN	Oslo, Norway
	17,910	R. Ghana	Accra, Ghana
9:30 A.M.	6,105+	V. Indonesia, 8FB63	Djakarta, Indonesia
	7,205	V. America Relay	Thessaloniki, Greece
	9,585+	V. Indonesia, 8FB22	Djakarta, Indonesia
9:45 A.M.	3,980	V. America Relay	Munich, W. Germany
	9,615	R. Pyongyang	Pyongyang, N. Korea
	11,765	R. Pyongyang	Pyongyang, N. Korea
10 A.M.	3,980	V. America Relay	Munich, W. Germany
	6,105+	V. Indonesia, 8FB63	Djakarta, Indonesia
	6,130	R. Ghana	Accra, Ghana
	7,340	R. Pakistan	Karachi, Pakistan
	9,585+	V. Indonesia, 8FB22	Djakarta, Indonesia
	9,755	R. Pakistan	Karachi, Pakistan
	9,760	V. America Relay	Munich, W. Germany
	15,335	All India R.	New Delhi, India
	17,910	R. Ghana	Accra, Ghana
	21,545	R. Ghana	Accra, Ghana
10:15 A.M.	15,305	Swiss B. C.	Berne, Switzerland
	17,760	R. Bucharest	Bucharest, Rumania
	17,810	R. Nederland	Hilversum, Neth.
	17,820	Canadian B. C., CKNC	Montreal, Canada
	17,830	Swiss B. C.	Berne, Switzerland
	21,480	R. Nederland	Hilversum, Neth.
	21,595	Canadian B. C.	Montreal, Canada
10:30 A.M.	9,620	R. Belgrade	Belgrade, Yugoslavia
	11,735	R. Belgrade	Belgrade, Yugoslavia
	15,240	R. Belgrade	Belgrade, Yugoslavia
	15,285	R. Prague	Prague, Czechoslovakia
	17,840	R. Prague	Prague, Czechoslovakia
	21,735	R. Prague	Prague, Czechoslovakia
10:45 A.M.	7,275	V. Nigeria	Lagos, Nigeria
	15,365	V. Nigeria	Lagos, Nigeria
	21,455	V. Nigeria	Lagos, Nigeria

TIME (EST)	FREQ.	STATION (CALL)	LOCATION
11 A.M.	7,285	V. America Relay	Rhodes, Greece
	11,875	R. RSA	Johannesburg, South Africa
	15,220	R. RSA	Johannesburg, South Africa
	15,325	R. Pakistan	Karachi, Pakistan
	15,345	Kuwait B. S.	Kuwait
	17,935	R. Pakistan	Karachi, Pakistan
	21,590	Kuwait B. S.	Kuwait
11:15 A.M.	7,125	R. Warsaw	Warsaw, Poland
	9,550	Windward Is. B. S.	St. George's, Grenada
	11,800	R. Warsaw	Warsaw, Poland
11:30 A.M.	7,205	V. America Relay	Thessaloniki, Greece
	9,560	R. Amman	Amman, Jordan
11:45 A.M.	9,735	Deutsche Welle Relay	Kigali, Rwanda
	11,925	Deutsche Welle Relay	Kigali, Rwanda
12 NOON	9,695	R.V. Gospel, ETLF	Addis Ababa, Ethiopia
	11,825	V. Free China, BED69	Taipei, Taiwan
	11,910	R.V. Gospel, ETLF	Addis Ababa, Ethiopia
	15,125	V. Free China, BED60	Taipei, Taiwan
	15,275	Deutsche Welle, DMQ15	Cologne, W. Germany
	15,370	V. Free China, BED93	Taipei, Taiwan
	17,720	V. Free China, BED39	Taipei, Taiwan
	17,845	R. New York World-wide, WNYW	New York, USA
	17,875	Deutsche Welle, DMQ17	Cologne, W. Germany
	17,890	V. Free China, BED40	Taipei, Taiwan
12:15 P.M.	11,855	B. S. Kingdom of Saudi Arabia	Djeddah, Saudi Arabia
	15,285	R. Ghana	Accra, Ghana
	15,345	Kuwait B. S.	Kuwait
	21,590	Kuwait B. S.	Kuwait
12:30 P.M.	11,855	B. S. Kingdom of Saudi Arabia	Djeddah, Saudi Arabia
	11,990	R. Prague	Prague, Czechoslovakia
	15,275	Deutsche Welle, DMQ15	Cologne, W. Germany
	17,655	R. Cairo	Cairo, UAR
	17,840	R. Prague	Prague, Czechoslovakia
	21,735	R. Prague	Prague, Czechoslovakia
12:45 P.M.	7,205	V. America Relay	Thessaloniki, Greece
	15,435	Deutsche Welle Relay	Kigali, Rwanda
1 P.M.	9,550	Finnish B. C., OIX2	Pori, Finland
	9,705	R.V. Gospel, ETLF	Addis Ababa, Ethiopia
	11,780	R. Clube Mozambique	Lorenco Marques, Mozambique
	11,805	Finnish B. C. OIX8	Pori, Finland
	15,185	Finnish B. C. OIX5	Pori, Finland
	15,205	V. America	Wooferton, England
	15,270	Syrian B. C.	Damascus, Syria
1:15 P.M.	9,560	R. Amman	Amman, Jordan
	11,780	R. Clube Mozambique	Lorenco Marques, Mozambique
	11,790	R. Afghanistan	Kabul, Afghanistan
	11,855	B. S. Kingdom of Saudi Arabia	Djeddah, Saudi Arabia
	15,265	R. Afghanistan	Kabul, Afghanistan
	15,345	Kuwait B. S.	Kuwait
	17,895	R. Portugal	Lisbon, Portugal
	21,495	R. Portugal	Lisbon, Portugal
	21,590	Kuwait B. S.	Kuwait
1:30 P.M.	6,100	R. Belgrade	Belgrade, Yugoslavia
	7,200	R. Belgrade	Belgrade, Yugoslavia
	7,343	United Nations R.	Geneva, Switzerland
	9,620	R. Belgrade	Belgrade, Yugoslavia
	11,920	R. TV Ivorienne	Abidjan, Ivory Coast
	15,205	V. America Relay	Wooferton, England
	15,350	R. Lebanon	Beirut, Lebanon
	15,420	BBC Relay	Cyprus
	21,630	R. Nederland Relay	Bonaire, Neth. Antilles
1:45 P.M.	11,875	R. RSA	Johannesburg, South Africa
	15,325	Canadian B. C., CKCS	Montreal, Canada
	15,420	BBC Relay	Cyprus
	21,480	R. RSA	Johannesburg, South Africa
	21,595	Canadian B. C.	Montreal, Canada
2 P.M.	6,540	R. Pyongyang	Pyongyang, N. Korea
	7,195	V. America Relay	Monrovia, Liberia
	9,615	R, Pyongyang	Pyongyang, N. Korea
	11,795*	Deutsche Welle, DMQ11	Cologne, W. Germany
	15,090	All India R.	Bombay, India
	15,345*	Deutsche Welle, DMQ15	Cologne, W. Germany
	17,705*	Deutsche Welle, DMQ17	Cologne, W. Germany
2:15 P.M.	9,585	V. Indonesia, 8FB22	Djakarta, Indonesia
	11,715	V. Indonesia, 8FC2	Djakarta, Indonesia
	11,945	Sudan Interior Mission, ELWA	Monrovia, Liberia
	15,260	Cyprus B. C.	Nicosia, Cyprus
	15,310	R. Sofia	Sofia, Bulgaria
	15,420	BBC Relay	Cyprus
	17,825	R. Sofia	Sofia, Bulgaria
2:30 P.M.	6,030	R. Baghdad	Baghdad, Iraq
	6,070	R. Sofia	Sofia, Bulgaria
	6,095	R. Baghdad	Baghdad, Iraq
	7,195	V. America Relay	Monrovia, Liberia
	9,510	R. Bucharest	Bucharest, Rumania
	9,560	R. Sofia	Sofia, Bulgaria
	9,585	V. Indonesia, 8FB22	Djakarta, Indonesia
	9,740(2,5,7)	R. Kiev	Kiev, USSR
	11,700(2,5,7)	R. Kiev	Kiev, USSR
	11,715	V. Indonesia, 8FC2	Djakarta, Indonesia
	11,940	R. Bucharest	Bucharest, Rumania
	15,150(2,5,7)	R. Kiev	Kiev, USSR
2:45 P.M.	6,130	R. Ghana	Accra, Ghana
	7,275	RAI	Rome, Italy
	9,710	RAI	Rome, Italy
	11,800	RAI	Rome, Italy
	21,690	Windward Is. B. S.	St. George's, Grenada
3 P.M.	6,020	R. Nederland	Hilversum, Neth.
	6,030	R. Baghdad	Baghdad, Iraq
	6,085	R. Nederland	Hilversum, Neth.
	6,095	R. Baghdad	Baghdad, Iraq
	9,715	R. Nederland	Hilversum, Neth.
	11,730	R. Iran	Tehran, Iran
	11,945	Sudan Interior Mission, ELWA	Monrovia, Liberia
	15,020	V. Vietnam	Hanoi, N. Vietnam
	15,135	R. Iran	Tehran, Iran
	17,855	R. Havana Cuba	Havana, Cuba
3:15 P.M.	9,009	Kol Zion, 4XB31	Jerusalem, Israel
	9,510	R. Bucharest	Bucharest, Rumania
	9,625	Kol Zion, 4XB71	Jerusalem, Israel
	9,665	Swiss B. C.	Berne, Switzerland
	11,865	Swiss B. C.	Berne, Switzerland
	11,940	R. Bucharest	Bucharest, Rumania
	15,345(1)	R. Norway, LKU	Oslo, Norway
	21,730(1)	R. Norway, LLL	Oslo, Norway
3:30 P.M.	6,620	R. Peking	Peking, China
	7,235	RAI	Rome, Italy
	9,575	RAI	Rome, Italy
	9,625	Kol Zion, 4XB71	Jerusalem, Israel
	11,675	R. Peking	Peking, China
	11,800	RAI	Rome, Italy
	15,060	R. Peking	Peking, China
	15,445	V. America Relay	Monrovia, Liberia
	17,725	R. Cairo	Cairo, UAR
	17,845	R. New York World-wide, WNYW	New York, USA
3:45 P.M.	6,065	R. Sweden	Stockholm, Sweden
	7,125	R. Warsaw	Warsaw, Poland
	9,715	R. Nederland	Hilversum, Neth.
	11,910	R. Sweden	Stockholm, Sweden
4 P.M.	6,035	V. America Relay	Monrovia, Liberia
	9,640	V. Free Korea	Seoul, S. Korea
	15,205	V. America Relay	Wooferton, England
	15,445	V. America Relay	Monrovia, Liberia
	17,725	R. Cairo	Cairo, UAR
	17,845	R. New York World-wide, WNYW	New York, USA
4:15 P.M.	11,765	R. Sofia	Sofia, Bulgaria
	11,970	R. Sofia	Sofia, Bulgaria
	15,310	R. Sofia	Sofia, Bulgaria
	17,825	R. Sofia	Sofia, Bulgaria
4:30 P.M.	9,545	R. Ghana	Accra, Ghana
	11,730#	R. Nederland	Hilversum, Neth.
	11,780*	BBC	London, England
	15,140*	BBC	London, England
	15,285	R. Ghana	Accra, Ghana
	15,425#	R. Nederland	Hilversum, Neth.
4:45 P.M.	11,730#	R. Nederland	Hilversum, Neth.
	11,780*	BBC	London, England
	15,140*	BBC	London, England
	15,425#	R. Nederland	Hilversum, Neth.
	21,690	Windward Is. B. S.	St. George's Grenada
5 P.M.	9,510*	BBC Relay	Ascension Is.
	9,550	R. TV Belge	Brussels, Belgium
	9,660	R. TV Belge	Brussels, Belgium
	9,710	RAI	Rome, Italy
	11,715	R. TV Belge	Brussels, Belgium
	11,780*	BBC	London, England
	11,810	R. Ulan Bator	Ulan Bator, Mongolia
	11,850	R. Ulan Bator	Ulan Bator, Mongolia
	11,905	RAI	Rome, Italy
	15,140*	BBC	London, England
	15,160	R. Ankara, TAU	Ankara, Turkey
	15,340	RAI	Rome, Italy

