How to Make Money in Part-Time Servicing

ELECTRONICS ILLUSTRATED®

By the Publishers of MECHANIX ILLUSTRATED

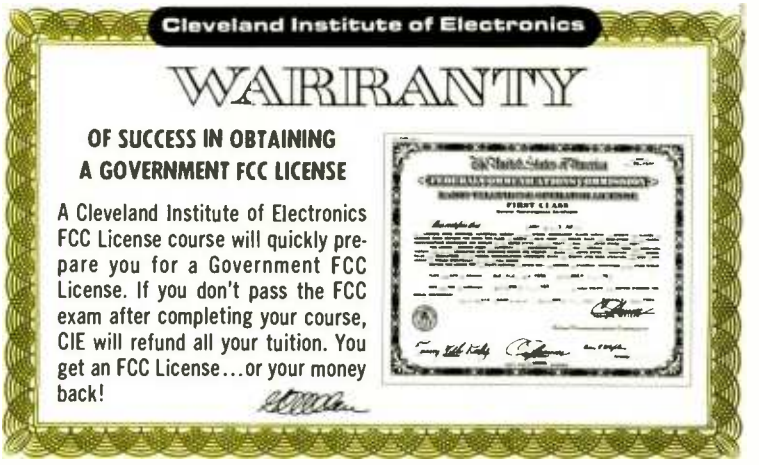
NOVEMBER 1968 • 50¢

- Remote Tuner for Vertical Ham Antennas
- The ABCs of Extension Hi-Fi Speakers
- Buffered CPO ✶ Doubly-Sure Light for CB
- Electronic Rhythm Section You Can Build
- DXing Sunspot Utilities ✶ Portable Time Standard
- How to Hook a Tape Player to a Phono

Build This Unique Micro Speaker System in a Reinforced Shoebox!

You can earn more money if you

Here's our famous CIE Warranty that you will get your License if you study with us at home



NOT SATISFIED with your present income? The most practical thing you can do about it is add to your Electronics know-how, pass the FCC exam, and get your Government License.

The demand for licensed men is enormous. Today there are over a million licensed broadcast installations and mobile transmitters on the air, and the number is growing constantly. And, according to Federal law, no one is permitted to operate or service such equipment without a Government FCC License or without being under the direct supervision of a licensed operator.

This has resulted in a gold mine of new business for licensed service technicians. A typical mobile radio service contract pays an average of about $100 a month. It's possible for one trained technician to maintain eight to ten such mobile systems. Some men cover as many as fifteen systems, each with perhaps a dozen units.

Opportunities in Industry

And there are many other exciting opportunities in the aerospace industry, electronics manufacturing, telephone companies, and plants operated by electronic automation. Inside industrial plants like these, it's the licensed technician who is always considered first for promotion and in-plant training programs. The reason is simple. Passing the Federal Government's FCC exam and getting your License is widely accepted proof that you know the fundamentals of Electronics.

So why doesn't everybody who "tinkers" with electronic components get an FCC License and start cleaning up?

The answer: it's not that simple. The Government's licensing exam is tough. In fact, an average of two out of every three men who take the FCC exam fail.

There is one way, however, of being pretty certain that you will pass the FCC exam. That's to take one of the FCC home study courses offered by the Cleveland Institute of Electronics.

CIE courses are so effective that better than 9 out of every 10 CIE graduates who take the exam pass it. That's why we can afford to back our courses with the ironclad Warranty shown above: you get your FCC License or your money back.

Mail Card for Two Free Books

Want to know more? Send the card at the left for a FREE copy of our school catalog, "How To Succeed In Electronics," describing opportunities in Electronics, together with our special book, "How To Get A Commercial FCC License." If card has been removed, just send your name and address to us.

ENROLL UNDER NEW G.I. BILL

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

CIE Cleveland Institute of Electronics

1776 East 17th Street, Cleveland, Ohio 44114

Accredited Member National Home Study Council
A Leader in Electronics Training... Since 1934

get a Government FCC License

These CIE men did it —so can you

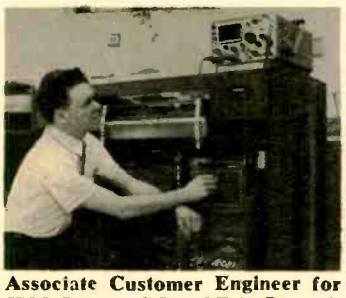
Not too long ago, the men shown here had only limited prospects in Electronics. Most had no training beyond what they'd gotten on the job or in service. So these men decided to "train up" with CIE for the FCC License exam. Today, as a result, they hold important jobs, with salaries to match. If you'd like to join their ranks, see for yourself on the page at left how easily you can train for an FCC License the CIE way.

Owns His Own Two-Way Mobile Radio Business. Ed Dulaney of Scottsbluff, Nebraska, got his 1st Class FCC License with CIE training. "It's helped me realize my highest ambition—owning my own business," he writes. "Now I manufacture my own two-way radio equipment, with dealers who sell it in seven states, and have seven full-time employees on my payroll."

Senior Transmitter Operator for Radio Station WBOE. Says Matt Stuczynski: "I give CIE credit for my 1st Class FCC License. Even though I had only six weeks of high-school algebra, CIE's lessons made Electronics easy. I now have a good job in studio operation, transmitting, proof of performance... and am on my way up."

"Theory Man" at General Dynamics. Harry J. Remmert III, of Groton, Connecticut, passed his 1st Class FCC License exam less than 11 months after enrolling with CIE. Since then, he's had two pay raises within 10 months. And, he adds, "I'm getting to be known as a theory man in my job with General Dynamics Research and Development Division."

"A Real Fine Business and Income." That's how the FCC License he got with CIE training has paid off for him, says Donald E. Breidenbach of Ponca City, Oklahoma. "Since passing the 2nd Class exam, I've opened my own two-way mobile radio business, and now have one of the best-equipped shops in northern Oklahoma."



Associate Customer Engineer for IBM. Raymond Ott of Erie, Pennsylvania, trained with CIE when he was in the Air Force. "The day after leaving service, I passed my 2nd Class FCC License exam with Radar Endorsement. When I arrived back home, I applied to IBM—and am now an Associate Customer Engineer on computers and related equipment."

"Swamped with Job Offers from All Over." Thomas E. Miller, Jr., completed his CIE training and passed the 1st Class FCC License exam while in the Navy. "After discharge," he reports, "my only problem was to pick the best offer, and I did—engineer with Indiana Bell Telephone. CIE made the difference between just a job and a management position."

"My New Job Pays $228 a Month More!" Eugene Frost of Columbus, Ohio, was stuck in low-pay TV repair work before training with CIE and getting his 2nd Class FCC License. Today he holds an important job as an inspector with North American Aviation. He says, "I earn $228 a month more and have a new home, two good cars, and a color TV."

← Mail postpaid card for complete information.

ELECTRONICS ILLUSTRATED

A Fawcett Publication

November 1968 Vol. 11 No. 6

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ELECTRONICS ILLUSTRATED

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- ☐ Communications
- ☐ Computers
- ☐ Broadcasting
- ☐ Industrial Electronics
- ☐ Electronic Control

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City_____

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106

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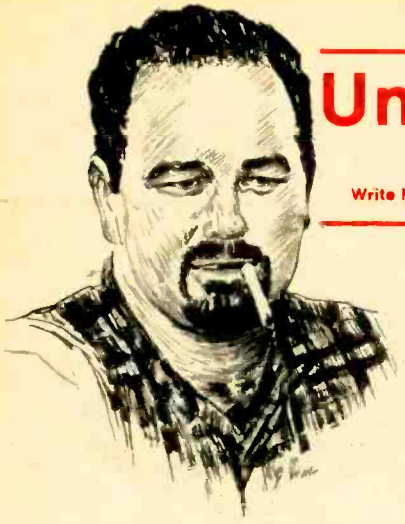

Uncle Tom's Corner

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 enjoyed the story about your visit to Swan Island and the Rolex watches that CIA agents are said to use as a method of ID. Which particular Rolex watch, where do I get one and how much does it cost?*

Lee Boggus, Jr.
Atlanta, Ga.

The CIA special seems to be the Rolex GMT-Master, available at your local jewelry or spy shoppe at about $250. It takes them around three months to order one if it's not in stock.

★ *Why isn't there a TV channel 1?*

Samuel Harper
Bakersfield, Calif.

About 25 years ago there was a TV channel 1 but when the FCC allocated VHF spectrum space after the war it was decided to give these frequencies (50 to 54 mc) over to the ham radio service as the 6-meter band.

★ *Maybe I'm off base but it seems to me that many years ago (in the 78-rpm era) pop records played for a good 3 to 3½ minutes. Anyway, the trend seems to be toward shorter and shorter selections on today's pop recordings. How much would it cost to play, record and press that extra minute of music we used to have years ago?*

Eugene Troster, Sr.
Lincoln, Nebr.

The only people to lose money on longer recordings are the pop music broadcasters. They have been pressuring recording companies to cut the playing time so that more music (and commercials) can be wedged into each hour. Some stations even have gone so far as to produce their own abbreviated versions of long-winded songs; they tape the original record and snip out the entire central portion. Bob Dylan's marathon songs have been a particularly good target for this type of butchering.

★ *My cousin bought a boat and I'd like to hear him talking while he's fishing. How can I tell if my receiver picks up the marine band?*

Franklin Merriwell
Tampa, Fla.

If you hear them playing The Halls of Montezuma, it's probably the Marine Band.

★ **FCC, Please Note:** The radical political group that has been getting its kicks from dynamiting PG&E high-tension towers in California is moving into your jurisdiction. Word is that they are eyeing the possibilities of setting up easily transportable pirate broadcast stations. Stations would consist of four suitcase-size units weighing 75 lbs. each and containing 117-V power supply, record player, tape deck, miniature mixing board and transmitter. The antenna will be a wire strung from a helium-filled balloon. Purpose of the stations would be to promote guerrilla activities and jam regular broadcast stations.

★ *Does aluminum siding on a house attract lightning?*

Mrs. George Boraggio
Athens, Ga.

People who live in aluminum houses can throw stones at this ridiculous old rumor. The National Fire Protection Association never has mentioned aluminum siding as being especially risky. Houses with this siding are no more attractive to lightning than any other kind.

★ *I'm one of Australia's leading UFO experts and I noticed in your column you mentioned that stories of vanishing ships have been pushed into the background because of flying saucers. I feel that there is a con-*

[*Continued on page* 8]

10-day trial trains you to fix 70% of all TV sets

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Study the first two lessons in your spare time. If within 10 days you don't feel qualified to tackle 7 out of 10 TV repair jobs, stop right there. Return the course and we'll refund every cent you mailed with your application.

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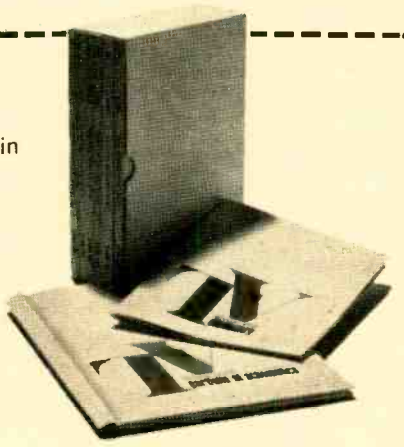

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Uncle Tom's Corner

Continued from page 6

nection between the disappearance of the ships and UFOs. Many others feel this way.

G. Puckett
Sydney, Australia

If you buy the idea that UFOs are run by intelligent beings then you shouldn't have any particular hang-ups about relating them to just about any mysterious event on earth. In this particular situation, it seems strange that such hostile acts have been carried out only against ships and not against isolated land communities. Personally, I feel that there is one zinger of a story somewhere behind the vanishing ships, especially the many that have gone pfffft in the area known as the Bermuda Triangle.

★ *My receiver has problems. Most of the stations I hear on the short-wave bands are repeated exactly 1 mc below their original frequency. For example, I get WWV on both 4 and 5 mc, also on 9 and 10 mc, 14 and 15 mc, etc. How can I straighten this out?*

Vic Yarosh
Livingston, N.J.

You're hearing images and a quickie solution would be by giving the set a little more soup with the addition of a preselector (an outboard tuned RF stage).

★ *What is the radio frequency of the Philadelphia Fire Department? Are there any directories that list police and fire radio stations?*

Ron D. Rorech
Philadelphia, Pa.

Philadelphia fire fighters use 153.95, 154.235 and 170.15 mc. Directories listing call-signs and frequencies of all state, county, municipal police and fire radio stations in specific metropolitan areas are available at $1 per area from Communications Research Bureau, P.O. Box 56, Commack, N.Y. 11725. Although additional areas are in preparation, the following already are available: New York City, southern California (police only), Chicago, Philadelphia, Detroit, San Francisco, Boston. Each directory contains hundreds of listings covering all stations for many miles around the central city. A Florida statewide directory also is available.

[*Continued on page* 10]

Our CB success has gotten out of hand.

MODEL XM 2300

MODEL M 2300

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Introducing our first great line of 5W base/mobile rigs.

Fanon, world leader in hand-held CB and intercommunication is ready with its first great line of base station/mobile rigs.

Not the largest line in the field—but the finest. Carefully and skillfully developed and engineered for top performance. Units you can place your confidence in...and all made in the U.S.A.

and the finest hand-held CB rig ever produced.

MODEL IC-5000. 3 space age IC Circuits for the ultimate in range and performance. 5 watts & 6 channels. Power boost antenna. Range booster. PA facility. Converts to base station with optional AC power supply. **$99.95**

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MODEL T 23 — Solid state engineering for unsurpassed reliability. 23 channels. Fiberglass expoxy circuit board with silicon transistors. Beautiful wood graining. Light-compact-powerful. Unique signal light tells you when S6 signal or better is received. **$159.95**

MODEL XT 23—The finest solid state mobile rig on the market. All 23 channels. Unsurpassed adjacent channel rejection. Helps pierce "skip".

Protected against overload, mismatched antenna and incorrect polarity. Base reflex type audio. Push/pull on-off switch with volume control.

Push/pull noise limiter and squelch. True PA system. **$199.95**

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Your new line looks great! Please send me additional information. I'm especially interested in:

M 2300 ☐ XM 2300 ☐ T 23 ☐ XT 23 ☐ IC 5000 ☐

Name _____ City _____

Address _____ State _____ County _____ Zip _____

CIRCLE NUMBER 45 ON PAGE 13

Uncle Tom's Corner

Continued from page 8

★ **Computerized Civilization Dept.** Bet you never thought you'd see the day when a computer would be regulating and protecting your morals, censoring out of your view those things that it did not want you to see. The day is here, gang! Many states are installing computers to issue license plate numbers for cars and the master computer at IBM has rushed to the rescue with a manual for Motor Vehicle Bureaus that tells of 2- and 3-letter combinations that are deemed objectionable for license-plate use. The MV bureaus are requested not to program these combinations into their computers. There are 482 specific combinations listed, plus a blanket condemnation of any use of the letter Q. Some of the obvious slang words are on the list but you also can forget about motoring along with license plates bearing such shockers as: BVD, DOG, FAT, PIG, POT, WOW and even that old eyebrow-raiser ZOO. As you might expect, the letters IBM were okayed. Interestingly enough, the computer eliminated the letters FBI but gave the green light to both USA and CIA. Hmmmm! Wonder if somebody got to that computer.

★ *Every time you feel compelled to mention the ARRL you always make it a jab in their ribs. Why?*

Alvin Mardner
Inkster, Mich.

Because beneath the League's exterior shell of artificial stuffiness there lies a hard core of genuine stuffiness.

★ *What is the most sensitive communications receiver available at any price? What receivers are used at government monitoring stations?*

Kenneth Woo
Chicago, Ill.

Sensitivity is not the prime consideration in determining the quality of a receiver. You also must take into account stability, selectivity and calibration. I would say that among the world's greatest receivers are Collins 51J and 51S series, Collins R-390 series, National HRO-500, Racal RA series, and the Lorch HR-240. Government monitors use

[*Continued on page* 12]

Learn I.C.'s...Build this new RCA Audio Amplifier Kit

RCA's new Integrated Circuit Experimenter's Kit, KD2112, is the first of its kind. You get a "short course" in integrated circuits, and you can build a 500-milliwatt audio amplifier or a variable-tone audio oscillator.

The heart of this new "all-parts-included kit" is an RCA linear integrated circuit—a multipurpose wide-band audio amplifier—containing the equivalent of 7 transistors, 11 resistors, and 3 diodes.

Each kit comes with a 20-page manual which gives complete step-by-step kit construction details. An extra I.C. "chip," with case removed, is also supplied so that its circuitry can be examined.

RCA's new Integrated Circuit Experimenter's Kit KD2112 is available from your RCA Distributor. Ask him for it, and learn more about I.C.'s.

RCA Electronic Components, Harrison, N. J. 07029

RCA

Uncle Tom's Corner

Continued from page 10

all of the above and also numerous others ranging from the troublesome Hammarlund SP-600 to the quaint Hallicrafters SX-28A which dates back to before World War II.

★ *Someone told me that Tom Kneitel died years ago and now a computer writes all your stuff.*

Joseph Kurinec
Johnson City, N.Y.

Sorry, I'm not programmed to answer your question.

★ *What is something called Operation Dragnet and why do we never hear anything about it from news media? I've heard some fantastic speculations about it.*

Rudy Eriebach
Texarkana, Ark.

If we're to believe usually-reliable sources—at least the few that were willing to discuss this subject—Operation Dragnet is a hush-hush FBI plan to arrest well over 500,000 persons considered political undesirables and potential security risks. This would be done should the President invoke Title II, Section 100—the so-called Concentration Camp Statute—of the McCarran Internal Security Act. The FBI has the master pickup list stored in a $2½-million Univac 1108 computer run by the Office of Emergency Planning at a secret location near Washington. The list is constantly updated and expanded with data and names fed to it by the FBI, CIA, military services, State Department, immigration people and a host of other groups keeping tabs on dissenters. About one million Federal Internal Security Warrants are already printed and the FBI estimates (it is said) that it could pull in from 3,000 to 12,000 people overnight and have them whisked off to federal detention camps at Avon Park, Fla.; Allenwood, Pa.; El Reno, Nev.; Tule Lake, Calif.; Wittenburg and Florence, Ariz. The whole plan can be put into action if the President decides there is an internal security emergency such as a declaration of war by Congress, an insurrection within the United States, or an imminent invasion of the U.S. or any of its possessions. Operation Dragnet is a very touchy subject, news media stay clear.

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11/68

Feedback from Our Readers

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

● COVER-UP

Your plastic dust cover [Sept. '68 EI] looked like just the thing to protect the tape recorder from the crumbs and other debris the kids drop on it after school. But this afternoon I found my wife using the cover as a tray to serve cake to the kids. What can I do to prevent that?

G. Spaulding
Bloomfield Hills, Mich.

Make another one for your wife.

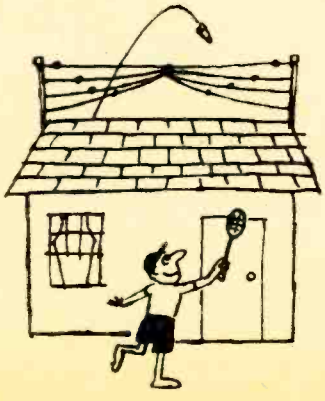
● FOR THE BIRDS

My mother doesn't want me to put up the multi-dipole antenna for SWLing [Sept. '68 EI] because she says the neighbors will object to the way it looks. She says if I can hide it some way I can put it up.

How long is a badminton net and what SW bands would I receiver from an antenna built into it?

Roger Kendall
Boca Raton, Fla.

Badminton nets are 20 ft. long. With that length you can receive 6, 10 and 11 meters. Why not take up tennis? With a 42-ft. net you also can bring in 13, 16, 19 and 20 and 25 meters.



● PICTURESQUE

In your July '68 Electronics in the News you had a picture of a girl holding large tubes from different instruments. Do you no her name and age?

B.J.
Hayward, Calif.

We call her Trixie, B.J., and if you can't see she's under 30 you need glasses as well as a spelling book.

● HEAR, HEAR!

I'm sorry but your portable public-address amplification system [Sept. '68 EI] just doesn't work. I've always had trouble making myself heard and I thought this would be just the thing. But now that I can talk loud nobody will listen.

H.R. Wheeler
Evanston, Ill.

Maybe they understand you now.

● MINI-NET

We've organized a network of license-free radio stations similar to the one in the article Making Like Murray the K on 1/10 Watt [Mar. '68 EI]. Any boy (or girl with her parents' consent) 14 to 18 with electronics knowledge and good English grades in school can join.

Amateur Broadcasting System
10 Donnybrook Rd.
Boston, Mass. 02135

EICO Makes It Possible

Uncompromising engineering—for value does it!
You save up to 50% with Eico Kits and Wired Equipment.

Cortina Stereo

THE VERDICT IS IN. High fidelity authorities agree: Cortina's engineering excellence, 100% capability, and compact dramatic esthetics all add up to Total Stereo Performance at lowest cost.

A Silicon Solid-State 70-Watt Stereo Amplifier for $99.95 kit, $139.95 wired, including cabinet. Cortina 3070

A Solid-State FM Stereo Tuner for $99.95 kit, $139.95 wired, including cabinet. Cortina 3200.

A 70-Watt Solid-State FM Stereo Receiver for $169.95 kit, $259.95 wired, including cabinet. Cortina 3570.

NEW Silicon Solid State 150-Watt Stereo Amplifier designed for audio perfectionists. Less than 0.1% harmonic distortion, IM distortion. Less than 0.6% at full output. Controls and inputs for every music source. $149.95 kit, $225.00 wired including cabinet. Cortina 3150.

NEW 70-Watt Solid State AM/FM Stereo Receiver for $189.95 kit, $279.95 wired including cabinet. Cortina 3770.

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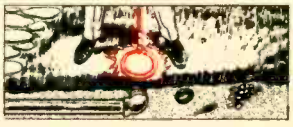

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CIRCLE NUMBER 6 ON PAGE 13

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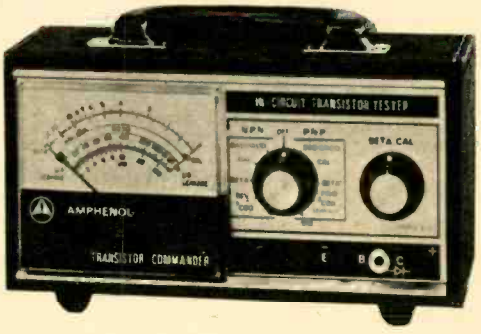
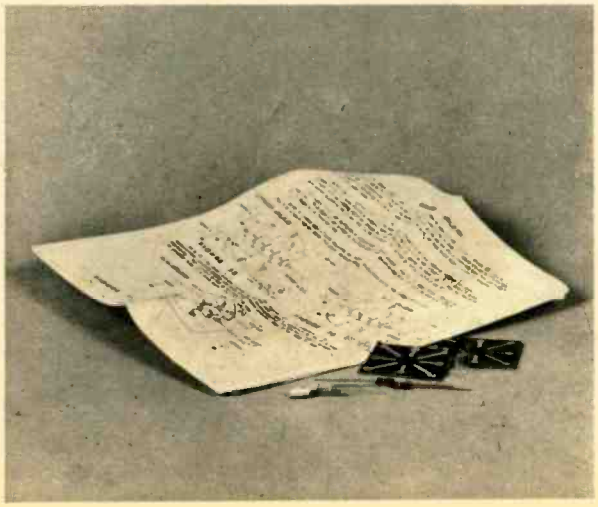
ALL-BANDER. . . The CRF-230 is a 23-band AC/DC receiver covering the AM and FM broadcast bands, international short-wave bands and amateur bands. In addition, the unit covers the 150-400 kc long-wave band and the European 64-90 mc FM broadcast band. Features include side-mount band selector knob, three combination tuning-bandspread knobs, calibrator, BFO switch for monitoring sideband or CW transmissions, dual antennas, front-panel earphone and headphone jacks, base, treble, volume, AFC, muting, selectivity and sensitivity controls. The back panel has tape recorder input and output, multiplex adaptor, external speaker and antenna jacks. $595. Sony Corp., 47-47 Van Dam St., Long Island City, N.Y. 11101.

Electronic Marketplace

Solid Service. . . The Transistor Commander Model 830 is a transistor analyzer that also measures supply voltages to 100 VDC and will function as a diode analyzer measuring both forward and reverse currents. In-circuit as well as out-of-circuit tests can be made. Current limiting is used both to protect the transistor or diode under test and to prevent damage to the tester. Foreward and reverse current in diodes can be checked without removing the diode from the circuit. $79.95. Amphenol Distributor Div., 2875 S. 25th Ave., Broadview, Ill. 60153.





IC Kit. . . The Integrated-Circuit Experimenter's Kit Model IC-100 is intended as a low-cost introduction to ICs. It includes two Fairchild U1941 ICs plus two resistors, two capacitors and two etched circuit boards. The accompanying instruction manual tells you how to hook them all together into such simple circuits as a square-wave generator, an audio preamp or a DC amplifier as well as logic circuits. $6.95. Kay Engineering, Box 3932, Long Beach, Calif. 90803

There has never been a better color-bar generator than the RCA WR-64B...until now!

The RCA WR-502A CHRO-BAR color-bar generator is all solid-state, battery operated... Provides color bars, dots, crosshatch, vertical lines, horizontal lines, blank raster... has rock-solid stability. It's the greatest yet. The CHRO-BAR. $168.00*.

RCA Electronic Components, Harrison, N.J. 07029

*Optional Distributor resale price. Prices may be slightly higher in Alaska, Hawaii and the West.

RCA

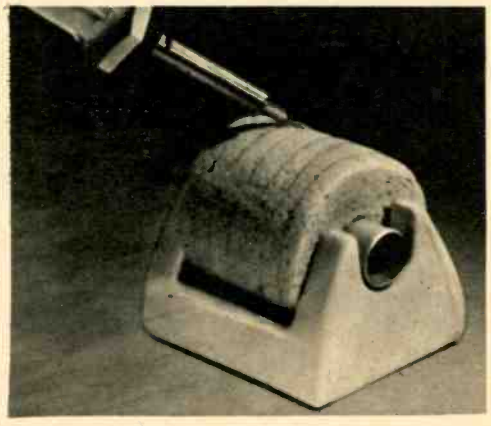
CIRCLE NUMBER 29 ON PAGE 13

Electronic Marketplace

Sideband Kit. . . The HW-100 SSB/CW transceiver covers five bands—80 through 10 meters. The hybrid circuit uses 20 tubes, two transistors (including one FET in the VFO) and 16 solid-state diodes. Front panel features in-

clude vernier tuning, band selector, mode selector, input level, driver and final tuning, selector switch, PTT/VOX switch, RF and AF gain control. Receiver sensitivity is listed at ½ μv for 10db S+N/N ratio for SSB, transmitter output at 180 watts PEP for SSB. $240. Heath Co., Benton Harbor, Mich. 49022.

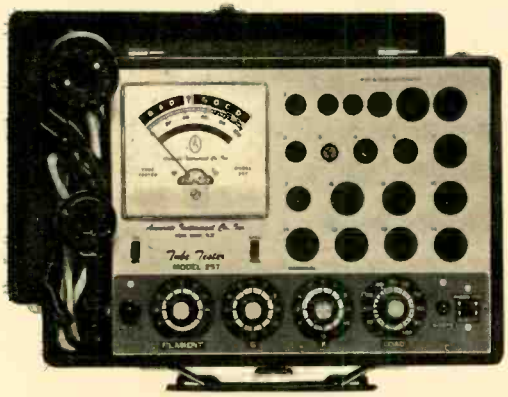
Fresh Tip. . . The Plato Rotating Soldering-Iron Cleaner is a set of cellulose sponges mounted in a porcelain base. It is heavy enough to stay in place on the workbench when it is used. The rotating action of the sponges, according to the



manufacturer, deposits excess solder or burned-on flux in the base, cleaning sponges automatically. The base doubles as a well, holding water to keep the sponges moist. $3.25. Replacement sponges, 99¢. Plato Products, Inc., Box 1019, El Monte, Calif. 91734.

The New 1968 Improved Model 257 **A REVOLUTIONARY NEW**

TUBE TESTING OUTFIT



- **Tests all modern tubes including Novars, Nuvistors, Compactrons and Decals.**
- **All Picture Tubes, Black and White and Color**

ANNOUNCING... for the first time

A complete TV Tube Testing Outfit designed specifically to test **all** TV tubes, color as well as standard. Don't confuse the Model 257 picture tube accessory components with mass produced "picture tube adapters" designed to work in conjunction with all competitive tube testers. The basic Model 257 circuit was modified to work **compatibly** with our picture tube accessories and those components are not sold by us to be used with other competitive tube testers or even tube testers previously produced by us. They were custom designed and produced to work specifically in conjunction with the Model 257.

COMPLETE WITH ALL ADAPTERS AND ACCESSORIES, NO "EXTRAS"

STANDARD TUBES:

- Tests the new Novars, Nuvistors, 10 Pins, Magnovals, Compactrons and Decals.
- More than 2,500 tube listings.
- Tests each section of multi-section tubes individually for shorts, leakage and Cathode emission.
- Ultra sensitive circuit will indicate leakage up to 5 Megohms.
- Employs new improved 4½" dual scale meter with a unique sealed damping chamber to assure accurate, vibration-less readings.
- Complete set of tube straighteners mounted on front panel.

BLACK AND WHITE PICTURE TUBES:

- Single cable used for testing all Black and White Picture Tubes with deflection angles 50 to 114 degrees.
- The Model 257 tests all Black and White Picture Tubes for emission, inter-element shorts and leakage.

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- The Red, Green and Blue Color guns are tested individually for cathode emission quality, and each gun is tested separately for shorts or leakage between control grid, cathode and heater. Employment of a newly perfected dual socket cable enables accomplishments of all tests in the shortest possible time.

The Model 257 is housed in a handsome, sturdy, portable case. Comes complete with all adapters and accessories, ready to plug in and use. No "extras" to buy. Only **$47.50**

NOTICE

We have been producing radio, TV and electronic test equipment since 1935, which means we were making Tube Testers at a time when there were relatively few tubes on the market, way before the advent of TV. The model 257 employs every design improvement and every technique we have learned over an uninterrupted production period of 32 years.

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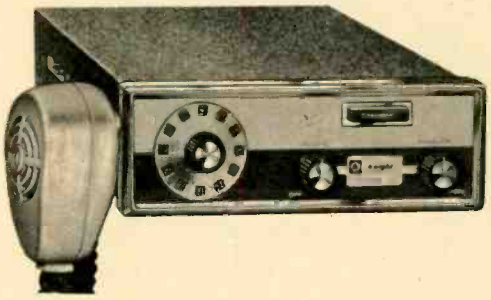
CIRCLE NUMBER 41 ON PAGE 13

Electronic Marketplace

CB Semi-Kit. . . The Safari IV is a 12-channel CB transceiver designed for CBers who like to brandish a soldering iron. While the transmitter section is factory-assembled and aligned, the rest is supplied as a kit. The 5-watter can be used



for base or mobile operation. Features include adjustable squelch, series-gate noise limiter to cut down ignition noise, crystals for channel 9 and push-to-talk microphone. Kit includes instructions, solder, wire. $79.95. Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680.

UHF Addition. . . The CR5-1AK is one of a series of UHF antenna kits that can be added to a VHF antenna. It's a 13-element corner reflector and, like all the kits, comes with UHF/VHF antenna coupler, two twinleads with

connectors, insulators, indoor UHF/VHF/FM adaptor, instructions. $15.95. (J-1AK, 7-element yagi, $15.50; J-3AK, 20-element yagi, $21.50.) Gavin Instruments, Inc., 1450 Route 22, Somerville, N.J. 08876.

Broadsides

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

TWO new manuals describe construction of **loudspeaker enclosures** — Enclosure Construction Manual (CF 802) and Enclosure Construction for JBL F Series Musical Instrument Speakers (CF 706). CF 802 contains design basics of ported cabinet construction, bracing, grille assembly and finishing details. Manual CF 706 discusses enclosures for musical-instrument speakers, especially those requiring high power-handling capabilities. Copies 50¢ each. James B. Lansing Sound Inc., 3249 Casitas Ave., Los Angeles, Calif. 90039.

Basics of **marine radio** frequencies and equipment are contained in Which Radio Telephone Is The Best For Me? It discusses recent rule changes by the International Telecommunications Union and includes an outline of the differences between AM, FM and SSB transmissions. Free copy from Raytheon Marine Products Operation, 213 E. Grand Ave., South San Francisco, Calif. 94080.

Flyer 755 describes Lafayette's LR-1500T **175-watt AM/FM-stereo receiver,** their most sophisticated entry in the audio-component marketplace. Copy free from Lafayette Radio Electronics, 111 Jericho Tpk., Syosset, N.Y. 11791.

Bulletin 371 lists more than 400 voltage-variable capacitors **(varactors).** Specifications define performance and include capacitance vs voltage and Q-value data. Performance charts show capacitance vs bias voltage, Q vs bias voltage, Q vs frequency and capacitance vs temperature. Free copy from Computer Diode Corp., Pollitt Dr., Fair Lawn, N.J. 07410.

A booklet titled **Professional Audio Controls** goes far beyond the usual clichés in discussing problems of equalization and useful dynamic range in commercial recording and similar professional applications. Ten basic types of filter and equalizer circuits are discussed, individually and as combined in equipment. The material does not appear to be recent (there is a reference to the NARTB, rather than NAB, tape equalization curve) but it should prove useful to those with a serious interest in audio. Copy 25¢. Altec Lansing Div. of LTV Ling Altec., Inc., 1515 S. Manchester Ave., Anaheim, Calif. 92803.

More than 3,500 **semiconductors**—zener diodes, digital and linear ICs, FETs, PNP/NPN power transistors, etc.—are described in condensed catalog 1968. Contains alpha-numerical and tabular listings with application data. Free. Dept. TIC, Motorola Semiconductor Products Inc., Box 13408, Phoenix, Ariz. 85002.

NEW FINCO® COLOR SPECTRUM™ antennas are "signal customized" for better color reception...

"the ANTENNA that captures the RAINBOW"

FINCO has developed the Color Spectrum Series of antennas—"Signal Customized" — to exactly fit the requirements of any given area. There is a model scientifically designed and engineered for your area.

Check this chart for the FINCO "Signal Customized" Antenna best suited for your area.

STRENGTH OF UHF SIGNAL AT RECEIVING ANTENNA LOCATION ▼	Strength of VHF Signal at Receiving Antenna Location				
	NO VHF ▼	VHF SIGNAL STRONG ▼	VHF SIGNAL MODERATE ▼	VHF SIGNAL WEAK ▼	VHF SIGNAL VERY WEAK ▼
NO UHF		CS-V3 $11.50	CS-V5 $18.50 CS-V7 $25.95	CS-V10 $37.95	CS-V15 $50.95 CS-V18 $59.50
UHF SIGNAL STRONG	CS-U1 $10.50	CS-A1 $19.95	CS-B1 $31.50	CS-C1 $45.95	CS-C1 $45.95
UHF SIGNAL WEAK	CS-U2 $15.95	CS-A2 $23.95	CS-B2 $41.95	CS-C2 $54.50	CS-D3 $73.50
UHF SIGNAL VERY WEAK	CS-U3 $22.95	CS-A3 $32.50	CS-B3 $52.50	CS-C3 $62.95	CS-D3 $73.50

All Prices Subject to Change

NOTE: In addition to the regular 300 ohm models (above), each model is available in a 75 ohm coaxial cable downlead where this type of installation is preferable. These models, designated "XCS", each come complete with a compact behind-the-set 75 ohm to 300 ohm balun-splitter to match the antenna system to the proper set terminals.

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CIRCLE NUMBER 26 ON PAGE 13

Cobra 98

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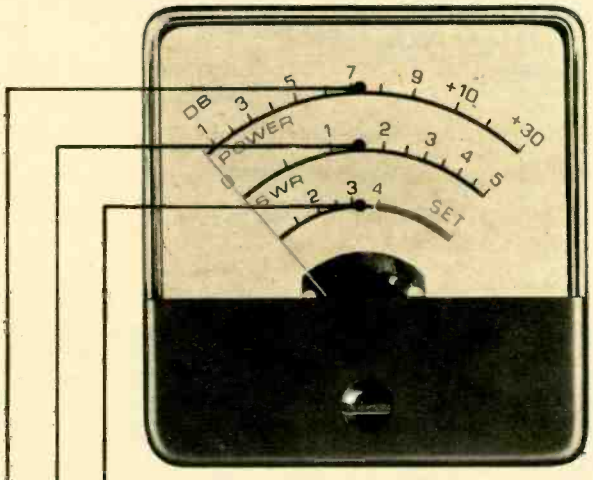

1. Built-in SWR bridge lets you tune your antenna for maximum output.
2. Forward-Reverse reflected Power Output Meter tells you how much power is going out.
3. "S" meter measures strength of incoming signals.

Outgrown your present CB? Step up to the new B&K Cobra 98, the new, 23-channel, fully deluxe CB that's built to outperform and outvalue most other rigs. The new triple scale (shown above) is only part of the story . . . the Cobra 98 looks like a million! The heavy die-cast aluminum front panel is magnificently finished in black and brushed aluminum.

And the Cobra 98 has all the power and performance features B&K is famous for —including exclusive Dyna-Boost that intensifies speech signals and extends range even farther!

Cobra—the big name in CB—now brings you the flagship of the line—the COBRA 98—it's the most! **$239.95**

B&K Division of Dynascan Corporation
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Where Electronic Innovation Is A Way Of Life

CIRCLE NUMBER 31 ON PAGE 13

A Real Shoebox Speaker

An interesting new material that can lead to some real groovy shapes.

By JOHN CAPOTOSTO

WHAT'S really new in speakers these days? When you get right down to it, nothing. The principles of operation are the same now as they have been for the last 40 years (see LIFE GOES ON & ON AT 40, March '66 EI). Of course modern speakers sound a thousand times better but they're still the same old permanent-magnet, voice-coil and cone affairs.

And up until now the construction of enclosures hasn't changed much, either. Cabinets are made of wood or composition board and are either rectangular, triangular or square. If you wanted to build a cabinet with curved surfaces it would be almost impossible. Just how would you go about making a hemispherical enclosure out of ¾-in. plywood?

Using a new heat-formable core material called Plyfoam XR, fiberglass cloth, hardener and resin, it is possible to construct a speaker cabinet in almost any shape you want. Plyfoam is similar in texture to Styrofoam, which is around in abundance at Christmas and is used to make decora-

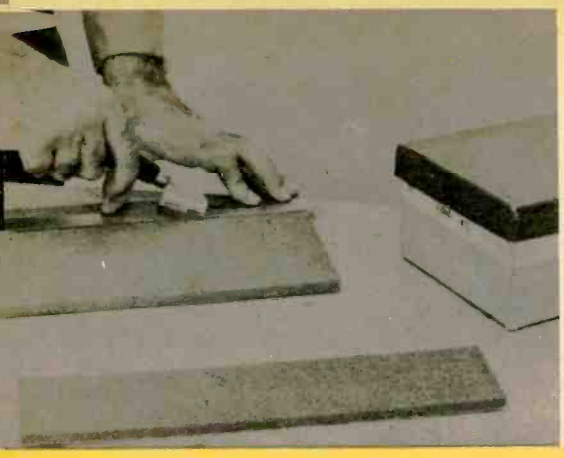


Fig. 1—First cut the Plyfoam sheet with sharp razor or knife to sizes of sides of shoebox. Edges will be butted so add the thickness of the Plyfoam.

Fig. 2—Batch of polyester resin is prepared with hardener which produces a quick cure. Resin is interlux No. 701. Mixing instructions are on the can.

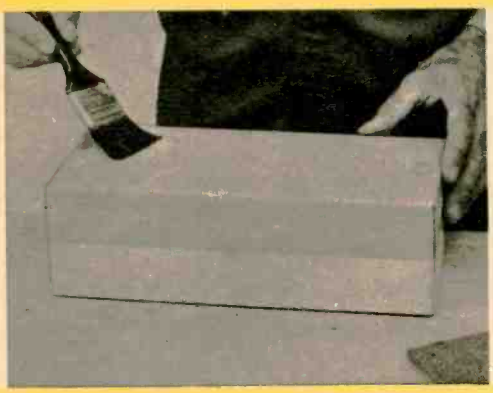


Fig. 3—Using an ordinary paint brush, apply the resin to the box or whatever form you are going to use. Be sure you don't brush resin too thin.

Fig. 4—After giving the box a coat of resin, give each of the pieces of Plyfoam a coat of resin. Then assemble the individual pieces on the box.

A Real Shoebox Speaker

tions and for packing. Plyfoam is relatively light in weight and speakers made from it aren't going to rival an AR-3 but it's an interesting application for an unusual material.

We show how to build a conventional-shape box because it might be best for you to try this new construction technique first on an easy-to-handle shape. After you have mastered handling the material you can tackle an enclosure that has compound curves.

Plyfoam can be cut and shaped with ordinary tools and can be used to make any shape no matter how intricate. Even round, oval or spherical designs are a snap. Beauty of it is you do not need complicated forms. Any household item with the desired shape becomes the form. To shape the Plyfoam sheet, you just heat it and bend. When it cools to room temperature it will become rigid and retain its shape.

For flat surfaces you use the Plyfoam cold. It is simply a matter of cutting it to size and then assembling the pieces. You then apply a coat of resin and a layer of fiberglass cloth for a tough, almost indestructible sandwich.

Plyfoam is a thermoplastic material which will soften when heated to about 200°F. In this state it can be stretched, twisted, formed and even knotted. When it cools it retains its shape.

Untreated, Plyfoam has little structural strength; it is brittle and will break like a cracker. Add a little resin and a layer of fiberglass cloth and the material becomes more

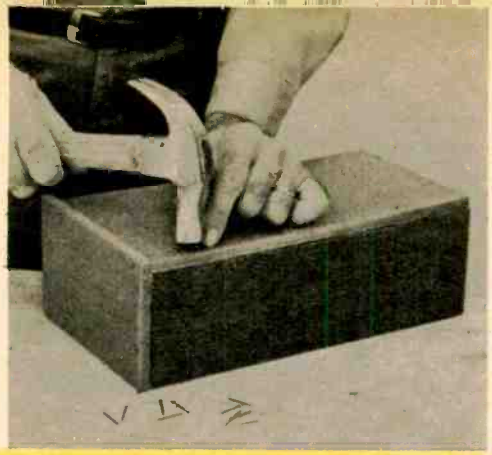


Fig. 5—After all the pieces of Plyfoam are assembled on the box, fasten them together with brads. This will assure rigidity while resin sets.

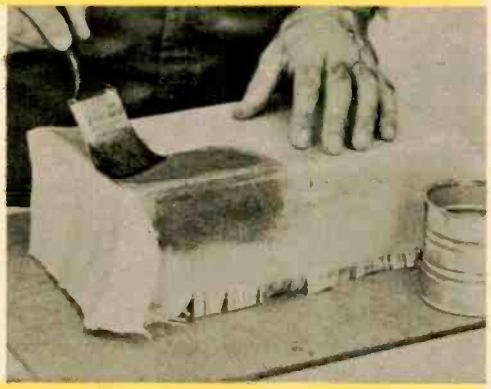


Fig. 6—Lay a piece of 7-oz. fiberglass cloth on box and impregnate with resin. Use rubber squeegee to remove bubbles, smooth surface.

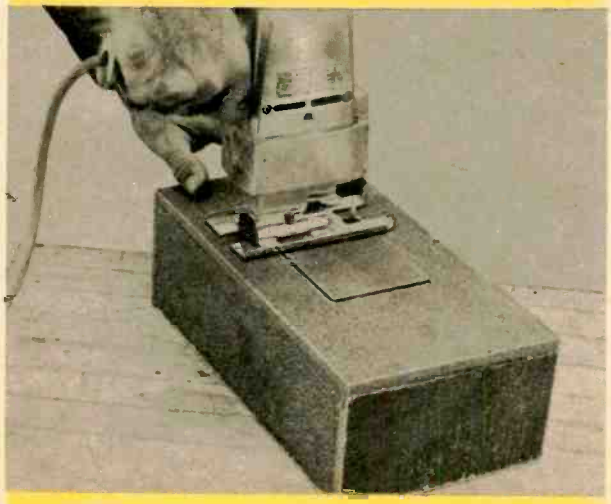


Fig. 7—After the resin has cured, cut an opening for speaker, using saber saw with metal-cutting blade. Install grille cloth from rear.

like a piece of steel.

Plyfoam is available in 3 x 3-ft. sheets in thicknesses of ¼, ⅜ and ½ in. When pieces are to be joined, just butt them together and fasten them temporarily with staples or round toothpicks. When resin is applied to the sheets it will permeate the joint, making it even stronger than the rest of the sheet.

Because of this unique property, strips of Plyfoam can be used when making large complicated shapes. In industry, ovens, heating blankets and banks of infrared lamps are used to heat large sheets. Since you won't have such equipment the strip method of construction is best as it requires no heat whatever. When the foam is cut into narrow strips the pieces become extremely flexible. Placed side by side, the strips can be held with toothpicks. Bend each piece as required either over a form or freehand.

Small pieces which can fit into a kitchen oven can be softened by setting the thermostat to 200°F. Left in the oven a few minutes, the piece will become limp and rubbery. Drape it over your form and allow it to cool. Remove the form and your piece will be ready to be covered with fiberglass.

When fiberglassing Plyfoam, certain work procedures must be followed. First, you should protect the surface of the table with newspapers or a sheet of plastic. Always keep plenty of solvent on hand to clean your hands and tools. The solvent for polyester resin is acetone but once the resin hardens nothing will soften it.

Polyester resin and fiberglass are available at marine supply houses. Plyfoam is available from Plyfoam, Inc., Vanderbilt Industrial Park, Hauppauge, N.Y. 11787. Write for literature and prices.

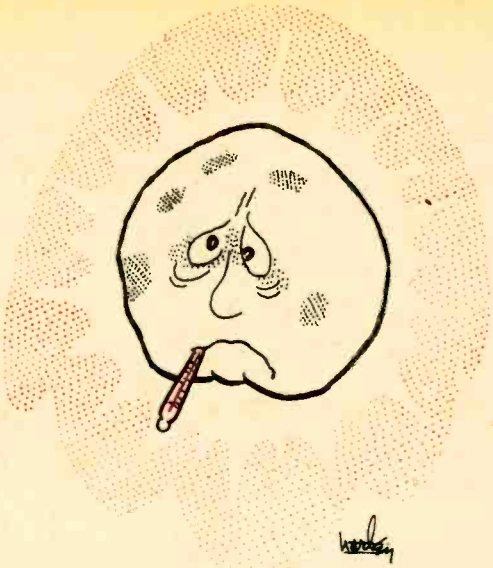
The resin is a heavy liquid which will harden only when a catalyst or hardener is added. Hardening time can be lengthened or decreased depending on catalyst quantity.

Information on the labels give approximate hardening times for different mixtures. When you start it is best to prolong the working time by using less hardener. Temperature also plays a role in the setting time. The higher the temperature the faster the set—an important point to remember in the summer.

This is the procedure for fiberglassing: 1) Coat the foam with a layer of resin. 2) Cover this with a piece of fiberglass cloth. 3) Add another coat of resin on top of the glass. After the resin hardens, sand it, then paint

[*Continued on page* 116]

DXing the Sunspot Utilities



By ALEX BOWER

While the sun has its spots you still have time for hot DX.

WITH solar activity currently at its peak, now is the time to hunt the rare ones on short wave's upper third—all of those frequencies between 20 and 30 mc—which, a few years from now, again will be empty. Of course, every listener knows the 11- and 13-meter SWBC bands are open and the upper reaches charged with SWBC harmonics. But equally important to the DXer is the hunt for rare utility stations that now are using these frequencies. Such exotic locales as American Samoa, Portuguese Guinea and Eritrea (Ethiopia's northern province) are ready and waiting for the alert SWL.

A utility transmission is intended for specific persons and generally is sent to one specified receiving point—unlike a broadcast transmission which is intended for as many people as are capable of receiving it. A utility station sometimes, as we shall see, carries material intended for eventual broadcast. But these relays are utility DX nonetheless.

Which utility networks operate above 20 mc? Well, those services requiring distant communications with mobile stations (such as aeronautical and marine) use the lowest frequency possible so that they can be heard in all directions with minimum QRM. On the other hand, services between fixed points using very directional antennas tend to use the highest frequency possible. The upper channels deliver the strongest signal at a distant point and often are open in only one general direction at a time. This limits their usefulness for mobile service but effectively reduces QRM for fixed networks.

PTP (point-to-point) transmissions can include a variety of material. Among the most interesting is programming originated by large SWBC organizations at headquarters and beamed to some distant relay base for rebroadcast. As such material must be picked up off the air twice before reaching the listener, it follows that the first link must be as clear and free of QRM as possible. Again, frequencies above 20 mc, with their selective openings, are preferred.

Despite the tremendous proliferation of overseas relay bases, most large SWBC organizations are short on point-to-point facilities and must use regular SWBC bands—often 13 and 11 meters. Professional receivers and receiving antennas can pick up 11- and 13-meter signals that would be down in the mud for the average overseas listener using an inexpensive set.

A few months ago, the VOA began broadcasting in Vietnamese 24 hours a day. One of the frequencies used to beam transmissions from California (fed from Washington via conventional telephone facilities) to transmitter sites in

EI's GUIDE TO UTILITY DX		
FREQ. (kc)	OPERATOR, OTHER NOTES	STATION LOCATION
20020	Dar es Salaam, Tanzania	East African Telecommunications Corp.
20575	NPM, Pearl Harbor, Hawaii	U.S. Navy
20696	Managua, Nicaragua	Tropical Radio Telegraph Co.
20753	AEZ, Asmara, Ethiopia	U.S. Navy (also 21790 kc)
20877	KUQ20, Pago Pago, American Samoa	RCA
21760	NPN, Guam	U.S. Navy (CW)
22760	NKA, Asmara, Ethiopia	U.S. Navy
24935	Lourenco Marques, Mozambique	Portuguese Marconi
25650	Bissau, Portuguese Guinea	Portuguese Marconi
26925	ABA, Honolulu, Hawaii	U.S. Navy

Asia is 21610 kc. This channel is used as late as 1000 PST (0100 in Southeast Asia) and sometimes even later. Another example is the BBC's 1130-1300 EST English transmission for Rhodesia. This is produced in London and then fed to the Ascension relay station on 21590 and 25670 kc (as well as via conventional PTP link on 18080 kc). Both these 11/13-meter operations, though on SWBC bands, fall into the category of utility, rather than broadcast, DX.

The bulk of PTP DX is provided by military and international telephone stations. A first-rate example of the latter is KUQ20, operated by RCA at Pago Pago, American Somoa, on 20877 kc. American Samoa has no SWBC at all. Another is the Tropical Radio Telegraph Co. at Managua, Nicaragua. Nicaragua does have SWBC stations but TRT probably will be easier to verify. A third which appears to be a telephone operation at Bisseau, Portuguese Guinea, has been heard calling Lisbon right in the middle of the 11-meter SWBC band on approximately 25650 kc.

Telephone transmitters may use either scrambled speech or single sideband. The latter may be monitored on any receiver equipped with a simple BFO (beat-frequency oscillator). It is a violation of both international and federal law to repeat or in any other way divulge contents of conversations heard. But all telephone transmitters regularly air test tapes that can be understood by any listener and *most* telephone organizations do not object to SWL reception reports of these test periods.

Much DX provided by U.S. military stations is in Morse Code but, happily, they often transmit markers for long periods. These CW markers consist of the call letters, repeated over and over, interspersed with the letter V. Any SWL can decode them. If you don't know Morse Code, copy down the dots and dashes and then get out your old Boy Scout Handbook or any reference with a Code list.

A good target in this category is NPN, operated by the U S. Navy on Guam. It has been heard at the upper edge of the 13-meter SWBC band on approximately 21760 kc. Guam also is a DX country without SWBC stations. Another interesting catch, now that the VOA's Hawaii relay has been shut down except for test periods, is the USN's ABA at Pearl Harbor. Although both are naval stations each uses these frequencies primarily for working other bases, rather than shifts. ABA has been heard on 26925 with voice transmissions.

Contrary to what some SWLs seem to believe, not all good catches are those that add to their total of countries logged. For example, Ethiopia is well represented on the SWBC bands but its territory of Eritrea is not. This area (which formerly did count as a separate DX country) borders on the Red Sea and is the site of a strategic U.S. military communications link that Washington has been able to maintain only through delicate negotiations. For frequencies and call letters see our Guide.

Stations may be found above 20 mc any time that it is daylight at the transmitter site and some also may operate well into the evening hours. DX conditions will vary considerably from day to day.

Look What's New In Your

NEW kit AD-27
$169.95

Heathkit FM Stereo COMPONENT-COMPACT

This new Heathkit AD-27 stereo compact has features not found in other units costing twice as much for one very simple reason. It wasn't engineered to meet the usual level of compact performance. Instead, Heath took one of its standard stereo/hi-fi receivers, the AR-14, and re-arranged it physically to fit a compact configuration. The result is performance that is truly high fidelity without compromise. It features 31 transistor, 10 diode circuitry with 15 watts per channel dynamic music power (enough to let you choose most any speaker systems you prefer), full-range tone controls, less than 1% distortion, and 12 to 60,000 Hz response. The pre-assembled FM stereo tuner section with 4-stage IF offers 5 uV sensitivity, excellent selectivity, AFC, and the smoothest inertia tuning. The BSR McDonald "500" turntable offers features usually found only in more expensive units . . . like low mass tubular aluminum tone arm, anti-skate control, cueing and pause control, plus a Shure magnetic cartridge with diamond stylus. It's all housed in a smart oiled walnut cabinet with sliding tambour door that disappears inside the cabinet. For value and performance choose the AD-27, the new leader in stereo compacts. Shpg. wt. 41 lbs.

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For the man who already owns a fine stereo amplifier, and in response to many requests, Heath now offers the superb FM stereo tuner section of the renowned AR-15 receiver as a separate unit. The new AJ-15 FM Stereo Tuner has the exclusive design FET FM tuner for remarkable sensitivity, the exclusive Crystal Filters in the IF strip for perfect response curve and no alignment; Integrated Circuits in the IF for high gain, best limiting; elaborate Noise-Operated Squelch; Stereo-Threshold Switch; Stereo-Only Switch; Adjustable Multiplex Phase, two Tuning Meters; two variable output Stereo Phone jacks; one pair variable outputs plus two fixed outputs for amps., recorders, etc.; front panel mounted controls; "Black Magic" panel lighting; 120/240 VAC operation. 18 lbs. *Walnut cabinet AE-18, $19.95.

NEW kit AA-15
$169.95*

HEATHKIT AA-15 Deluxe Stereo Amplifier

For the man who already owns a fine stereo tuner, Heath now offers the famous amplifier section of the AR-15 receiver as a separate unit. The new AA-15 Stereo Amplifier has the same superb features: 150 watts Music Power; Ultra-Low Harmonic & IM Distortion (less than 0.5% at full output); Ultra-Wide Frequency Response (±1 dB, 8 to 40,000 Hz at 1 watt); Ultra-Wide Dynamic Range Preamp (98 dB); Tone-Flat Switch; Front Panel Input Level Controls; Transformerless Amplifier; Capacitor Coupled Outputs; Massive Power Supply; All-Silicon Transistor Circuit; Positive Circuit Protection; "Black Magic" Panel Lighting; new second system Remote Speaker Switch; 120/240 VAC. 26 lbs. *Walnut cabinet AE-18, $19.95.

CIRCLE NUMBER 3 ON PAGE 13

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

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Now, Wireless Remote Control For Heathkit Color TV's

Control your Heathkit Color TV from your easy chair, turn it on and off, change VHF channels, volume, color and tint, all by sonic remote control. No cables cluttering the room . . . the handheld transmitter is all electronic, powered by a small 9 v. battery, housed in a small, smartly styled beige plastic case . . . feather-light and contoured to fit comfortably in your hand for easy pushbutton operation. The receiver contains an integrated circuit (15 resistors, 10 transistors, 1 diode) and a meter for adjustment ease. Circuit board construction and plug-in wire harness make installation of receiver and control motors easy. For greater TV enjoyment, order yours now.

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kit GR-295

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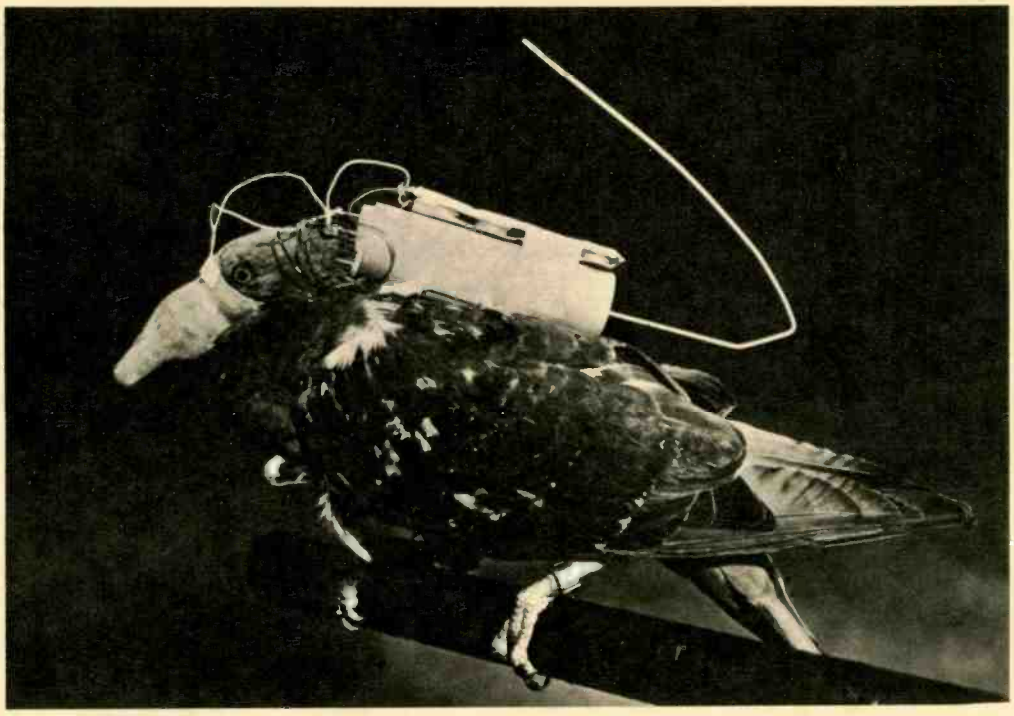
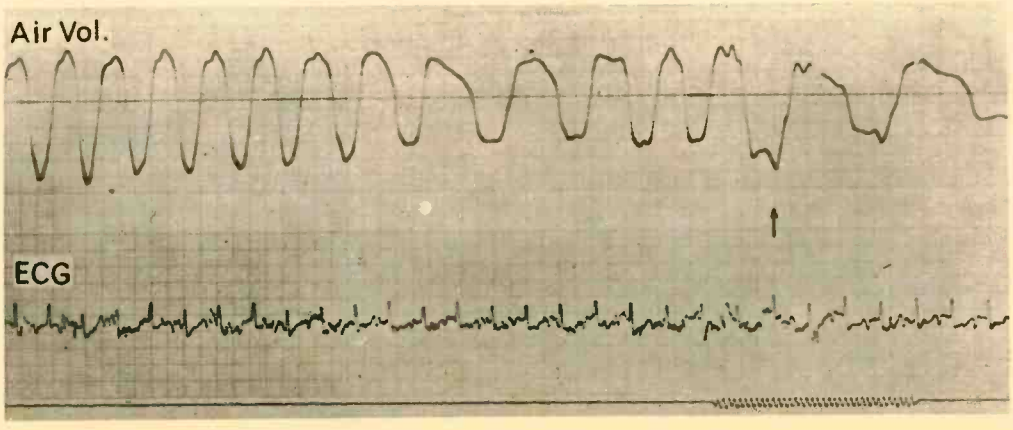
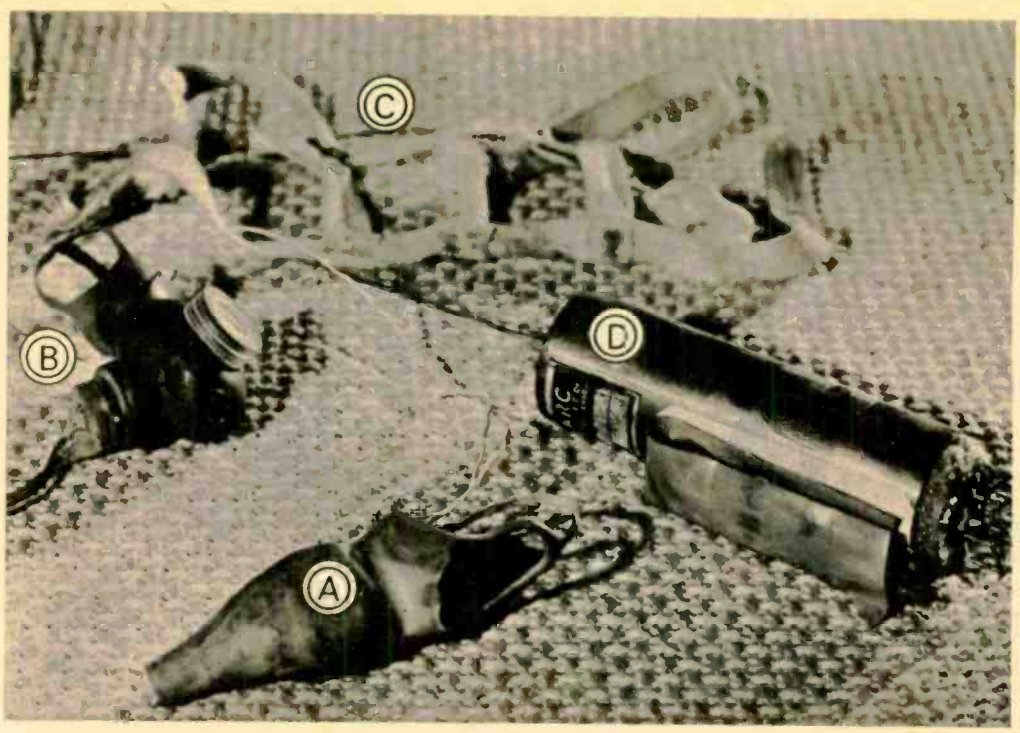


THE CASE OF THE BUGGED PIGEON

NO, the pigeon in our picture (above) is not from outer space, although it's carrying almost as much telemetry equipment as an astronaut. It's taking part in a bionics project directed by O.Z. Roy, Radio and Electrical Engineering Division, National Canadian Research Council of Canada. Preliminary results of the project include such interesting data as the fact that on take-off the pigeon's heart-beat rate jumps from 166 to 540 per min. (more than three times as fast). Flying is hard work, it seems.