TIME (EST)	FREQ.	STATION (CALL)	LOCATION
5:15 P.M.	9,510*	BBC Relay	Ascension Is.
	9,600*	R. Moscow	Moscow, USSR
	9,660*	R. Moscow	Moscow, USSR
	11,730#	R. Nederland	Hilversum, Neth.
	11,790*	R. Moscow	Moscow, USSR
	11,900*	R. Moscow	Moscow, USSR
	11,960*	R. Moscow	Moscow, USSR
	12,010*	R. Moscow	Moscow, USSR
	15,345+	R. Norway, LKU	Oslo, Norway
	15,425#	R. Nederland	Hilversum, Neth.
	17,795	R. Norway	Oslo, Norway
	21,655	R. Norway, LKC	Oslo, Norway
5:30 P.M.	4,940	R. TV Ivorienne	Abidjan, Ivory Coast
	9,510*	BBC Relay	Ascension Is.
	11,730#	R. Nederland	Hilversum, Neth.
	11,780*	BBC	London, England
	15,140*	BBC	London, England
	15,205	V. America Relay	Tangier, Morocco
	15,425#	R. Nederland	Hilversum, Neth.
5:45 P.M.	6,050	Western Nigeria B. S.	Ibadan, Nigeria
	11,705	R. Sweden	Stockholm, Sweden
	11,780*	BBC	London, England
	11,910	R. Sweden	Stockholm, Sweden
	15,140*	BBC	London, England
	15,205	V. America Relay	Tangier, Morocco
6 P.M.	6,005	Canadian Marconi Co., CFCX	Montreal, Canada
	7,235	All India R.	New Delhi, India
	9,530	All India R.	New Delhi, India
	9,550*	Finnish B. C., OIX2	Pori, Finland
	9,625*	Canadian B. C. CKLO	Montreal, Canada
	11,805*	Finnish B. C., OIX8	Pori, Finland
	11,875	R. Nacional de Nicaragua	Managua, Nicaragua
	11,895	All India R.	New Delhi, India
	11,945*	Canadian B. C.,	Montreal, Canada
	15,185*	Finnish B. C., OIX4	Pori, Finland
	15,190*	Canadian B. C.	Montreal, Canada
6:15 P.M.	6,110*	BBC	London, England
	9,510*	BBC Relay	Ascension Is.
	9,680*	R. Moscow	Moscow, USSR
	11,730*	R. Moscow	Moscow, USSR
	11,780*	BBC	London, England
	11,870*	R. Moscow	Moscow, USSR
	11,900*	R. Moscow	Moscow, USSR
	15,140*	BBC	London, England
	15,205	V. America Relay	Tangier, Morocco
6:30 P.M.	3,990	V. America Relay	Monrovia, Liberia
	6,105	V. Indonesia, 8FB63	Djakarta, Indonesia
	9,585	V. Indonesia, 8FB22	Djakarta, Indonesia
	9,755	R. Vietnam	Saigon, S. Vietnam
6:45 P.M.	15,445*	R. Japan	Tokyo, Japan
	17,824*	R. Japan	Tokyo, Japan
7 P.M.	9,510*	BBC Relay	Ascension Is.
	9,560*	R. Sofia	Sofia, Bulgaria
	9,620*	R. Sofia	Sofia, Bulgaria
	9,700*	R. Sofia	Sofia, Bulgaria
	15,260	BBC Relay	Ascension Is.
	15,445*	R. Japan	Tokyo, Japan
	17,825*	R. Japan	Tokyo, Japan
7:15 P.M.	6,110*	BBC	London, England
	6,155*	Austrian R., OE121	Vienna, Austria
	7,120	R. Peking	Peking, China
	7,130	R. Peking	Peking, China
	9,580*	BBC	London, England
	9,600*	R. Moscow	Moscow, USSR
	9,680*	R. Moscow	Moscow, USSR
	9,770#	Austrian R., OE147	Vienna, Austria
	11,730*	R. Moscow	Moscow, USSR
	11,735(2)	R. Norway, LKJ	Oslo, Norway
	11,780*	BBC	London, England
	11,850#(2)	R. Norway, LLK	Oslo, Norway
	11,870*	R. Moscow	Moscow, USSR
	11,900*	R. Moscow	Moscow, USSR
	15,345(2)	R. Norway, LKU	Oslo, Norway
7:30 P.M.	9,705*	R. RSA	Johannesburg, South Africa
	9,710#	R. Sweden	Stockholm, Sweden
	9,715*	R. RSA	Johannesburg, South Africa
	11,672	R. Pakistan	Karachi, Pakistan
	11,875*	R. RSA	Johannesburg, South Africa
	15,220*	R. RSA	Johannesburg, South Africa
	15,360	R. Pakistan	Karachi, Pakistan
7:45 P.M.	6,125	R. TV Belge	Brussels, Belgium
	9,600(2,5,7)	R. Kiev	Kiev, USSR
	9,660	R. TV Belge	Brussels, Belgium
	11,700(2,5,7)	R. Kiev	Kiev, USSR
	11,715	R. TV Belge	Brussels, Belgium
	11,730(2,5,7)	R. Kiev	Kiev, USSR
	11,837	V. Evangelique, 4VEH	Cap Haitien, Haiti
	12,010(2,5,7)	R. Kiev	Kiev, USSR
	15,285*	Vatican R.	Vatican City
	6,130*	R. Nacional Espana	Madrid, Spain
8 P.M.	6,234*	R. Budapest	Budapest, Hungary
	9,525	R. Havana Cuba	Havana, Cuba
	9,575*	RAI	Rome, Italy
	9,615	L.V. Victor, TIRICA	San Jose, Costa Rica
	9,730*	R. Berlin International	Berlin, E. Germany
	9,760*	R. Nacional Espana	Madrid, Spain
	9,833*	R. Budapest	Budapest, Hungary
	11,710	All India R.	New Delhi, India
	11,810*	RAI	Rome, Italy
	11,895	All India R.	New Delhi, India
	11,910*	R. Budapest	Budapest, Hungary
	15,160*	R. Budapest	Budapest, Hungary
	15,170*	R. Australia	Melbourne, Australia
	15,235	All India R.	New Delhi, India
	17,705	All India R.	New Delhi, India
	17,785*	R. Australia	Melbourne, Australia
	21,740*	R. Australia	Melbourne, Australia
8:15 P.M.	6,234*	R. Budapest	Budapest, Hungary
	9,510*	BBC Relay	Ascension Is.
	9,600*	R. Moscow	Moscow, USSR
	9,705*	R. RSA	Johannesburg, South Africa
	9,715*	R. RSA	Johannesburg, South Africa
	9,833*	R. Budapest	Budapest, Hungary
	11,730*	R. Moscow	Moscow, USSR
	11,870*	R. Moscow	Moscow, USSR
	11,875*	R. RSA	Johannesburg, South Africa
	11,900*	R. Moscow	Moscow, USSR
	11,910*	R. Budapest	Budapest, Hungary
	11,960*	R. Moscow	Moscow, USSR
	15,160*	R. Budapest	Budapest, Hungary
	15,220*	R. RSA	Johannesburg, South Africa
	15,260	BBC Relay	Ascension Is.
8:30 P.M.	5,930*	R. Prague	Prague, Czechoslovakia
	6,040*	Deutsche Welle	Cologne, W. Germany
	6,075*	Deutsche Welle, DMQ6	Cologne, W. Germany
	6,200	R. Tirana	Tirana, Albania
	7,345*	R. Prague	Prague, Czechoslovakia
	9,507	R. Tirana	Tirana, Albania
	9,535#	Swiss B. C.	Berne, Switzerland
	9,630*	R. Prague	Prague, Czechoslovakia
	9,720	R. Ceylon	Colombo, Ceylon
	9,735*	Deutsche Welle, DMQ9	Cologne, W. Germany
	11,715#	Swiss B. C.	Berne, Switzerland
	15,120	R. Ceylon	Colombo, Ceylon
	15,235*	R. Japan	Tokyo, Japan
	15,305#	Swiss B. C.	Berne, Switzerland
	15,365*	R. Prague	Prague, Czechoslovakia
	17,825*	R. Japan	Tokyo, Japan
8:45 P.M.	3,280	Windward Is. B. S.	St. George's, Grenada
	6,010	BBC Relay	Cyprus
	9,510*	R. Prague	Prague, Czechoslovakia
	9,520*	R. Denmark, OZF5	Copenhagen, Denmark
	9,535#	Swiss B. C.	Berne, Switzerland
	9,625	BBC Relay	Cyprus
	9,700*	R. Moscow	Moscow, USSR
	11,715#	Swiss B. C.	Berne, Switzerland
	11,810*	R. Bucharest	Bucharest, Rumania
	11,870*	R. Moscow	Moscow, USSR
	11,955	BBC Relay	Cyprus
	15,305#	Swiss B. C.	Berne, Switzerland
	15,320*	R. Australia	Melbourne, Australia
	17,725*	R. Japan	Tokyo, Japan
	17,825*	R. Japan	Tokyo, Japan
9 P.M.	3,265	R. Demerara, ZFY	Georgetown, Guyana
	3,280	Windward Is. B. S.	St. George's, Grenada
	6,025#	R. Portugal	Lisbon, Portugal
	7,130	V. Free China, BED7	Taipei, Taiwan
	9,570*	R. Bucharest	Bucharest, Rumania
	9,675	R. del Pacifico, OAZ4L	Lima, Peru
	11,885*	R. Bucharest	Bucharest, Rumania
	11,935#	R. Portugal	Lisbon, Portugal
	15,120	R. Ceylon	Colombo, Ceylon
	15,125#	R. Portugal	Lisbon, Portugal
	15,345	V. Free China, BED49	Taipei, Taiwan
	17,690	R. Cairo	Cairo, UAR
9:15 P.M.	6,070	R. Pakistan	Karachi, Pakistan
	6,130*	R. Nacional Espana	Madrid, Spain
	7,135	R. Pakistan	Karachi, Pakistan
	9,710#	R. Sweden	Stockholm, Sweden
	15,250*	R. Bucharest	Bucharest, Rumania
	15,320*	R. Australia	Melbourne, Australia
	15,520	R. Pakistan	Dacca, Pakistan

TIME (EST)	FREQ.	STATION (CALL)	LOCATION
9:30 P.M.	5,025	Southern Cross R., CP75	La Paz, Bolivia
	6,040*	Deutsche Welle	Cologne, W. Germany
	9,715+	R. RSA	Johannesburg, South Africa
	9,745	V. Andes, HCJB	Quito, Ecuador
	11,765	Southern Cross R., CP39	La Paz, Bolivia
	11,775*	Trans World R.	Bonaire, Neth. Antilles
	11,875+	R. RSA	Johannesburg, South Africa
	15,170*	R. Lebanon	Beirut, Lebanon
9:45 P.M.	6,200	R. Tirana	Tirana, Albania
	9,735*	Deutsche Welle, DMQ9	Cologne, W. Germany
	15,170*	R. Lebanon	Beirut, Lebanon
10 P.M.	6,060	RAI	Caltanisetta, Sicily
	6,110*	BBC	London, England
	6,130*	R. Nacional Espana	Madrid, Spain
	6,234*	R. Budapest	Budapest, Hungary
	7,130	V. Free China, BED7	Taipei, Taiwan
	9,510*	BBC Relay	Ascension Is.
	9,580*	BBC	London, England
	9,645	Faro del Caribe, TIFC	San Jose, Costa Rica
	9,683	RAE	Buenos Aires, Argentina
	9,705+	R. RSA	Johannesburg, South Africa
	9,720	R. Ceylon	Colombo, Ceylon
	9,760*	R. Nacional Espana	Madrid, Spain
	9,780	R. Peking Relay	Tirana, Albania
	9,833*	R. Budapest	Budapest, Hungary
	11,730#	R. Nederland Relay	Bonaire, Neth. Antilles
	11,775*	Trans World R.	Bonaire, Neth. Antilles
	11,840*	R. Portugal	Lisbon, Portugal
	11,875+	R. RSA	Johannesburg, South Africa
	11,900*	R. Moscow	Moscow, USSR
	11,955	BBC Relay	Cyprus
	15,120	R. Ceylon	Colombo, Ceylon
	15,125	V. Free China, BED60	Taipei, Taiwan
	15,220+	R. RSA	Johannesburg, South Africa
	15,345	V. Free China, BED49	Taipei, Taiwan
	15,430*	V. Free Korea, HLK41	Seoul, S. Korea
	17,720	V. Free China, BED39	Taipei, Taiwan
10:15 P.M.	5,955	R. Cultural, TGNA	Guatemala City, Guatemala
	6,234*	R. Budapest	Budapest, Hungary
	9,570*	R. Bucharest	Bucharest, Rumania
	9,600*	R. Moscow	Moscow, USSR
	9,645	Faro del Caribe, TIFC	San Jose, Costa Rica
	9,700*	R. Moscow	Moscow, USSR
	9,720	R. Ceylon	Colombo, Ceylon
	9,833*	R. Budapest	Budapest, Hungary
	11,730#	R. Nederland Relay	Bonaire, Neth. Antilles
	11,775*	Trans World R.	Bonaire, Neth. Antilles
	11,840*	R. Portugal	Lisbon, Portugal
	11,870*(?)	R. Warsaw	Warsaw, Poland
	11,900*	R. Moscow	Moscow, USSR
	11,910*	R. Budapest	Budapest, Hungary
	15,120	R. Ceylon	Colombo, Ceylon
	15,430*	V. Free Korea, HLK41	Seoul, S. Korea
10:30 P.M.	3,300	R. Belize	Belize, Br. Honduras
	4,820	R. Evangelica HRVC	Tegucigalpa, Honduras
	5,930*	R. Prague	Prague, Czechoslovakia
	5,955	R. Cultural, TGNA	Guatemala City, Guatemala
	5,980	R. Nacional El Salvador, YSS	San Salvador, El Salvador
	6,040	L.V. Tolima, HJLB	Ibague, Colombia
	9,555	R. Nacional El Salvador, YSS	San Salvador, El Salvador
	11,920*	V. Andes, HCJB	Quito, Ecuador
	11,990*	R. Prague	Prague, Czechoslovakia
	15,255*	V. Andes, HCJB	Quito, Ecuador
	15,430*	V. Free Korea, HLK41	Seoul, S. Korea
	17,860+	R. Moscow	Moscow, USSR
	3,300	R. Belize	Belize, Br. Honduras
10:45 P.M.	4,820	R. Evangelica HRVC	Tegucigalpa, Honduras
	5,930*	R. Prague	Prague, Czechoslovakia
	6,025+	R. Portugal	Lisbon, Portugal
	7,345*	R. Prague	Prague, Czechoslovakia
	9,540*	R. Prague	Prague, Czechoslovakia
	11,705+	R. Sweden	Stockholm, Sweden
	11,920*	V. Andes, HCJB	Quito, Ecuador
	11,935+	R. Portugal	Lisbon, Portugal
	15,255*	BBC Relay	Cyprus
	11,990*	R. Prague	Prague, Czechoslovakia
	11,955	V. Andes, HCJB	Quito, Ecuador
	15,260	BBC Relay	Ascension Is.
	15,430*	V. Free Korea, HLK41	Seoul, S. Korea
11 P.M.	4,855	R. Clube Mozambique	Lorenco Marques, Mozambique
	4,967	Kuwait B. S.	Kuwait
	4,976	R. Uganda	Kampala, Uganda
	5,026	R. Uganda	Kampala, Uganda
	6,050	R. Clube Mozambique	Lorenco Marques, Mozambique
	9,560*	R. Sofia	Sofia, Bulgaria
	9,620*	R. Sofia	Sofia, Bulgaria
	9,680	R.V. Gospel, ETLF	Addis Ababa, Ethiopia
	9,700*	R. Sofia	Sofia, Bulgaria
	15,340	RAI	Rome, Italy
	15,430*	V. Free Korea, HLK41	Seoul, S. Korea
	17,750	Kuwait B. S.	Kuwait
	17,795	RAI	Rome, Italy
	21,560	RAI	Rome, Italy
11:15 P.M.	4,855	R. Clube Mozambique	Lorenco Marques, Mozambique
	4,967	Kuwait B. S.	Kuwait
	6,025+	R. Portugal	Lisbon, Portugal
	6,050	R. Clube Mozambique	Lorenco Marques, Mozambique
	6,234*	R. Budapest	Budapest, Hungary
	7,115*	Thai National B. S.	Bangkok, Thailand
	7,270	R. RSA	Johannesburg, South Africa
	9,525	R. RSA	Johannesburg, South Africa
	9,680	R.V. Gospel, ETLF	Addis Ababa, Ethiopia
	9,833*	R. Budapest	Budapest, Hungary
	11,900	R. RSA	Johannesburg, South Africa
	11,910*	Thai National B. S., HSK9	Bangkok, Thailand
	11,935+	R. Portugal	Lisbon, Portugal
	15,125+	R. Portugal	Lisbon, Portugal
	15,160*	R. Budapest	Budapest, Hungary
11:30 P.M.	3,380	Malawi B. S.	Blantyre, Malawi
	4,845	R. Botswana	Gaberones, Botswana
	4,855	R. Clube Mozambique	Lorenco Marques, Mozambique
	4,932	Nigerian B. C.	Benin City, Nigeria
	5,990	RAI	Rome, Italy
	6,050	R. Clube Mozambique	Lorenco Marques, Mozambique
	7,115*	Thai National B. S.	Bangkok, Thailand
	9,530*	R. Moscow	Moscow, USSR
	9,565	Deutsche Welle, DMQ9	Cologne, W. Germany
	11,890*	R. Moscow	Moscow, USSR
	11,910*	Thai National B. S., HSK9	Bangkok, Thailand
	15,180*	R. Moscow	Moscow, USSR
	17,945	R. Pakistan	Karachi, Pakistan
	21,590	R. Pakistan	Karachi, Pakistan
11:45 P.M.	3,285	South African B. C.	Johannesburg, South Africa
	4,845	R. Botswana	Gaberones, Botswana
	4,855	R. Clube Mozambique	Lorenco Marques, Mozambique
	6,050	R. Clube Mozambique	Lorenco Marques, Mozambique
	6,145*	Deutsche Welle, DMQ	Cologne, W. Germany
	7,301	R. Biafra	Orlu, Biafra
	9,510*	R. Bucharest	Bucharest, Rumania
	9,545*	Deutsche Welle, DMQ9	Cologne, W. Germany
	11,780	R. Clube Mozambique	Lorenco Marques, Mozambique
	15,250*	R. Bucharest	Bucharest, Rumania

Soldering Iron Care

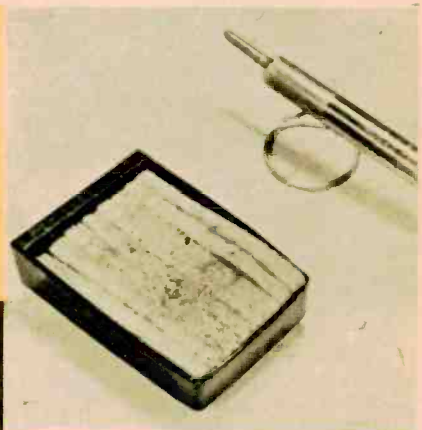
JUST as a shootin' iron was essential to the well being of the wild-west cowboy, so the soldering iron is vital to every electronics experimenter. Proper care of a soldering iron means keeping the tip clean and bright to get maximum heat transferred from the heating element to the connection being soldered.

To win this battle you must fire the first shot—tin the tip! This is a matter of coating the tip with a layer of solder which gives the tip greater heat-transfer ability and protection. First, clean the tip with soldering paste. After the iron comes up to full heat, plunge the tip into the can of paste. After a few seconds of sizzling, apply a liberal amount of rosin-core solder to the tip then shake off the excess solder. If you see any spots where solder did not adhere, apply more. After the tip is completely coated, wipe it with a rag to remove excess solder and the tinning job is done. To keep the tip clean, wipe it off on steel wool, a rag or a wet sponge after each connection you solder. If after repeated use a film of corrosion builds up, retin the tip once again.