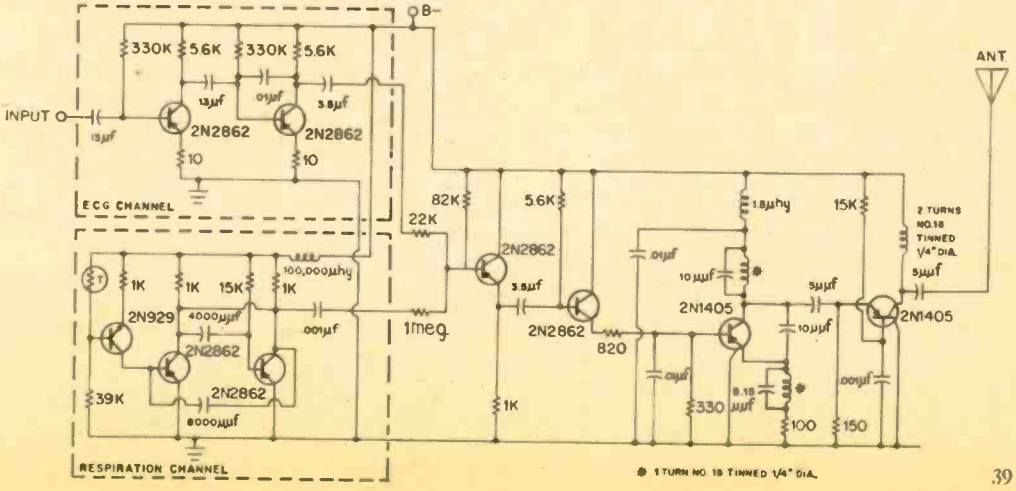
Telemetry provides information on body temperature (in two places), breath rate, breath volume, wing-beat frequency and heart rate—via an electrocardiogram (ECG). In the chart (below) recording breath volume and ECG, the arrow toward



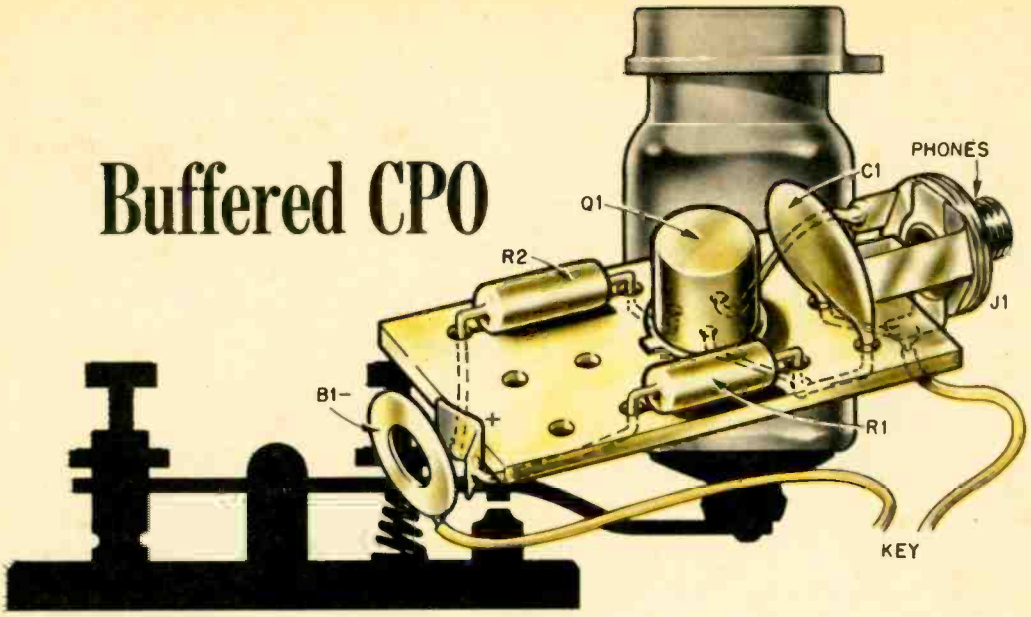


the right indicates the moment of landing. Only two factors are recorded at a time to keep pigeon's pack light. This information is transmitted from the pigeon simultaneously by a circuit like that below. Input for the ECG channel is from electrodes painlessly implanted in the pigeon's chest cavity. The thermistor (circled resistor with *T* next to it) in the respiration channel senses temperature changes in a face mask as air is inhaled and exhaled, recording breathing rate (rather than air volume). This measurement was later abandoned when it was discovered that the pressure-sensitive transducer used to record air volume was reliable and provided more information (including breath rate).

The gear spread out in the picture above includes (A) mask with breathing-rate gauge, (B) mask with gauge for measuring the volume of air breathed, (C) harness, (D) transmitter. Antenna is a ground-plane (quarter-wave) using the transmitter's metal case as a ground. It transmits an FM signal at 230 mc.—*Thomas W. Hill*



Buffered CPO

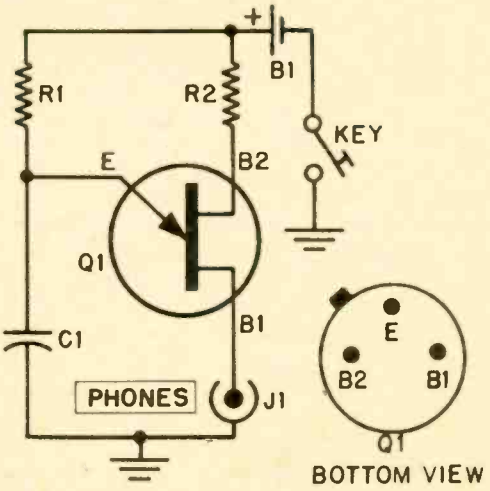


OFF you go on vacation with a tightly-packed suitcase and the thought of a code exam when you get back. Thing to do is take along a CPO (code-practice oscillator) so you can get in a little practice during your free time. And the tiniest CPO to take is our Buffered CPO which fits in a plastic Bufferin bottle (1 13/16 in. long x 1-in. dia.) It produces good volume with 8-ohm phones.

The circuit, built on an 11/16 x 1 3/16-in-piece of perforated board, uses one unijunction transistor. To keep it small, use ¼-watt resistors and a miniature (⅜-in. dia.) disc capacitor for C1. Cement a small piece of metal at the left side of the board for the positive cell contact. The phone jack at the right side is held to the board by its leads.

First thing to do is drill a ¼-in. dia. hole in the center of the bottom of the plastic bottle for jack J1. Then drill a ⅛-in. dia. hole in the bottom for the two key wires. A ½-in. dia. washer serves as the negative contact for the cell. After mounting the parts, slip the board in the bottle and carefully fit the key wires through their hole. Secure the jack, then install the cell and push the washer up against its negative end. Put the cap on and you're all set. You may have to play around with the cell and washer to be sure there's good pressure against the cell.

Steve Daniels



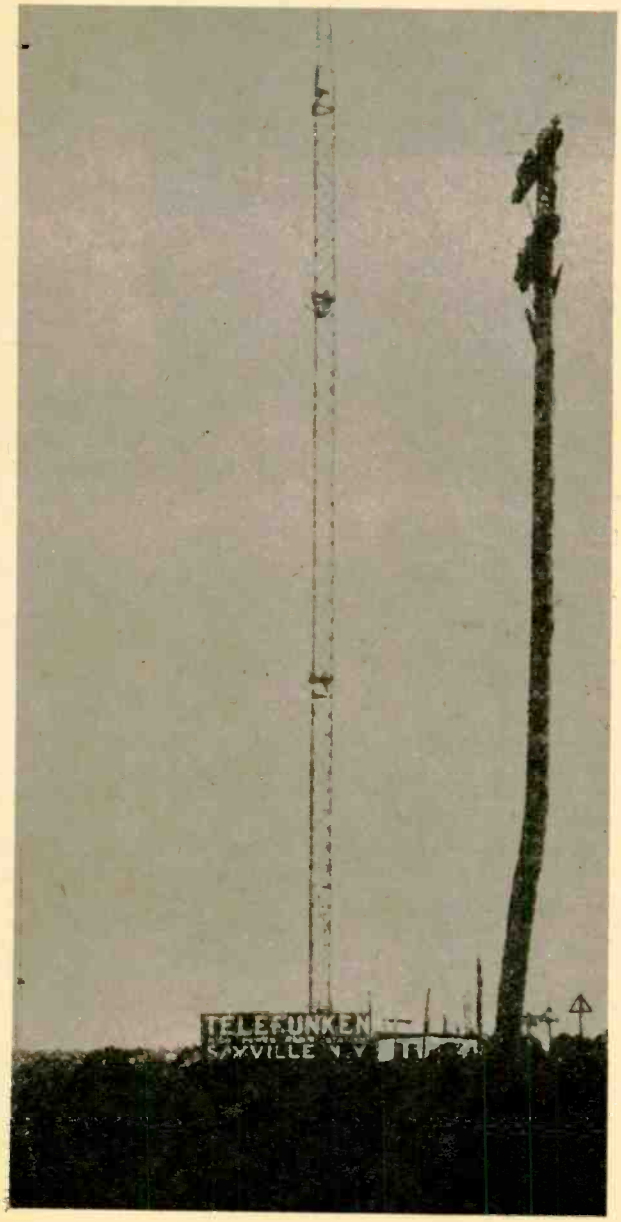
When key closes, C1 charges through R1 until E/B1 junction resistance drops. C1 discharges through phone. Cycle repeats at rate set by C1.R1.

PARTS LIST

B1—1.4 V mercury cell (Mallory RM675)
C1—.1 μf, 10 V miniature ceramic disc capacitor (Centralab UK10-104 or equiv.)
J1—Miniature phone jack
Q1—2N2646 transistor (GE, Motorola)
R1—3,300 ohm, ¼ watt, 10% resistor
R2—680 ohm, ¼ watt, 10% resistor

Wired board is ready for installation in bottle. Wires go through hole in bottom to key. Be sure bottle cap exerts pressure against washer (left).

The Secret of Sayville



This is how the mysterious transatlantic station in Sayville, N.Y., looked in 1915 before it was seized by U.S. Government. Photo (from Popular Radio magazine) shows Telefunken sign, still seen in Brooklyn Eagle photo at time of seizure.

By BOB ANGUS

EVERY day, hundreds of commuters on the Long Island Railroad's Montauk Branch pass an antenna array three-quarters of a mile west of the South Shore town of Sayville. Most don't even bother to look up from their newspapers. The few ham operators in the crowd have long since determined that the transmitter is used for air traffic control by the FAA and have gone back to their reading. But this 100-acre site was the only direct radio link with northern Europe during the first few months of World War I and provided one of the first big spy scares that threatened U.S. neutrality. So well kept was the secret of Sayville that even engineers who worked there didn't realize that the station had one of the world's first magnetic recorders and used it as a coding device.

The strange case of Sayville started early in 1913 with the work of a German electrical engineer, Dr. H.G. Goldschmidt, on a marshy tract of land outside Tuckerton, N.J. In those palmy days you didn't need a license to go on the air. Most transatlantic stations were in the hands of such European firms as Marconi and Pathé. Dr. Goldschmidt formed a company and sold stock in Germany. Soon the Goldschmidt Wireless Telegraph Co. was in business in Tuckerton with an 820-ft. antenna, accepting commercial messages for transmission to station POZ (in Nauen, Germany) owned by Telefunken. Although Dr. Goldschmidt didn't say so, it was believed commonly that Telefunken had accepted his stock in exchange for radio equipment and hence was the real owner of the station.

In any case, by July 5, 1913, Goldschmidt was ready to communicate experimentally with Nauen and less than a year later—on June 18, 1914—the station was opened with an exchange of messages between President Woodrow Wilson and Kaiser Wilhelm. Almost all the equipment came from Telefunken. The one notable exception was a gadget made in Springfield, Mass., by the American Telegraphone Co. It was a device that could record messages on steel wire.

At the same time, Telefunken was at work on its own site in Sayville. German engineers erected a 500-ft. tower next to a little white operations building. Then they made their first tactical error—somebody put up a huge billboard bearing the name Telefunken.

When Senator Henry Cabot Lodge of Massachusetts heard about it he saw it as a threat. Could a German-owned radio station

The Secret of Sayville

Charles E. Apgar, an amateur radio operator of Westfield, N.J., was the hero of the Atlantic Communication mystery. He first deciphered its high-speed transmissions by recording them on the Edison cylinder machine in the foreground and playing them back (accidentally) at a reduced speed. Photo, reproduced from Popular Radio, was made that year.

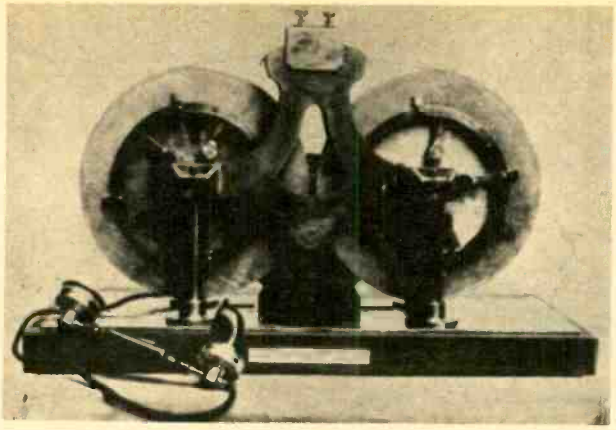
on American soil eventually be used for espionage against the United States or against U.S. interests? Taking no chances, Lodge pressured Congress into passing a law requiring that all wireless stations be licensed, a forerunner of the Communications Act. Licenses, under the law, could be granted only to U.S. citizens or corporations. The law empowered the Bureau of Navigation to make regular inspections of stations, gave the President power to seize them in time of national emergency and required operators to send all messages "in plain English" without the use of ciphers or codes.

The Sayville station opened on January 27, 1914, with the usual message of goodwill from the Kaiser to President Wilson. Actually, Sayville had been in operation on an experimental basis since May 10, 1913, when it received the first test message from POZ. Some 60 days later—on July 15—Sayville sent its first message to Nauen.

On the day it opened, the station still displayed its advertisement for Telefunken. A reporter for the New York Times wanted to know how, after the passage of Senator Lodge's bill, a foreign-owned station stayed on the air. A spokesman for Telefunken at that company's Broadway office answered, "We have no interest in the station. It has been purchased by U.S. interests."

Pursuing the subject, the reporter found that the new owner was the Atlantic Communication Co. of 90 West St., New York City. Atlantic's manager, A.E. Debec, said that his firm was made up of American stockholders who had purchased the Sayville plant "with some German capital." Atlantic's president was Herman Metz, then just finishing his first term in Congress after a career that included the making of a small fortune as importer and manufacturer of dyestuffs and drugs. Most of his business contacts were in Germany and he represented such German interests as I.G. Farben and Agfa in the United States.

Under Metz, Atlantic Communication installed two important pieces of equipment at Sayville. One was a Telegraphone magnetic recorder similar to the device at Tuckerton. The other was a Morse Code sender that operated from punched tape, allowing automatic, high-speed keying. The Telegraphone, the forebear of the tape recorder, was a wire recorder that looked not unlike the first Ampex tape models. It had been patented by the Danish telephone engineer, Valdemar Poulsen, and originally was designed to increase the capacity of telephone circuits. Instead of tape reels, the Telegraphone used two spools of piano wire. Poulsen wanted to record messages at a slow speed and, by speeding up the wire and transmitting the rapid, high-pitched signal by wireless or telephone line to a similar recorder at the other end, cram as much as eight



An early model of the Poulsen Telegraphone (from about 1908) looked like this. The model installed at Sayville transmitter probably was later version with reels placed hoizontally like early tape-recorder models. Telegraphone recorded on steel wire but was direct antecedent of German Magnetophon tape recorder of World War II era from which all modern professional recorders are derived.

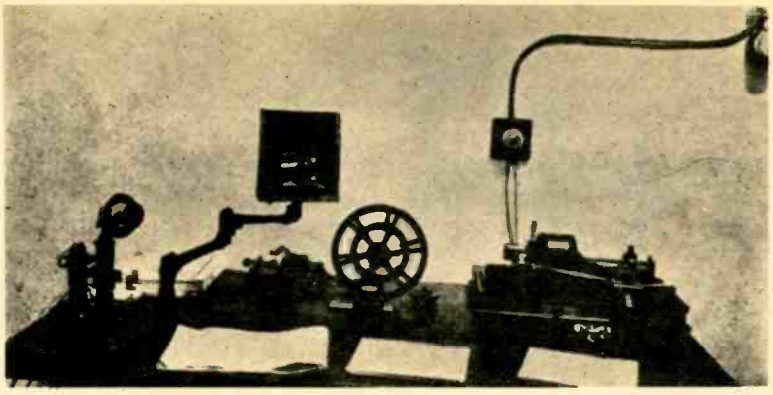
This photo of the operating room at Sayville appeared in a report prepared by the Institute of Radio Engineers for publication in March, 1914—before the furor over the station began. No mention was made of the Telegraphone though it might have been among the objects on the table at center.

times the usual number of messages into a single transmission. The recorder at the receiving end would record the undecipherable signal at high speed, then play it back at normal listening speed while an agent transcribed the message. As Poulsen saw it, the Telegraphone also would prevent unauthorized eavesdropping and eliminate the errors that plagued cable transmissions since the agent could repeat any section of the wire he didn't understand clearly.

When the American Telegraphone Co. was established around 1904, however, its U.S. stockholders saw Poulsen's device less as an adjunct to the telephone than as a business machine that could be sold for about half the price of Edison's cylinder Dictaphone. By 1908, American Telegraphone had run through almost $100,000 without producing a recorder. Then industrialist Charles Dexter Rood gave Telegraphone a shot of badly needed new capital—$188,000, enough to give him controlling interest in the company. Years later, an attorney for dissident stockholders was to imply that the money might have been supplied by the forces behind Atlantic Communication.

In any event, Rood managed to get into production, delivering a handful of machines to selected customers. Among them were the Imperial German Navy, Goldschmidt and Atlantic Communication. At the same time, American Telegraphone's own sales organization asked in vain for machines to fill orders. Rood replied that there were imperfections in the current model and that he was experimenting with a new version. This was the same answer that the U.S. Signal Corps received when, after the U.S. entered the war in 1917, it wanted to purchase machines for dictating. (One of the ostensibly defective models found its way to the 1915 Panama-Pacific Exposition in San Francisco, despite Rood's non-cooperation and promptly received a Gold Medal.)

On August 3, 1914, two apparently unrelated events occurred. The German Lloyd liner Kronprinz Wilhelm left her berth in the



In addition to magnetic wire recordings, the Sayville station used a punched-paper tape system for automatic, high-speed transmission of Morse Code. This rig punched the tape. Transmitter was equipped with spring contacts to close wherever a hole was punched in tape.

The Secret of Sayville

North River for a seemingly normal run to Bremerhaven. However, she had been provisioned for six months at sea and was loaded with coal up to the level of her deck. On the main deck was a huge crate of what appeared to be electrical equipment. Nobody thought much about it until some ten days later the Kronprinz Wilhelm seemed to have disappeared from the face of the earth. She had not been reported sighted by other liners on the transatlantic run. Yet the line seemed unconcerned.

The second event was Germany's invasion of France. England immediately moved to support France and cut the extension of the transatlantic cable from England to Germany, leaving Tuckerton and Sayville as the only direct link between the U.S. and northern Europe. The predictions of Senator Lodge less than a year before seemed to be coming true and Washington had the excuse it was looking for. Censors (two Navy wireless operators) moved into Tuckerton on August 7.

Meanwhile, Germany had found transmission from Sayville's 500-ft. tower unreliable, particularly in periods of high sunspot activity. The answer was a mid-Atlantic relay station that picked up the Sayville signal and relayed it to Nauen. When the story was told to the newspapers a reporter for the New York Times asked an official of Atlantic Communication if the Kronprinz Wilhelm was being used for this purpose. "You've guessed it," came the reply.

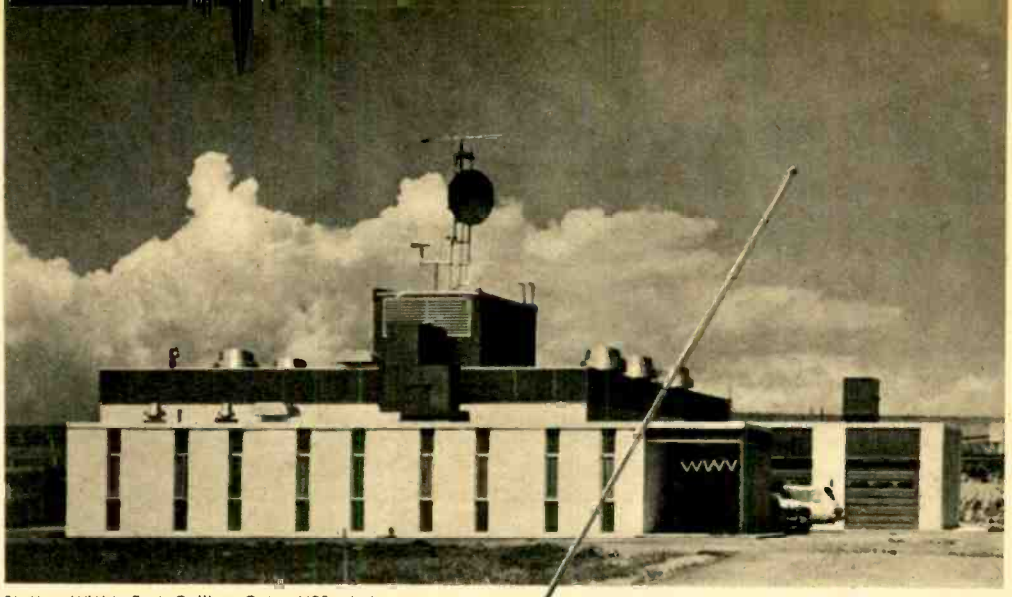
The next step was to examine the financial structure of Atlantic Communication a bit more closely. Since Atlantic appeared to be an American-owned company it had received a license for Sayville. The investigators found, however, that while Metz was the president, Dr. Karl George Frank, a German national, was the secretary-treasurer and actual head of the firm. Metz was, it developed, the only American to own stock in the company and his holdings were only enough to qualify him as a corporate officer. The balance of the stock was held in Germany by arms of the Telefunken combine. In charge at the transmitter was a German naval officer, Captain Zenneck.

Toward the end of August, Secretary of the Navy Josephus Daniels discovered that Tuckerton was operating without a license. So he ordered it seized and closed. On September 10 the station reopened, manned by U.S. Navy personnel. Whether the Navy seized Tuckerton's Telegraphone along with the other equipment or whether it was taken out by the German operators nobody knew, for the Navy clamped a lid of secrecy on the entire operation.

Almost coincidental with the closing of Tuckerton, ham radio operators along the East Coast were detecting a high-pitched buzz that went on the air every night at exactly 11 p.m. when Sayville began its transmissions to Germany. One particularly poetic ham described it as "a musical note like the buzzing of a titanic bumble bee which sped through space." Nobody seemed to know what it was but hams agreed it came from Sayville.

On the morning of May 7, 1915, Americans awoke to find that German U-boats had sunk the Cunard liner Lusitania off the Irish coast, taking with her a large number of American passengers. Within hours, reports

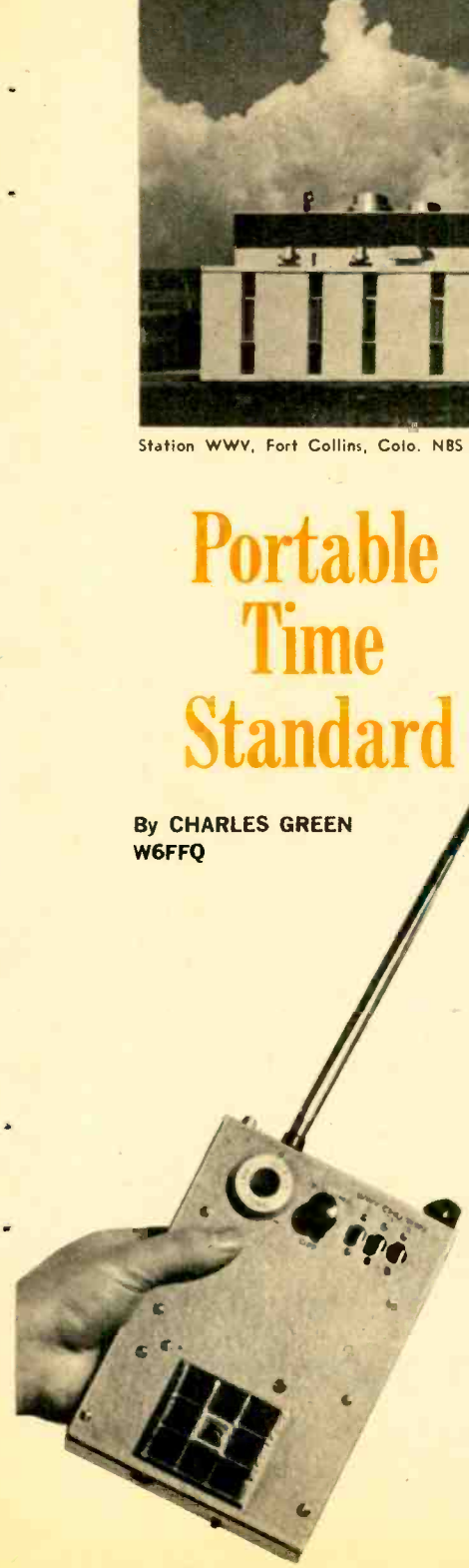
[*Continued on page* 111]



Station WWV, Fort Collins, Colo. NBS photo.

Portable Time Standard

By CHARLES GREEN
W6FFQ



EVERYONE has some kind of hang-up. There's the superstitious guy who won't walk under a ladder and the person who won't climb one because of his fear of height.

Then there are the obsessive types who never arrive late for appointments and who constantly check the time with a watch, the radio or by calling the telephone company. Nothing is precise enough for them. Nothing, that is, except EI's Portable Time Standard. Using it and the broadcasts of WWV, the compulsive clock-watcher will be able to hear time signals which are accurate to five parts in 10^{11}.

Not much larger than a paperback book, our WWV (National Bureau of Standards) and CHU (Dominion Observatory, Canada) receiver can be carried in a pocket, briefcase or left in a small corner of a desk. Turn it on and it will give you instant time 24 hours a day every day of the year.

The U.S. station, WWV, is located at Fort Collins, Colo., and broadcasts simultaneously on 2.5, 5, 10, 20 and 25 mc. Canadian station CHU is located in Ottawa and transmits on 3.33, 7.335 and 14.67 mc.

You'll find detailed information about WWV and CHU transmissions in the Radio Amateur's Handbook. In brief, the WWV signal is a tick (pulse) every second and time is given in CW and voice every five minutes. On CHU voice announcements are made each minute in either English or French in Eastern Standard Time. One-second pulses also are transmitted.

Portable Time Standard

Our Portable Time Standard tunes three of the most widely received frequencies: WWV on 5 and 10 mc and CHU on 7.335 mc. The receiver (actually a converter plus a pocket transistor radio) uses two FETs and a conventional transistor in a circuit which includes a tuned RF stage, mixer and oscillator. The mixer's output goes to the built-in transistor radio. In effect, our Portable Time Standard is a double-conversion receiver.

Construction. The transistor radio is the IF/AF portion of the receiver. Four modifications have to be made to it to disconnect its volume control so volume and power can be controlled externally by R7 and S4.

Remove the radio's carrying strap by bending out the wire clip at the phone jack. Take off the back cover, remove two small screws holding the circuit board, lift out the board and turn it over. Refer to Fig. 3. Unsolder the wire to the center lug of the volume control. Connect a length of small-diameter enameled wire (No. 28) to the lead and slip a length of spaghetti over the connection to prevent shorts.

Unsolder the lead to the right lug (hot) of the volume control. Solder a length of No. 24 or smaller hookup wire to the lead and slip spaghetti over the connection. Solder a length of small-diameter hookup wire to the left lug (gnd.) of the volume control. Put the wires close to the volume-control shaft and carefully replace the circuit board. Solder a length of hookup wire to the spring connector (—) battery contact. Replace the cover and, if necessary, cut a notch in it where the wires come out. Set the tuning knob to 540 kc, turn the volume control full clockwise then tape the knobs in place.

Cut the Minibox down to a 1⅛-in. thickness and drill holes at the corners for sheet-metal screws. Cut a 2½ x 4⅜-in. piece of perforated board and temporarily position it and the transistor radio in the main section of the Minibox as shown in Figs. 1 and 2. Drill mounting holes at each corner of the board and install the board with ⅜-in. spacers and ground lugs at each corner.

Temporarily place the radio, B1, B2, and L3 where shown. Draw an outline of the radio case, remove the radio, then measure and sketch within the outline a 2 x 2¼-in. hole for the radio's speaker grill (see photo on first page of this article). Cut the hole for the speaker grill and put the radio in the Minibox. Be sure to drill a hole for the radio's phone jack. Make a bracket from scrap aluminum to fit around the radio and attach the bracket with small sheet-metal screws. Mount B2 with another aluminum bracket and attach B2's holder.

Remove 25 turns from the top end (grid) of L1's secondary and take out the iron core. Cut off the top of the coil so its length is about 2 in. and mount the coil with a ground lug connected to pins 3 and 4 as shown in Fig. 2.

Connect the components where shown and use No. 22 wire to connect S1, S2 and S3 to flea clips on the board. Use spaghetti and keep the wires short and rigid.

Make the gimmick capacitor by tightly twisting together four turns of No. 22 plastic-insulated hookup wire. Make sure that all the components are bent down so they will not be touched by the back cover. Drill holes in the back cover over C18, C20 and C21 so they can be adjusted with the cover on. Cut a cardboard disc to fit on C1's dial. Mount a banana plug on the end of the whip antenna

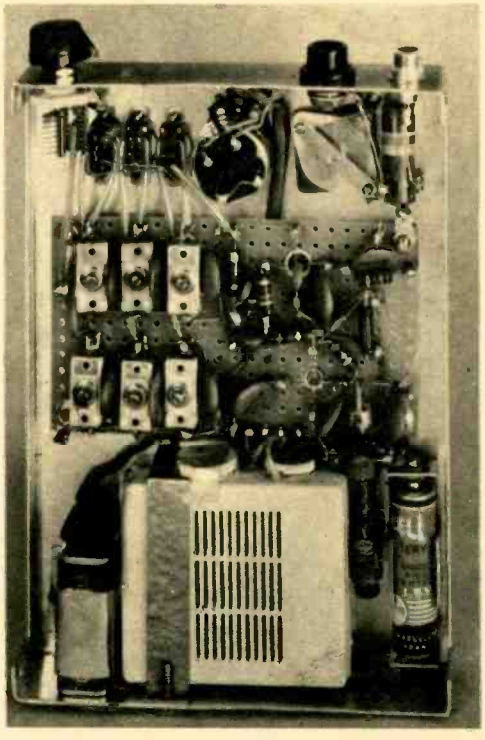


Fig. 1—Our model was built in main section of Minibox whose thickness was reduced to 1⅛ in. The parts layout at top and on board is critical.

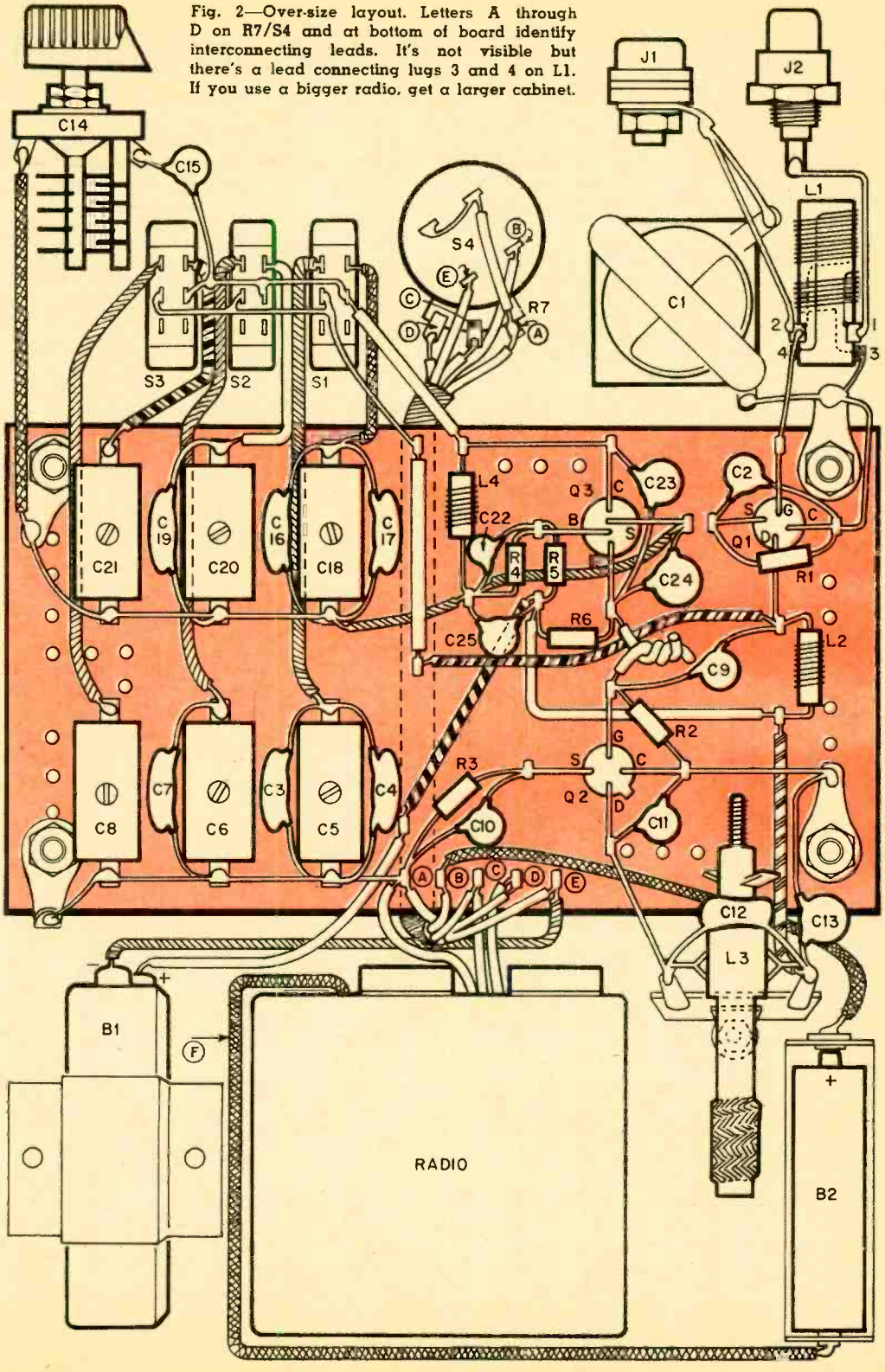


Fig. 2—Over-size layout. Letters A through D on R7/S4 and at bottom of board identify interconnecting leads. It's not visible but there's a lead connecting lugs 3 and 4 on L1. If you use a bigger radio, get a larger cabinet.

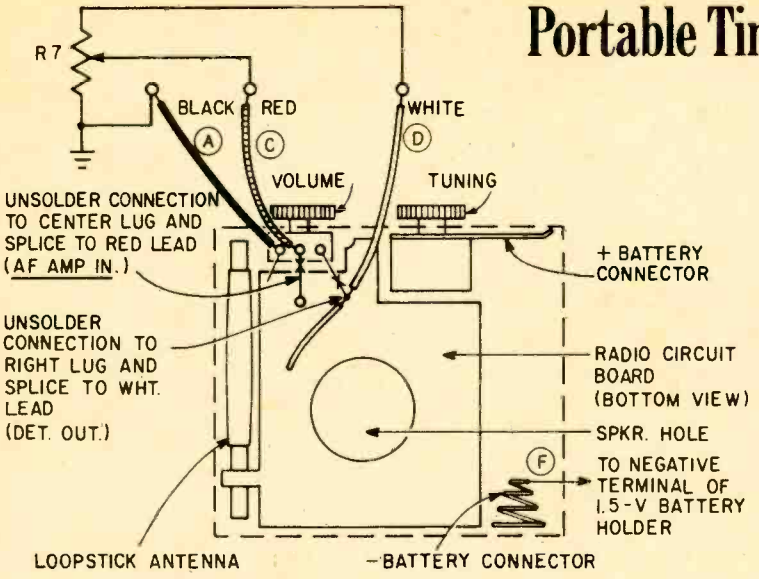


Fig. 3—Colors on leads A,B and C are arbitrary and refer to wiring in our model. Use letters to identify wires in schematic and pictorial. Positive battery connector is ground; therefore, connection is not made to it since ground of radio is tied to converter ground through lead A to volume control. Leads to center and right lugs of volume control are removed and connected to pot R7 in converter.

then install B1 and B2 and the cabinet cover.

Alignment. Before aligning the receiver, let the components cool down a few hours to room temperature. Then remove the cover and turn R7 full clockwise. Adjust C1 and C14 to midrange and set S1, S2 and S3 to their off (down) positions.

Connect an RF signal generator to J2 and set it up for a 5-mc modulated output. Turn S1 *on* (up), adjust C5 and C18 for maximum volume then tune C1 for maximum volume. Because RF stage Q1 is not neutralized, readjust C1 and mark its dial *5* just below the point of oscillation. Set S1 to *off*.

Set S2 to *on*. In the same way adjust C20 and C6 with a 7.3-mc-signal. Then adjust C8 and C21 (with S3 *on*) with a 10-mc signal. Mark C1's dial *10* at the maximum-volume point.

Disconnect the signal generator and put on the back cover. Because the calibration of many signal generators is not accurate, you should now make an on-the-air adjustment. Success will depend on good reception of 5, 7.335 and 10-mc signals and will vary with the propagation conditions at different times of day or night.

Connect a good outside antenna to J2. Set *peak* trimmer capacitor C14 so its plates are half meshed. Set S1 to *on*, C1 to 5 mc, then adjust C18 until you hear WWV at 5 mc. Set S1 to *off*.

Set S2 to *on*, C1 to 7 mc and adjust C20 until you hear CHU. Then set S2 to *off* and S3 to *on*. Turn C1 to 10 mc and adjust C21 until you hear WWV. Adjust L3's slug for peak volume.

Reception depends on your antenna, propagation at a particular time of day and the frequency. In good-signal locations, a whip antenna connected to J1 will be adequate. After the components age, you may have to adjust the oscillator trimmers again. This should be done with C14 set at midrange and the cover on.

How It Works. Signals from a whip antenna in J1 or a long-wire antenna plugged in J2 are tuned by L1 and C1 and fed to the gate of RF amplifier Q1. The amplified signal is tuned by L2 and the capacitors switched into the circuit by S1A, S2A or S3A.

Oscillator Q3 is tuned 540 kc away from the input-signal frequency. The oscillator frequency is determined by the tuned circuit made up of L4 and the capacitors switched into the circuit by S1B, S2B or S3B. Miniature variable capacitor C14 peaks the oscillator to the exact frequency.

The gimmick capacitor couples the oscillator output to the gate of mixer Q2. The resulting 540 kc output at the drain of Q2 is coupled by the L3/C12 tuned circuit to the loopstick antenna in the radio. The radio is fixed-tuned to 540 kc and its volume is controlled by R7.

Switch S4 is a DPST switch (part of R7) that controls the power for both the radio and the converter.

PARTS LIST

B1—8.4 V mercury battery (Mallory TR-146X or equiv.)
B2—1½ V battery (size AA)
Capacitors: ceramic disc; unless otherwise indicated, 50 V minimum
C1—10-365 μμf miniature variable capacitor with dial (Lafayette 99 G 6217)
C2,C10,C13—.005 μf
C3,C16—100 μμf, NPO temp. coefficient
C4,C7,C11,C17,C19,C24—47 μμf, NPO temp. coefficient
C5,C6,C8,C18,C20—4-40 μμf trimmer capacitor (⅜ x ¾ in. Elmenco Midget. Allied 43 B 7079 or equiv.)
C9—220 μμf
C12—470 μμf, silvered mica
C14—2.3-14.2 μμf miniature variable capacitor (E. F. Johnson 160-107, Allied 43 B 3760)
C15—4.7 μμf, NPO temp. coefficient
C21—1-12 μμf trimmer capacitor (⅜ x ¾ in. Elmenco Midget. Allied 43 B 7077 or equiv.)
C22,C25—.001 μf
C23—22 μμf, NPO temp. coefficient
J1—Banana jack J2—Phono jack
L1—1.7-5.5 mc antenna coil (J. W. Miller B-5495-A, Lafayette 34 H 3714. Modified, see text)
*L2,L4—4.7 μh RF choke (J. W. Miller 74F476AP)
*L3—Loopstick antenna (J. W. Miller Type 6300)
Q1,Q2—3N128 field-effect transistor (RCA)
Q3—2N1180 transistor (RCA)
Resistors: ½ watt, 10% unless otherwise indicated
R1,R3—2,700 ohms
R2—1 megohm
R4—47,000 ohms
R5—4,700 ohms
R6—1,000 ohms
R7—5,000-ohm audio-taper potentiometer with DPST switch (S4)
S1,S2,S3—DPDT miniature slide switch (Lafayette 99 H 6186 or equiv.)
S4—DPST switch on R7
Misc.—7 x 5 x 3-in. Minibox (modified, see text), Miniature transistor AM radio (Allied 10 B 4037 J or equiv.), holder for size AA battery, 52-in. telescoping antenna (Lafayette 99 H 3008 or equiv.), ⅜-in. metal spacers, gimmick capacitor (four turns No. 22 hookup wire, see text), perforated board, flea clips

*L2,L3 and L4 are available for $2.25 plus 60¢ for postage and handling from Tridac Electronics Corp., Box 313 Aldon Manor Br., Elmont, N.Y. 11003. Canadians add $1. No foreign orders.

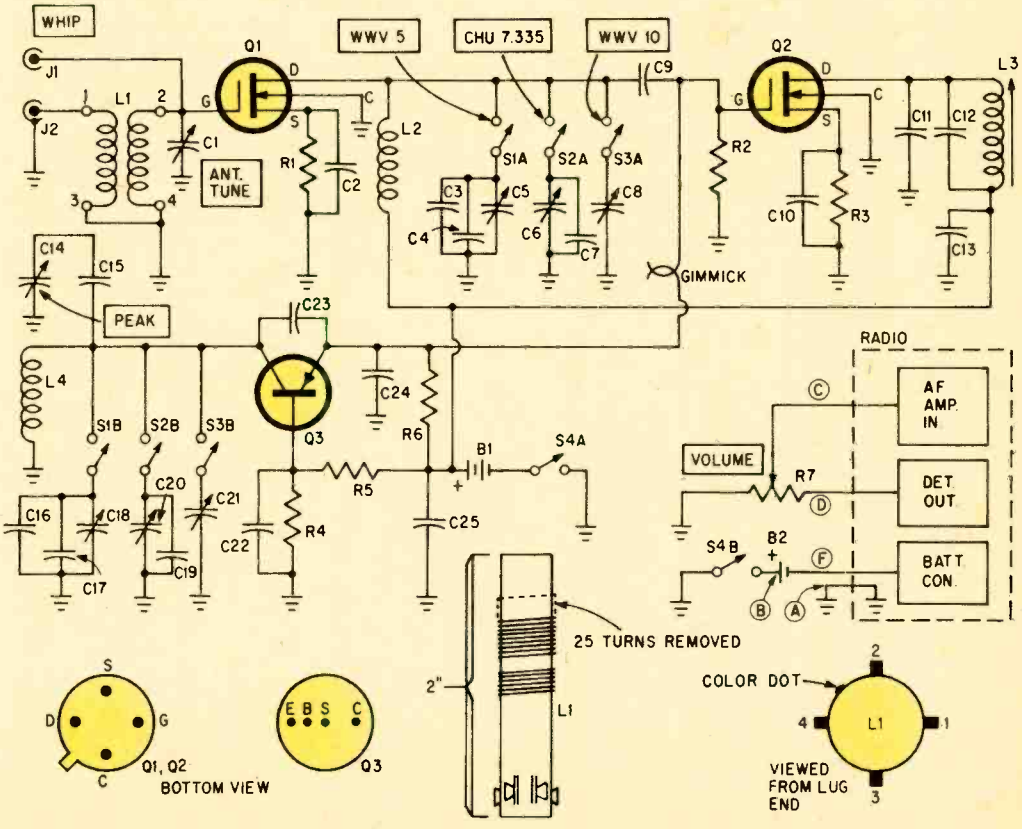


Fig. 4—Incoming signals are amplified by Q1, tuned and fed to mixer Q2. Output of oscillator Q3 is coupled to mixer via gimmick capacitor. Output of mixer goes to L3 and is inductively coupled to radio's antenna.

Hi-Fi Today

* It tapes all kinds!

By John Milder

ALMOST a year has gone by since the Philips-sponsored cassette recording system grabbed the lead from 8-track and 4-track cartridges in the booming business of convenience tape. Although 8-track and 4-track remain strong in the automotive market, the cassette definitely has pushed them toward the door of the home—and almost out of it. So it seems time for some speculation on the cassette's future.

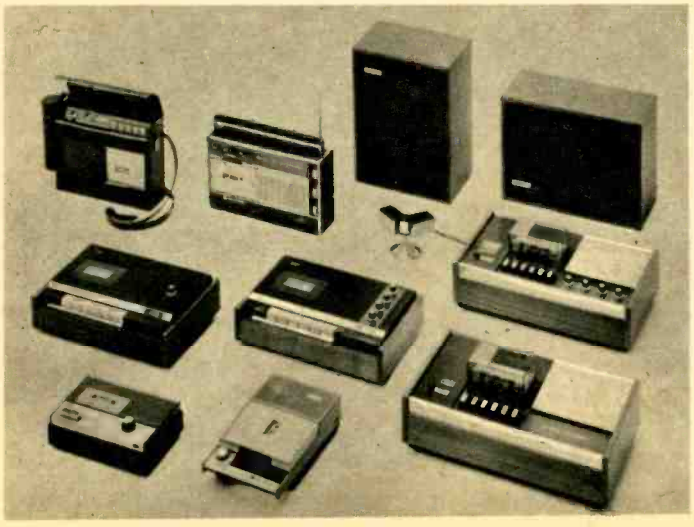
The recording and playback quality of the cassette has come quite a way. I'm particularly impressed with Ampex's Micro cassette machines. The deck versions sound very respectable when hooked to a wide-range audio rig and even the self-contained units sound pretty good over their limited-range speakers. Ampex, Bell & Howell and Norelco now offer playback-only decks for less than $60 (all actually are built by Philips but I've tried only the Ampex) which is down where the price for play-only tape *has* to be if it's to create a real market.

The sound of the best cassette machines, though startlingly good by last year's standards and expectations, decidedly is *not* really hi-fi. They sound like the best mass-market console phonographs—which is not bad. But I don't believe cassettes are going to get much better—and make the jump into the hi-fi category—unless something in the basic parameters of the system changes. And I believe that something should be the tape speed which will have to go up to 3¾ ips to provide the frequency response, dynamic range and freedom from distortion required for real fidelity. The alternative—availability of some super-tape like Du Pont's Crolyn at reasonable prices—seems to me to depend on many more *ifs*.

Is 3¾ ips a practical possibility? Hard to say. The terms of the agreement by which Philips licenses cassette-recorder manufacture specify 1⅞ ips as the only speed permissible under the agreement. (Teac, however, has announced an automatic-reverse deck with both speeds.) And the difficulties in getting enough playing-time at a higher speed are formidable, since the super-thin tapes that would make it possible are not (yet) of high enough overall quality.

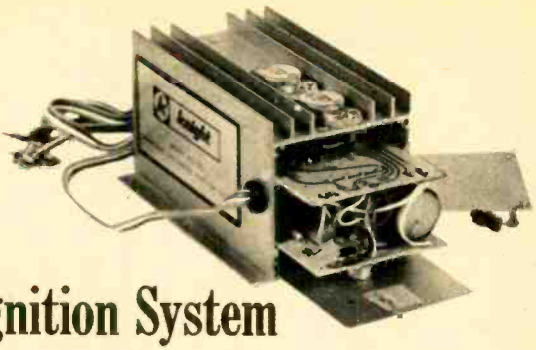
I'm pretty well convinced, though, that the high-quality tape customer should settle once and for all on open-reel recording as *the* long-term best choice. But the cassette entrepreneurs are pushing the new-new-new medium so hard that the trade press is beginning to make it sound as though everything else were obsolete—including the pop record.

[*Continued on page* 119]



All cassette recorder lines are growing fast. Bell & Howell, for example, had no models at all last year, introduced the eight models shown here this year—models ranging through mono, stereo, playback-only, record decks, portables, with radios, with speakers, etc.

Knight-Kit KG-372



Capacitive-Discharge Ignition System

ONE of the few auto accessories that really improves engine performance is a solid-state ignition system. Such a system provides a hotter and longer spark and consistently at very high speeds. It reduces distributor-point wear because the points switch only a small current necessary to trigger a silicon controlled rectifier.

The $29.95 Knight KG-372 is a capacitive-discharge system. It is a kit version of the $39.95 Delta Mark-10 system. Here's how it works: A DC-to-DC converter steps 12 VDC up to 400 VDC which charges a capacitor connected in a series with the car's coil. When the distributor points *open* a small holding voltage is removed from the gate of a silicon controlled rectifier. The SCR conducts and connects the charged capacitor directly across the primary of the ignition coil. This causes the capacitor to discharge into the coil. The large discharge current in the coil's primary induces a very high spark voltage in the coil's secondary.

Pre-wired ignition-coil terminal boards fit on coil screws. Thumb nuts come with kit and allow you to switch back to original ignition system.

As you can see, the current fed to the coil's primary is determined by the capacitor and not the points. Because the capacitor recharges very fast, the coil's secondary voltage is essentially independent of engine speed. The higher secondary voltage allows the spark-plug gap to be increased and this results in a larger and hotter spark.

To install the KG-372 you lift two wires off the coil's connectors, attach two small terminal boards to the connectors and hook the original coil wires to the boards. Installation time is less than 10 minutes.

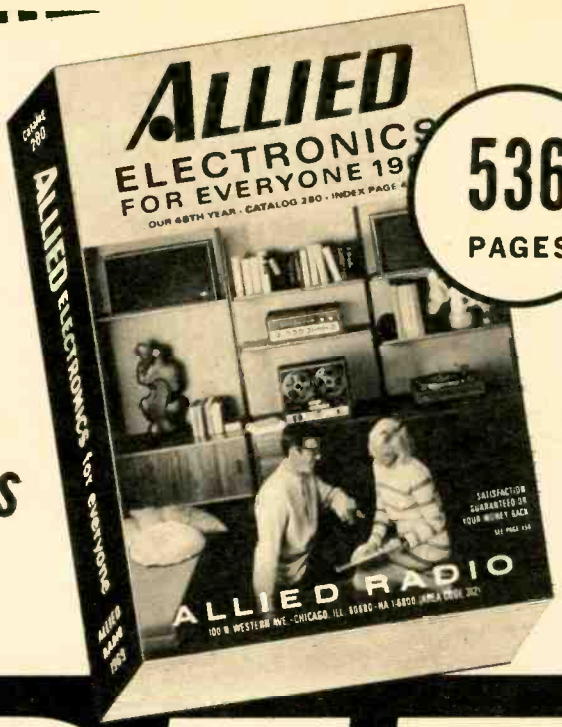
If you do not regap the plugs you will notice little, if any, low-speed improvement. What you will get is much greater high-speed acceleration. You will also get better wet-weather performance. Installed in a Dodge Dart, a notorious staller in damp weather, the KG-372 eliminated the stalling.

After the plugs were regapped to the recommended .040 in. there was again no noticeable improvement in low-speed performance but there was a sharp improvement at high speeds. Over a measured distance the car passed a check point at 50 mph instead of the usual 40+ mph.

Though not mentioned in the instruction manual, but at the suggestion of a mechanic who installs Delta systems, we advanced the engine timing 2½°. The car now moved like a bat-out-of-hell, passing the checkpoint at 55 mph. But since the manual does not suggest advancing the timing we restored it.

The kit is a snap to put together in about an hour. All leads were pre-cut for the circuit boards. Unfortunately, the boards are of poor quality and you don't get a second chance to correct a mistake. Try to remove an incorrectly installed part and the etched wiring lifts right off. Use the smallest possible soldering iron and double check every connection before soldering.

the Best thing in Electronics is



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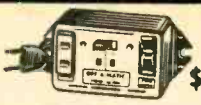

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CIRCLE NUMBER 23 ON PAGE 13

Good Reading

By Tim Cartwright

TAPE RECORDING. By C. N. G. Matthews. Museum Press, Ltd., London, England. 128 pages. $2.50

The author begins at the right point, to my way of thinking, with a short discussion of sound—rather than the usual chapter on electricity. And he has that rare facility (for a technical writer) of knowing where to stop in an explanation. He shows it in four excellent chapters on tape, recorders and the processes of recording and playback. Also good is his discussion of practical recording techniques. The only weak points are a skimpy chapter on servicing and an even lighter (and none too accurate) once-over for loudspeakers. The machines illustrated are all European and the terminology noticeably British but that doesn't really matter. I hope this book turns up in the usual book racks. If not, the publisher's address is 39 Parker St., London W.C. 2.

BEGINNER'S GUIDE TO ELECTRONICS. By Terence L. Squires. Philosophical Library, New York. 194 pages. $6

This volume, also slim and also from England, is one of a small but seemingly increasing number that actually present elementary electronics without insulting the reader's intelligence or arousing suspicions about the publisher's motives. Although there's a final chapter on electronic careers that suggests the book is aimed at young readers it's written in adult style—and in a fine, unstuffy, unpedantic way. Besides an excellent treatment of basic theory, components and circuits, the author offers pertinent (and quick) descriptions of modern electronic industries (including discussions of radar and medical electronics that are unusual for a beginner's book). Definitely recommended.

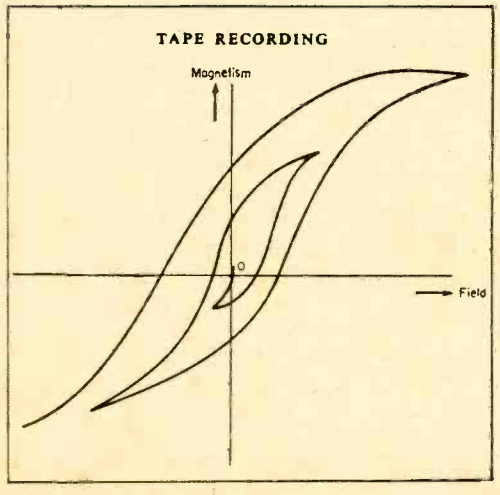


Diagram from Tape Recording shows spiraling hysteresis loop of decreasing AC magnetic field.

DX HANDBOOK. By Wayne Green, W2NSD/1. 73, Inc., Peterborough, N.H. 128 pages. $3

As the author/editor says at the start, DXing is more an obsession than a hobby for many people. And even those who wouldn't go to the not unusual lengths of arranging their home site or work schedule around the DX core will still go quite a way for any loose bit of gossip on logging someplace new. That fact dictates the nature of this handbook—which is chock full of gossip, tips, hints, and various individual experiences. Everything is about as formal and organized as the social scene at an earthquake. I can't imagine it being any other way.

WAVEFORM MEASUREMENTS. By Rufus P. Turner. Hayden Book Co., New York. 86 pages. $2.95

The nice, non-technical young lady (probably) who wrote the blurb accompanying this book says how great it is to have everything about waveform measurements in one place—as if waveforms were a well-defined subject like, say, microwaves. Well, I'm not all that excited about separating measurements from their usual context (things they measure) but it does make it possible to get a little chummier with one's test instruments. And, when something a bit weird appears on the old scope it should help to have this thorough a reference on various phenomena.

And Make Note of . . .

HOW TO USE YOUR VOM, VTVM, & OSCILLOSCOPE. By Martin Clifford. Tab Books, Blue Ridge Summit, Pa. 187 pages. $3.95

PRACTICAL COLOR TV SERVICING TECHNIQUES. By Robert L. Goodman. Tab Books. 295 pages. $4.95

A Rhythm Section You Can Build

By FRED B. MAYNARD

Electronic drums and cymbals play 11 rhythms from waltz to watusi.

IT's going to be a big bash. You've been planning it a long time and even have gone to the expense of hiring a caterer to take care of the food and drinks. For dancing you've invited two musician friends to add rhythm accompaniment to your piano playing.

At the last minute they call to say their car broke down and they'll be delayed a few hours. You'll never be able to get the crowd swinging with a solo piano.

A disaster? And how, but it wouldn't have happened if you had our electronic rhythm section standing by. Plug it into your musical-instrument or hi-fi amplifier and you have a two-man rhythm section that can give out with a bass drum, conga drum, claves and cymbal.

The rhythm section can play almost any rhythm you want—waltz, march/polka, fox trot, samba, bossa nova, watusi, cha-cha, rhumba and tango. And it does it with a variety of sounds—bass drum, conga drum, claves and cymbal. If you like you can add the sounds of snare drums, hi-congas and wood blocks. It will operate with a precision that is likely to throw you at first but after you get used to it, you'll see it's a fine accompaniment for piano, guitar or accordion.

The circuitry may, at first glance, appear somewhat involved. It is not, however. The circuits are straightforward and tolerant, and unless errors are made, it will work the first time. The parts will run about $40 and

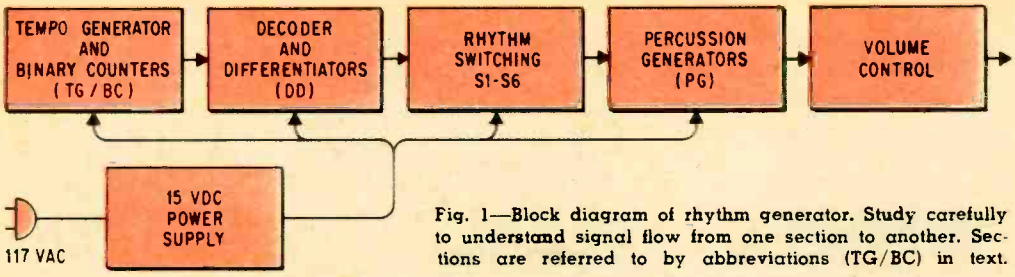


Fig. 1—Block diagram of rhythm generator. Study carefully to understand signal flow from one section to another. Sections are referred to by abbreviations (TG/BC) in text.

Rhythm Section

that's low when you consider a cheap trap-drum set can start at about $300.

How it Works

The system's block diagram is shown in Fig. 1. The schematics are shown in Figs. 2, 3, 5, 8 and 9. The connections between the four sections are indicated on the schematics.

Figure 2 (top) shows the Tempo Generator and Binary Counters (TG/BC). This consists of a free-running multivibrator (Q1, Q2) which generates a continuous train of pulses at a rate of about 80 to 500 pulses-per-minute (not per second). This rate is controlled by *tempo* potentiometer R5.

The tempo generator drives three cascaded binary counters, Q3 to Q8. These counters accumulate eight binary numbers from the tempo generator and then start over again. The counter has a feedback loop through S1 which, when closed, causes the counter to accumulate only six counts before starting all over again.

The eight count provides the basic rhythm for 4/4 time and syncopated beats. The six count generates the basic ¾ and 6/8 rhythms. Two outputs are taken from each counter. These are marked $\overline{X}$ (read not X) X, $\overline{Y}$, Y; $\overline{Z}$ and Z. These outputs are wired to the correspondingly marked inputs in the Decoder and Differentiator (DD) circuits (Fig. 3).

The DD is a system of three-input *and* gates. The 14-transistor circuit, which must be built carefully, generates an output for each binary number accumulated in the counter of the TG/BC (Fig. 2). On the eight count (with S1 open) the decoder outputs are activated one at a time and in order from beat 1 to beat 8. Under this condition, beat 1 is the downbeat, and beats 1, 3, 5, and 7 are the basic 4/4 and cut-time (2/4) beats. Beats 2, 4, 6 and 8 are syncopated or off-time beats.

In the six-count condition (S1 closed) beats 1 and 5 do not sound. Beat 3 is the downbeat and beats 6 and 8 are the afterbeats for the waltz (3/4) rhythm. Beats 2, 4, and 7 are the 3/4 time off or syncopated beats.

This is how the DD works: As the counters accumulate the binary numbers, there are always three outputs up, or positive, and the other three are down, or at ground potential. Any three transistors in the DD whose bases are connected to the *up* outputs will conduct and produce an output pulse. This condition occurs eight times in eight different combinations of up or down on the counter outputs. The X, $\overline{X}$ outputs change eight times, the Y, $\overline{Y}$ change four times and the Z, $\overline{Z}$ change twice on each eight count cycle.

This accounts for the eight transistors on the X lines, four on the Y, and two on the Z lines. (Base resistors R23, R24, R25, etc., are 20,000 ohms in our model. However 10 per cent values from 5,000 to 25,000 ohms will work.) The decoder outputs have differentiating networks with a diode so that the positive portion of the differentiated output waveform is passed as a trigger into the switching network and from there to the Percussion Generators (PG).

Rhythm Switching (Figs. 4 and 5). The DD outputs, which are the rhythm-beat triggers to the PG, are routed through the switching system shown in Figs. 4 and 5. This switching system consists of a 6-pole 11-position rotary switch (S2) and four SPST toggle or slide switches (S3,S4,S5,S6). The wiring of the rotary switch is shown in Fig. 4 as though the switch waters were laid out flat. When wiring the switch, make sure that you identify correctly the first position. That is, when the switch shaft is tuned full counterclockwise, the wiper touches contact No. 1. This position corresponds to the first (left) vertical row

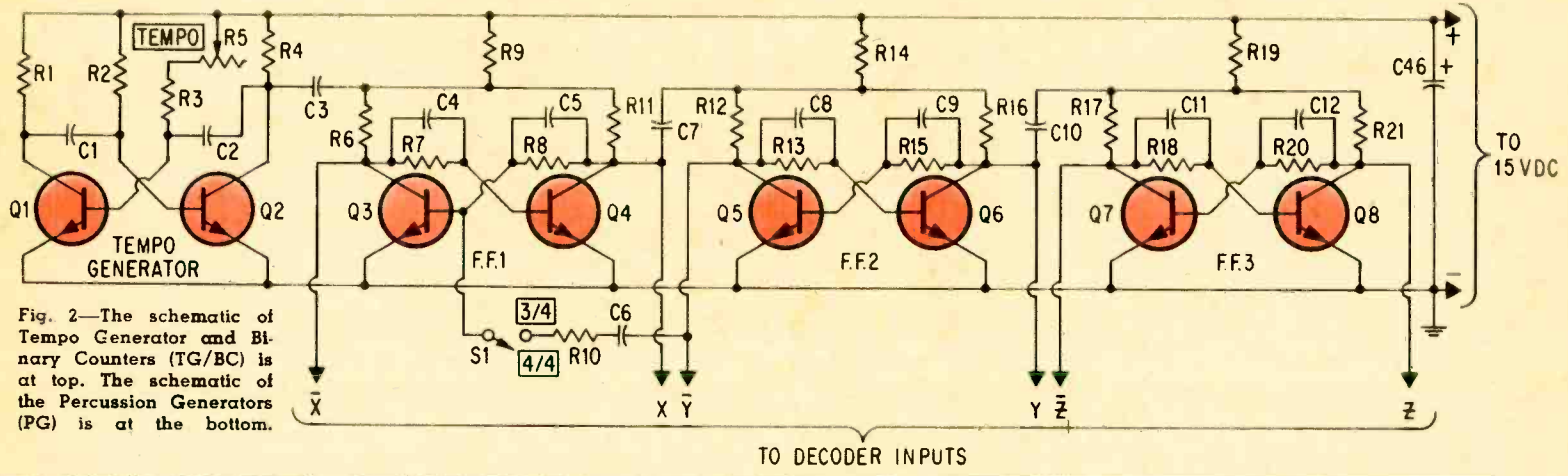
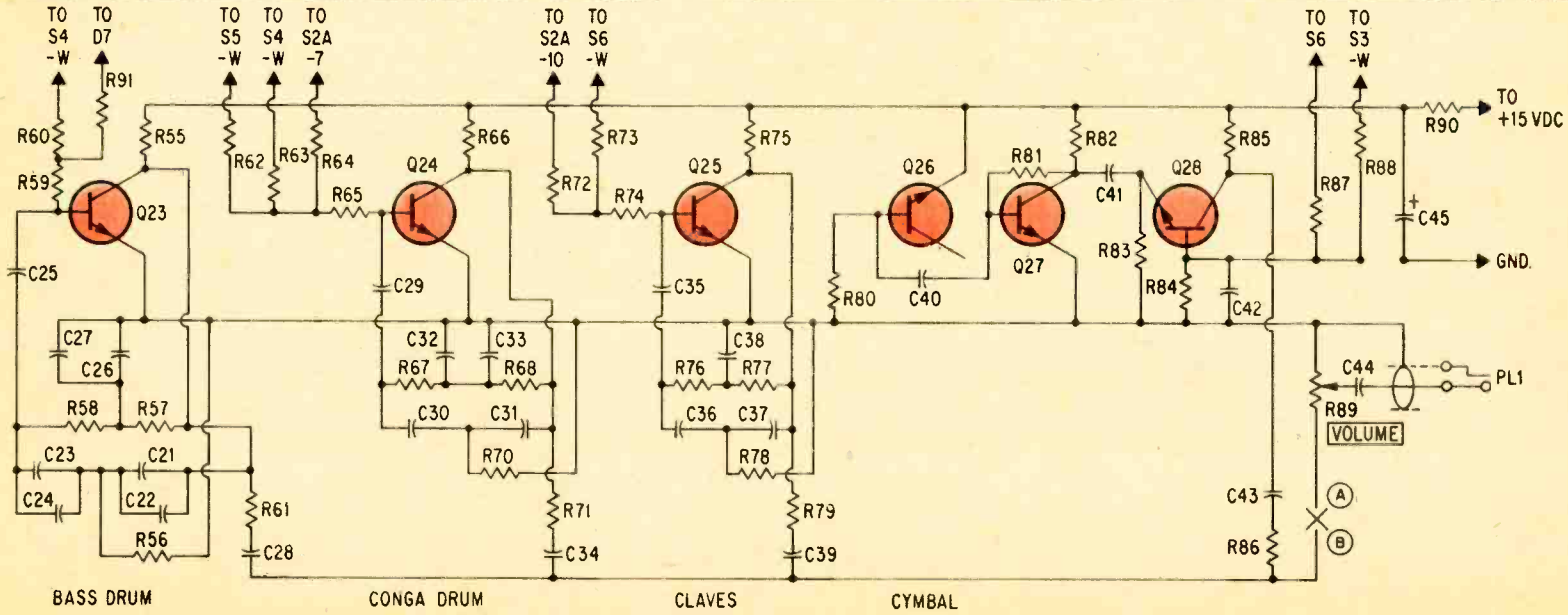


Fig. 2—The schematic of Tempo Generator and Binary Counters (TG/BC) is at top. The schematic of the Percussion Generators (PG) is at the bottom.