If the tip becomes pitted and worn, file away the rough edges to restore the original shape. But before filing a tip, make sure it is copper. Some irons have iron-plated tips that must not be filed—to do so will ruin them. Follow the special tinning and cleaning instructions that come with these irons.

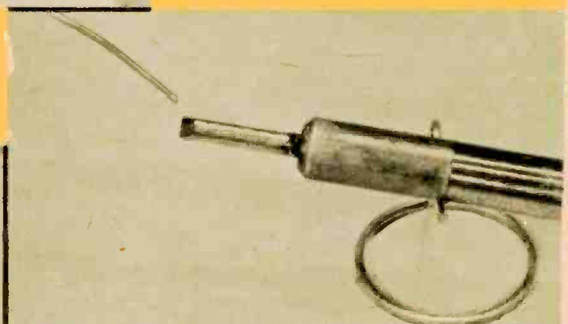
—*Marshall Lincoln*

A well-tinned and shaped tip. If the tip becomes pitted and very dirty it should be filed—but only if it's copper. Don't file iron-plated tip like this.



To keep a tip clean during use, wipe it on a damp sponge after each connection is soldered. This sponge and a plastic holder are made by Ungar.

Tip must be free of oxidation deposits before tinning. Clean it by plunging in can of soldering paste.



After tip has been cleaned, coat it with solder and wipe off excess. A smooth coating of solder will mean a good electrical connection.

BFO for Any Radio

By BUD MICHAELS, WB2WYO

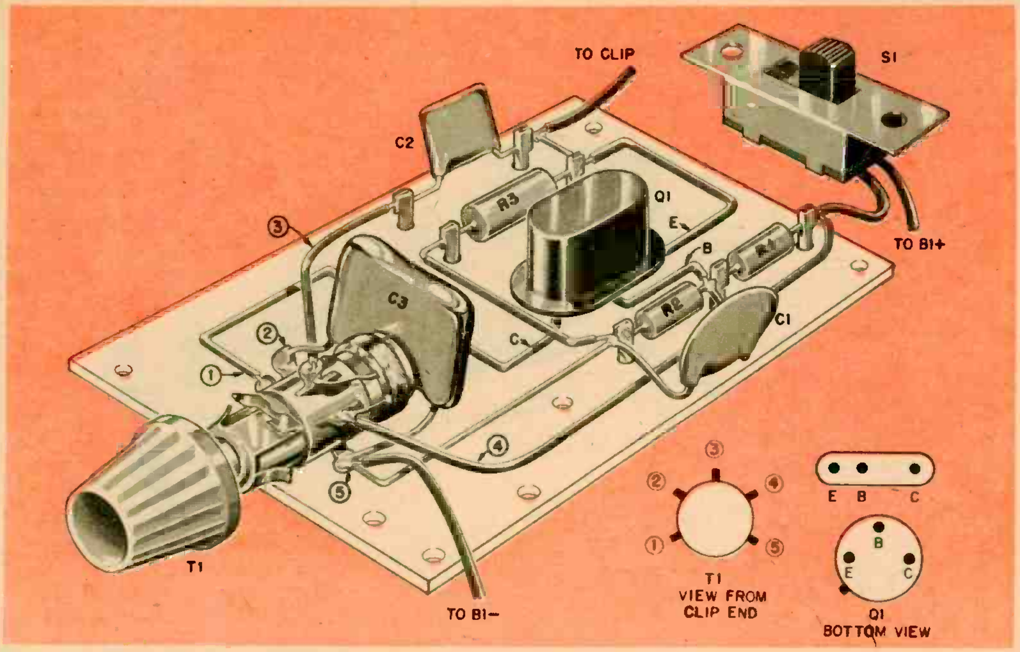
INTEREST in listening to short wave and hams has increased enormously. One of the reasons for this is the inclusion of short-wave bands in pocket (and larger) transistor radios. Scan a dealer's shelves of such radios and you'll notice just about every other set is equipped to tune short wave in addition to the broadcast, and possibly, FM bands.

One thing that always comes as a surprise when tuning ham frequencies is to hear chatter that sounds like Donald Duck, and *pfftt—pfftt* noises. The former are single-sideband (SSB) signals, the latter are code (CW) transmissions.

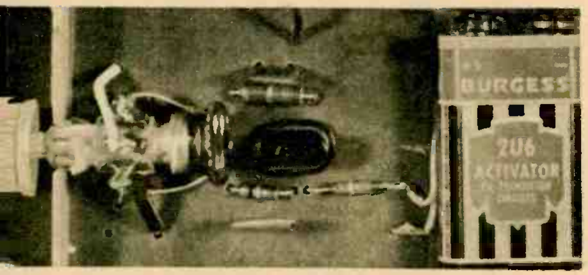
To make something out of an SSB signal, the carrier that was removed at the transmitter must be replaced at the radio. To turn CW signals into code tones, the unmodulated carrier must beat against another signal. Our BFO (beat frequency oscillator) does these things by generating a signal around 455 kc, the IF frequency of most general-coverage receivers. The signal is radiated into the radio where it beats against the received signal in the IF strip.

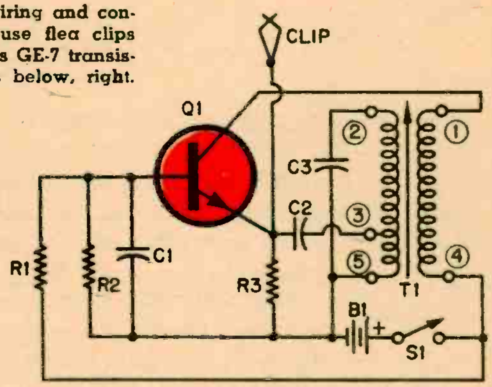
Construction. The parts for our BFO fit in a 4¾ x 2 x ⅞-in. plastic box. All components except the switch and battery can be mounted on a 1⅞ x 2½-in. board. If you choose the author's construction technique, drill 1/16-in. dia. holes in the board and slip the wires from the components through. Otherwise, use perforated board and flea clips. The coil is held in place by its wires. The switch can be glued to the box cover.

The coil has an adjustable slug, but no brass shaft; you must fit a screwdriver directly in the slug to tune it. You can make a tuning shaft by epoxying a plastic drinking straw to the slug.



Author drilled holes in board in his model and put wiring and connections underneath (below). Other technique is to use flea clips and perforated board (above). Base diagram of author's GE-7 transistor is at top in lower right of pictorial. Schematic is below, right.





BFO for Any Radio

PARTS LIST

B1—9 V battery
C1—.02 µf, 25 V or higher disc capacitor
C2—.01 µf, 25 V or higher disc capacitor
C3—470 µµf, 25 V or higher disc capacitor
Q1—General-purpose NPN transistor (GE-7, 2N1087, 2N170, etc.)
R1—22,000 ohm, ½ watt, 10% resistor
R2—10,000 ohm, ½ watt, 10% resistor
R3—1,500 ohm, ½ watt, 10% resistor
S1—SPST toggle or slide switch
T1—Miniature transistor-oscillator coil (J. W. Miller 2020, Allied 54 C 0895)
Misc.—Plastic box, perforated circuit board, flea clips, alligator clip

Tune Up. Adjust the tuning knob so the slug is at the bottom of the core. Place the BFO next to a radio with the clip lead on or near the radio's antenna. Tune in a local station. Turn on the BFO—you should hear a whistle from the radio. Adjust the BFO's tuning knob until the whistle is very strong. You should be able to tune the BFO from a high-pitch whistle through a null back to a high pitch again while turning the knob in the same direction. Adjust the knob to produce the zero beat.

Using the BFO. Tune the bands and listen for what sounds like Donald Duck chatter. Turn on the BFO and tune it very slowly until the chatter becomes intelligible.

CB Corner

By Len Buckwalter, KQA5012

Special Status For Channel 9

IT'S OFFICIAL! Channel 9 has been set aside for emergency communications only. Reversing years of opposition to the use of CB channels for special purposes, the FCC has restricted the use of 9 to these special circumstances:

1. Emergency communications involving the safety of life or protection of property.

2. Communications necessary to render assistance to a motorist.

To prevent confusion over the definition of an emergency message, the FCC stressed that the message must have a direct relation to the safety of individuals and could not be warnings in general. Similarly, motorist assistance messages must aid a particular driver in distress.

Under these guidelines, the FCC considers the following messages acceptable on the newly designated 9:

There is a fire in the building on the corner of 6th and Main St.

Base to Unit 1. The Weather Bureau has just issued a thunderstorm warning. Bring the sailboats into port.

There has been a four-car collision at Exit 10 on the Beltway. Send police and an ambulance.

I am out of gas on Interstate 95.

A tornado has been sighted six miles north of town.

These messages would *not* qualify for transmission on Channel 9:

This is Observation Post 10. No tornados sighted.

Traffic is moving smoothly on the Beltway.

I am out of gas in my driveway.

In simpler terms, the FCC says messages should be transmitted on 9 under certain priorities. The most urgent messages would relate to an existing danger, like a fire or auto accident. Just below this would be communications relating to a potentially hazardous situation such as a car stalled in a dangerous place, a lost child or a boat out of gas. Following in priority would be assistance calls for a disabled vehicle and, at the bottom of the list, transmission of road and street instructions to a motorist.

In settling the matter, the Commission stressed that 9 may not be used as a non-emergency calling channel. Some groups urged that they be allowed to call a station on 9 and then give instructions to switch to a different channel to conduct communications. It was argued that a call on 9 could raise a station engaged in monitoring for emergencies. The Commission quashed the request and cited the fact that every one of the many comments from public-safety officials opposed general calling. The Commission feels that support from these agencies could be valuable if they decide to monitor 9 on a 24-hour basis.

Several other changes follow in the wake of the new rule. Since 9 is effectively removed as a frequency for interstation traffic (units of a different call sign) there will be a replacement frequency. Channel 15 has been authorized for interstation use.

Requirements to report emergency communications to the FCC are relaxed under the new rule. You will not have to notify the FCC in Washington unless the emergency extends over a period of 12 hours or more.

Now that the law is on the books, the big question is what CBers will do with it. Few can dispute the fact that highway assistance is desperately needed and that volunteer CBers by the thousands are eager to help. No one has much to complain about in the legal department. This is the first upbeat ruling the Commission has made about CB in my memory. This summer we'll be listening for blissful silence on 9—punctuated, hopefully, by CBers riding to the rescue.

Not So Brushless . . . The alternator spun into most new cars about 10 years ago. But someone circulated the notion that alternators don't interfere with a mobile CB rig.

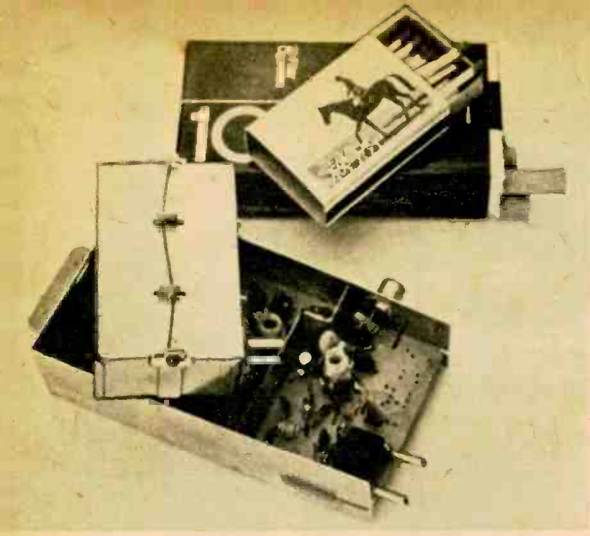
But let a couple months roll by and alternators often turn static-y as generators. It's the old brush problem again. Tucked between an alternator's stator and rotor (comparable to the old field and armature) are carbon brushes that slide over slip rings.

Some CBers try alternator filters with varying success. But the best cure would begin when the car is tuned up. The serviceman should clean the slip rings and renew the brushes if they're half worn. Poor spring tension on brushes is another factor.

Tune in...

11 ISSUES

A special money-saving offer to readers of Electronics Illustrated from our companion publication, Mechanix Illustrated—perennially America's favorite how-to-do magazine. You'll find every issue chock full of the kind of informative and useful articles the modern man needs to keep up with his complex world. Look to MI when it comes to buying or taking care of a car, modernizing a home, doing workshop projects, staying abreast of the fun vehicle scene, camping...or just coping effectively with the ever-changing world.



TV Goes

After numerous false starts it now looks mechanical tuning and a loud hello to

At left, mini-sized UHF TV tuner manufactured by Standard Kollsman Industries. Employing varactor-controlled tuning, device is about size of matchbox.

By FOREST H. BELT

THE FCC finally has put its foot down. UHF TV tuners soon will have to tune as easily as the VHF variety. This means no more manipulating to get the right UHF channel. Problem is, manufacturers don't want any part of a detent tuner that covers channels 14 to 83; they can't afford it and no one needs it.

TV manufacturers have only a little time to comply, the deadline is just a few months away. While certain schemes to accomplish UHF/VHF equity are already in production, they're limited methods—little more than mechanical gadgetry. Design engineers concerned with the long-term feasibility of a new UHF tuning method are pinning their hopes on a tiny semiconductor that has been stealing the limelight from integrated circuits—the varactor diode.

New Breed. A varactor diode is made by diffusing p-and n-type silicon materials together. These two blocks of silicon have been *doped* so as to obtain an excess of charges of opposite polarity (n vs. p). The two blocks behave like the metal plates of a variable capacitor. However, instead of having an insulator such as air between metal plates, the diode has a *junction* which separates the two blocks of doped silicon. Upon application of a reverse bias, the junction becomes a nonconductive depletion layer (see Fig. 1).

As the reverse bias is increased, the depletion layer enlarges, further separating the "plates" of the diode capacitor. Capacitance is then reduced.

A standard value of capacitance is stipulated for a specific voltage by diode manufacturers. The capacitance then varies above and below that value as bias is decreased or increased. Forward bias isn't used. Typical voltages for varactors lie between 2 and 30 V. While capacitance values and ranges depend on the application, most varactors are below 500 $\mu\mu$f.

Varactors have several names. They are called capacitance diodes, variable-capacitance diodes, voltage-variable-capacitance diodes, voltage-variable diodes, voltage-variable capacitors and tuning diodes. They are also marketed under several brand names: Varicap, Epicap, Minicap, Voltacap, Capistor and Varactron to name a few.

The silicon material used in a varactor must be carefully doped and the junction carefully formed, otherwise capacitance won't change uniformly with voltage (see Fig. 2). Uniform production of varactors has been a headache for U.S. manufacturers. Until lately, only German and Japanese firms have been able to get uniformity in their diodes.

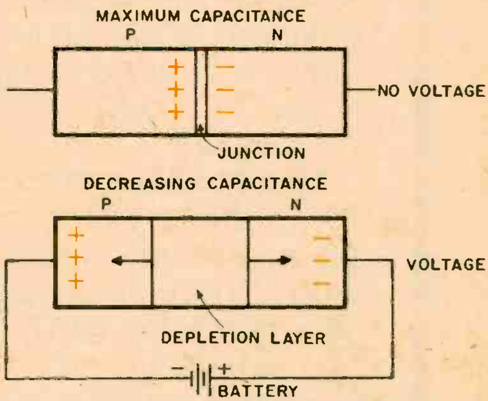


Fig. 1—Varactor diodes are diffused from n- and p-type silicon. Two blocks of silicon are separated by insulating region which is enlarged by voltage.

Tuning Electronic

like we can say goodbye to old-time voltage-variable-capacitance diodes!

At right, new varactor diode manufactured by KEV Electronics Corp. is shown being lifted out of tuner assembly. Diode should make UHF tuning easier.

A good number of European TV receivers have been tuned by these diodes for several years. With fewer channels to contend with (European programming is limited), the limited capacitance spread of the varactors wasn't a problem. American sets, however, practically burst at the seams with programming so American manufacturers have had to cool their heels until the right diodes appeared on the market.

Now that Japanese TV sets have varactor tuning,. U.S. producers—who have until now only toyed with the idea—feel the hot breath of the competition on the backs of their necks. It's a matter of stepping up or losing more of the market.