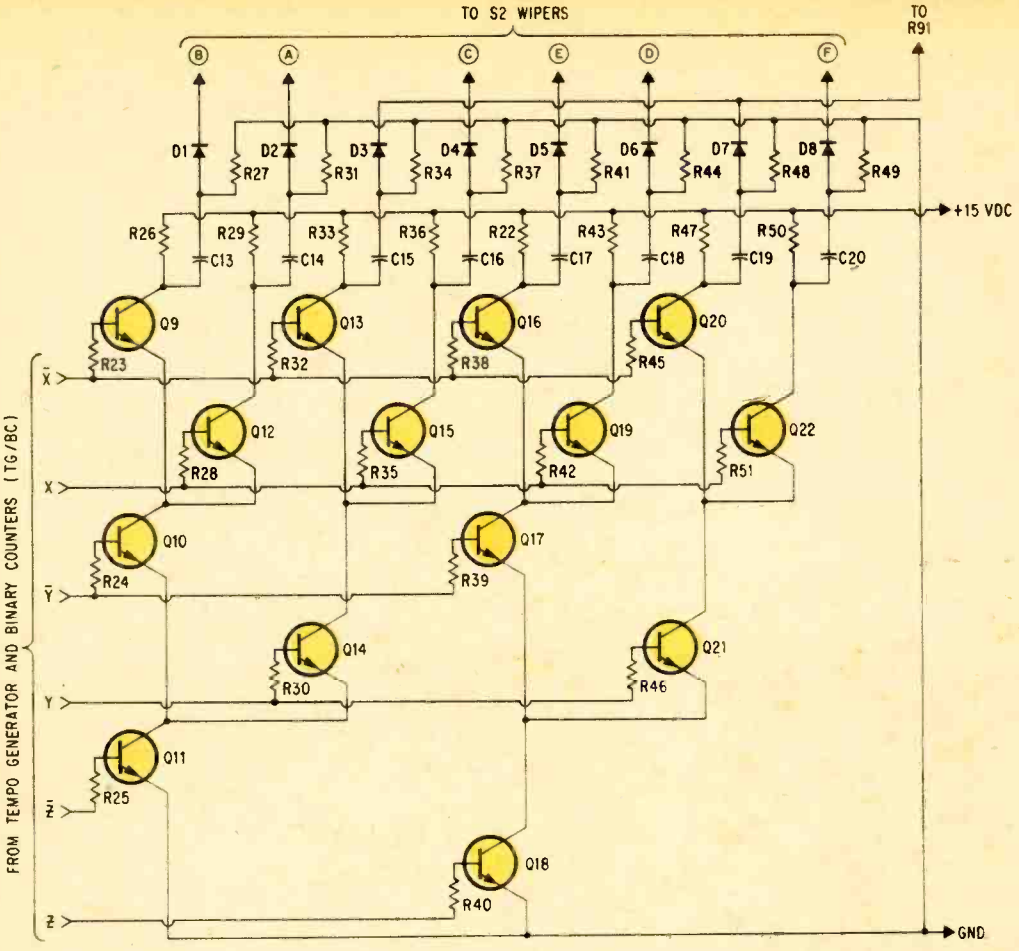


Fig. 3—Schematic of Decoders and Differentiators (DD). System of three-input "and" gates generates outputs for binary numbers accumulated in TG/BC. Trigger outputs go via switching to percussion generators.

Rhythm Section

of contacts marked *waltz* in Fig. 5.

Note in Fig. 3 that DD outputs 3 and 7 (between *A* and *C* and between *D* and *F*) do not go to the rotary switch. Instead, they are connected via R91 to bass-drum transistor Q23. These outputs are for the first and third beats in 4/4 (march, polka, etc. time, on which the bass drum always sounds). On waltz tempo, these outputs are not activated and do not interfere, since the bass drum does not sound on beats 1 and 5.

The four SPST switches have the following functions: S1 is the 4/4 or 3/4 rhythm control. When *on* you get the 3/4 and off, the 4/4 tempo. Switch S7 controls AC power. Switches S3 to S6 are coupler switches. When S4 is closed, the conga drum will sound when the bass drum sounds. Switch S3 makes the cymbal play with the bass drum. Switches S5 and S6 similarly route the cymbal beats to the conga and clave generators making them sound whenever the cymbal does.

Rhythms. Rotary switch S2 provides the 11 basic rhythms shown in Fig. 5. For the first three—waltz, Viennese waltz and jazz waltz—S1 must be in the 3/4 position. The next eight rhythms are all 4/4—march/polka, fox trot, samba, bossa-nova, watusi, cha-cha, rhumba and tango.

The Percussion Generators (Fig. 2, bottom). These are the circuits which produce the actual sounds that you hear. Up to this point, the circuits described simply generate either eight or six beats per measure. These beats are routed in various ways by the switches to produce the percussion sounds and rhythms.

In Fig. 2, Q23, Q24 and Q25 are the drum-sound generators. These are twin-tee phase-

shift oscillators with collector-to-base 180° phase-shift feedback. Normally, the transistors' bases are not forward biased and the oscillators are quiescent. The differentiated trigger pulses from switch S2 are passed to the transistors' bases. These pulses turn the transistors on, causing them to oscillate for a very short period. This produces a ringing effect which is characteristic of the sound produced by drums. The circuit configurations of the generators are the same. However, the capacitor and resistor values in the phase-shift network are different. The Q23 bass-drum generator oscillates at about 100 cps. Generator Q24 resonates at about 250 cps and produces a sound like claves (wood blocks).

The generators work best with fairly high-gain transistors and several should be tried to get the best one. The generators can be made to oscillate continuously by temporarily attaching a 100,000 to 200,000-ohm resistor from B+ to the transistor's base.

Transistor Q26, the cymbal generator, is the only tricky part in the project. Transistor Q26 is connected as a reverse-biased base-emitter diode. In this condition the P-N junction produces noise. Not all transistors make good noise diodes; therefore, one of your jobs will be to find a good noise diode among several transistors. We suggest that Q26 and Q27 (Q27 is simply an amplifier) be temporarily wired in the circuit and several

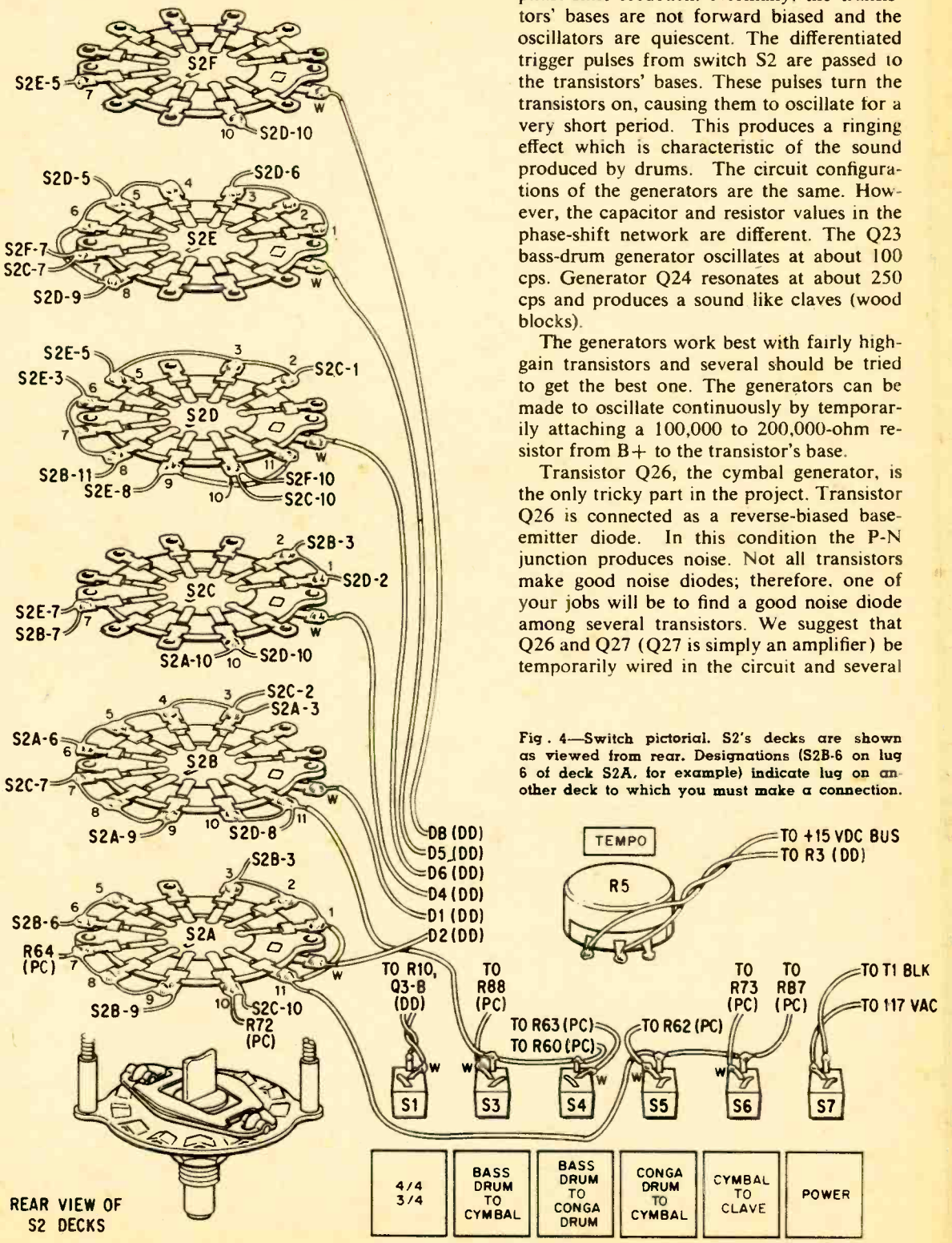


Fig. 4—Switch pictorial. S2's decks are shown as viewed from rear. Designations (S2B-6 on lug 6 of deck S2A, for example) indicate lug on another deck to which you must make a connection.

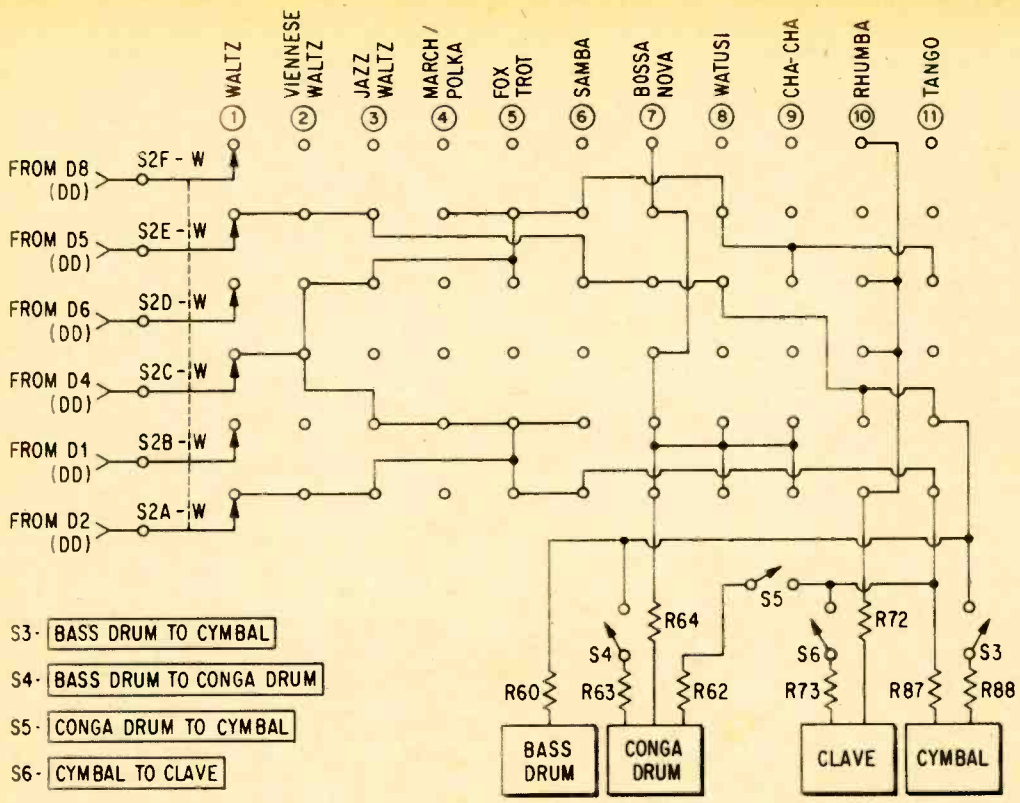


Fig. 5—Switching schematic. Keep this handy to double-check your wiring of the rhythm-selector switch (S2).

Rhythm Section

transistors tried in the Q26 position. The noise can be monitored with earphones, an amplifier or an oscilloscope connected from the collector of Q27 to ground. Noise sounds like a fairly high-pitched hiss. On a scope it appears as a continuous band of fine, random vertical lines. The best transistor is one which provides the loudest and smoothest hiss.

Transistor Q28 is a percussion gate. It is normally off and prevents the noise from entering the output line. When a positive trigger from the DD is injected, the gate opens and allows the noise through with decaying envelope. The sound produced is much like an after-beat cymbal.

Each of the generator outputs is coupled to a common line through capacitors (C28, C34, C39, C43) and resistors (R61, R71, R79, R86). This line goes to volume control R89 and through isolating capacitor C44 to a shielded cable for connection to an amplifier. (The musical-instrument amplifier we used with our generator and shown in the photograph on the first page of this article is a Lafayette 13-0148 WX.) In the event that instrument sounds are not approximately of equal loudness, the resistor values can be changed for a better balance. A larger resistor will reduce the output and vice versa.

If the bass drum is not loud enough, connect a 100,000-ohm (or less) resistor (R69 in Parts List) in parallel with R61.

Construction

As we said, the circuitry is not critical. Perforated board and push-in terminals are the best approach.

You can use transistor sockets if you like. We soldered our transistors directly to the terminals in all circuits except the Q23 to Q25 drum generator and the Q26 noise-diode positions, where it is desirable to select transistors.

The circuits require a 15 to 18-V supply and pull almost 150 ma. Ten C or D cells in series will operate it quite satisfactorily for fairly long periods. For continuous use a power supply is more economical. Fig. 9 shows the supply we built.

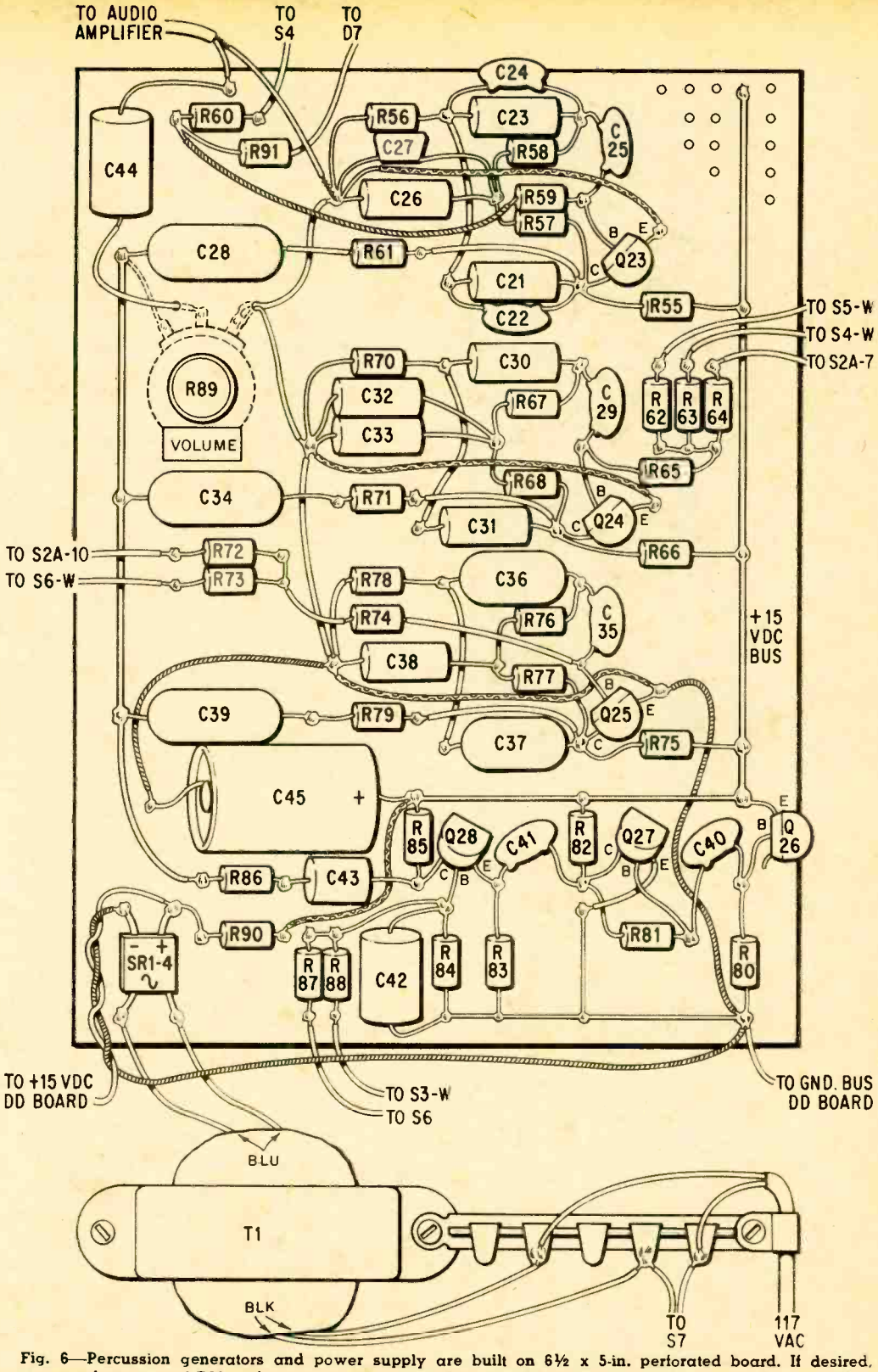


Fig. 6—Percussion generators and power supply are built on 6½ x 5-in. perforated board. If desired, mount volume control R89 on front panel. We mounted on board because volume is controlled on amplifier.

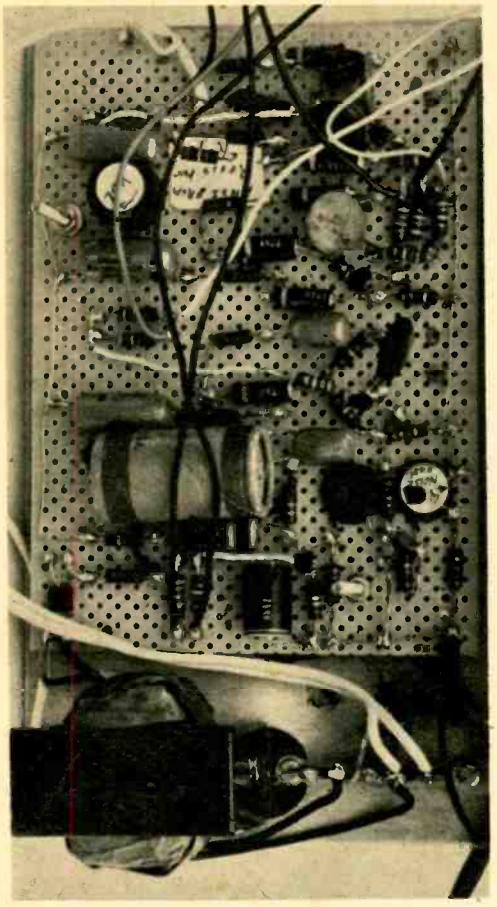


Fig. 7—Percussion Generator and Power Supply board is mounted at left side of 12-in.-sq. piece of plywood. At right (not shown here) is board with Tempo Generator and Binary Counters parts.

The project can be finished off by mounting the circuitry in a plywood box. The switches can be mounted on a front panel along with *tempo* control R5 as shown in Fig. 11.

Since the project may be used with vacuum-tube amplifiers, which operate at high voltages, output capacitor C44 (see Parts List on last page of this article) should be at least a 200-V paper or mylar type. Any amplifier can be used with the project, but since the percussion sounds generate high peak power, best results will be obtained on at least a 20-watt amplifier with a 12-or 15-in. woofer speaker.

Most hi-fi systems and musical-instrument amplifiers (guitar, accordion, etc.) have this peak-power capability.

On Your Own

If you would like to expand the project, it is quite easy to do. For example by building more drum generators like those shown in Fig. 2, but using other capacitor values in the phase shift networks, a series of lower or higher-frequency sounds can be obtained. These may sound like snare drums, wood blocks, triangles and cow bells. To add these sounds, more and different switching will be needed. By following the pattern of Fig. 5, extra switching shouldn't be difficult to add.

As we pointed out, the cymbal circuit may be the most difficult one to get working properly. If you run into trouble you will still have a good-sounding project by substituting one of these other generators in its place.

If you wish to go even further, you can expand the counter with one more flip-flop stage. This will accumulate 15 counts, or twelve counts with feedback. The decoder and switching will have to be expanded.

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Rhythm Section

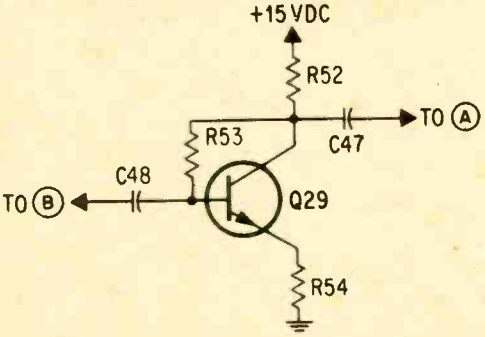


Fig. 8—If your amplifier doesn't have enough gain, add this one-transistor preamp at the points marked A and B in the bottom schematic in Fig. 2.

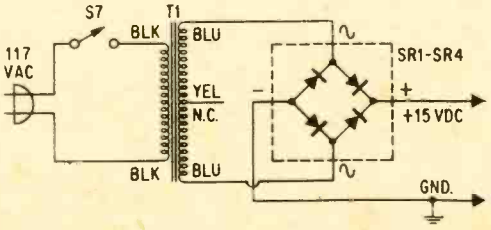


Fig. 9—Power supply. Complete bridge rectifier (SR1-SR4) is encapsulated part. Four 200 ma, 100 PIV diodes could be used instead. A filter capacitor, C45, is shown in bottom schematic in Fig. 2.

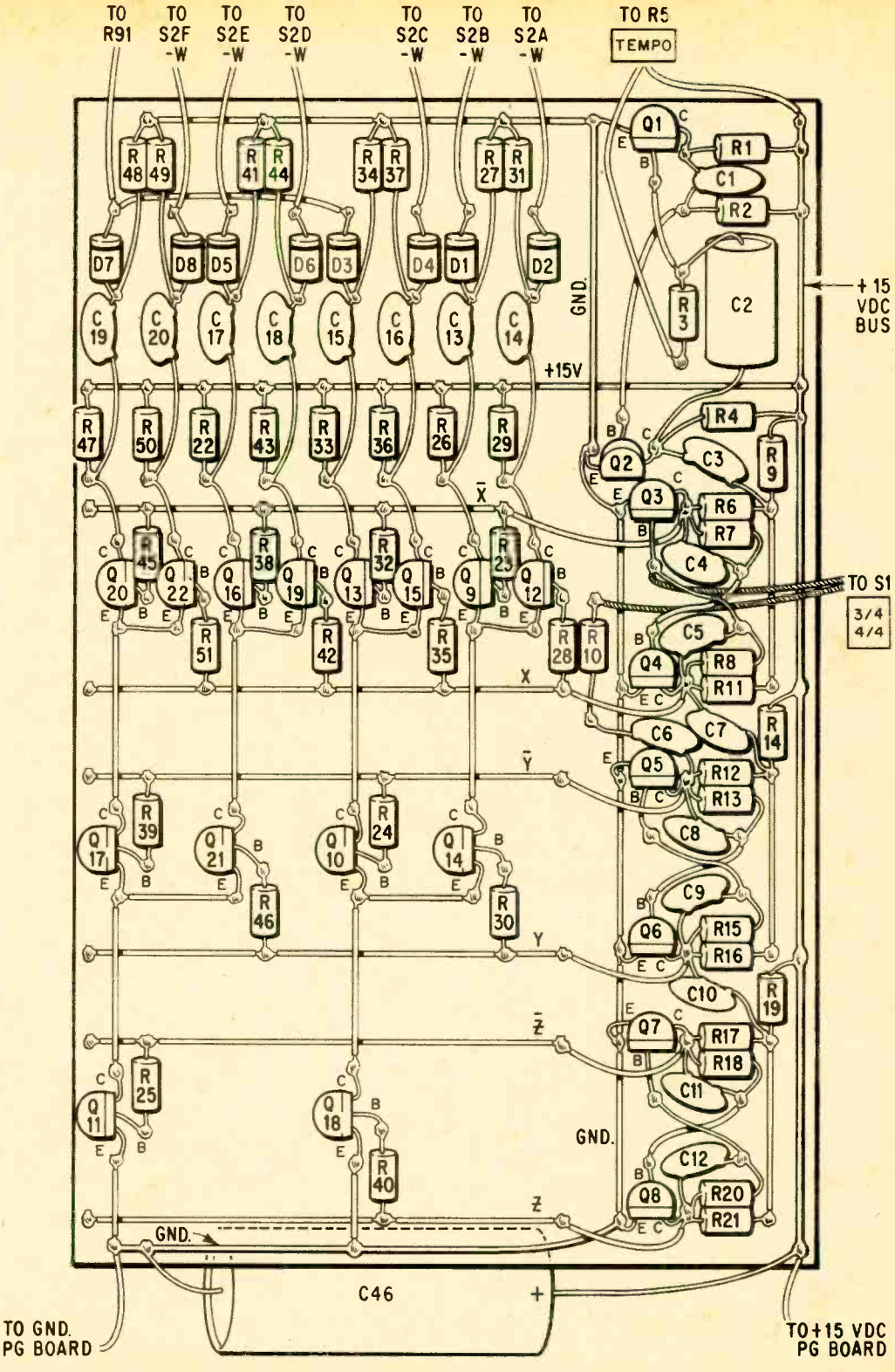


Fig. 10—An 8½ x 5-in. perforated board contains Tempo Generator, Binary Counters as well as Decoder and Differentiators. Wiring will be tight so use spaghetti insulation generously or build on larger board.

Rhythm Section

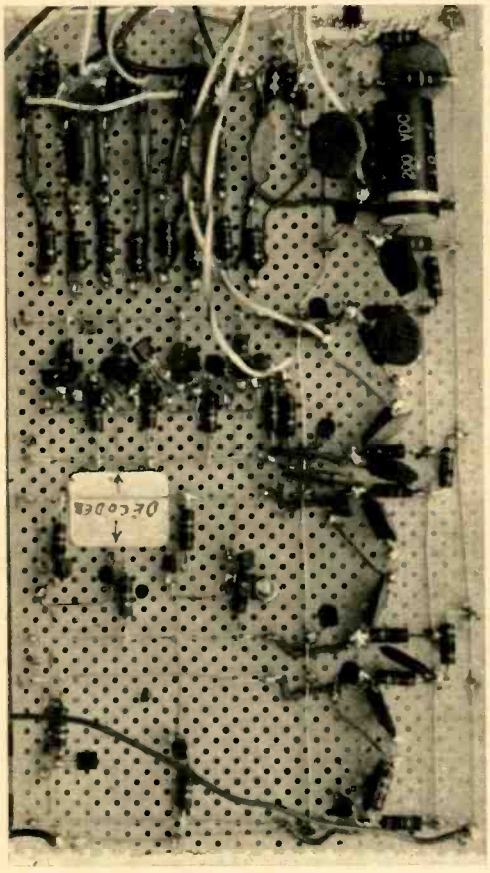


Fig. 11—Tempo Generator and Binary Counters/ Decoder and Differentiators. Pictorial of this board is in Fig. 10. Crowded parts will require careful wiring unless you want to build on larger board.

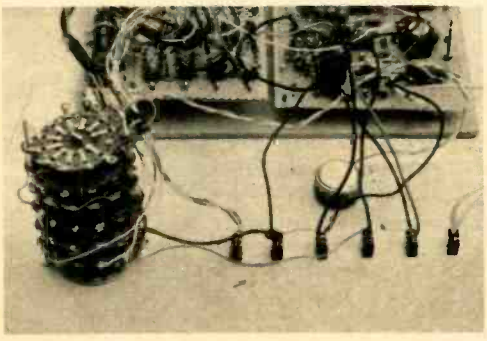


Fig. 12—Ready for cabinet. Front panel with switches is in foreground. On board at back are TG/BC and DD board (left) and PG board (right).

PARTS LIST

Capacitors: 50 V or higher unless otherwise indicated

C1,C6,C13,C14,C15,C16,C17,C18,C19,C20, C25,C29,C35—.1 μf disc

C2—1 μf (not electrolytic) tubular

C3,C4,C5,C7,C8,C9,C10,C11,C12—.005 μf disc

C21,C23,C26,C30,C31,C32,C33,C38—.01 μf tubular

C22,C24,C27,C40,C41—.02 μf disc

C28,C34,C39,C43,C47,C48—.1 μf tubular

C36,C37—.005 μf tubular

C42—.25 μf tubular

C44—.05 μf tubular

C45—250 μf, 50 V electrolytic

C46—2,000 μf. 15 V electrolytic

D1 through D8—1N4001 diode (Motorola)

PL1—Phone plug

Q1 through Q29—MPS2926 transistor (Motorola. Order Allied Stock No. 49 R 26 MPS2926 MOT. 40¢ plus postage; not listed in catalog)

Resistors: ½ watt, 10% unless otherwise indicated

R1,R4,R52,R82,R85—10,000 ohms

R2,R57,R58,R67,R68,R76,R77,R86—100,000 ohms

R3—220 ohms

R5—1 megohm linear-taper potentiometer

R6,R11,R12,R16,R17,R21—2,200 ohms

R7,R8,R10,R13,R15,R18,R20,R23,R24,R25, R28,R30,R32,R35,R38,R39,R40,R42,R45, R46,R51—22,000 ohms

R9,R14,R19,R90—1,000 ohms

R22,R26,R29,R33,R36,R43,R47,R50—6,800 ohms

R27,R31,R34,R37,R41,R44,R48,R49,R53, R80,R81—1 megohm

R54—100 ohms

R55,R66,R75—6,800 ohms

R56,R70,R78—4,700 ohms

R59,R60,R62,R63,R64,R65,R72,R73,R74, R87,R88,R91—470,000 ohms

R61—1.5 megohms (see text)

R69—100,000 ohms, in parallel with R61 (see text)

R71,R79—1.5 megohms

R83—3,300 ohms

R84—560,000 ohms

R89—25,000 ohm, audio-taper potentiometer

S1,S3 through S7—SPST switch

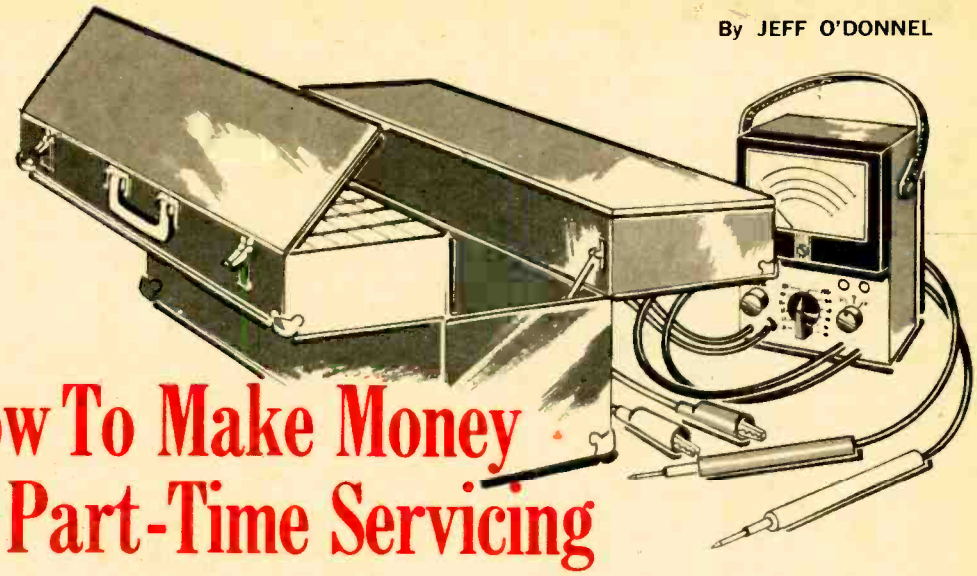
S2—6-pole, 11 position rotary switch (Mallory 1361L or equiv.)

T1—Filament transformer; secondary: 12.6 V center tapped @ 1½ A (Triad F-25X or equiv. Allied 54 E 4959. $3.75 plus postage; not listed in catalog)

SR1 through SR4—Full-wave bridge rectifier (Motorola MDA920-2. Order Allied Stock No. 49 R 26 MDA902-2 MOT. $1.69 plus postage; not listed in catalog) Or, four 1N4001 diodes.

Misc.—Perforated circuit board, flea clips, AC line cord, knobs

By JEFF O'DONNEL



How To Make Money In Part-Time Servicing

IF YOU'RE a regular reader of EI who builds the projects *and gets them working* it's more than likely you've got the technical know-how to pick up a few dollars doing part-time servicing in the evenings and on weekends. The fact is—regardless of the screams of industry trade groups and well-intentioned but ill-informed legislators—many electronic hobbyists make excellent part-time technicians in TV and hi-fi servicing, radio repair, CB installation and maintenance and electronic odd-jobbery.

Naturally, the exact type of part-time servicing you can tackle will depend on your background. For example, if your experience is limited to helping fellow CBers maintain their equipment it would be logical to limit your part-time work to CB—perhaps installation and repair. If your regular job is in electronics—say as a commercial radio installer—and your hobbying takes in everything from building your own tuners and amplifiers to fixing the neighbor's toaster, you might well be able to handle something more complex—perhaps TV servicing.

The important point to keep in mind is that you can be successful in part-time servicing if you limit yourself to those areas in which you have a reasonable degree of competence and if you arm yourself with the tools and equipment necessary to do the job. If you do, word-of-mouth advertising will be your greatest business asset. If you don't, you will find yourself getting complaints instead of recommendations.

It's true that the man in the local service shop has several years of formal or informal training and an equipment investment of several thousand dollars. But remember that you probably will not be doing the same type of work. Fact is, you most likely will go after the work the average service shop would spend money to avoid, such as repairing table radios or CB gear.

Let's look at some of these situations and see how you can fit in.

In many parts of the country a small business requiring a really cheap CB installation simply cannot find anyone to do the job. The commercial radio dealers concentrate on the relatively expensive business radio installations and the local service shop cannot afford to tie up a technician

How To Make Money In Part-Time Servicing

earning $25-40 a day to realize a $25 fee for a CB job that might take eight hours of work. But $25, picked up on a Saturday for installing a CB base and mobile for a drug or cleaning store, is a nice bit of extra change for the part-timer. And there will be $5 or $10 repairs you can do in an evening.

The minimum fee for hi-fi repairs in New York City is $12.50 per half-hour plus parts. Seem high? It is. Yet many service shops run by hi-fi dealers fill their day's schedule at this fee because *quality* hi-fi service is not easy to find. Maintenance and repair of a hi-fi perfectionist's equipment takes high-quality, often laboratory-grade equipment. Service-grade equipment found in TV repair shops often is not good enough. Nor can the average service technician take time out to lend the sympathetic ear to hi-fi woes that means so much to these customers.

Two tubes and a service fee can represent a service-shop bill of $5.25 or higher for an old table radio that could be replaced for only $7.95 in a discount store. So a lot of radios don't *get* repaired. Just about everyone has an old radio around that needs some sort of work. As a part-timer with no store rent, insurance or similar costs you might be able to handle radio (and small appliance) servicing at more attractive prices.

TV Servicing is very touchy ground, particularly in those states where there is pressure for licensing of TV technicians. But the fact is that many a hobbyist is an excellent TV technician. The thing you have going for you is that a majority of TV service work consists of replacing tubes and making fine adjustments (particularly to color sets). And should you wind up with a TV receiver that needs bench work you probably will find a wholesale shop to back you up. In fact, there are TV service centers that specialize in doing bench work for the part-timer, giving him a boost by supplying tubes and other parts at wholesale prices.

Now, about getting started in part-time servicing—you must begin by understanding one important principle: Small as your operation might be it is a *business,* not a *hobby.* (Your customers will not excuse sloppy workmanship because you are a part-timer.) Get some stationery and appropriate business forms. And, most important, register your business if that is the local practice. While registration means paying your fair share of taxes it also means you will be able to obtain business discounts.

The day of the screwdriver mechanic never really existed. Good equipment repairs require specialized equipment—not necessarily expensive, but specialized. If you handle only radio repairs you can get by with a VTVM and an RF signal generator (both inexpensive kits), a speaker for substitution and a small stock of commonly-used tubes—and, if you have a few extra dollars, a really cheap tube checker. Of course, many modern radios—even the inexpensive ones—have FM reception. Fortunately, most inexpensive FM or AM/FM table and portable radios can be aligned with an AM signal generator as long as it goes to 108 mc.

Hi-fi servicing takes a relatively heavy outlay before you handle your first call. Your basic equipment must be a VTVM and an AC-VTVM (or

a combined instrument), a low-distortion audio signal generator, distortion meter, stereo generator and some test records (try to get those put out by CBS Laboratories). Load resistors of 4, 8 and 16 ohms at 100 watts will round out your starter kit. The signal generator, distortion meter, AC-VTVM and test discs will be used to run frequency and distortion checks. The stereo generator will be used, preferably in the customer's presence, to determine whether what he calls the fuzzy sound is due to the tuner or antenna system.

The important thing to remember about hi-fi servicing, because of the nature of your customer, is that 75 per cent of every job is putting on a convincing show. Even if you just change a tube let him see you take at least a 1-kc distortion measurement. Show him that your work really *did* improve performance. One firm rule about hi-fi servicing: Never align a stereo receiver or tuner yourself unless you have the manufacturer's alignment procedure in front of you and service equipment of a quality equal to that specified by the manufacturer. Your customer, Old Golden-Ears, will hear any alignment error you have made magnified many times. You're better off returning the unit to the manufacturer's service station and charging only for your service call. If you really believe the equipment cannot be restored to like-new performance or that doing so will be prohibitively expensive, tell the customer just that. Don't try for a large service fee. He will appreciate your honesty and might possibly give you the new equipment sale or installation. Best of all, he will brag about you to other hi-fi buffs.

TV Servicing is easy money, providing you live in a city with a wholesale service shop or center. Most of your service work will be changing tubes and your most important piece of equipment will be a well-stocked tube caddy. Next in importance are a color-bar generator and degausser for color receivers. Many people cannot adjust a color set for anything other than dysentery-green or rash-red skin tones. Get known as an expert in color adjustments and you'll spend many evenings making nice, clean service calls.

Of course, there will be times when the TV owned by the little old lady who calls you once a month to put the plug in the wall *really* breaks down and you will have to make a repair in the shop. You will need a VTVM and an oscilloscope—any inexpensive scope with a response to 4.5 mc—and, the most important bench tool of all, the Sams Photofact for the set. The Photofact will give you the proper voltages and scope waveforms. If you cannot correct the difficulty with the instruments you have don't play games; take the set immediately to a wholesale service shop. They will fix the set and also tell you what the trouble was so you'll know what to do when you get a similar complaint. Chances are the next time the customer calls it will be for a repair within your capability.

PA service and rentals are a source of part-time work that's easily overlooked. And it's clean—if you can't make a service call while wearing a white shirt you're doing something wrong. While large PA installations are tied up by the commercial sound houses there's a lot of work in church bazaars, PTA meetings, amateur shows and the like for the part-timer. And don't overlook PA rentals. A $150 portable system can rent for $20 or more a night. Figure another $10 to $15 if you go along as operator (to protect the equipment). PA repair is about the nicest of all electronic work. There's not much that can go wrong with [*Continued on page* 119]

Hi-Fi How-To, Extensions Division

By LEN BUCKWALTER K1ODH

YOU'VE just finished installing an extension speaker in your basement workshop. After going upstairs to turn on the radio to which the speaker is connected, you set the radio's volume control for a comfortable listening level. On returning to the shop you're astounded to find hardly anything is coming out of the speaker.

A quick look at the speaker wire would reveal the villain: it is thin No. 22 and has introduced as much resistance as the extension speaker itself. The wire and speaker were each about 3 ohms and this caused audio power to split between them. In other words, half the radio's output power was simply turning into heat in the line.

That could be the problem you'll face when you want to run audio a long distance. It happens when extension speakers are located in another room, placed out on the patio or when you're wiring a large area for sound. Power losses not only cause annoying volume unbalance, they also eat up precious amplifier output power.

In a hi-fi system, long lines can take the wallop out of strong bass notes. Reason for this is the way audio power is produced by music. Studies of orchestras playing a variety of music reveal that instruments which produce low-frequency notes generate more power than high-frequency instruments. Look at these examples of sound pressure.

bass drum in 50-100 cps range 100db
full orchestra at 300 cps 75db
high-frequency instruments:
10,000 cps 50db
15,000 cps 42db

The figures show that low-frequency instruments produce vastly more power than, say, a flute or a triangle. Thus, greater currents produced in an amplifier by bass notes need a low-loss speaker line. Here's how to prevent the line from being power-grabber.

Size-Up The Wire. The salesman in a radio-parts store may routinely recommend any wire, such as lamp cord, for an extension speaker. But the wire to be used for a lengthy speaker installation requires more critical selection. A look at some figures shows why. If you run No. 18 lamp cord between an amplifier and speaker separated by only 13 ft., about 5 per cent of the audio power is lost. This is hardly significant and lamp cord is fine when speaker and amplifier are in the same room. But if smaller No. 24 wire is used the maximum distance drops to about 3 ft. Although No. 24 wire is sold in 50-ft. rolls and marked for loudspeaker use, it is a poor choice for a long line. To find out how much loss is tolerable, we can draw from the rules followed by commercial sound installers.

Public-address system installers who must distribute audio efficiently have a good rule-

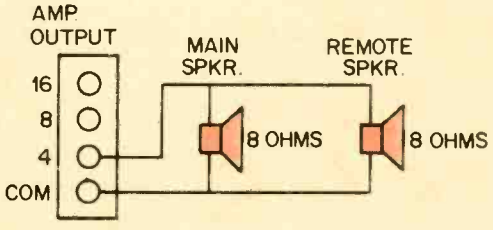


Fig. 1—When speakers are connected in parallel line impedance is reduced. If impedance of speakers is the same, divide the impedance of one by number on line to determine line impedance. The text explains how to determine the line impedance when the speakers are of different impedance.

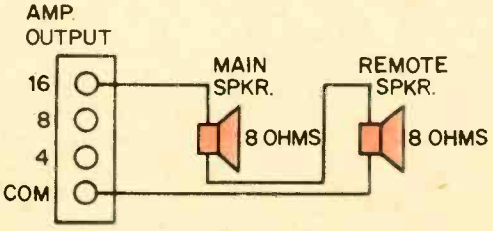


Fig. 2—When several speakers are connected in series, impedance of the line is the sum of individual speaker impedances. Series method of connecting hi-fi speakers should be used only if speakers are of comparable size and power-handling capability or volume will be unbalanced.

of-thumb: losses up to 15 per cent are tolerable for speaker lines that operate at low impedance (4, 8, and 16 ohms). To determine wire gauge and length within the 15 per cent limit, check the table at the end of this article. It shows for example, that you can connect a 4-ohm speaker as much as 47 ft. from an amplifier with No. 18 wire. Thus, you can run, say, the half-watt audio output of a table radio or TV from attic to basement and still find ample sound at the end of the line. If you wish to operate a 4-ohm speaker 75 ft. from the radio you would have to use heavier No. 16 wire.

Multiple speakers affect the line's impedance and, as the table shows, the lower the impedance the shorter the line for a given loss. The big problem is to avoid losses which cause unequal sound levels in near and distant speakers. Here's how to use the table for two situations where more than one speaker is to be connected to a line.

The first example, where two speakers are to be connected to a hi-fi amplifier, is shown in Fig. 1. This is a parallel connection with two 8-ohm speakers connected to the line. Since two 8-ohm speakers in parallel become a load of 4 ohms, the line must be connected to the amplifier's 4-ohm tap for a correct impedance match. The line is now considered 4 ohms up to the point at which the speakers are paralleled. Beyond that point it is 8 ohms and the wire size for the remote speaker should be taken from the 8-ohm column in our table to insure equal power to both speakers with a loss that can be ignored.

The impedance of speakers connected in series, as in Fig. 2, adds. A 4, 8, and 16-ohm speaker connected this way would total 28 ohms. In a parallel hookup, the total impedance is easy to figure when the speakers have the same impedance. Divide the number of speakers into the impedance of one. For example: four 16-ohm speakers in parallel have a net impedance of 4 ohms.

When speakers of *unequal* impedance are connected in parallel, compute the total impedance this way: divide the product of their

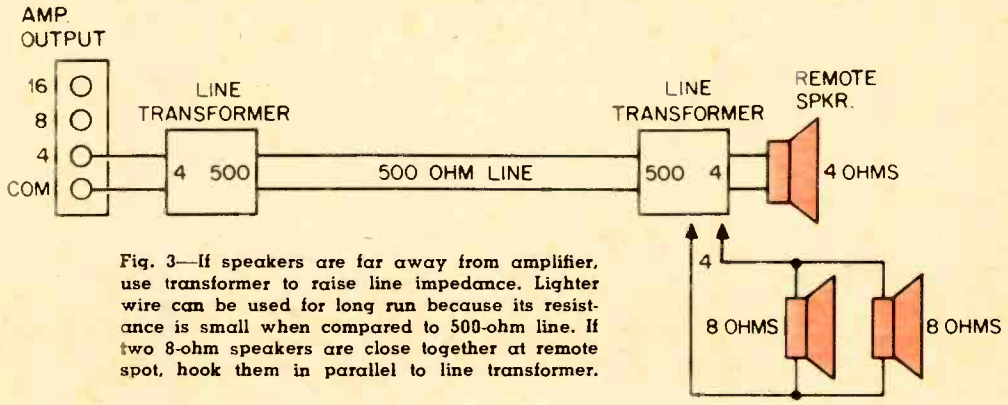


Fig. 3—If speakers are far away from amplifier, use transformer to raise line impedance. Lighter wire can be used for long run because its resistance is small when compared to 500-ohm line. If two 8-ohm speakers are close together at remote spot, hook them in parallel to line transformer.

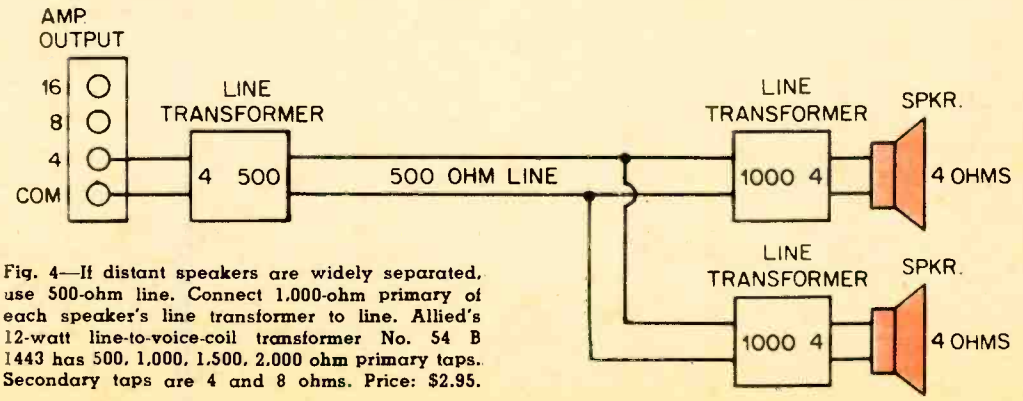


Fig. 4—If distant speakers are widely separated, use 500-ohm line. Connect 1,000-ohm primary of each speaker's line transformer to line. Allied's 12-watt line-to-voice-coil transformer No. 54 B 1443 has 500, 1,000, 1,500, 2,000 ohm primary taps. Secondary taps are 4 and 8 ohms. Price: $2.95.

Hi-Fi How-To, Extensions Division

impedances by the sum of their impedances. For example: a 4- and 16-ohm speaker in parallel.

$$\frac{4 \times 16}{4 + 16} = 3.2 \text{ ohms}$$

For more than two unequal-impedance speakers, add the reciprocals of each impedance, then take the reciprocal of their sum. For example, a 4, 8, and 16-ohm speaker in parallel:

$$\frac{1}{\frac{1}{4} + \frac{1}{8} + \frac{1}{16}} = \frac{1}{7/16} = \frac{16}{7} = 2.2 \text{ ohms}$$

Next typical situation is adding an extension speaker to a TV, phono or table radio. In most cases, these speakers in these devices are rated at about 4 ohms. Connecting another speaker in parallel would reduce the impedance to 2 ohms. This introduces two problems because of the low output power of these sets.

First, there is a bad downward mismatch when you connect a 2-ohm load to a 4-ohm output-transformer secondary. There's a shorting effect which causes power loss and distortion.

This example shows why an upward mismatch is preferred. Let's say a 24-ohm load is connected to the 4-ohm output of an amplifier. This is considered an upward mismatch of 6-to-1. It prevents *half* the amplifier power from reaching the speaker.

Now reverse the condition. Connect a 1-ohm load to the amplifier's 4-ohm output for a downward mismatch of 1-to-4. This time more than 4 times the power would be lost. The comparison shows that losses accelerate far faster in the downward direction. If you had 12-ohm speaker line, for example, there'd be less loss if it's connected to amplifier's 8-ohm tap (3:2, upward) than to the 16-ohm tap (4:3, downward).

Second, there's the problem of wire size: the table indicates it would be possible to run a 2-ohm line, say, 38 ft. with No. 16 wire. That's a heavy costly wire size to work with.

A better connection would be to hook the radio speaker in series with the extension speaker. This raises the line to 8 ohms which significantly reduces the wire requirement. It's now possible, for example, to run the remote speaker up to 95 ft. away with No. 18 wire. There is still a mismatch (4-ohm amplifier into an 8-ohm line), but it's upward and not serious.

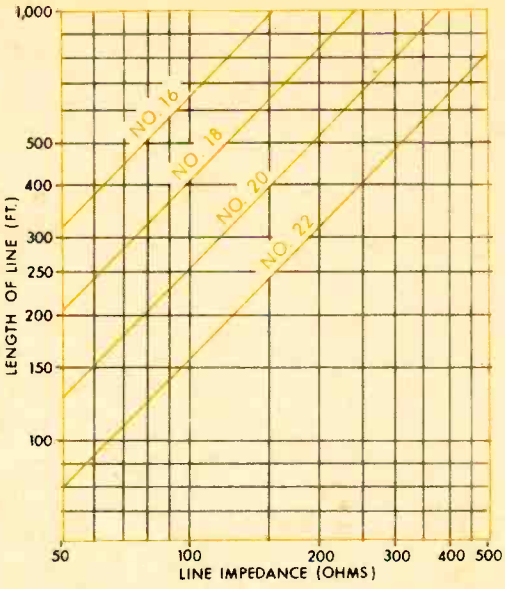


Fig. 5—Graph shows relationship of required wire size and line impedance for particular line length. For pratical example, first multiply figures on both scales by 10. If run is 2,000 ft., line impedance must be 500 ohms if you use No. 18 wire or 1,000 ohms if the wire size is to be No. 20.

The point is that wire size must be chosen according to the total impedance presented by the speakers in combination.

Incidentally, it is good idea to avoid connecting hi-fi speakers in series. An inexpensive extension speaker may interact with the main speaker and degrade sound quality. One way to prevent interaction is to install a main-remote switch to operate the speakers independently. The series hookup for a TV or radio, on the other hand, is acceptable. Sound quality isn't as critical, and the line impedance, though high, will be tolerable.

Way-Out Audio. Juggling wire size and ohms isn't the only method for extending audio beyond the usual listening area. Another approach relies on a technique of the power industry. When going cross-country, electricity is almost always stepped up to many thousands of volts. This vastly reduces the amount of current carried in the line—and it's current that produces heat loss.

This technique is adapted to public-address systems which abandon the usual 4, 8 and 16-ohm in favor of the 70-V line. Audio voltage is stepped up to that level to lower the line current. (By contrast, an audio amplifier usually produces less than 10 V in the speak-

EI'S GUIDE TO EXTENSION-SPEAKER WIRING

WIRE SIZE	WIRE RESISTANCE (Ohms per ft.)	SPEAKER IMPEDANCE (OHMS)			
		2	4	8	16
10	0.0010	150 ft.	300 ft.	600 ft.	1,200 ft.
12	0.0016	95	190	380	760
14	0.0026	60	120	240	475
16	0.0040	38	75	150	300
18	0.0064	23	47	95	190
20	0.0101	15	30	60	118
22	0.0161	9	18	37	75

For quick reference, look in the column under the appropriate speaker impedance for the length of wire you plan to use and read out the wire size at the left. If you have an 8-ohm speaker and will use 70 ft. of extension line, for example, you must use No. 18 wire (60 ft. is the limit for No. 20). If you want to figure precise values, multiply the distance by *twice* the resistance per ft. (speaker line is a *pair* of wires) to obtain line resistance. This figure should be less than 15 per cent of speaker impedance if power loss is to be held within the allowable 15 per cent. In our example, line resistance would work out to 0.896 ohms, less than 15 per cent of the 8-ohm speaker impedance.

er line.) By boosting the amplifier's output voltage it similarly is possible to cover long distances with thin wire and still without serious losses.

The simplest way to boost the output voltage of an audio amplifier is with a transformer, which also changes impedance. The transformer raises the amplifier's output impedance—from the voice-coil values of 4, 8 and 16 ohms—to a higher value. The advantage of raising impedance is apparent in the chart of Fig. 5. For example, a pair of No. 22 wires, when operated at 500 ohms, can carry audio as far as 800 ft. This is a far cry from operating at 4 ohms, where No. 22 wires would convert audio power to heat long before that distance. The chart, incidentally, is similar to one used by sound men who feel a high-impedance line should not waste more than five per cent of the audio power.

Here's how a hi-fi amplifier can be converted for high-impedance operation. In most electronic parts-distributors' catalogs you'll find *line-to-voice-coil* transformers. Although these transformers are really designed to be used with PA amplifiers, they also can be used with hi-fi equipment. You install one transformer next to the amplifier (or TV set) to raise output impedance to 500 ohms. An identical transformer at a distant speaker drops the 500-ohm line impedance to that of the remote speaker.

An alternate speaker hookup is shown in Fig. 3. Here you see how to operate several speakers from a common line transformer. If you wish to feed audio to a group of distant speakers, you might not need a line transformer at each one. If two 8-ohm speakers, for example, are close to each other, they can be wired in parallel so they match the 4-ohm output of the transformer. The wire size and permissible lengths for this section of the installation are shown in the table.

Another installation is shown in Fig. 4. This assumes great distance between speaker branches and that the line impedance must remain high to preserve power. This can be handled by using a 1,000-ohm line transformer connected across the line at each speaker. Since the transformers are in parallel, they appear as 500 ohms on the line and are a perfect match to the 500-ohm transformer at the amplifier.

A simple one-speaker installation might use a Stancor A8101, which matches one of two voice-coil impedances (6-8 or 3.2) to 500 ohms. A more flexible transformer is the Stancor A7947 or Allied 54 B 1425. Each offers several impedances enabling you to parallel a number of speakers to a common line with good matching. For example, if an amplifier has 500-ohm output, three remote speakers should each have a 1,500-ohm transformer for a perfect match to 500 ohms. (A transformer of this type costs about $3.) Be sure not to exceed the wattage rating of the transformer. The frequency response of these transformers probably will not equal that of your hi-fi rig, but sound quality should be adequate for an extension speaker.

Besides versatility, a multi-impedance transformer like the Stancor A7947 offers some control over volume. All systems we've pictured are matched, which means that power fed to the line by the amplifier is split equally among speakers. It's possible, however, to introduce a deliberate mismatch to change the power to a particular speaker. Assume a speaker, for example, is wired to the line with a 1,000-ohm line transformer. By changing the tap from 1,000 to 500, the speaker will absorb more power from the line. Raising the tap to 1,500 or 2,000 ohms will reduce power and volume.

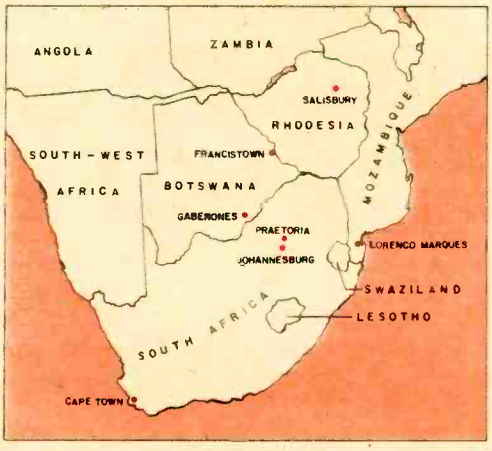
The Listener

By C. M. Stanbury II

Epitaph for Two

TWO names familiar to readers of this column will, it seems, be appearing no longer—Radio Americas and the BBC station at Francistown, Botswana. The closing down of R. Americas last May already has been noted; the Francistown closing, although it occurred earlier, was harder to spot for a number of reasons.

From Dec. '65 until March 31 of this year, Botswana (formerly Bechuanaland) rated as a hot topic among distant radio listeners, both MW and SW variety. This column first suggested, last year, that the BBC's anti-Rhodesian station at Francistown seemed to have been put on the air with American help. But, contrary to what we originally thought, no VOA equipment was used. Although Washington never admitted to playing any part in the operation, the key unit was a Gates 50-kw air-transportable BCB rig that can be operational within 24 hours wherever there's a spot of dry land big enough (and dry enough) to set it on.



Map of southern Africa shows awkward position of Botswana as site for anti-Rhodesian station. Angola, Mozambique, South Africa and South-West Africa all favor the Salisbury government.

On March 31 the station closed, with some of its duties taken oven by BBC Ascension and the rest simply dropped. There were several reasons for Francistown's failure and eventual demise: the British financial crisis, Rhodesian jamming and (the one they're not talking about officially) pressure from South Africa—both direct and indirect through Botswana's financially dependent government.

The success of Rhodesian jamming apparently was more psychological than anything else. Monitoring reports indicate that one jammer operated on each Francistown frequency and all three jamming transmitters were located at the capital, Salisbury. In other parts of Rhodesia the jamming should have been relatively ineffective. But, right from the word go, Rhodesia and her friends were able to convince almost everybody that BBC Botswana was a second-rate opertaion and therefore easily jammed.

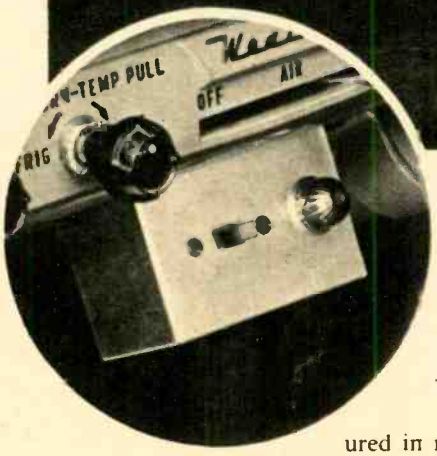
Meanwhile, the 10-kw short-wave transmitter from Francistown has been turned over by the BBC to the government station, R. Botswana, with headquarters at Gaberones. DXers should watch for it at 2300 EST on 7295 kc. This is not the mysterious BBC African station heard by North American SWLs in '66 and '67 on 7295 at 2300 EST. London won't talk about that one any more than they will about any U.S. role in the Francistown operation.

As a postscript to EI's visit to and report on R. Americas, we had wondered whether the SW rig then on Swan was the one silenced back in 1966 at the height of the controversy over its location. That earlier transmitter had fine modulation. But when RA returned to 6 mc late in '67 its modulation was on the bassy side.

EI's reporters say they can't be sure but they would find it strange if the 1966 transmitter had been replaced by a second one besause that would make the replacement rig a couple or three decades old—and where could the RA gang have found an antique transmitter? That's what they say.

What is Medium Wave? Down through the years this question has served as an excuse for considerable DX blood-letting but the National Bureau of Standards refers to all frequencies between 300 and 3000 kc as MW.

[*Continued on page* 115]



Auto Flasher

By FRANK V. EFFENBERGER

YOU may not realize it but when you change a tire on a busy expressway your life expectancy can be measured in minutes. Reason for this is that other drivers looking at your taillights may not know you're stopped and inadvertently will zero in on you. To make your car stand out when you're in trouble, you must have flashing lights to attract attention.

Rear-end accidents are becoming more common because of the high speeds at which people drive. The seriousness of this problem is attested to by the fact that by law, all cars from 1966 on have been equipped with an emergency light-flashing system.

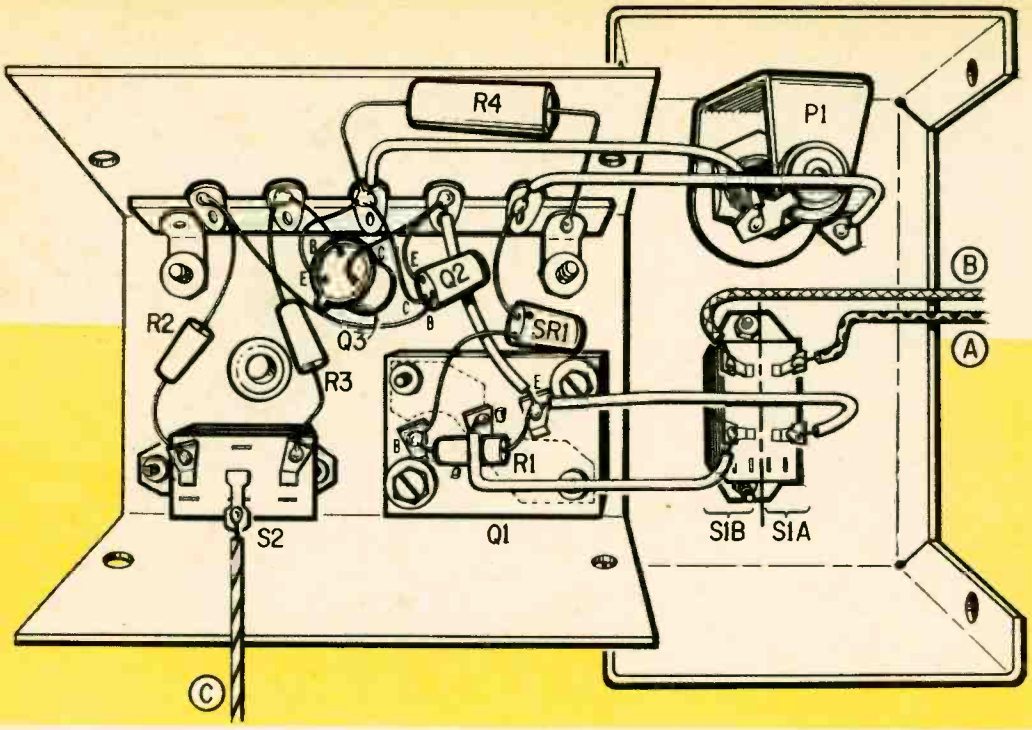
If your car is older than 1966, you have no other recourse than to use an external flashing light or flares. But for less than $5 you can equip your car with an emergency light-flashing system using your existing parking and taillights.