Motorola, Standard Kollsman, Texas Instruments and a Massachusetts company called KEV Electronics say their varactor-producing facilities are now in high gear. Others are trying. By the end of this year designers hope to have a wholly domestic supply of inexpensive, dependable varactors for TV tuners.

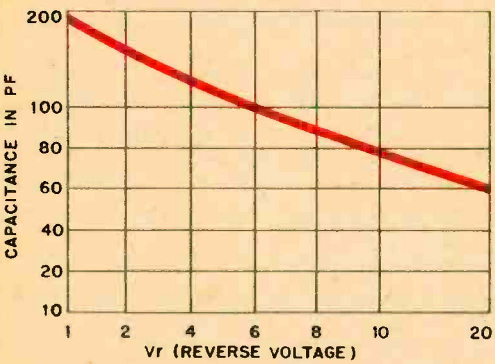


Fig. 2—Doping of silicon and formation of junction is critical if capacitance is to change uniformly with the voltage. The curve is of a Motorola diode.

Stereo Was First. Like a shot from the blue, the hi-fi industry used electronic tuning before TV people ever knew they were in a semiconductor age. Glamour innovations usually occur first in TV; this time, some top-of-the-line stereo receivers stole the show.

One stereo-FM receiver which uses varactors is the Fisher 500-TX. The diodes form part of an elaborate front-end that reduces crosstalk and noise by using dual-gate field-effect transistors. Fig. 3 is a simplified diagram of the RF and oscillator stages.

Four of the varactors are special back-to-back types. A fifth varactor is used for automatic frequency control (AFC). The common cathode of each back-to-back varactor receives the DC tuning voltage. Voltage is more positive for a higher frequency (greater reverse bias and therefore less capacitance).

Remote Control. A varactor tuner offers unique advantages because it requires only an adjustable voltage to alter frequency. One is convenient remote control. The tuning voltage can come from anywhere; only DC flows through the wires.

Another innovation made possible is all-electronic signal seeking. Stations on the Fisher tuner can be selected automatically. This is also true for Bogen's Model DB240 receiver. A simplified diagram (Fig. 4) shows how Bogen does it.

The DC voltage for the varactors is produced by current flowing in transistor Q6. The voltage stored across C3 controls Q6's conduction point. For manual tuning, potentiometers adjust the voltage across C3.

For automatic tuning, transistors Q4 and Q5 are connected across the 30-VDC supply.

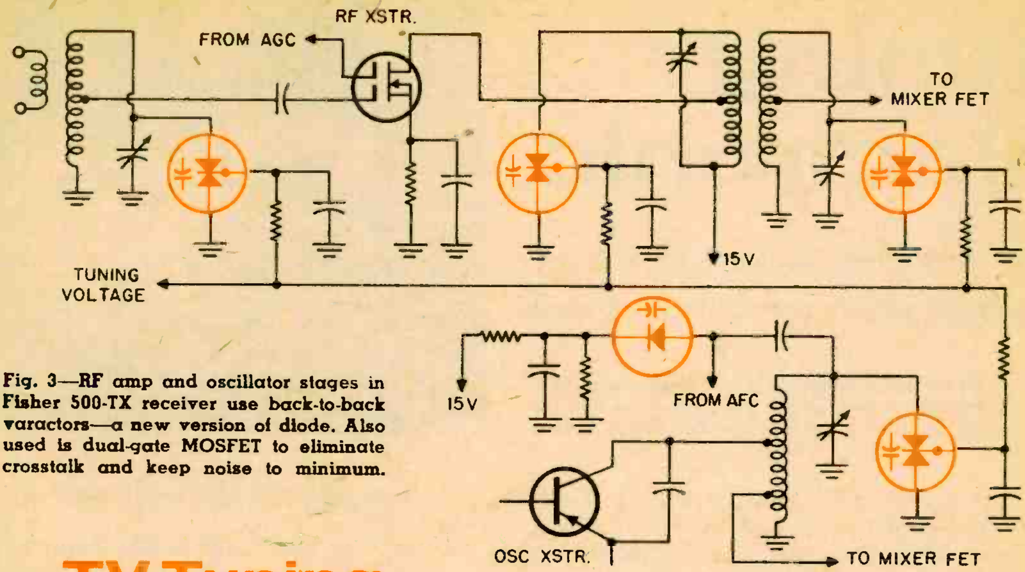


Fig. 3—RF amp and oscillator stages in Fisher 500-TX receiver use back-to-back varactors—a new version of diode. Also used is dual-gate MOSFET to eliminate crosstalk and keep noise to minimum.

TV Tuning Goes Electronic

When Q5 is operating, its current charges C3; conversely, current from Q4 discharges C3. A flip-flop stage (Q7 and Q8) determines which transistor is operating.

Suppose a listener pushes the *up* button. The flip-flop operates Q5, C3 charges and the voltage developed by Q6 goes up. More voltage applied to the tuner's varactors reduces their capacitance and raises the frequency.

The *down* button has an opposite effect. The flip-flop operates Q4, capacitor C3 discharges and DC from Q6 goes down—the varactors now have increased capacitance so frequency is lowered.

The search has to be stopped when a station is encountered. That's the job of transistors Q1, Q2 and Q3. As a station is tuned the ratio-detector S-curve voltage is applied to FET Q1. This allows either Q2 or Q3 to neutralize Q4 or Q5 (by shutting off current), stopping whichever is operating. The charge on capacitor C3 holds steady and the tuner stays on the station.

If the electronic tuner reaches one end of the dial without encountering a station, a set of diodes reverses the flip-flop and the frequency search goes in the other direction.

The tuning dial of the Bogen DB240 is a voltmeter. There is no cord, track or pulleys. At the low end of the band, 4 V tunes the varactor front-end to 88 mc; 24 V tunes it to 108 mc. The meter scale card is calibrated in mc instead of volts.

Hi-fi wasn't the only field to first use varactors. Varactors are used in communications gear, too. A Gonset single-sideband transceiver has one in its VFO. This makes incremental tuning (a form of digital tuning) possible. A switch sets a voltage range for one segment of the tuning band and a potentimeter fine tunes the exact voltage for the varactor.

Varactors also have shown up in test equipment. One example is the B&K Model 415 television sweep generator. A 60-cps voltage applied to a varactor swings the IF or RF frequency up and down. This is a tremendous improvement over the old electromechanical, vibrating capacitor plate. And it's more efficient and economical than the saturable inductor which has been used recently in sweep generators.

Television Tuners. Only three set-makers have demonstrated varactor tuners in this country. So far, none is a U.S. company. One is Panasonic (Japan); another is Telefunken (Germany); the third, Electrohome (Canada). The Telefunken set can't be bought here.

Panasonic produces its own variable-capacitance diodes. Interestingly, the Panasonic tuner also is band-switched by diodes, further simplifying the tuner. One stage of the Panasonic tuner is illustrated in Fig. 5.

The channel-tuning inductances in this RF amplifier stage are coil L1 and transformer

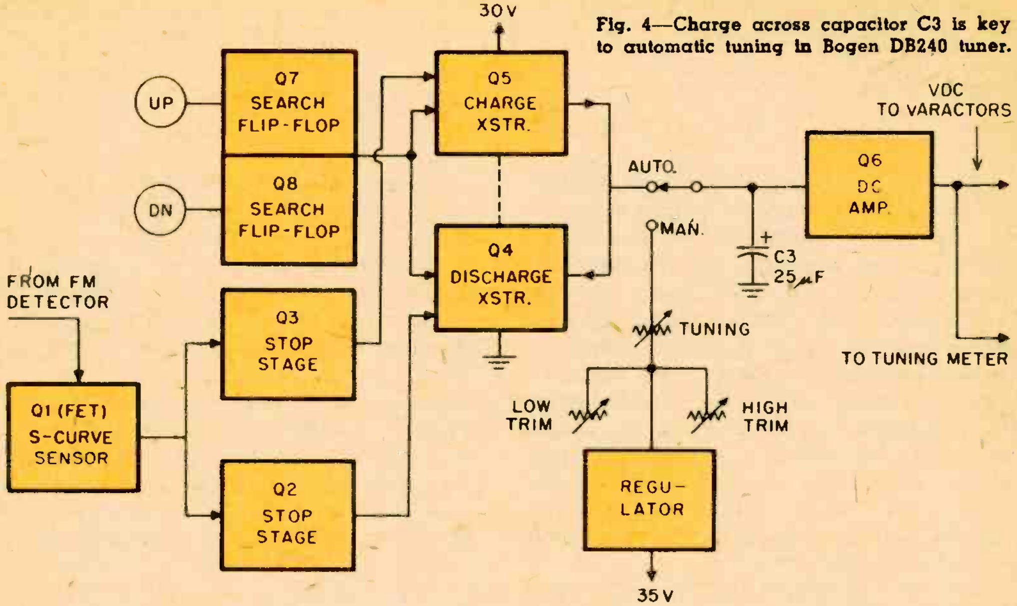


Fig. 4—Charge across capacitor C3 is key to automatic tuning in Bogen DB240 tuner.

T2. The windings of both components are tapped. Trimmers C6 and C7 are part of the tuning capacitance—most of it is in varactors D4 and D5 (shown in color). C4 and C5 are large values; they ground the varactor's anodes for a signal.

The DC tuning voltage (applied to D4 and D5 through R4 and R5) comes from potentiometers—there's one for each position of the channel knob. Each pot sets the voltage so the varactors tune in a specific channel.

For high-band VHF, contacts on the channel selector apply −1 V to switching diodes D1, D2 and D3. That forward-biases them. The diodes ground the taps on L1 and T2 through the large values of C1, C2 and C3, so only a part of each winding is in the tuning circuit. For low-band VHF, the contacts apply +5 V to the three diodes. Reverse-biased, they are open, so the full inductances of L1 and T2 tune the RF stage.

How come no American TV sets have varactor tuning? As we've said, the diodes have been a problem. European suppliers boiled down to two firms: Intrachem (a subsidiary of ITT) and Siemens (in Germany). They couldn't possibly turn out enough diodes to satisfy the demand if all U.S. tuner-makers started making varactor models.

That's not the only rub. U.S. manufacturers have spent a lot of effort ridiculing varactor tuners. Too expensive, unreliable, not wanted, they said. The story has changed

[*Continued on page* 101]

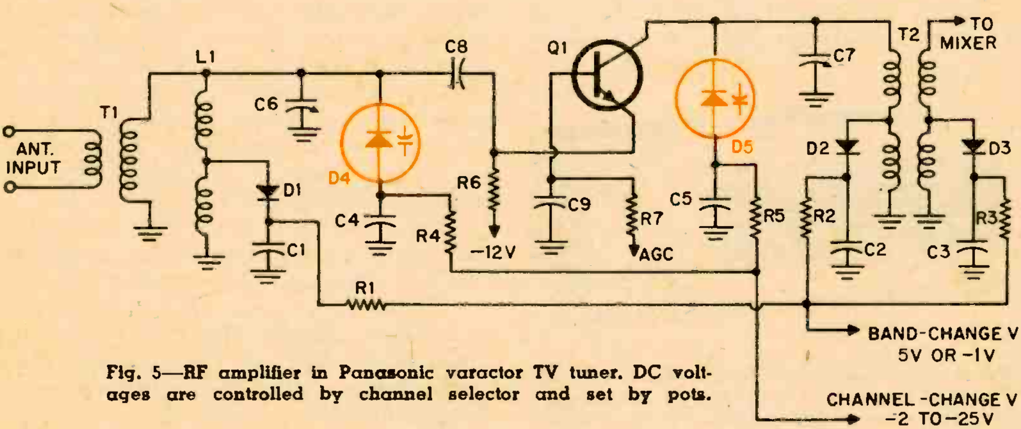


Fig. 5—RF amplifier in Panasonic varactor TV tuner. DC voltages are controlled by channel selector and set by pots.

Hi-Fi Today

By John Milder

Escalating The War With Japan

PANASONIC's recent entry into the component hi-fi business with items such as a receiver costing $1,000 (see picture below) has made me wonder about the future of audio manufacturers in this country. In case you haven't been shopping lately, Japanese equipment has almost displaced American-made components in many audio stores. In the big electronic parts houses (Radio Shack in particular) house-brand stereo components that are made in Japan are practically the only kind you can find. The Japanese may not have made a dent in turntables and speakers, but they have given just about everything else their attention.

This isn't to suggest that we throw up a blockade to protect some infant industry. Audio just isn't. The fact is that Joe Consumer has profited from the Japanese invasion. Aside from this—and protection never works anyway—the irony of the situation is that such a blockade would hurt U.S. audio manufacturers, who rely on Japan as much as saki drinkers do.

Japanese subassemblies such as FM front-ends, IF strips, amplifier modules and so on have been a staple in American components since 1964. In the past two or three years the amount of American brand equipment that is manufactured from ground zero in Japan has become staggering. Harman-Kardon is the latest to have their receivers assembled under the Rising Sun and the list of manufacturers to rely on Japanese industry runs the gamut from the makers of low-price house-brand equipment (such as Olson) to makers of higher price prestige gear.

Panasonic's latest entry is the Model SA-4000. It's a 60-watt (rms) per channel (8 ohms) stereo FM receiver with automatic tuning. Price, $1,000.

The signs are now clear that audio is becoming as much the province of the Japanese as the photographic market previously had. It makes you wonder what we might accomplish by following the Japanese pattern of having no war research to preoccupy her engineers, and no war production for her factories.

There is no denying the performance of Japanese equipment, and its tremendous value (particularly in watts-per-dollar). It also comes with thoughtful amenities such as extra inputs and outputs on receivers that allow them to be used as separate preamps or power amps. We should see this on more domestic equipment. The quality control of Japanese gear has been generally outstanding, probably because of the rigid requirements in Japan for the export of all precision goods.

For a long time now, it's bugged me that most tape recorder manufacturers turn out decks heavy on marginal features such as automatic reversing and sound-on-sound, but are not so quick to provide some really useful performance details. It has been impossible, for instance, for most recording enthusiasts to deal with the fact that tapes have different response characteristics. Far from being an esoteric detail, these variations can produce as much as 3-4db of difference in a recorder's performance at the high end.

I'm glad to say that something is finally being done, with the arrival of premium tape formulations for cassettes. This tape varies considerably from the garden variety in terms of biasing and equalization requirements. Concord's new F-106 cassette deck provides a switch to let the user select the correct bias for regular and wideband, low-noise tape such as TDK. Advent's Model 200 cassette unit provides a bias switch which can be set for regular, TDK-type, or the new chromium-dioxide (CrO_2) tapes.

But the amenity is also important for open-reel decks, and its good to see it appear in the new Wollensak 6250 recorder. Now that the ice is broken, I hope other manufacturers will follow quickly. Matching a tape machine to the tape you have available is as important as anything else in the production of high-fidelity recordings.

No, it's not the sun rising above San Francisco. Spot of light on horizon has a more earthly source: an Electro-Optics LAS-2002 laser.

A Death Ray on Every Doorstep?

By JORMA HYYPIA

Lasers are becoming more powerful, more efficient, more deadly!

PREPARE yourself. In the near future you may come face to face with a laser when you least expect it. It could happen in your dentist's office, in school, in a factory—or most probably, during your stint in the armed forces. Skeptical? Then take a look at what has been happening:

• In August 1969, after the flight of Apollo 11, American scientists aimed a laser beam at a reflector placed on the moon's surface by Commander Neil A. Armstrong during the first moon walk. Measurements made with a laser at the University of Texas' McDonald Observatory on Mount Locke showed that the moon is about 131 ft. farther from the earth than previously thought. This experiment may continue for as long as 10 years; the laser beam travels a round-trip distance of 464,542 mi.

• French scientists, using what may be the world's most powerful laser, succeeded, during 1969, in generating tiny thermonuclear explosions in a laboratory. This fusion of deuterium nuclei (using the beam of a neodymium laser located at the Limeil Weapons Research Center operated by the French AEC near Paris) simulates the release of energy in the hydrogen bomb and in stars. The French laser is said to deliver a pulse of up to 50 billion watts within five-billionths of a second; it can be pulsed three times a minute. Such a laser may simplify the design of nuclear weapons.

• Defense officials in the U.S. have concluded that laser guidance—now

Latest applications of lasers: (top left) laser glazing to prevent cavities; (bottom left) filing of 1,000 bits of information in single crystal; (above) laser communications via telescope with Surveyor 7.

Death Ray?

being deployed in Vietnam—is the cheapest method of delivering bombs on targets. The F-4, OV-10 and F-104 are principal aircraft outfitted so far with a laser-guided bombing system. Bulldog missiles—the laser version of the Bullpup—could go into action this fall under a Navy contract. And the U.S. Air Force, at a base in New Mexico, is going full speed ahead with a laser weapons program bearing the code name *Eighth Card*. Latest success: a drone was shot down using a laser antiaircraft gun.

Of course, there are as many peaceful uses for lasers as there are death rays. Before we take a brief look at the world of tomorrow, let's review the basic principle behind the laser.

How They Work. The laser is not just one instrument. It is a family of related devices that provide *l*ight *a*mplification by *s*timulated *e*mission of *r*adiation (hence the acronymn LASER). Basically, lasers are devices which emit light in a highly controlled and artificial manner, much like a photographer's flashbulb as compared with an ordinary lightbulb.

Let's talk about the way you salt your food. You use a salt shaker, right? But look how you use it—you don't just shake it in any direction, but in such a way that you force the salt out along a short linear path.

The salt bounces back and forth between the bottom and the cap of the shaker. But with each shake a small portion of salt escapes through the holes in the cap and keeps on going in the direction your arm was moving. You might call this controlled salt dispensing.

In contrast, uncontrolled dispensing would occur if you were to hold the salt—minus shaker—in the palm of your hand and toss it in the direction of your food. This uncontrolled motion is what happens with ordinary (incoherent) light; the light persists in spreading even though efforts may be made to force it into a narrow beam.

Lasers, however, provide controlled (coherent) light much like a salt shaker. The laser tube (optical salt shaker) is energized

General Telephone & Electronics color-TV projection system. Picture 4-ft. wide is obtained from three laser beams modulated by color signal.

by flashes of light (rather than arm muscle) obtained from a built-in light source. This light source gets things going by jiggling certain types of atoms in the laser tube into excited states (high energy levels). These atoms subsequently revert to less excited states and in so doing give off photons of light.

These photons behave much like salt in a shaker. They bounce back and forth between the two ends of the laser tube until their movements become synchronized. One end of the laser tube also has holes, but they are optical holes achieved with the use of a partially silvered mirror which allows some of the light to pass through (most of it is reflected back toward the rear of the tube where another mirror reflects it back again). As with the salt, the emergent coherent light is released in a narrow stream of individual pulses having such high directionality that it spreads very slightly over long distances.

A ruby rod was used as the optical shaker in the first laser. While a ruby laser produces only pulses of coherent light, there are other types of lasers which can produce beams of continuous radiation. (Non-pulsing beams are more easily produced with gas lasers such as the helium-neon laser.)

All sorts of materials have been made to lase—gases such as carbon dioxide and neon, semiconductor materials, even liquids. Liquid lasers have evoked much interest because they utilize different organic dyes. Just about any desired wavelength of coherent light can be generated simply by choosing the proper kind of dye. Moreover, each dye laser can be tuned to different wavelengths within a limited range, whereas most lasers emit light having one characteristic wavelength.

The output powers of lasers (measured in watts) vary greatly. Some have outputs of only a fraction of a watt. These are strong enough and safe enough for use in such applications as surveying and the study of optics in classrooms. On the other end of the scale are workhorse lasers having outputs of up to 1,000 watts. They not only produce continuous beams of light but also considerable heat energy—enough to burn holes through steel and even diamond. Such lasers are used for cutting, drilling and welding. The lasers which produce billions of watts are pulsed so their outputs are useful for only tiny fractions of a second.

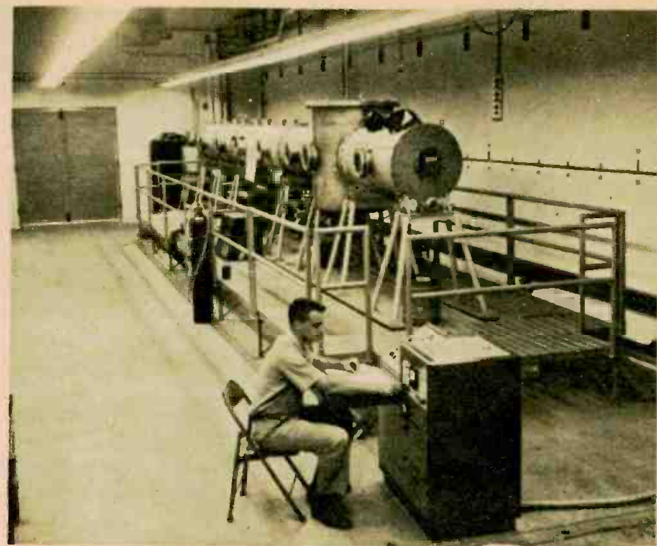
Skin of You Teeth. By 1971 you may open wide to have your teeth zapped with a hot laser beam. The dentist will paint your teeth with a special sodium glazing solution, aim the laser and press a button. It's done in an instant. The laser light will fuse the enamel of your teeth into a hard, decay-resistant coating.

Though it sounds scary, the treatment is painless because each tooth is glazed so quickly—in less than twenty-billionths of a second—that the intense heat hasn't time to penetrate to sensitive nerve endings. The inventor of the process, Dr. Fred M. Johnson of Electro-Optical Systems, claims that teeth glazed with a ruby laser remain undamaged when immersed in solutions which produce cavities in untreated teeth. The treatment shouldn't be expensive since the laser will cost the dentist no more than his present X-ray equipment.

King-Size Color TV. Would you believe that color-TV pictures soon will be projected on outdoor movie screens? It's possible thanks to rapidly advancing laser-TV technology.

General Telephone & Electronics already has developed a successful laboratory model of a laser-TV display system that produces a good quality picture 4-ft. wide. Such a sys-

Death Ray?



High-power laser designed by scientists at Air Force Avionics Laboratory (Aeronautical Systems Div.), Wright-Patterson AFB, Ohio. Specific application for laser isn't designated—most laser projects are classified—but sign on metal tube says Radiation Analyzer.

U.S. Air Force Photo

tem (in a more compact package) should be ideal for classroom TV projection, military training purposes (i.e., providing realistic environments for simulated piloting of aircraft), and applications such as the display of stock market reports and airplane flight schedules and flight patterns.

The GT&E system uses two lasers as light sources: a krypton gas laser for red light and argon gas laser for blue and green light. The primary colors are mixed to obtain the rest of the spectrum. As the light beams pass through electro-optical modulating equipment, signals from a standard color-TV set are impressed on them. The modulated beams are then sent through a complex system of prisms and rotating and vibrating mirrors for a rapid scanning of the projection screen.

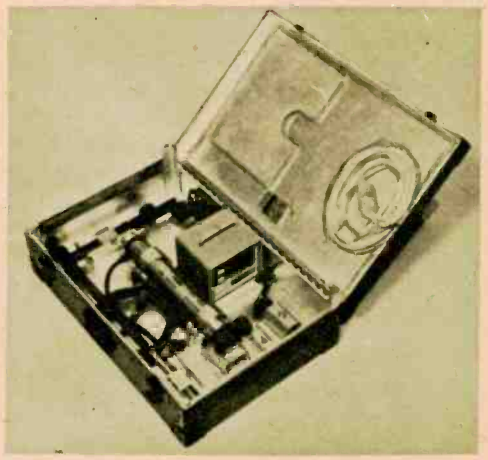
Another company working on a similar laser-TV system is Hitachi, Ltd. of Japan. Hitachi scientists have demonstrated a laser-TV system which produces an image 10-ft. wide. An improved model will be shown at Expo '70 in Osaka.

Death Ray. When the laser was invented a decade ago, many saw it as a possible answer to the long-sought death ray for military use. As we've said, the laser has, indeed, become a death ray of sorts in Vietnam and in the laboratory. Aside from bomb delivery and missile tracking systems, range finders and boresights, the laser has other military applications.

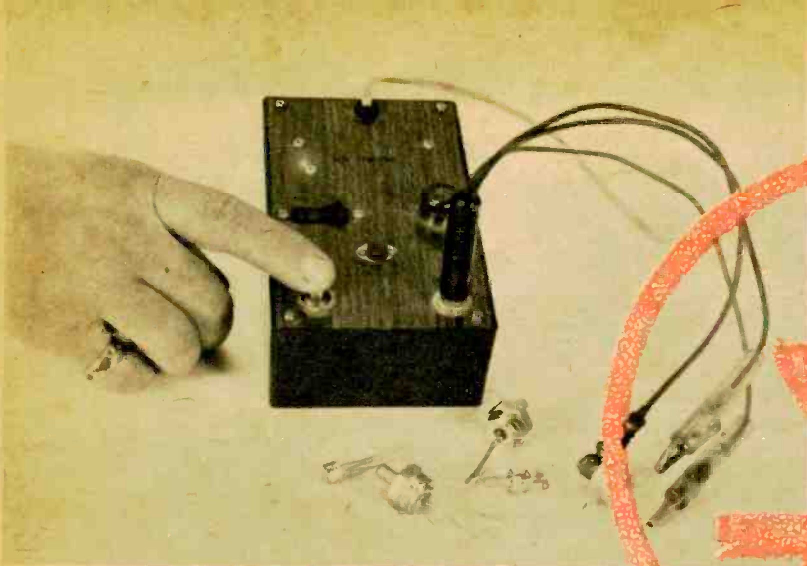
A Direct Fire Simulator (DFS) developed by Holobeam, Inc., enables troops engaged in combat training to fire weapons without the use of live ammunition. The bullet's trajectory is simulated by pulses of laser light. The system—which is capable of firing 6,000 rounds per minute—can be used with a variety of weapons, including the M-14 and M-16 rifles, the T-72 Gatling machine gun, 106-mm recoilless rifles and tank-mounted cannon. The invisible infrared light pulses are intercepted by special detectors which determine whether hits have been made.

The laser has also gone to sea. Following [*Continued on page* 101]

U.S. Air Force Photo



Laser boresight, packaged here for use in the field, reduces manhours required to align weapons and increases accuracy by as much as 50 per cent.




Low-Cost SCR Checker

By GARY McCLELLAN

SCRs have become quite common around the home and shop. Yet it's surprising how few people who work with them own a suitable checker. Although low-cost commercially-made checkers are still not available, you can have a checker of your own for about $5.

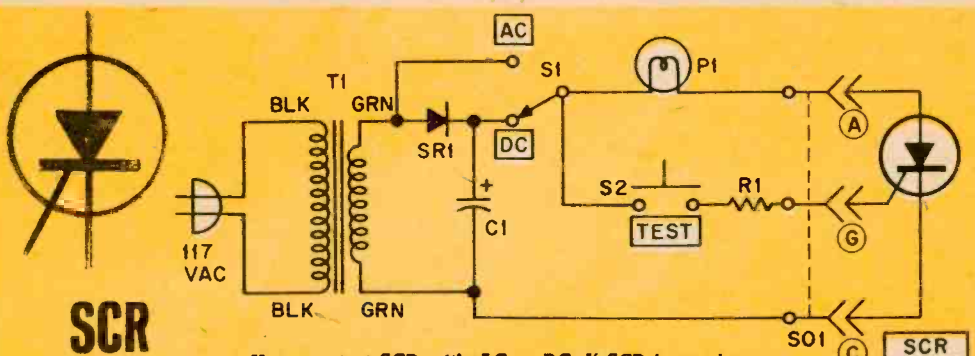
Our SCR checker uses the well-known go no-go or good-bad principle of operation. Since SCRs generally do not become weak, this type of test works well. Also, the go no-go principle simplifies the test procedure. In fact, you can run a complete test on an SCR in seconds.

How it Works. Our checker puts the SCR to be tested in a circuit consisting of a power supply (C1, SR1 and T1) and a load, P1. A triggering circuit, consisting of R1 and S2 fires (turns on) the SCR to determine if it works. In this circuit P1 generally shows the leakage of the SCR, but when switch S2 is pushed, P1 indicates the SCR's gain.

Our checker was built in a 6¼ x 3¾ x 2-in. utility case, but you may build it into anything you like. Parts (and wiring) placement is not critical. All of the parts in our model were mounted on the cover of the case.

Construction. Start off by laying out the parts as shown in the photo on the next page. When everything is positioned to your satisfaction, mark the mounting holes and drill. You might want to apply a piece of wood-grained plastic to the panel as we did. This stuff really improves the appearance.

Start the wiring by connecting the AC line cord to the primary (black leads) of T1. Next, connect C1 and SR1 to T1's secondary (green leads). Be sure of the polarity of these two components when you install them. Now, wire rocker switch S1. From S1 run a wire to S2 and P1. Connect a wire from the other side of P1 to the anode lug on transistor socket SO1 and from there connect another wire to J1. Next, connect R1 between S2 and the gate lug on SO1. Also run a wire from the gate lug to J1. Finish up the wiring by grounding the cathode lug on the transistor socket and by grounding J1. When finished, check over your wiring, and if all's well, button 'er up. At this point make up a set of test leads—alligator clips on one end, two-circuit phone plug on the other to check



SCR Checker

You can test SCR with AC or DC. If SCR is good, P1 should light when S2 is closed. Open S2 and P1 should go out in AC mode, stay on in DC mode.

SCRs that don't fit in SO1.

Operation. Plug the checker into the AC line and set AC-DC switch S1 to the AC position. Obtain a good SCR, connect it to the checker and note P1. For a good SCR P1 should not be lit (no leakage). Now press and release test switch S2. Lamp P1 will light and then go out (this test shows gain). Set the AC-DC switch to the DC position. Lamp P1 should not be lit at this point (again showing no leakage). Now press and release switch S2. Lamp P1 will light and stay on even after the switch has been released. This verifies that the SCR is good.

You will find that other good SCRs will check out the same way. Any SCR that shows leakage, no gain or deviates from the above tests in any way should be considered bad. We've included a quick-check chart to simplify your testing. For convenience, cut it out and paste it on the back of your checker.

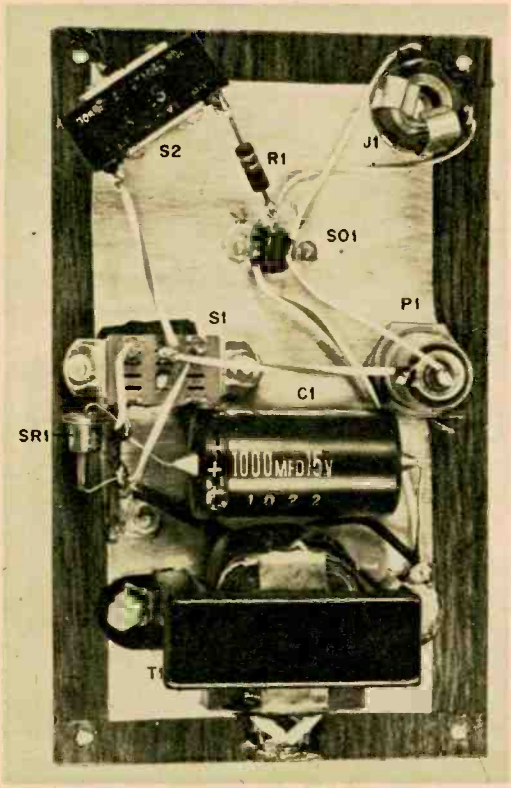


Photo shows location of parts on our box's cover plate. Socket SO1 is for SCRs in TO-5 case. J1 accommodates plug with clip leads for other SCRs.

OPERATING PROCEDURE

Plug checker in AC line. Plug SCR in SO1 or connect with clip leads plugged in jack J1.

Set S1	S2 open	S2 closed	S2 open
AC	P1 off	P1 on	P1 off
DC	P1 off	P1 on	P1 on

PARTS LIST

C1—1,000 µf, 15 V electrolytic capacitor
J1—Two circuit phone jack
P1—No. 44 pilot lamp and socket
R1—47 ohm, ½ watt, 10% resistor
S1—SPDT rocker switch
S2—SPST pushbutton switch
SO1—transistor socket
SR1—Silicon rectifier; minimum ratings: 750 ma, 50 PIV
T1—Filament transformer: 6.3 V @ 1.2 A
Misc.—6¼ x 3¾ x 2-in. Mini utility case (Radio Shack 270-627), two-circuit phone plug, alligator clips

The Listener

By C. M. Stanbury II

Dry Tortugas

IN our September '69 column I wondered out loud about the relations of R. Americas and Dry Tortugas. Dry Tortugas was a portable transmitting operation on 1040 kc which was an off-the-air relay.