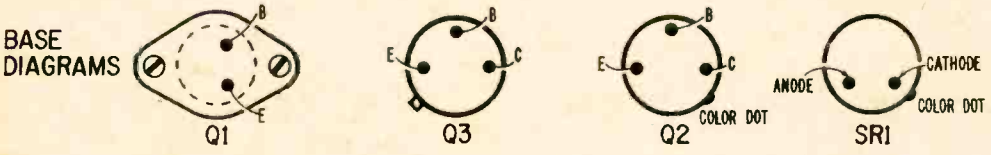
In one mode of operation our flasher will cause all your parking and taillights to flash simultaneously. In the other mode of operation, the left and right lights will flash alternately. You would flash them in this manner when you want to get through slow-moving traffic quickly.

Construction

All components will easily fit in a 3¼ x 2⅛ x 1⅝-in. Minibox. First thing to do is drill the holes for power transistor Q1 in the U-section of the Minibox. You'll find a drilling template packed with the transistor's mounting kit. After you've drilled all holes, clean them up with a file to make sure there are no burrs which could short Q1's emitter or collector leads to the cabinet.

Before mounting Q1 with the mica insulating washer, put a very light coat





Auto Flasher

of silicone grease on the underside of the transistor and the outside of the Minibox. After mounting Q1, check with an ohmmeter to make sure there's no continuity between Q1's case and the box.

In the main section of the Minibox, drill and cut holes for DPST switch S1 and the pilot-lamp holder. The other holes to be drilled in the U-section of the Minibox are for switch S2, the terminal strip and the three wires which are used to connect the flasher to

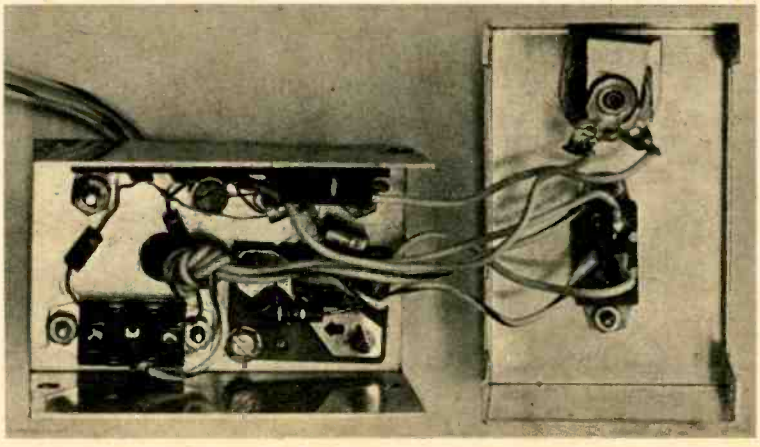
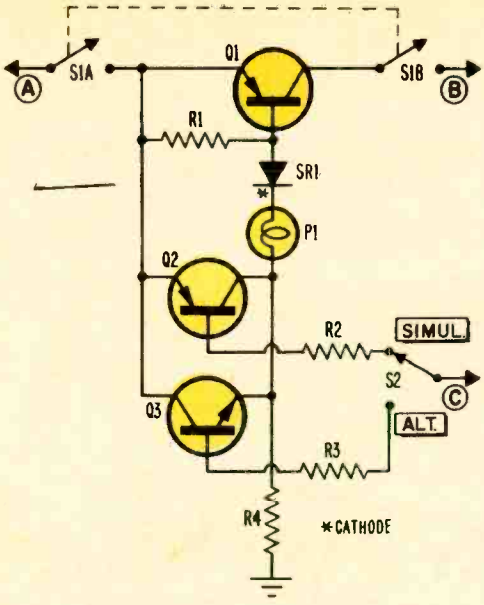


Photo of inside of both sections of Minibox in which flasher is built. In right side (box's main section) install only power switch S1 and pilot lamp P1. Install all other parts in U-section of box. The wires connecting the two halves should be 6-in. long.

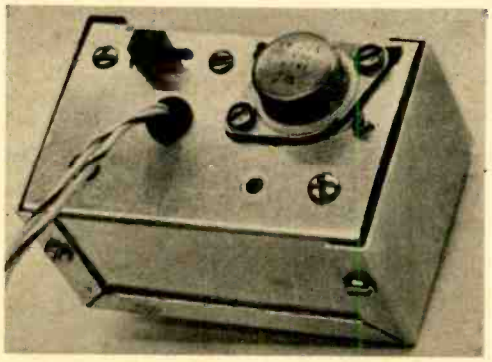


Pictorial at left shows location of parts. Leads A, B and C (shown going down and to right) go through grommeted hole between R2 and R3. Lead A connects to + 12 V; leads B and C connect to directional-lights' wires. Be sure to connect leads from Q2 and Q3 correctly and put spaghetti on them to prevent shorts. In schematic above, S1 is power switch. S2 selects simultaneous or alternate flash. P1 flashes in time with the car's lights.

your direction-lights' wiring. Be sure to use a grommet in the hole through which the wires pass.

Installation

Mount the flasher at the bottom edge of the dashboard, making sure there's good electrical contact between the box and the dash. This is necessary to establish a connection between the flasher circuit's ground and the car's ground. If you use a painted Minibox, scrape away the paint as you may also have to do under the dash.



Back of flasher. Slide switch S2 selects alternate or simultaneous flash. Be sure the case of Transistor Q1 does not touch ground when power is on.

PARTS LIST

P1—No. 49 pilot lamp
Q1—2N2869/2N301 transistor
Q2—2N408 transistor
Q3—2N388 transistor
R1,R3—470 ohm, ½-watt resistor
R2—4,700 ohm, ½-watt resistor
R4—120 ohm, 2-watt resistor
S1—DPST slide or toggle switch
S2—SPDT slide or toggle switch
SR1—1N3754 diode (RCA)
Misc.—3¼ x 2⅛ x 1⅝ Minibox, Mounting kit for TO-3 type transistor (Lafayette 19 H 1532), pilot-lamp socket, grommet, five-lug terminal strip

Connect the flasher's B+ lead (A) to any wire or lug that connects to the positive battery terminal. A good point is the battery lug on direction-signal flasher, or the hot lug on the ignition switch.

The two remaining leads (B and C) from the flasher are connected to the front directional-signal wires which go to the right and left lights. You can either cut into the wires or you can use a multiple adaptor, which is available at auto-supply stores. You connect this adaptor to the engine-compartment terminal block.

Operation and Checkout

The flasher must be used with the car's directional signals. To standardize, plan on always pulling the directional signal to the left when you want to use the flasher. Then, set S1 to *on*. With S2 in the *simultaneous* position, all lights will flash together.

When you set S2 to *alternate*, the left and right lights will flash alternately. However, if the right and left signal lamps don't blink alternately (that is, if they blink only on the left, the right or all together), reverse the two connections (leads B and C) to the directional-lights' wiring.

If you don't need both alternate and simultaneous flash, then modify the circuit as follows:

Simultaneous flash only. Eliminate Q3, R3 and S2. Connect R2, previously connected to S2, to lead C.

Alternate flash only. Eliminate Q2, R4 and S2. Connect R3, previously connected to S2, to lead C.

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WBBH, THE STATION WITH EVERYTHING

By TOM KNEITEL

IT all seems to have begun some time in March, 1966. The 60-meter international broadcast band was suddenly (and happily) lit up by a new voice—a station that really knew how to get attention. It was operating on 4970 kc, long the frequency of station YVLK, Radio Rumbos in Venezuela, one of the more popular stations in the band, and only a squeak away from the 5-mc channel of WWV, the station of the National Bureau of Standards and a sure attention-getter.

There it was, playing both popular and classical music, giving out news bulletins and humor. "This is station WBBH, New Brunswick, N.J., 4970 kilocycles, for the discriminating short-wave listener. WBBH is operated by the students of the Courtland School of Music," said the announcer. Listeners throughout the northeastern states quickly logged its high-quality signals which went on the air each evening at 7 p.m. (3 p.m. on weekends).

True to the traditions established by fellow North-American short-wave broadcasters WBBH requested that listeners send in detailed reception reports, addressed to a post office box in New Brunswick. In return, listeners were rewarded with a classy blue and white QSL card signed by the operator, a fellow named Fisk.

Each of the cards bore a personal message from Fisk explaining the educational status of WBBH and giving a brief rundown of the equipment. The transmitter was a Gates BFE-50C. Those listeners who were hip to the finer things in life were certainly impressed; Gates is the manufacturer of some of the finest broadcast equipment in the world. And the fact that WBBH was operating in the 60-meter band, where American broadcasters do not get permission to set up shop, proved that someone had pull.

And then it happened.

It took three months before a listener with the curiosity common to most SWLs, called a field office of the FCC to get further information about WBBH. At first, the FCC people must have figured that someone was putting them on—or else that the caller was a bit confused about the callsign and frequency of this new broadcaster. As far as their records were concerned there was no such station! A quick check with Washington confirmed that WBBH did not, could not, exist.

Signals don't lie, however, and when the FCC monitor (alerted by the casual inquiry) tuned in on 4970 kc and was greeted by the strains of Mendelssohn, witty patter, and harmonica music, he got kind of shook up.

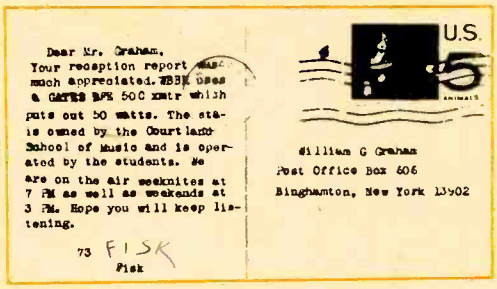
A check of the New Brunswick telephone directory revealed that there was no Courtland School of Music. The station's post office box turned out to belong to a college student who happened to be a licensed ham operator. Now the picture was beginning to take shape.

Rushing to the ham's house, FCC inspectors were further rattled by the fact that the ham operator denied any knowledge of WBBH. And the station was on the air while the student was being interviewed.

Out they went to the direction-finders in their cars. It took about 20 minutes to pinpoint the location of WBBH in Fairlawn, N.J., a few miles away.

When the FCC knocked on the door the operator had not been tipped off and WBBH was still in full operation. A young fellow welcomed the FCC people and readily admitted that he was the operator of WBBH—although he insisted that the ham operator was his partner and had even donated his post office box for the cause so that the FCC would be thrown off the track.

In the station's studio, the FCC people were amazed to see stacks of reception reports from listeners spread between Maine and Maryland—even some (from a few DXers who had guessed at the true nature of WBBH) wishing them luck in *not* getting


Dear Mr. Graham,
Your reception report was much appreciated. WBBH uses a GATES BFE 50C xmtr which puts out 50 watts. The sta- is owned by the Court land School of Music and is operated by the students. We are on the air weeknites at 7 PM as well as weekends at 3 PM. Hope you will keep listening.
73 FISK
Fisk
U.S.
5
Animals
William G Graham
Post Office Box 606
Binghamton, New York 13902

Listener in Binghamton, N.Y. received this QSL but station details and signature both are phony.

...EXCEPT A LICENSE

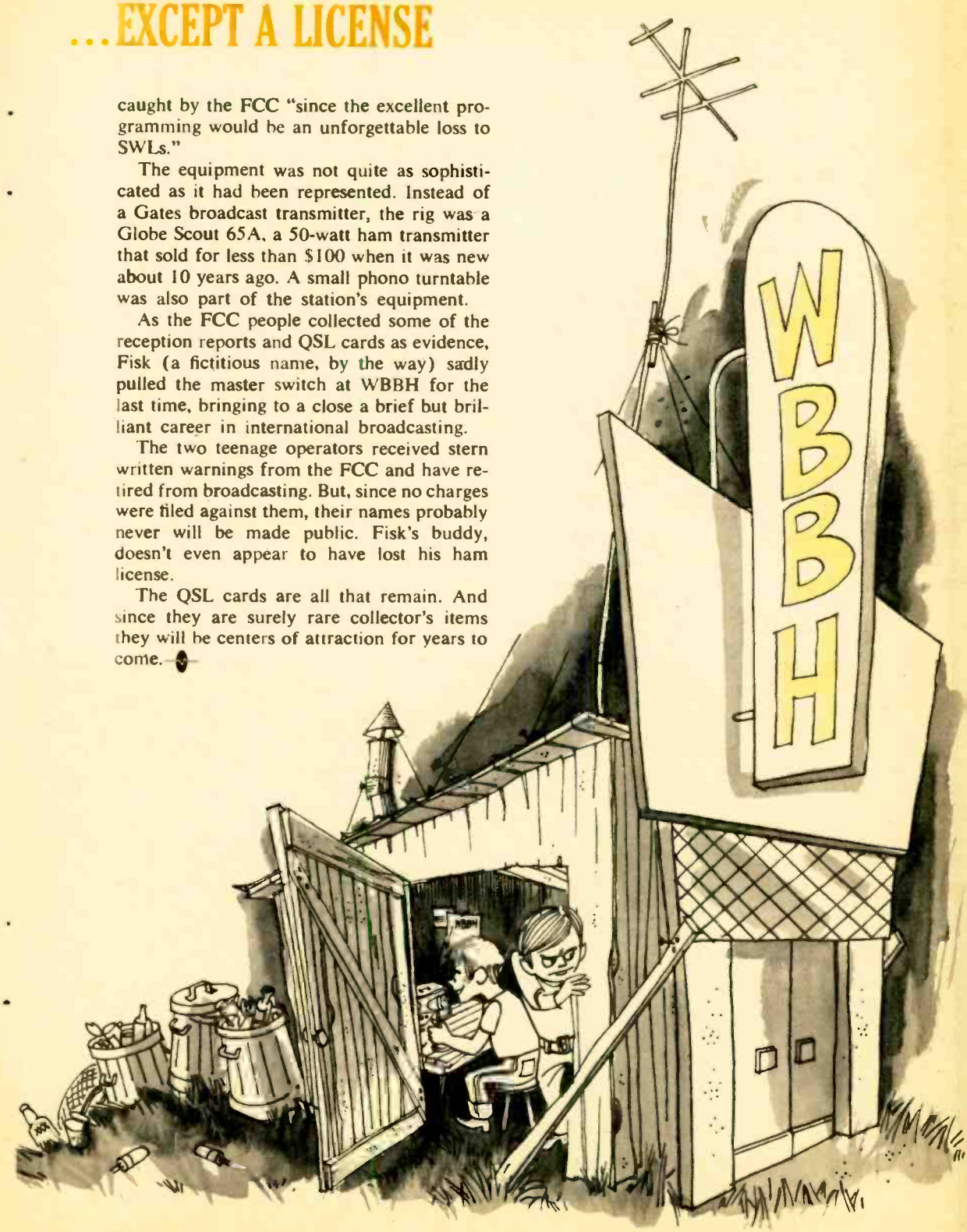
caught by the FCC "since the excellent programming would be an unforgettable loss to SWLs."

The equipment was not quite as sophisticated as it had been represented. Instead of a Gates broadcast transmitter, the rig was a Globe Scout 65A, a 50-watt ham transmitter that sold for less than $100 when it was new about 10 years ago. A small phono turntable was also part of the station's equipment.

As the FCC people collected some of the reception reports and QSL cards as evidence, Fisk (a fictitious name, by the way) sadly pulled the master switch at WBBH for the last time, bringing to a close a brief but brilliant career in international broadcasting.

The two teenage operators received stern written warnings from the FCC and have retired from broadcasting. But, since no charges were filed against them, their names probably never will be made public. Fisk's buddy, doesn't even appear to have lost his ham license.

The QSL cards are all that remain. And since they are surely rare collector's items they will be centers of attraction for years to come.



Doubly-Sure Light for CB

By JOSEPH RITCHIE

TAKE a look at your CB transceiver. If it's a budget rig chances are there is nothing on the front panel to tell you that you really are *transmitting* a signal. And if the rig is equipped with transmit or modulation lamps, or both, it's likely these lamps only let you know the B+ voltage is going to the RF and modulator circuits. They don't tell you if anything is going up into the skyhook. You could just sit there talking into the mike without knowing anything is getting out.

Add EI's Doubly-Sure Light between your rig and antenna transmission line and you'll know with certainty that the transceiver is putting RF into the antenna. In addition you'll know when you talk that modulation is going out with the RF. And the bright and flashing lamps will add a touch of excitement to your base or mobile installation.

How It Works

Take a look at the schematic. The Doubly-Sure Light gets a sample of the RF energy fed into the transmission line. The transceiver is connected to coax connector J2 and the antenna is connected to jack J1. A sample of the RF voltage in the line appears across voltage divider R1 and R2. (The power drawn by the circuit is negligible.) Diode D1 rectifies the RF sample. The resultant DC voltage at D1's cathode, which appears only when there is RF on the transmission line (when you push the push-to-talk button) biases Q2 into conduction causing *output* lamp P2 to light. Since capacitor C2 prevents the DC from getting to Q1's base, Q1 does not conduct at this time and *modulation* light P1 does not light.

When modulation is applied to the carrier (when you start talking) the AC modulation waveform is passed by C2 to Q1's base. This causes collector current to flow in step with the applied modulation; therefore, P1 flashes in step with the modulation.

The model shown is intended for base operation and includes an AC power supply. For mobile operation simply eliminate the power supply consisting of T1, SR1 and C5. Connect the circuit (A, the junction of P1 and P2) to the auto's battery. Use a switch to control power and be sure to connect the cabinet to the car ground.

Construction

The Doubly-Sure Light is built in a 5¼ x 3 x 2⅛-in. Minibox. While the circuit layout isn't terribly critical, try to follow the pictorial as closely as possible. The circuit is assembled in the U-section of the Minibox on three terminals strips which are cut down from larger strips. Jack J1 and J2 should match your existing antenna connectors.

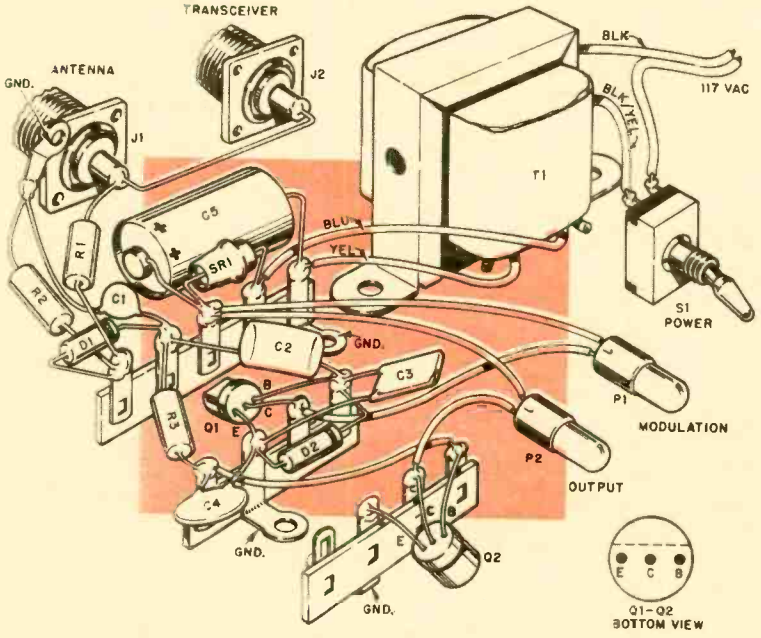
Lamps P1 and P2 require very little power —only 35 ma. at 12 VDC. Do not substitute standard high-current lamps as they will either burn out Q2 or they will be so dim you can't see them in moderate light. The low-current lamps are supplied with several multi-color lamp holders. We used red for *output* and green for *modulation* but

you can do whatever you want.

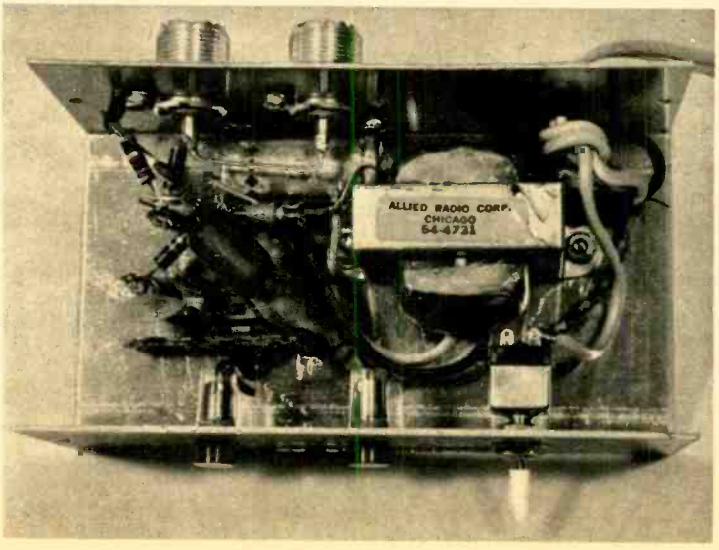
To mount the lamps, drill two 5/16 in. holes and push the holders into them. If they don't lock in place put a drop of cement inside the cabinet to insure they don't fall out. The lamp itself has two projections which grip the holder when the lamp is pushed into the holder.

Mount transistors Q1 and Q2 using the leads full length—do not cut them short. Use a heat sink, such as an alligator clip, on each lead when soldering. The leads on diodes D1 and D2 should be no less than ½ in. long and, again, use a heat sink when soldering. Make certain the diodes are installed with the correct polarity. In both instances, the diodes' cathodes face a transistor base. (The cathode is marked with a color or a black band.)

If you are building the AC model make certain there is sufficient clearance for switch S1 before mounting T1. (It's a tight fit.)

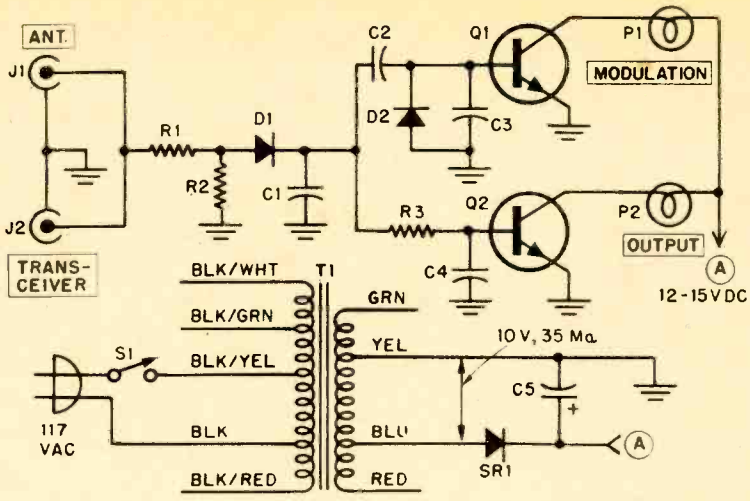


The cathode of silicon rectifier SR1 in our model is connected to the positive end of C5. The cathode ends of D1 and D2 are marked with a black band. Cut off the unused leads from T1 where they come out of the core. Be sure to note the lugs on the terminal strips which are used for grounds.



To simplify construction in U-section of Minibox, first install all parts at left. Then install the power transformer at the right and finally mount the power switch at the right of the front panel. Keep the coax connectors at the top, left, close to each other.

Output of transceiver comes in at J2 and goes out J1. A small portion of RF is applied to voltage divider R1, R2. D1 detects signal and applies DC to base of Q2 causing it to conduct and P2 to light. DC cannot get through C2, therefore Q1 does not conduct and P1 does not light. When carrier is modulated, AC modulation waveform is passed by C2 to Q1's base. This causes Q1 to conduct and P1 to come on.



Doubly-Sure Light for CB

Checkout

Connect the negative lead of a DC voltmeter to the cabinet and the positive lead to SR1's cathode. Then turn on power. The meter should instantly rise to about 16 VDC. If it rises above 20 VDC, or is less than 12 VDC there is a wiring error.

Make up a patch cord with a short length of the same transmission line that goes to your antenna. On each end install the same type male connector as is on your antenna's transmission line.

If the voltage checks out connect your transceiver to either J1 or J2 and connect the antenna to the other jack. Press the push-to-talk button but do not talk (modulate); P2 should light to full brilliance and P1 should not light until modulation is applied. However, P1 might flash the instant the push-to-talk button is pressed, but the light should not stay on.

As you speak P1 will blink or flash in step with the modulation. If P1 blinks or flashes when you are not speaking there is an intermittent in your transceiver which is modulating the transmitter with noise. Note that the intensity of P1 is not related to the modulation intensity. Also, P1 will not normally be as bright as P2. Do not attempt to modify the circuit to get P1 to the same brilliance as P2 because the modification will probably destroy Q2.

If you have built the mobile model there is no need to check the DC voltage as the auto battery supplies the power. Because the auto battery provides a regulated voltage source, whereas the AC supply will not (the transformer is small to keep the cost down), lamp P1 will glow somewhat brighter in the mobile model.

When installing the Light in a car, you make the ground connection by attaching the cabinet to the underside of the dash. To get good contact, scrape away the paint on the Minibox where it touches the car's metal.

PARTS LIST

Capacitors: 25 V or higher
C1—100 μμf ceramic disc
C2—.22 μf or .25 μf mylar
C3—.01 μf ceramic disc
C4—.1 μf ceramic disc
*C5—250 μf, 25 V electrolytic
D1,D2—1N60 germanium diode
*J1,J2—SO-239 coax connectors (see text)
P1,P2—Muralite Type L-12/35 panel lamp
Q1—2N3391 transistor (GE)
Q2—2N3393 transistor (GE)
R1,R2—4,700 ohm, ½ watt, 10% resistor
R3—10,000 ohm, ½ watt, 10% resistor
*S1—SPST switch
*SR1—Silicon rectifier; minimum ratings: 50 PIV, 100 ma
*T1—Low-voltage rectifier transformer (Allied 54 B 4731)
*Misc—5¼ x 3 x 2⅛-in. Minibox, terminal strips, AC line cord

A kit of parts containing the P1,P2 lamp assemblies and Q1 and Q2 is available for $2.25 plus 75¢ for postage and handling from Custom Components, Box 352, Aldon Manor Br., Elmont, N.Y. 11003. A kit containing all parts except those marked with an * is available for $4.25 plus 75¢ for postage and handling. N.Y. State residents add appropriate sales tax. Canadians add $1. No foreign orders.

Notes from El's DX Club

OUR ten-country award is, of course, the easiest to obtain but some of our ham members, in keeping with the true DX spirit, insist on doing it the hard way. James H. Ansen, W4ZIT (Florida) worked all ten of his countries on 40 meters and his list of QSLs includes SP2AH (Poland) on 7040 kc and UQ2GW (Latvia) on 7030. Incidentally, the latter frequency just happens to be one used from time to time by R. Peking for transmissions to the USSR.

An interesting catch reported by Timothy C. Armstrong (California) is radio beacon NQM, Midway Island, on 379 kc. He heard it around 0100 PST.

Gerry L. Dexter (Wisconsin) reports that ZYZ32, R. Rural Brasileira, currently is using 15105 kc in 19-meter international territory until about 1825 EST.

According to reports aired by R. Sweden, two well-known SW stations are planning power boosts. The Hellenic National Broadcasting Institute (Greece) is looking forward to 100 kw while R. Ankara (Turkey) is contemplating 250 kw.

Although the British pirate scene—or at least what's left of it—is highly confused, the script may go like this: R. Caroline's transmitters will be taken off their present ships, which are in very bad shape, and placed aboard the Galaxy, formerly used by R. London. Meanwhile, R. London's 75-kw rig will be set up on an unused antiaircraft fort 12½ mi. off the British coast. It will become R. Swinging Holland with programs in English and Dutch, using 764, 1034 and 1502 kc. R. Caroline probably would remain on one of its present frequencies—1169 or 1187 kc. It *could* happen that way.

Although reception is erratic, R. Omdurman (Sudan) sometimes appears in the Midwest with good signals on 4994 kc around 2300 EST.

Surinam has returned to the international SW wars. Bob LaRose (New York) reports that R. Surinam now is operating on 15453 kc with programs in English, Dutch, Hindi and Chinese until 2230 EST sign-off.

What is almost certainly rare R. Angkatan Udara, a broadcast station operated by the Indonesian air force at Djarkarta, has been heard by Don Jensen (Wisconsin) on 11903 kc around 0700 EST. Japanese listeners report RAU definitely is on this frequency at that hour.

R. Noumea (New Caledonia) often can be received in eastern North America on 7170 kc at 0500 EST. Should be even easier out west (where it will be 0200 PST).

A new frequency for R. Baghdad (Iraq) is 11785 kc with sign-on at 2300 EST. It also still is heard on 7180 at the same time.

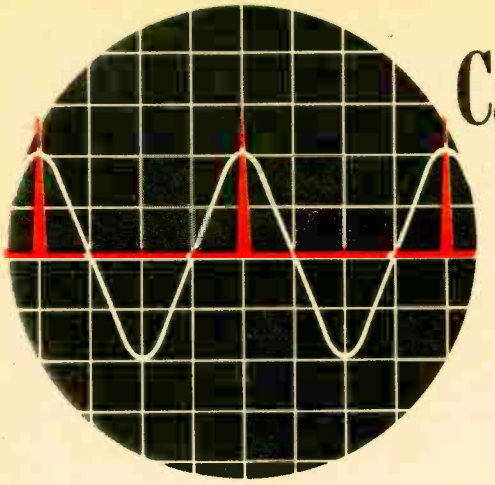
Gerry Dexter has nailed down a local ID from the Soviet broadcast station at Petropavlovsk-Kamchatskiy on 11690 kc. Time was 1430 EST.

Trans World R., Monaco, has been heard up on 11700 kc. Wednesdays only, with Arabic until 1325 EST sign-off, when they ID in English.

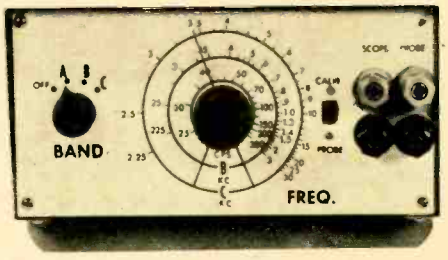
Propagation: With sunspot activity still relatively high, daytime DX generally should be good to excellent, with the 15, 17, 21, and even 26 mc providing some excellent opportunities. During hours when both the transmitting and receiving sites are in daylight the amateur 10-meter band will open regularly on some longer path and CB openings also will be fairly frequent.

At night, conditions are expected to be better than they were last November and December when only the 6-mc band was open for long periods. This year, the 9-mc band also will be open for DX. From Latin America 11 and possibly 15 mc will also be open at night.

Because noise levels due to thunderstorm activity are at a minimum in the northern hemisphere during the winter months BCB DX should improve significantly, with European and some African openings fairly frequent.



Calibrator for Your Scope's Sweep



By CLARE GREEN, W6FFS

YOU can't beat an oscilloscope for showing exactly what's happening in a circuit you're troubleshooting. The waveforms it displays may range from the most simple sine wave to highly complex square or pulsed signals. The displays can reveal distortion, peak-to-peak voltage and frequency.

But the frequency of the displayed waveform may be almost impossible to determine on an inexpensive service scope. The switch-selected sweep ranges on such scopes are calibrated in only approximate ranges. And the fine frequency control doesn't do much except stop the movement of the display.

Our calibrator will enable you to measure the frequency of audio and low-frequency RF signals with your scope. The generator produces sharp pulses at calibrated frequencies and feeds them to the scope's vertical input.

For an example of how you use the calibrator, look at the illustration above. Here you see superimposed a sine wave, spike pulses and the horizontal and vertical lines of the scope's graticule.