One of the transmitters that it acted as relay for was R. Americas which was itself an off-the-air relay. At the time I hypothesized that R. Americas was much closer to Dry Tortugas than people guessed.

My argument assumed that R. Americas ID's were originating from one location, however I had not thought of relayed IDs.

In the meantime I have been searching for an end to this clandestine story. My inquiries led me to the Multronics Corp., a consulting firm which designed and operated the Dry Tortugas station.

The company said that the stations they were copying were not on Swan Island (the announced location of R. Americas.) Multronics stated that Dry Tortugas received its programming from three short-wave locations. These were Boston, Greenville and Belmont, Calif. The spokesman for the firm refused to identify the stations by name. Generally these stations would have been WRUL (now WNYW) the Voice of America's central transmitting facility and KGEI. When the Multronics Corp. was informed that other ID's were copied on this frequency the reply was: "Due to certain security aspects of the operation it is quite possible the ID's were arranged to confuse as part of the operation."

What this means in effect is that all of us who thought we were hearing a broadcast from Swan Island heard nothing more than a line from Boston.

Unknown to many SWLs, Brazil has more domestic stations on international SWBC than any other country.

Brazil, in terms of area, is the largest country in South America. Like many other underdeveloped industrial countries, Brazil has beautiful cities like Brasilia that gives you an idea of the future. Yet a short distance away are tribes with customs that date back to the time when man first set foot upon the continent.

Political thought is another resource of the country that has gone undeveloped. Brazil is ruled by a military dictatorship whose thorn in the side are leftists such as those who recently kidnapped the U.S. Ambassador.

Since the present regime has more radio stations than even the Soviet Union, she has a stronghold when it comes to information. Almost every station between 16 and 31 meters is directed at the Brazilian population, with a good number being commercial operations. You will be hard pressed to find a broadcast in a language other than Portuguese.

A number of the stations have QSL cards printed and they will answer a report written in English. You will find that regular monitoring of these stations (see chart) will give you quite an ear for the language.

Propagation: Short-wave conditions will be good on the 16- and 19-meter bands during daylight hours. DX on 13 meters will be fair, while CB DX and amateur 10-meter DX will be poor. During the hours of darkness, DX should be good on all bands from 49 to 19 meters.

Because sporadic-E propagation (a seasonal phenomenon) will be at a peak, short-skip openings in the 10- and 11-meter bands will be frequent during the hours between 10 a.m. and 3 p.m., local time. Some TV DX is also likely due to sporadic-E.

BCB DX will continue to be poor because of high summer noise levels.

FOURTEEN FROM BRAZIL

Freq. (kc)	Station	Location
9565	R. Jornal do Comercio	Recife
9585	R. Exelcior	Sao Paulo
9595	R. Cultura de Bahia	Salvador
9720	R. Nacional	Rio de Janeiro
9730	R. Farroupilha	Porto Alegre
11720	R. Nacional	Brasilia
11805	R. Globo	Rio de Janeiro
15105	R. Rural Brasileira	Rio de Janeiro
15145	R. Jornal do Comercio	Recife
15155	R. Difusora de Sao Paulo	Sao Paulo
15165	Ceara Radio Clube	Fortaleza
15335	R. Farroupilha	Port Alegre
15370	R. Tupi	Rio de Janeiro
15445	R. Nacional	Brasilia

Horizontal Defect Detector for TV Servicing

By WILLIAM B. COOMES

THE SYMPTOMS: sound but no picture—a black screen. Diagnosis: could be many things but to start you listen for that 15,750-cps whistle that comes from the set's high-voltage section. If you have good ears and hear it you know that section is working.

But not everyone can hear that frequency. (Of course you could disconnect the high-voltage lead to the pix tube and try to draw an arc to the chassis.)

A safer and faster way to find out whether the high-voltage section is working is with our Horizontal Defect Detector. It's a field-strength meter tuned to 15,750 cps. When brought near the set, or any component operating at that frequency, the meter shoots upscale.

Construction. First, wind coil L1 on the ferrite core removed from the loopstick antenna specified in the Parts List. The wire is No. 34 enameled. Tape the wire to one end of the rod leaving a 4-in. length for lead No. 1. Then tape the wire along the rod to within ⅛-in. of the other end. Now wind 900 turns (don't worry about losing count of a few turns) in a single layer along the length of the rod ending about ¼ in. from the other end. (If you get tired of counting, tape the wire, noting the number of turns to that point, and take a rest.) This portion of the coil should be wound smoothly and closely so it will fit in the space available. However, if you can't get 900 turns in the space, add the remaining turns to the next winding.

Pull out a 4-in. loop of wire for the tap (wire No. 2). Wrap electrical tape over the lower 2-in. of the coil then scramble wind 1,100 turns over the tape. Coat this portion of the coil with Q-dope or nail polish to hold the wire.

The coil is mounted in a 5/16-in. dia. hole in the center of one end of the box, ⅜-in. above the back. Variable capacitor C1 is mounted in the other end of the box. The meter requires a 1½-in.-dia. hole in the top of the front panel and a ⅛-in. hole at each corner of a 1-9/32-in. square. The remaining parts (except for C2 are mounted on a 1⅞ x 1⅜ in. Piece of perforated board as shown in the pictorial and photo.

Check-Out and Operation. Hold the completed unit in front of an operating TV and tune C1 for maximum indication on M1. Mark the position of the knob at this point. Hold the detector in front of and close to the screen of an inoperative TV set. If M1 deflects, the high-voltage section is working.

Horizontal Defect Detector for TV Servicing

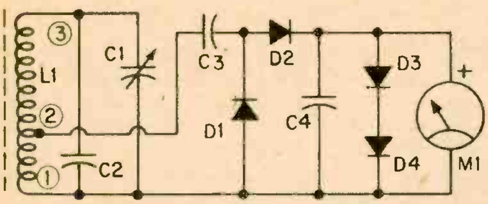
The reading should be about half-scale or higher.

After removing the back of the TV, the signal can be traced back through the high-voltage rectifier, the horizontal-output transformer (always be extremely careful when working around the high voltage section), the horizontal-output stage and the horizontal oscillator.

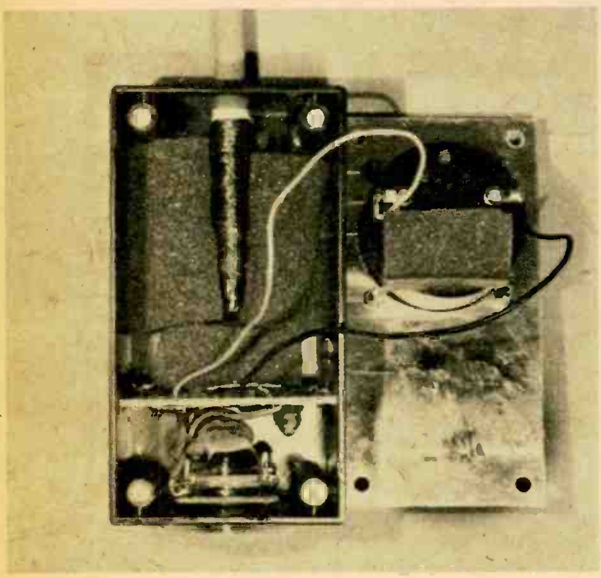
How it Works. Pickup probe L1, wound on a ferrite rod, is part of a tuned circuit whose other parts are C1 and C2. Capacitor C3 couples the signal to detector diodes D1 and D2. The detector circuit is connected to a tap on L1 to prevent the Q of the tuned circuit from being lowered. Meter M1 indicates the presence and strength of the signal. Diodes D3 and D4 provide overload protection for M1.

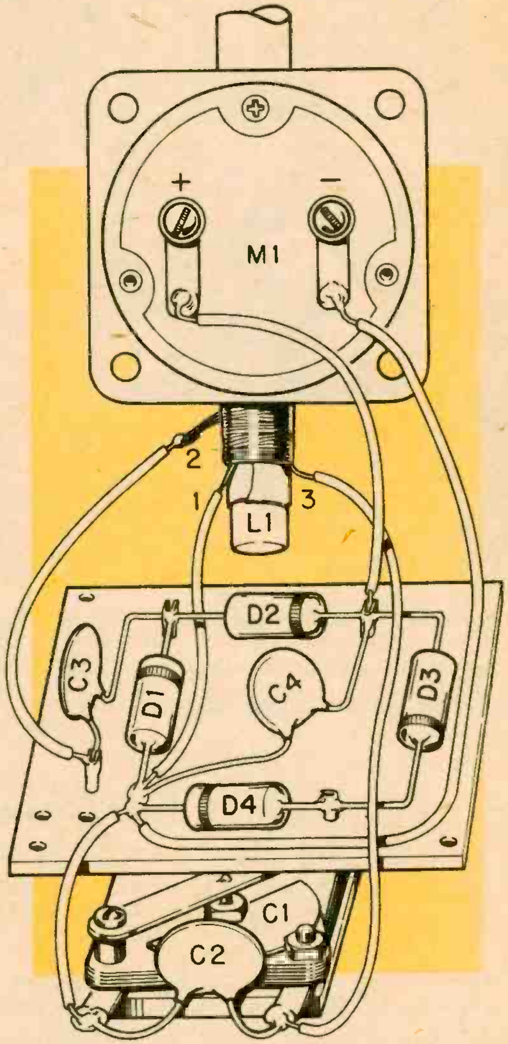
PARTS LIST

C1—10-365 µµf miniature variable capacitor (Lafayette 99 E 62176)
C2—680 µµf 30 V or higher disc capacitor
C3,C4—.001 µf, 30 V or higher disc capacitor
D1-D4—General-purpose germanium diode (Lafayette 19 E 15057. Pkg. of 10 for 79¢)
L1—Pick-up coil: 2,000 turns No. 34 enameled wire wound on ferrite core from Lafayette 32 E 82027 loopstick antenna)
M1—0-50 µa DC microammeter
Misc.—4 x 2⅛ x 1⅝-in. Bakelite utility box with aluminum panel, perforated board



Detector schematic, above. In photo below, note 1,100-turn winding on L1 and vertically mounted board. Pieces of sponge rubber hold L1 in place.





Lead 1 on L1 is start of winding, 2 is tap, 3 is end of winding. Corresponding numbers are on L1 in the schematic. Parts layout isn't critical.

"Bell & Howell's proven programs turn out the kind of men we want,"

Say men who do the hiring for top firms in computer, aerospace, television-radio and automation electronics.

A leading computer company: "He has some appreciated abilities not found in graduates of other programs. He has a knowledge of oscilloscopes of any size and complexity—how to use them, repair and service them. His circuit analysis is above average for a man with this experience."

An electronics company: "Perhaps the most valuable asset these 30 men have is the ability to adapt to new work projects with little hesitancy. Their training has enabled them to efficiently perform a variety of tasks and (thus) increase their potential for advancement."

A top TV-radio manufacturer: "I have personally been pleased to note that the men you have sent us show Bell & Howell Schools have consistently kept up with the times in the electronics field."

A major aerospace firm: "It has been our experience that your men have been able to stay abreast of the rapidly changing technical picture in the aerospace industry. They have been able to meet the challenge and consequently maintain an excellent competitive position."

Note: Firm names available on request.

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There are some very real advantages to getting all of your Electronics training from Bell & Howell's Proven Programs.

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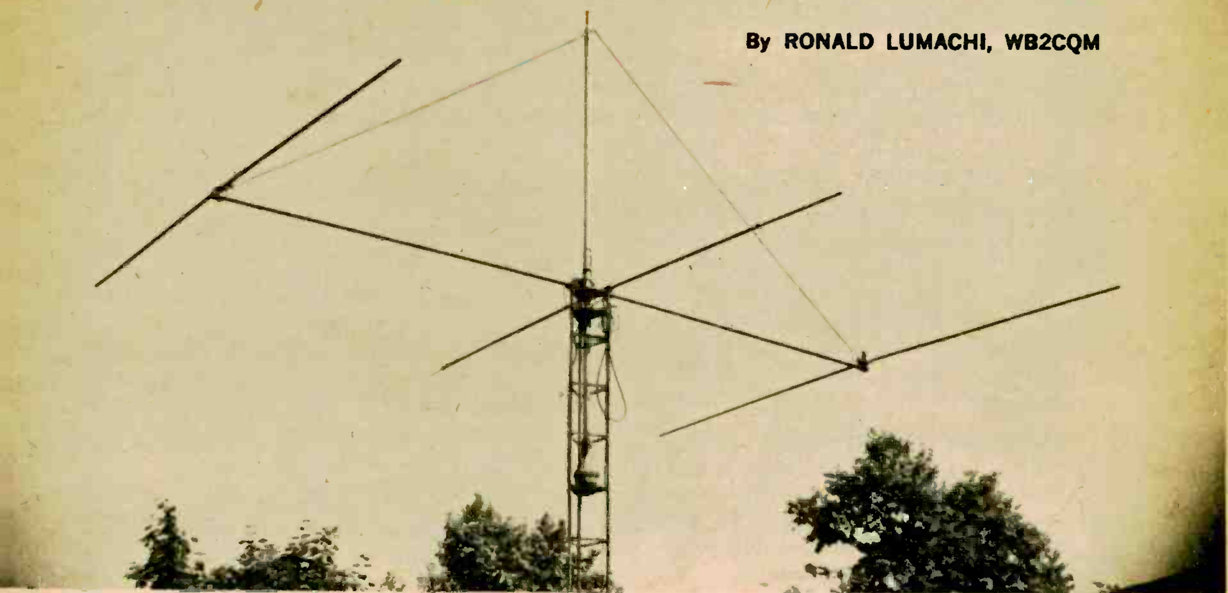
Bell & Howell offers four different Lab-at-Home Plans—one of which is com-

A Ham Yagi With Total Tuning

By RONALD LUMACHI, WB2CQM



SAY you live in the New York area and want to beam Europe and Africa for an elusive DX station. If QRM is bad you can get real up-tight. But when you start getting knifed in the back by Mid-Western and West Coast stations that are also aimed east, you can quickly lose your cool.

No need to go off the air or start working South America. The way to pull in the weak ones is with our Ham Yagi with Total Tuning.

The rig is a three-element antenna with a gain of 7 to 8db. Sound pretty conventional so far? It isn't. Big thing about it is its total tunability. Mounted on its rear (reflector) element is a tuning device that tunes the antenna for a high front-to-back ratio. This means rock-bottom signal pickup from the rear.

For example, an antenna on the East Coast beamed east will be able to reduce Central-

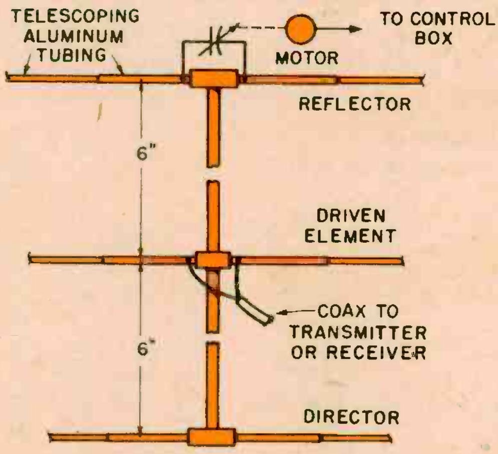
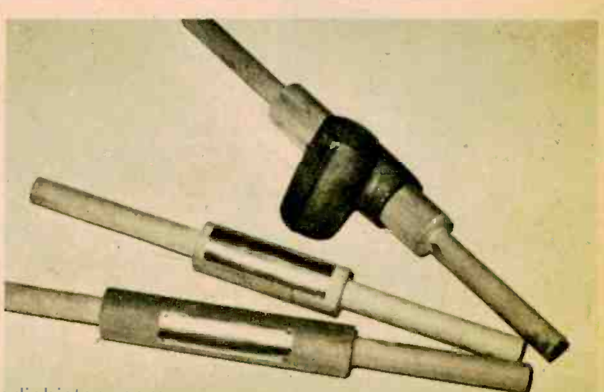


Fig. 1—Antenna (left) consists of three dipole antennas parasitically coupled (no direct connection between elements). Tuned reflector rejects signals from rear. Elements (below) are supported on boom by Nu-Rail aluminum crosses that are attached to supports by set screws (metal strips prevent set screws from burrowing in wood). Standard 1¼-in. dia. electrical conduit is ideal for the boom.



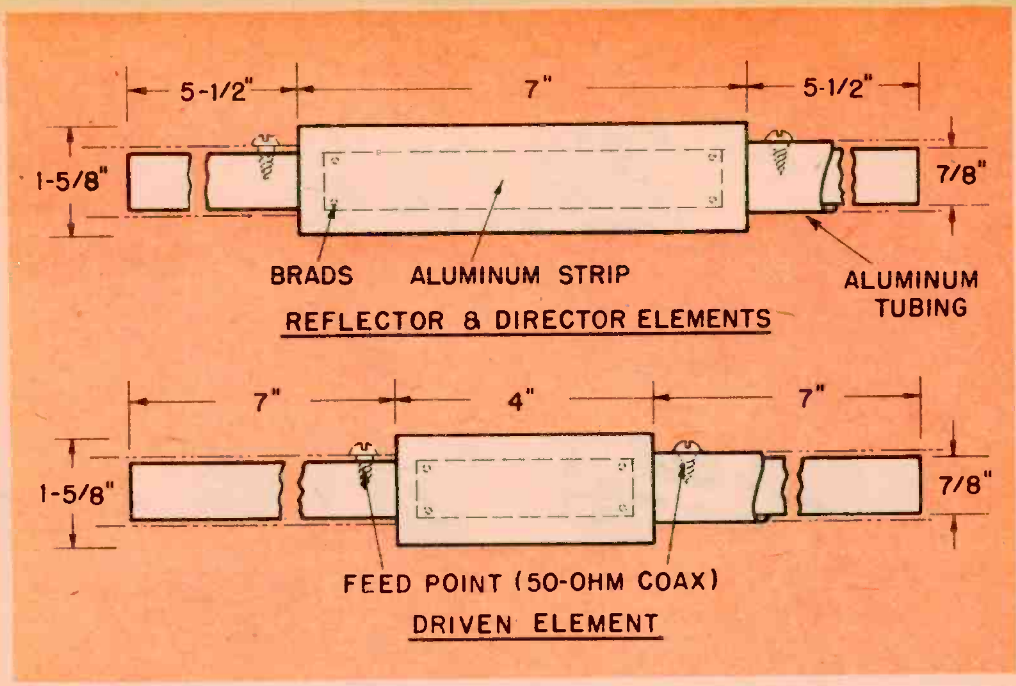


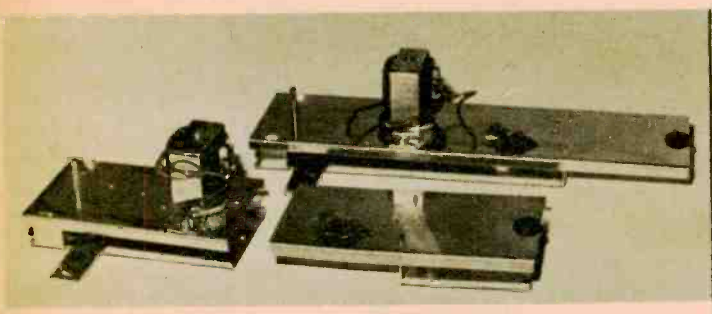
Fig. 2—Make center-element supports from 1⅝-in.-dia. wood pole. You'll need 5 ft. for three supports.

and Western-State QRM by at least 30-40-db. Therefore, a W6 station in California with as S-9 signal will be reduced to about S-3.

A similar tuning device can also be installed on the director element to further improve tuning If you install a tuner (same construction as the reflector's tuner) on the director, you must reduce the director's length by five per cent. We include dimensions in a table for operation on 20, 15 and 10 meters as well as the Citizens Band. Since the antenna exhibits reciprocal characteristics, it can also be used for transmitting.

Construction. For multi-band operation, you have two choices. You can make the elements with 1-in. and ⅞-in. tubing that will telescope. Or you can build the antenna for operation on 20 meters (greatest dimensions) and put knife switches on the elements (Fig. 8). The switches will disconnect outer ends of the elements to shorten them for operation on the higher-frequency bands.

Take a look at a diagram of the antenna in Fig. 1 to get an idea of what it's all about. The reflector, driven element and director are made of aluminum tubing and joined at the center with the wood supports shown in Figs. 1 and 2. The supports are made from a 1⅝-in.-dia. wood pole. The aluminum tubing is forced on the ends and held with wood



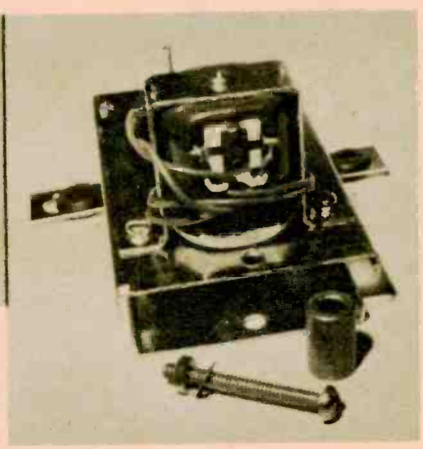
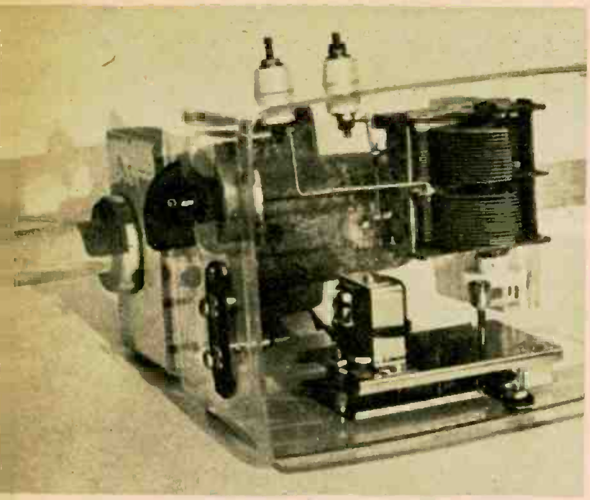


Fig. 3—Motor/gear-train assembly (rear, top photo) requires modification. Cut wire then saw frame in two about 1-in. to right of motor. Discard right side (lower right). Install ⅝-in. spacer (right photo) to provide support. Secure spacer with screw. Put nut on motor side of frame.



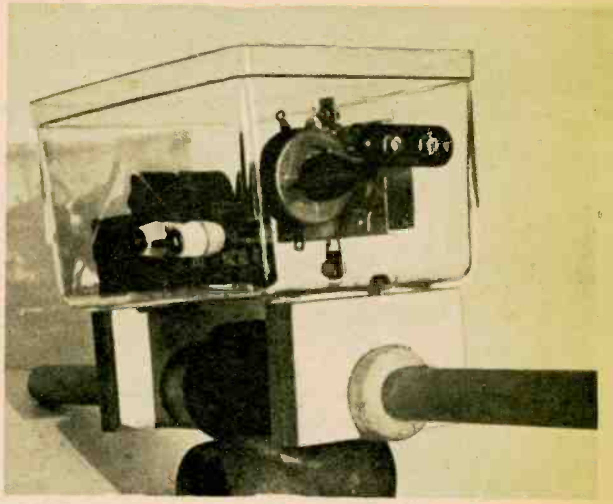


Fig. 4—Tuning unit. Select from gear assortment small brass gear and put on motor's shaft. Put nylon gear (check meshing) on capacitor's shaft. Cement with epoxy. Mount components in box and connect as in Fig. 7. Connect capacitor's stators then connect frame to one lead-in bushing, stators to other.

A Ham Yagi With Total Tuning

screws. The wood supports are attached to the boom with Nu-Rail aluminum crosses as shown on the top support in Fig. 1. The aluminum strips on the supports prevents the screws in the crosses from burrowing into the wood.

If you use knife switches, force a 12-in. length of wood dowel into the element ends as shown in Fig. 8. Leave a 2-in. space between the aluminum tubing and mount an SPST knife switch on the wood between the elements. The arm of the switch should be connected to the outer section of the element. Be sure to include the length of the switch arm (about 1½ in.) when calculating the overall dimensions.

The Tuning System. The key to the high front-to-back ratio is the tuned reflector element. A two-section (connected in parallel) variable capacitor, found in every AC/DC table radio, is series-installed between each of the halves of the reflector element as shown at the extreme right of the schematic in Fig. 7. The element is electrically lengthened as more capacitance is introduced into the circuit. The DC drive motor operates on 1.5-3 VDC. The motor is reversed by changing the battery polarity with switch S1.

The lengths of each half of an element must be identical in order to resonate at the proper frequency. Therefore, it is important that the wire from the rotor and stator plates of capacitor C1 to the feed-thru insulator and

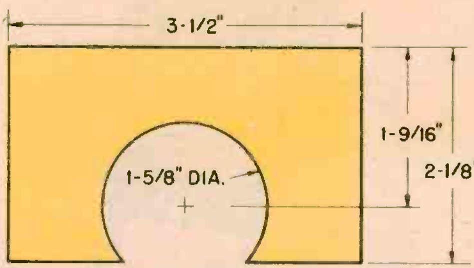


Fig. 5—To mount plastic tuning-unit box on reflector element above cross, make two supports of ½ or ¾-in. plywood using this sketch as guide.

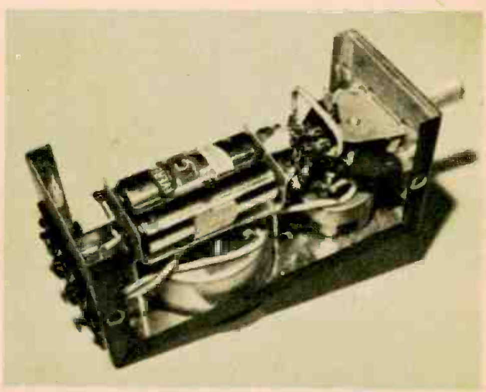


Fig. 6—Control box houses lever switch, speed-control pot (under switch) meter and battery holder. Terminal strip is on left end of the box.

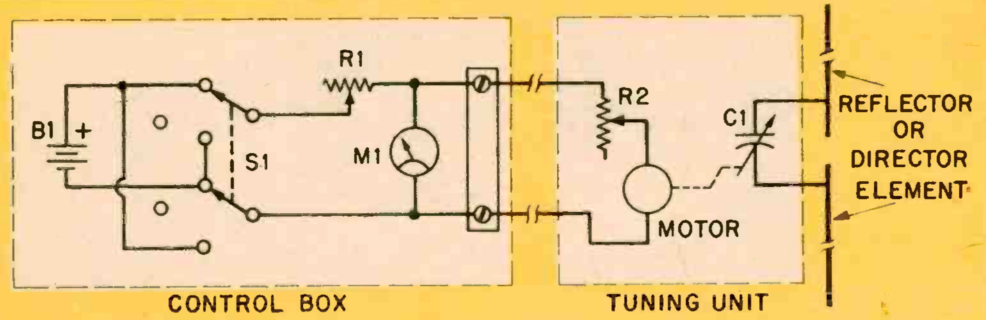


Fig. 7—Control-circuit schematic. S1 reverses polarity of voltage to capacitor drive motor to change its rotation. Connect units with lamp wire. Voltage on M1 drops when capacior stops turning.

TOTAL ELEMENT LENGTHS				
Band	Freq. (mc)	Director	Driven	Reflector
20 m	14-14.35	31′ 9″	33′ 6″	34′
15 m	21-21.45	21′ 6″	22′ 5″	23′ 2″
CB	26.965-27.255	16′ 10″	17′ 3″	17′ 9″
10 m	28-29.7	15′ 9″	16′ 10″	17′ 1″

finally to the elements (see Fig. 4) must be exactly the same length. For example, if one feed-thru insulator is closer to one element, add extra wire in order to equal the wire length to the other element. Make the measurement from the capacitor and include the wire length in the plastic box.

The control-box components are mounted on the main section of a 5 x 2¼ x 2¼ in. aluminum Minibox as shown in Fig. 6. Lever switch S1 is wired so that it will reverse the polarity of the voltage to the motor. Switch S1 has a center-off position. Mount the 20-ohm pot on top of the box and install the battery holder on the back of the meter.

Final Construction and Tuning. Before installing the tuner on the reflector, connect the wire from the control box to the tuner. Reduce R1's resistance to a minimum and adjust R2 so the motor will start each time the lever switch is moved. If too much resistance is used, the motor will not turn. Speed control R1 sets the speed of capacitor rotation. Once in motion, the speed of the motor can be reduced. Practice with the unit for a while to become familiar with its operating characteristics.

The meter serves a dual function. It monitors the voltage to the motor and indicates

[*Continued on page* 101]

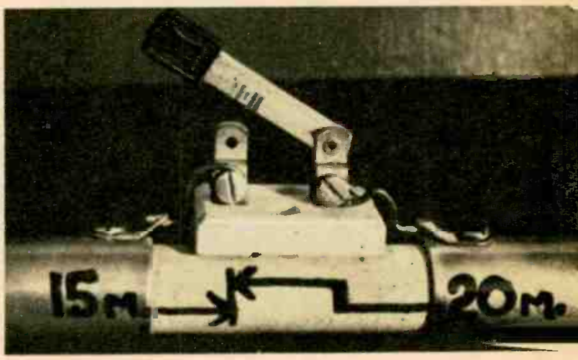


Fig. 8—Knife switches along elements make antenna multi-band. Include length of switch in element measurements to maintain the overall dimensions.

PARTS LIST

B1—1½ V penlite cells (two reqd.)
C1—Two section superhet variable capacitor (Allied 43 A 3529 or equiv.)
M1—DC voltmeter, 3-0-3 V (Allied 52 A 7631)
R1, R2—20 ohm, 3-watt wirewound potentiometer, Allied 46 A 3835)
S1—Two pole, three-position, non-shorting lever-action switch (Centralab 1455, Allied 56 A 4027)

Miscellaneous

Aluminum conduit: 1¼-in. o.d. x 12-ft. long
Battery holder (two AA cells)
DC motor with gear train (Edmund Scientific Co., 100 Edscorp Bldg., Barrington, N.J. 08007. Catalog No. 60,700. $1 postpaid)
Gear assortment (Edmund Scientific Catalog No. 60,352. $1.50 postpaid)
Knife switch, SPST (Allied 56 A 4884)
Lead-in bushing (Allied 47 A 6223)
Nu-Rail crosses: No. 10, 1¼ x 1¼ in., three reqd. (Hollaender Mfg. Co., 3841 Spring Grove Ave., Cincinnati, Ohio 45223. $2.68 ea. plus postage for 3 lbs.)
Plastic box (approx. 5 x 7 x 8 in.)
Two-screw terminal strips (two reqd.)
Wood dowel, ¾-in. dia. x 12 ft.
Wood pole, 1⅝-in dia. x 5 ft.
Aluminum tubing, 1 in. and ⅞-in. dia.
Aluminum Minibox, 5 x 2¼ x 2¼ in.

Recording engineer has set up mikes in the studio and is presetting his console for recording session.

How About a Glamorous Job in a Recording Studio?

By FOREST H. BELT

I LIVE in Kentucky and, aside from my interest in electronics, I really dig country and western music. Down here it's the Nashville Sound that rings the bell. A career mastering the recording of this style is what I'm going to talk about. But whichever part of the country you live in and whatever your musical taste, you'll find that making a hit record is about as exciting an adventure as you can find.

If you're interested in action, recorded music is where it's at. Recording is a giant business with teen-agers and adults buying records, albums and tapes by the millions. The recording of every selection is presided over by a technical team that knows how to get along with celebrities as well as hard work. Glamor and painstaking thoroughness go hand in hand—making for long hours and much excitement.

Let's take a look at the recording team. The producer first gets together with the recording artist and they decide which songs to record and how they want the arrangement to sound. Some producers even dig up new material or write it themselves.

The producer lines up musicians, background singers, anyone who can make the artist sound good. He arranges rehearsals and sets up recording sessions. At one time he was called the artist and repertoire man, or A & R man. But now his influence goes far beyond the confines of a control room.

When a record is made he is the one man responsible for how the finished recording sounds. And he has nothing more to guide him than his own ear. Only after he says

Recording session at RCA studios in Nashville. Jim Ed Brown, country and western star, is at center mike, facing camera. Background singers are at his left, musicians are located at his right. Note how personnel is separated by baffles.

that a take is okay can the artist and musicians relax and go to the next number. Otherwise they may repeat a number a dozen times until they come up with the right blend of instruments, background and lead voice.

Even after a good take the producer may make a note to edit certain portions—a muffed word, a sour note, a poorly timed bridge, these must be taken out and replaced by better versions on earlier takes.

Important as the producer is, the operation centers around the recording engineer. His domain is the control room and his job is to do the mixing. The studio may have two, ten or even 20 microphones in use during a session. He blends together the sounds they pick up.

The engineer has to make sure the mikes are placed right, then set the controls on the console so the sound from the mikes is balanced. He wants just the right amount of drum, bass, piano, rhythm guitar and steel and lead guitar. Of course, the lead voice has to come through loud and clear.

This is a delicate task, demanding experience and a good ear. The engineer is alert to each instrument yet aware of the whole sound. While the producer guides him and decides when the ball of wax is okay, he must make all the subtle changes throughout a song via his control panel. Not only must his work be quick, it should be smooth. Watching an engineer play his board is a fascinating experience.

A recording engineer has to know every channel of his console intimately—and some of the newer studio models are unbelievably complex. He should know mikes and which ones to use for certain effects, he should be familiar with the acoustics of his studios and know how to use baffles (large movable par-

Chet Atkins, producer and recording star, sits to the right of engineer (in shirt sleeves) during a session and discusses the drum level for this mix. Producer has final say on balance of vocal and music during recording. Atkins is top authority on style called the Nashville Sound.

titions) to alter the sound. He must master the special effects available in his console: echo, reverberation, vibrato, filters, harmonic generators. He has to be able to doctor out any flaw which appears on the tape.

The engineer has a right-hand man in the technician. This chap keeps the tape machines threaded, moves the mikes and baffles during a recording session and keeps the equipment in a state of readiness and in perfect operating condition. All technical problems in the control room or studio are his responsibility.

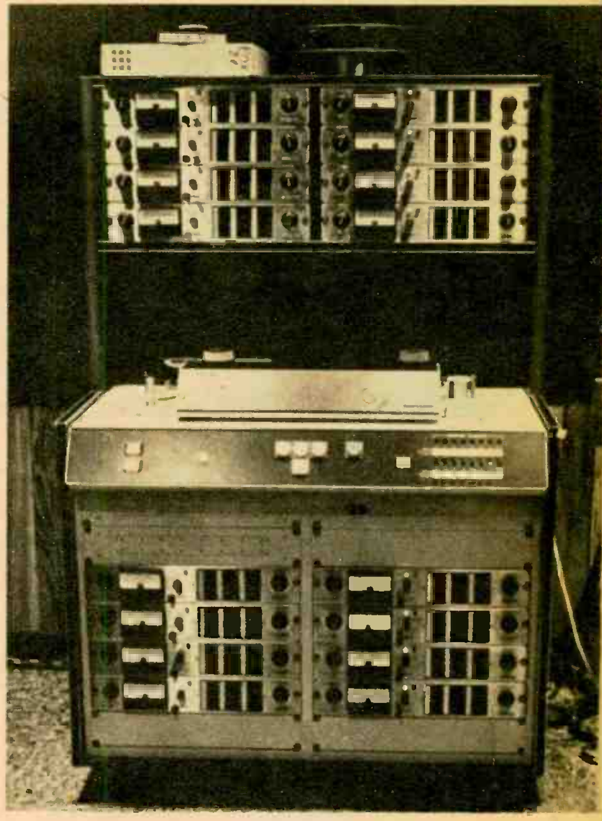
The technician must know his electronics. Not only should he know a lot about audio gear, tape mechanisms, etc., but the more he aspires to be a mixer or engineer in his own right, the more he must know about acoustics and the art of developing an ear for music. There is a big jump between knowing how to repair a console and being able to operate one.

A career in a recording studio usually attracts people who like to work with big names in the industry, temperamental as they may be. They are interested in music and sound reproduction and want to learn as much as possible to achieve several different goals.

Advancement usually goes this way: you may start as an apprentice technician, then go on to technician, engineer and perhaps producer, just as we have described. Even at the apprentice level if you have what it takes you may get a crack at running the board. If your mixing shows promise you'll start getting the experience that could make you a success story.

Most ambitious engineers hope to become producers. But that's not the only step upward. Supervisory and administrative spots also are natural steps. These positions include: engineering supervisor, chief engineer, special effects engineer and other technical specialties.

Technical ability isn't the only way up the ladder. One of this country's leading record producers is Chet Atkins, who also is a famous recording artist. Chet plays the guitar, as you may know. Starting as a performer at RCA Victor, he moved up to become a talented A & R chief, then producer and now he's vice president in charge of the RCA studios in Nashville.



Though three-track tape machines are found in many studios, 16-track models (above) now are seen in better facilities. Decks use 2-in. tape.

Recording experts acknowledge that Chet has a phenomenal ear. In spite of his executive duties and a heavy concert schedule, he still sits in at the console now and then to direct sessions for some of the leading Nashville artists. He is an authority on the legendary Nashville Sound. Chet's case is a bit unusual but not outside the realm of the possible.

There are a variety of jobs in the industry. Movie studios use mixers on their sound stages. Television films and tapes require sound recording, too. Large sound companies often add background and mood music to films long after the editing is done (when a working print is available). Other recording teams make records from movie sound tracks.

Technicians play a big role at record-manufacturing and tape-duplicating facilities. Large auditoriums, such as Lincoln

Center and Madison Square Garden in New York or the Santa Monica Civic Auditorium in Los Angeles, use engineers having mixing and maintenance skills. And radio and TV stations which broadcast live performances need sound mixers and technicians.

Nashville alone has three dozen recording studios. Most big cities have five or six. If you look under Recording Services in the Yellow Pages of the New York or Los Angeles telephone directories you will find over 150 listed. There are hundreds of small motion-picture firms near Hollywood which produce industrial movies, documentaries and TV commercials—all using sound tracks. New York City also has dozens of independents.

Once you climb to the rank of producer you may prefer to free-lance. Many professionals do. An artist can always hire his own producer to supervise his recordings. However, the studios generally insist on their own engineers doing the console work. A producer frequently works with just one or two favorite studios whose engineers suit him best.

This doesn't mean a recording engineer can't free-lance, too. Top artists often take along their own sound equipment and mixing people when they go on a concert tour; they can't be sure of sound systems, acoustics or personnel in the locations they play.

The technique of recording a modern hit can be fun. For example, Bones Howe, a popular freelance producer and engineer (who does a wild scene with hard rock), produced an exciting record last year. Things started with a rhythm track he taped in Hollywood using a 16-track tape. Several weeks later, in Las Vegas, he had his singing group add the vocal tracks. Some weeks after that, in a studio in Los Angeles, strings, woodwinds and brass were added.

By this time the tape was getting a bit crowded. Even with 16 tracks you can dub and overdub only so much. Bones had to have certain tracks ping-ponged—this means that two or more tracks are mixed and put on one clear track; it clears the first tracks for more dubs. This way, a 16-track machine can finally wind up having two dozen or more channels of music.

Back in Hollywood, Bones added the final touches: some special rhythm effects. He then began mixing it all down for the final version. The result of his efforts is the title song for the Age of Aquarius album done by The Fifth Dimension.

Even with all the fun, people do need to earn a living. In studios with unions there are four job grades: recording technician, recording technician first class, recording engineer and master recording engineer. Pay for technicians begins just under $8,000 a year. It's less in non-union studios. A recording engineer makes from $11,000 to as much as $14,000 for the job of master engineer. In non-union studios an engineer who has a good ear and works well with producers may be paid more than that.

A producer first earns little more than an engineer. There's no union backing him up. However, if he gains a wide following among recording artists, and especially if big-name artists demand *his* ear for their recording sessions, his salary may become exceptional. A good producer, in constant demand, can make anywhere from $20,000 to $50,000 a year. If he has his own independent company his earnings can go into six figures.

Recently, mixers and producers have been concerned about a problem having to do with their environment. Sound comes through to the control room at a fairly high level via theater-size speakers. There's danger of hearing deterioration after long periods of listening. A number of engineers and producers now have their ears tested regularly for loss of hearing.

If you're interested in a career like this, start via electronics training which emphasizes audio equipment and acoustics. Experience with a broadcast station could mean a lot; many studio chiefs look there when they recruit. Often you can get into broadcasting while you're still in high school or college. An educational station provides lots of opportunities.

Not too many recording engineers have a college degree. However, as one chief engineer points out, "A little college never hurt anybody. If I have to choose between a guy with this background and a guy without it, I'll naturally pick the college man. It doesn't mean he'll make a better technician or engineer, but the odds are in his favor."

One studio executive says it takes three things to make a good recording engineer: desire, technical training and a good ear—in that order. Not all studio people agree that an ear can be acquired, but this executive insists that motivation can overcome a lot, though it may take some people a longer time to make the grade.

Ham Story in Blighty

Continued from page 42

Remember that money, whether you call it wages, salary or income, is twice as rare in Britain as it is in the U.S. Essential items, except for things like education and medical treatment, are on a par. This leaves the ham with far less income to spend on equipment than an American has.

It's unlikely that the average British ham will ever spend more than $200 on his equipment. Yet, as penny pinching as British hams may sound, they are affluent compared with some amateurs in Europe.

Owing to the British genius for invention and compromise, homebrew gear is excellent. There's loads of government surplus to be adapted or cannibalized. Very popular, for example, are ex-ambulance sets which can be adapted easily to amateur VHF frequencies.

With hams relying on these items, it's not surprising that most ham activity is on 160 meters (1.8 to 2 mc). At least 65 per cent of British hams and about 85 per cent of mobile operators use only 160 meters even though the power limit is 10 watts.

VHF operation is popular, though not so prevalent as it is in Germany. There are 2- and 4-meter bands, but nothing on 6 meters. A small and enthusiastic group works UHF. There's also a lot of activity on 80 meters. A British ham can cover the whole of the British Isles and get well into Europe on this one.

AM survives, mostly through the efforts of veteran reactionaries, but SSB is rapidly becoming accepted as the most efficient mode of communication (apart from CW). There is also amateur teletype and television, both with their own enthusiastic following.

DX activity is divided into two kinds—the distant and the rare. Technically, Andorra or San Marino are only a few blocks away but a DXpedition there arouses as much excitement in Britain as it would anywhere. Normal DX is the Pacific, the Far East and South America, as well as the West Coast of North America. The East Coast of North America is just across the Pond so reliable skeds are routine, even mobile to mobile.

There is even DX in Britain. Some of the remote counties have little amateur activity so any operation from, say, Carmarthenshire in Wales, meets with an enthusiastic response

[*Continued on page* 100]

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Ham Story in Blighty

Continued from page 98

from Englishmen as well as from overseas amateurs collecting British counties.

Mobile activity in Britain is still behind the U.S. but is catching up fast. The automobile is not so ubiquitous in Britain and two-car families are rare. Nevertheless, there are about 2,000 mobile operators in the country, the majority operating on 2 meters. A small elite specializes in mobile DXing; they use SSB on 10, 15 and 20 meters.

Reciprocal licensing has added a new dimension to British amateur radio not only because of the tourists who come to Britain, but also because Britons now travel in Europe in hordes at vacation time, mostly with cars and trailers, and the hams want to go on talking.

Americans may think of Britain as being part of Europe, but no Briton worth his cup of tea would agree with this, despite official efforts to drive Britain economically deeper into Europe. No! The British ham feels Europe is abroad and he wants to obtain a handful of exotic callsigns for his vacation and change prefixes dramatically from border to border. Ohm, Marconi and all the other experts never thought of this one.

Basic Test Gear For Color TV

Continued from page 31

with that equipment. A full-dress alignment is necessary if someone has tightened down all the screws or if a severe RF-IF repair has been made.

Such an alignment is also necessary if you are a buff like me and want each set to operate at peak performance. There is rarely a color TV which has a picture free from some overshoot, 920-kc beat, 4.5-mc beat, etc. If you have to fix that, you'll need an alignment setup.

There are some really deluxe alignment generators available now. Both B&K and Sencore have new solid-state alignment rigs complete in one package. The generator, markers, adapters, etc. are all inside; all you need is your scope or VTVM.

On the other hand, you can purchase separate generators, markers and jigs. RCA, Heathkit and Eico are just a few who manufacture this equipment. The addition of these units gives you a 100 per cent capability.

Death Ray On Every Doorstep?

Continued from page 80

the Thresher submarine disaster in 1963, the Navy initiated an intensive program to develop more efficient underwater illumination systems. The problem: how to spot your target without illuminating the interfering clutter of suspended particles.

The solution is ingenious. Very short pulses of blue-green laser light are beamed into the search area and synchronized with a TV monitor which turns on and off rapidly. While each laser pulse is traveling to and from the target the monitor is off so that it doesn't display random objects illuminated by a pulse of light. The monitor turns on only during those brief moments when light pulses reflected by the target reach the receiver. This device can penetrate nine times farther (in clear water) than conventional systems.

TV Tuning Goes Electronic

Continued from page 75

now, and for the better.

One tuner builder, Standard Kollsman, has offered varactor tuners for some time. This company bridged the tuning gap by developing and making its own varactor and switching diodes.

But until the recent FCC dictum, set builders have been indifferent. They still seem cautious about varactor tuners. Despite advantages such as reliability, remote control and small size, cost scares them.

Nevertheless, one U.S. brand has a varactor UHF/VHF tuner coming in its models. Another Canadian color TV will have it later this year.

A Ham Yagi With Total Tuning

Continued from page 93

each extreme of the capacitor's rotation. At such points watch for the voltage to drop about ½ V. Release the lever and change direction by moving S1 to the other side.

Final antenna tuning is simple. After installing the antenna on your roof, turn it 180° away from a steady signal source. Tune in a steady, unmodulated carrier from a local radio operator 3-5 miles away. Using S1 to turn the capacitor's drive motor, watch your receiver's S-meter drop for a minimum indication. There is only one point where the antenna will null the incoming signal.

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Your advertisement can reach this mail-buying audience for only 50¢ per word . . . payable in advance (Check or M.O. please) . . . minimum 10 words. Closing dates are the 20th of 4th preceding month i.e. copy for the January issue must be in our office by September 20th. Mail to ELECTRONICS ILLUSTRATED, 67 West 44th St., New York, N. Y. 10036. Word count: Zipcode number free. Figure one word: Name of state (New Jersey), name of city (New York); sets of characters as in key (14-D); also abbreviations as 35MM, 8x10, D.C., A.C.

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ELECTRONICS ILLUSTRATED Classified Advertising Order Form

For information on terms, closing dates, etc., see heading at top of Classified Section.

INSTRUCTIONS:

50c a word
Minimum Ad 10 Words

WORD COUNT: Zip code free. Figure one word for name of state (New Jersey); name of city (Little Falls); sets of characters as in key (M-14); abbreviation of Northwest (NW); but note separate initials as in a name (M. D. Brown), 3 words counted as a word each.

DEADLINE FOR ADS: Copy must be in by the 20th day of the fourth preceding month for the issue in which the ad is to appear.

BLANKLINE: May be placed both above and below the ad, if desired. Each blank line is charged as 5 words.

TO: ELECTRONICS ILLUSTRATED • 67 W. 44th St., New York, N.Y. 10036 • Att.: Classified Advertising Dept.

Gentlemen: Here's our copy for the Classified Section of ELECTRONICS ILLUSTRATED. Remittance of $________ is enclosed to cover ________ insertion(s) in the ________ issue(s).

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
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CIRCLE NUMBER 10 ON PAGE 11

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