To measure the frequency of the sine wave, you would adjust the scope's frequency to display two or three cycles with their peaks centered right over vertical graticule lines.

Next, you would display the output of the calibrator and adjust its frequency control until you saw spikes right on top of the same vertical lines on which you saw the sine-wave peaks. The frequency opposite the pointer on the calibrator's dial is the frequency of the sine wave.

The calibrator unit uses a unijunction transistor in a R/C timing circuit which generates pulses from 25 cps to 30 kc. The unit is compact, has a built-in battery supply and is housed in a 7 x 3½ x 3-in. aluminum cowl-type box.

Construction

Most of the components are mounted on a 2¾ x 6-in. piece of perforated board. The dial is drawn on a piece of bristol board which is cemented on the cabinet's front panel. The layout of the components is not critical, but for best results duplicate ours.

Start construction by laying out and cutting the front-panel holes using the front-panel photograph as a guide. Mount the perforated board above the bottom of the box with a ⅜-in. sleeve spacer at each corner. Mount the front panel components where shown.

Mount the parts on the board with push-in terminals (flea clips) as shown and install a ground lug under the mounting screws just below BP2. We mounted B1 on the board with an aluminum strap bolted to the board. However, B1 can also be mounted on the rear panel if it's easier. Make sure that tabs on the specified rotary switch are removed to allow its operation as a 4-position switch. Use lock washers on both R2 and S1 to prevent movement. Connect the components as shown and keep the leads short and tied down to prevent movement.

Calibration

Connect your scope's vertical input to BP3 and BP4 (*scope*) and connect an audio

oscillator to BP1 and BP2 (*probe*). Set S2 to *probe*. Adjust the oscillator for an output of 25 cps at about 3 V peak-to-peak. Adjust the scope's controls to display one cycle on the CRT. Adjust the scope sync control to the lowest position that just keeps the display from moving.

Set S2 to *calibrate*. S1 to band *A*. R2 (*freq.*) counterclockwise (maximum resistance) and turn R2 slowly clockwise until one pulse is displayed on the scope. Mark the dial 25. Repeat this method of calibration for as many other frequency points as you want on the dial for each band.

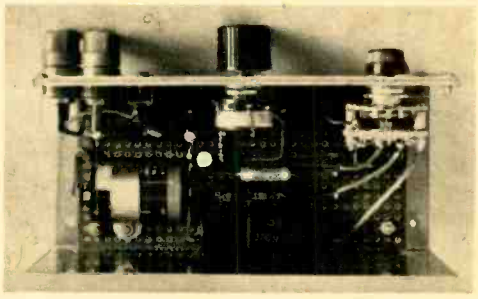
If either the oscillator or the scope does not have the frequency range necessary to cover the calibrator's range, an accurately calibrated radio receiver can be used for the 10- to 30-kc frequencies of band *C*. Connect BP3 and BP4 to the receiver antenna and ground terminals, set S2 to *calibrate* and tune the receiver for the harmonics of the upper end of the *C* band. The frequencies can then be found by noting the frequency difference between the received signals on the receiver's dial.

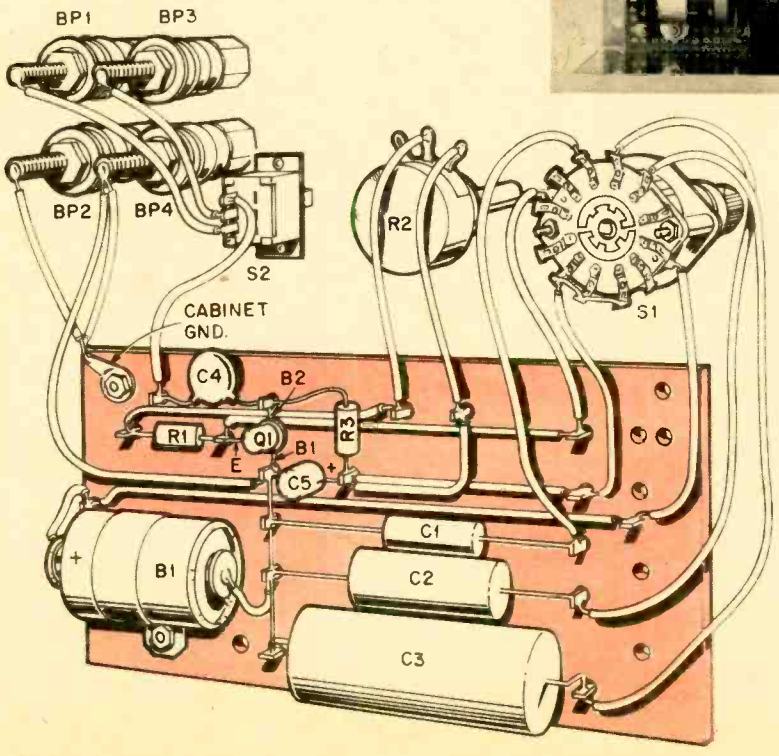
Operation

The calibrator has about a 3V peak-to-peak output on all bands and this should be sufficient to calibrate most scopes. The scope's probe should be connected to *probe* terminals BP1 and BP2 and the scope vertical input should be connected to *scope* terminals BP3 and BP4 with a short length of coax. Make sure that the ground or chassis connections are to BP2 and BP4.

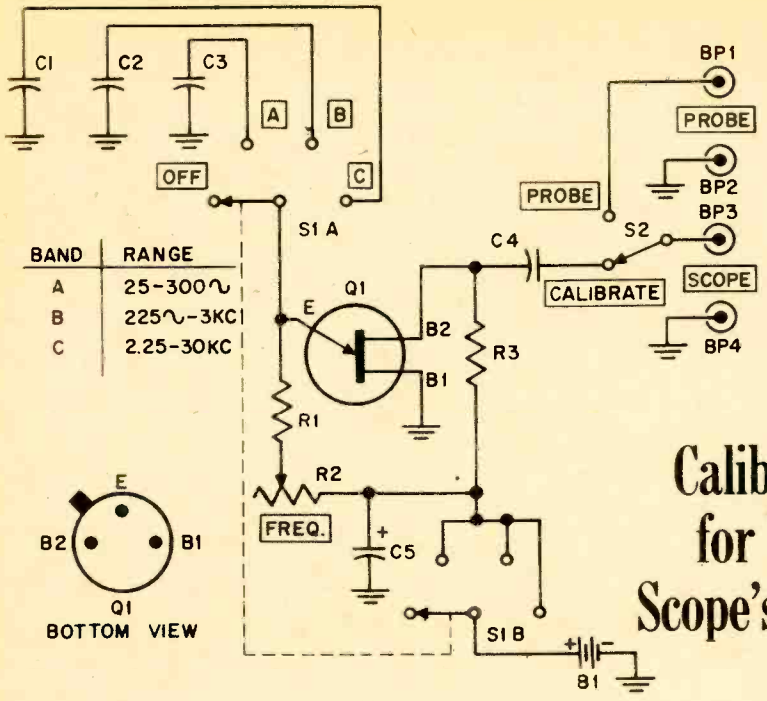
For normal scope operation, set S1 to *off* and S2 to *probe*. Since the calibrator does not require warm-up, you can use the instrument as soon as it's turned on. When you want to calibrate the scope's sweep, set S1 to the desired band, S2 to *calibrate* and adjust R2 to the desired frequency.

You can also use the calibrator to check the scope's time base and horizontal-deflection linearity. Connect *scope* terminals BP3 and BP4 to the scope's vertical input, set *band*





Parts layout on circuit board isn't critical. We suggest you wire board first (either in the cabinet or out of it) and then install the binding posts, switches and potentiometer on the front panel. Use the Ohmite potentiometer specified in the Parts List rather than a pot from your junk box. Be sure to mount the board on spacers so the flea clips on the underside don't touch the cabinet.



When power is turned on, capacitor selected by S1A charges through R1,R2. Eventually voltage across capacitor (and Q1's emitter) reaches a level which causes conduction through Q1's E/B1 junction. This causes pulse of current to flow through R3, B2/B1 to ground. Pulse goes via C4 to output. Capacitor selected by S1A discharges through E/B1 junction, cycle repeats.

Calibrator for Your Scope's Sweep

switch S1 to C, *freq.* control R2 to midrange and S2 to *calibrate*. Adjust the scope's vertical gain for a convenient display height. Set the sweep and sync controls for a display with as many markers as there are major vertical graticule lines.

Adjust the scope's horizontal width and centering controls to align the markers with the graticule's major vertical lines. You can then observe if any non-linearity exists between the marker spacing and the graticule lines. Lined up markers means perfect linearity across the CRT.

Adjust the scope's vertical centering control to move the display up to the top of the CRT. Increase the scope's vertical gain until the markers fill the CRT vertically. Observe the CRT display to see if any non-linearity exists between the markers and the graticule.

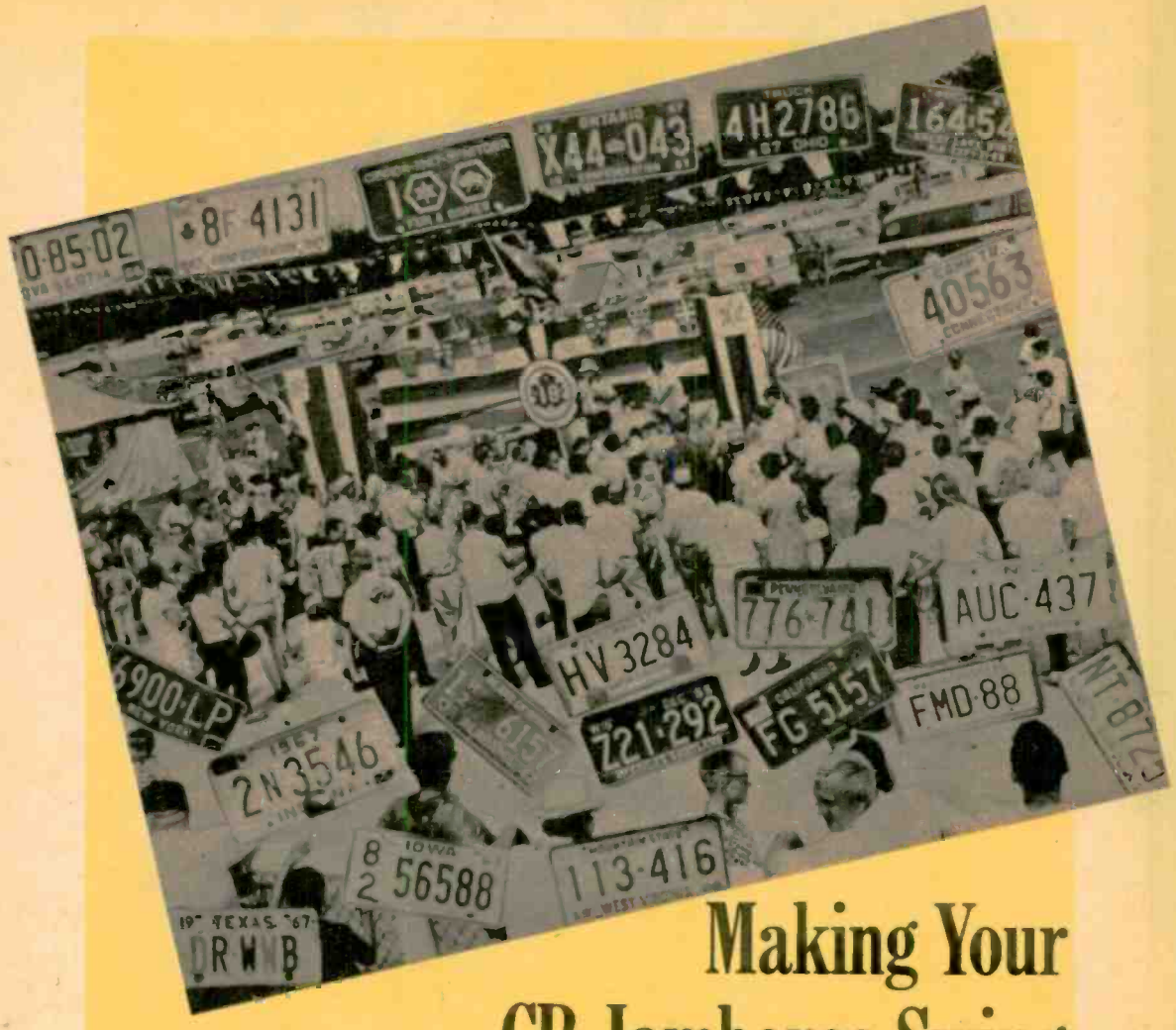
How It Works

Unijunction transistor Q1 is connected in an R/C timing circuit to cover 25 cps to 30 kc in three ranges. When power is applied, B1 charges C1, C2 or C3 (selected by S1A) through R1 and R2 to a voltage that causes the E/B1 junction of Q1 to conduct. When this happens, a sharp current pulse flows through R3 and the B2/B1 circuit of Q1 to ground. The negative voltage pulse is coupled by C4 to BP1.

When the resistance of the E/B1 junction falls it discharges the capacitor selected by S1A. This causes B1 to recharge the capacitor through R1/R2. This repeats the pulse-generating cycle. The frequency of the pulse is governed by the value of R2 and the range selected by S1A.

PARTS LIST

B1—8.4 V mercury battery (Mallory TR-286 or equiv.)
BP1,BP3—Red 5-way binding post
BP2,BP4—Black 5-way binding post
C1—.01 μf, 50 V tubular capacitor
C2—.1 μf, 50 V tubular capacitor
C3—1 μf (not electrolytic) 50 V tubular capacitor
C4—.01 μf, 500 V ceramic disc capacitor
C5—30 μf, 10 V electrolytic capacitor
Q1—HEP-310 unijunction transistor (Motorola)
R1—2,200 ohm, ½ watt, 10% resistor
R2—50,000 ohm, linear-taper potentiometer (Ohmite CU5031, Allied 46 B 1511)
R3—1,000 ohm, ½ watt, 10% resistor
S1A,S1B—2-pole, 6-position, non-shorting miniature rotary switch (Centralab PA-2003, Allied 56 B 4922)
S2—SPDT slide switch
Misc.—3⅜ x 7 x 3½-in. cowl-type metal cabinet (LMB W-2C, Newark Electronics Corp., 500 N. Pulaski Rd., Chicago, Ill. 60624. Stock No. 91F1092, $3.36 plus postage), perforated board, pointer knob, ⅜-in. spacers



Making Your CB Jamboree Swing

By ALAN LEVESQUE

WEBSTER (my neighbor, Harry Webster) defines a CB jamboree as an organized get-together at which CB operators can meet and chat, peruse new equipment on display from manufacturers and win competitions and door prizes. That's what Webster always says. But there are *jamborees* and **jamborees.**

Most CBers agree that annual shindigs such as the Florida-National CB Jamboree, the Grandfather Mountain Jamboree (N.C.), and the Caddo District CB Radio Club Jamboree (Tex.) are worth an excursion of several hundred miles for the festivities. Each year these jamborees attract thousands of CB operators, some of them planning their vacations around the jamboree as the focal point of a cross-country trip.

Almost anybody can con a bunch of CBers into showing up at the First Annual Whatzisville CB Circus. But it's a success only if it makes them

Never underestimate the power of a pretty girl to adorn jamboree proceedings—and provide publicity pictures like this. Jo Ann Gornick (Miss Great Lakes) presents a Lafayette transceiver as a door prize with help from the activities chairman (left) and club president (center) at an Ohio jamboree.

For an outdoor jamboree, try a mobile command post combining CB communications with car-top PA system to round up visitors for major program events, announce prize winners, locate lost children and so on.

Making Your CB Jamboree Swing

want to come back a second year. That means they must have fun. My favorite jamborees have shared several features. All have been in a pleasant location (usually outdoors unless the climate tended toward summer rains). All have had good facilities (no problems finding milk for the kids, parking spaces, adequate rest rooms). All had an interesting and varied program of events with plenty of prizes. And all were run by a hard-working bunch of organizers.

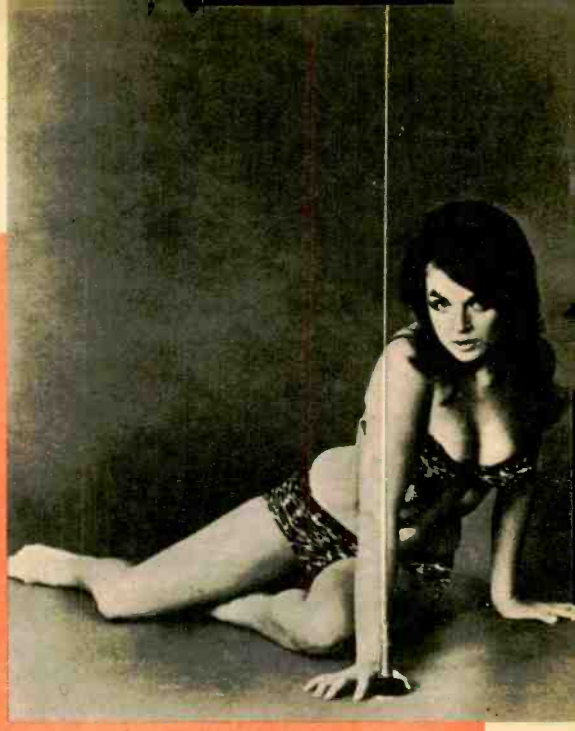
That means *you* if your club is to have a real success. Four or five live wires can't do it alone. Before the club can begin work on a jamboree it must pass two tests: can it count on all members to help with the work and can it count on them to chip in on working capital? Unless a few hundred dollars can be raised at the start (for deposits, printing, postage and so on) you may as well quit.

Once you've decided that it's truly jamboree time in Dixie (or wherever) select *one person* who will be in charge of the overall concept, planning and execution. There can be only one boss—one person whose word is final in all decisions and disputes. He supervises the various committees that will be required and makes sure everybody attends the meetings.

The jamboree season runs from May through the end of September. While a jamboree should fall within these dates, you must be careful to avoid holidays (proven losers for jamboree attendance). It's also poor practice to run a jamboree on a day when someone else has a previously scheduled jamboree within a 200-mi. radius of yours.

If you decide on an outdoor site you're sure to have problems supplying adequate electrical power. If it's an indoor site get one with air conditioning. Outdoor sites for jamborees include parks, shopping-center parking lots, fair grounds, picnic areas. Indoor sites

Some CB manufacturers have well-equipped communications vans that can be exhibited at CB jamborees. Regency, Pace, Courier are among those that are seen most often.



For eye-popping publicity you can't beat something like the Hellcat Girl. She is an in-person feature of this year's jamboree in Lincoln, Nebr., courtesy of Hy-Gain antennas in whose parking lot it is being held.

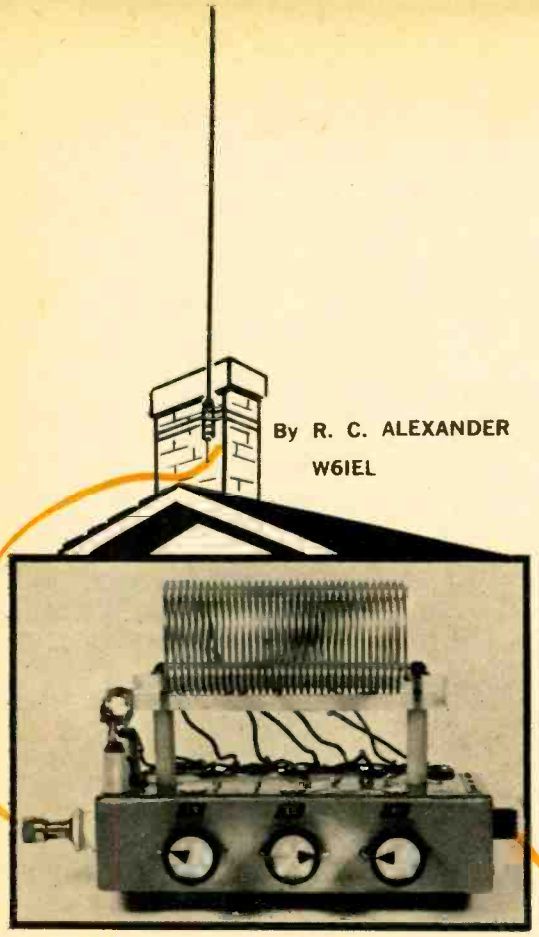
can include lodge and convention halls, school gymnasiums and community centers.

Be sure to reach an understanding with the landlord about the use of a PA system, electricity for exhibitors, availability of refreshments, hours, maximum number of people admitted, parking and the erecting of antennas, booths, signs and so on. This also would be the time to check on availability of camper/trailer parking facilities in the neighborhood and contact your insurance salesman to make sure that the club's liability insurance will cover any jamboree mishaps.

As soon as you settle on a date and place start the publicity wheels grinding—and grind they must! Press releases containing as much information as possible (more detailed ones can be sent out later) must be directed to CB clubs and newspapers in the state and to all magazines carrying regional CB news. Be sure to include an address where CBers can write to check details that might not be clear. Remember that national publications require as much as six months advance notice before the issue in which the information is to appear. But it's almost impossible to put together a jamboree in less than three months and that's enough advance notice for many magazines.

This also is the time to start contacting those companies you hope to have as exhibitors. A neat typewritten letter on a club letterhead (forget telephone calls or in-person visits) should tell exhibitors about the jamboree site and its facilities, give an approximation of your planned attendance (be conservative, never exaggerate) and a definite, firm price for setting up the exhibit. The price depends on the estimated cost of the jamboree, the number of exhibitors planned and whether there will be an admission charge to those CBers attending. Don't plan on making the jamboree a money-raising device, incidentally—it never works out that way. Try to break even with a little to spare.

[*Continued on page* 111]



Remote Tuner for Vertical Antennas

By R. C. ALEXANDER
W6IEL

YOU wake up with a start. That old intuition, from years of digging DX out from under 15 layers of QRM, tells you skip is rolling in. You fire up the receiver and there it is—the DXpedition to the Tsooris Islands. The chance of a lifetime and you're going to blow it because the antenna is tuned to 15 meters and you're listening on 20.

Of course you could run out in that driving rain through a field of mud to tune the antenna to 20 but why do it the hard way? If you're one of the many hams using the standard 23-ft. vertical antenna just connect our remote tuner to the base and you can change bands from the shack in a matter of seconds—no longer than it takes to throw a switch.

As the name implies, the remote tuner is a remote-controlled vertical-antenna tuner covering 80 through 10 meters. Basically it's a tapped inductor of 35 turns, 2 in. dia. (8 turns per in.) with the appropriate taps selected by relays controlled from the shack.

The shack's control unit is simply a low-voltage power transformer and a rotary switch that energizes a particular relay. Each relay selects not only the band tap but also connects the Z-match (impedance) for each band in use. Since the Z-match is adjustable, it is calibrated at the time of installation to insure the minimum SWR.

Construction. The tuner section to be installed at the base of the antenna is built on any chassis large enough to hold the coil, four relays and tuning capacitors C1, C2 and C3. Coil L2 is needed only if the antenna is shorter than 23 ft. It provides a match on the 10- and 40-meter bands. (L2 is a 5/8-in.-dia. coil (10 turns per in.) It will be pruned later on if necessary.

Small clips should be used at the ends of the connecting wires from the relays to make tuning as easy as possible. After the correct taps on L1 are established the clips can be removed and the wires soldered permanently to the coil. We show both techniques in the pictorial; five taps are shown soldered and two are shown with the cut-and-try clips.

To insure proper operation, follow the photographs and pictorial as closely as possible. Mount the relays on one side of the chassis and the tuning capacitors on the opposite side. The input coax connector (SO2) is on one end of the chassis near RY1

while the output, a porcelain insulator (BP1), is on the other end of the chassis near RY4.

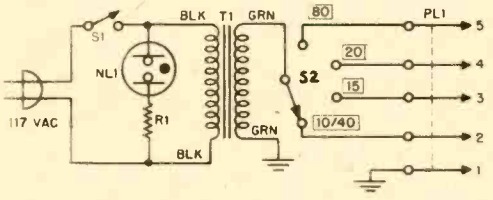
Coil L1 should be mounted approximately 2 in. off the chassis, using steatite or porcelain insulators. Similarly, L2, if used, should be mounted on small standoff insulators.

The connections between the relay terminals and L1 should be made with at least No. 16 *stranded* wire. Do not use solid wire because vibration at the bends could cause the wire to break.

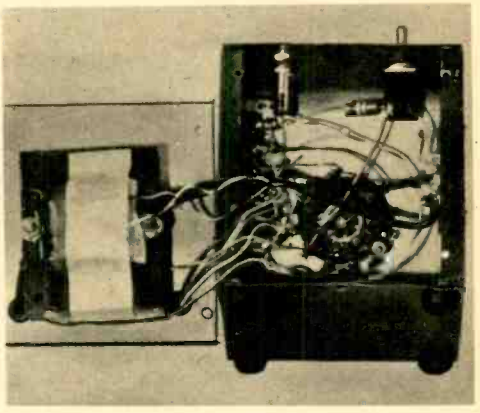
The completed antenna tuning assembly should be mounted at the base of the antenna in a watertight cabinet. A large Minibox or electrical box with covers sealed with silicon adhesive such as GE RTV or Silastic, makes a perfect watertight installation. But don't seal the box until the adjustments to L1 have been made.

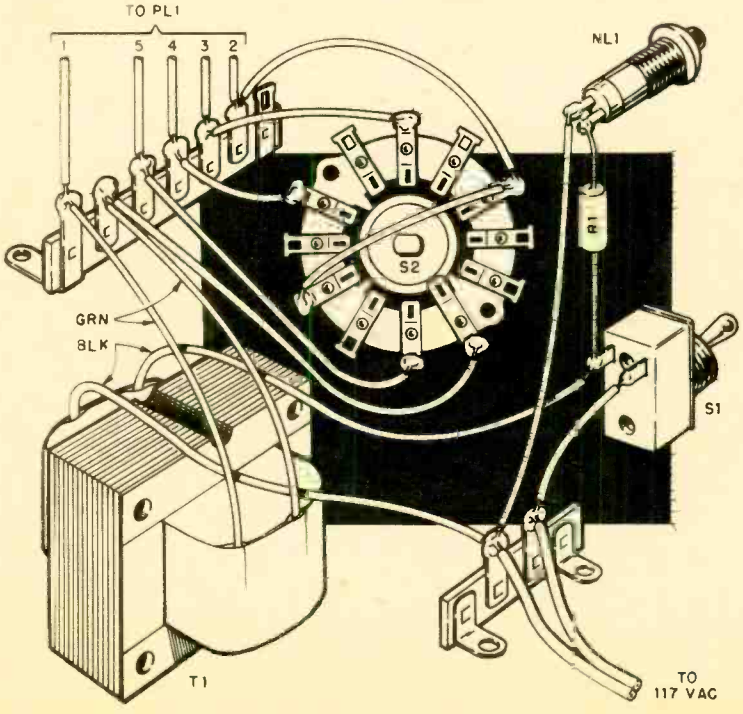
An attractive control unit can be built in a sloping-panel meter case as shown. Cover the meter cutout (if the cabinet has one) with a sheet of aluminum and mount a single-pole five-position rotary switch on the aluminum plate. Mount power switch S1 and power-indicator lamp NL1 on the top of the cabinet. Cut an aluminum plate to fit the back of the cabinet and mount transformer T1 on the plate.

T1's output must match the relays. If the



Control section, which is located in shack, contains standard filament transformer whose output is fed by S2 to one of the four relays in the antenna unit.





Control-section parts are installed in a 4-in.-wide sloping-panel cabinet (above). Transformer is mounted on rear cover panel and neon light and power switch are mounted on top. Layout isn't critical so you can use a larger box to avoid crowding. For convenience, we used every other contact of the 12-position rotary selector switch.

Remote Tuner

relays are 6.3 V. T1 must have a 6.3-V secondary. If the relays are rated at 12.6 V, T1 must have a 12.6-V secondary. Make certain T1's secondary current is sufficient for the relay because T1 will always be on when the tuner is in use. For example, if the relays require 1 A, T1's output must be rated for a minumum of 1 A. Since only one relay is in use at any given time, T1 need be rated for but a single relay.

The control section can be connected to the antenna section with a section of five-conductor TV antenna-rotator cable.

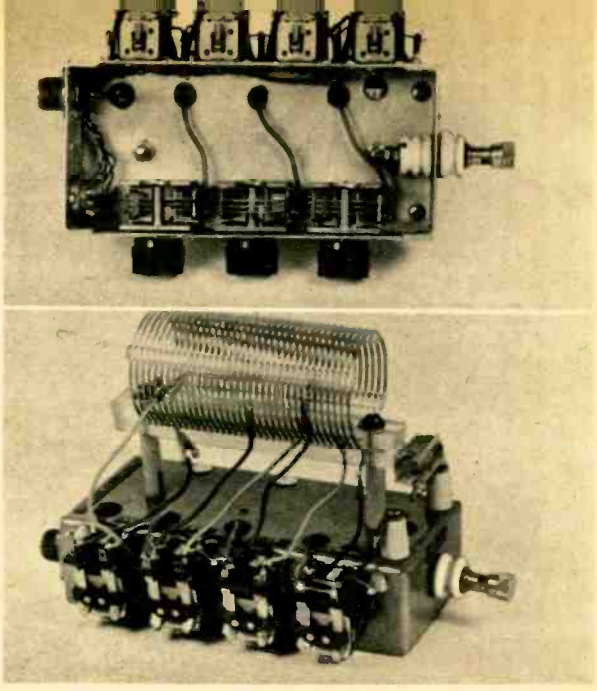
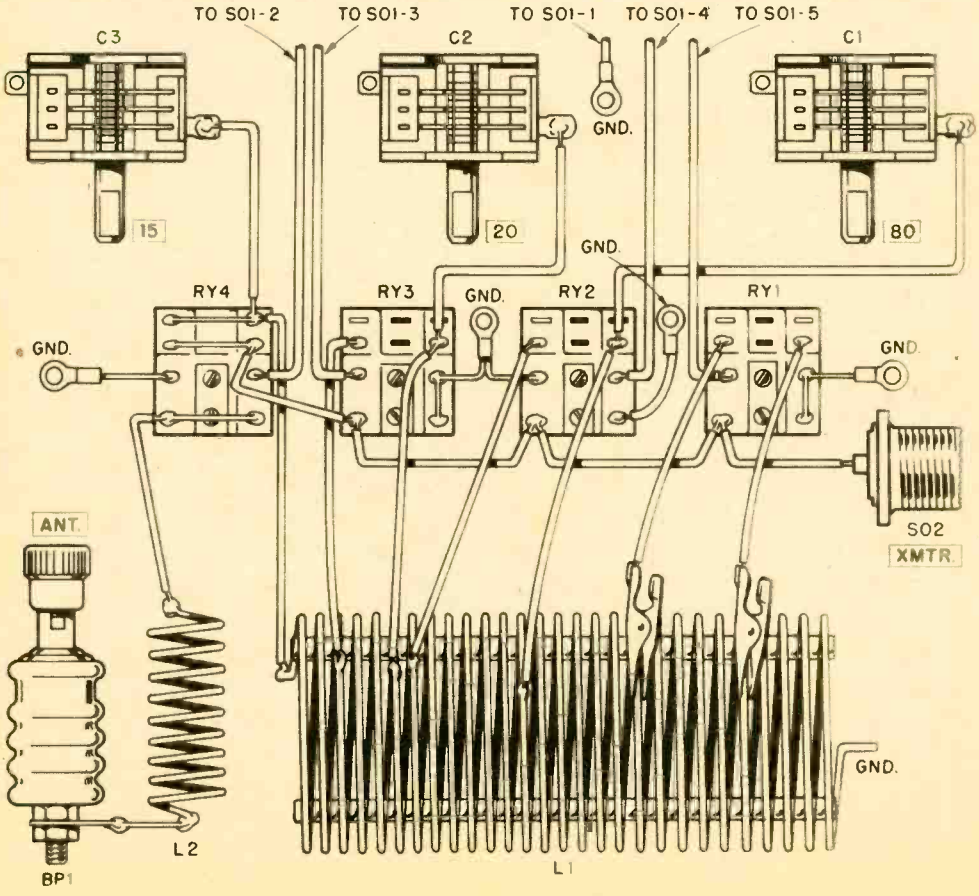
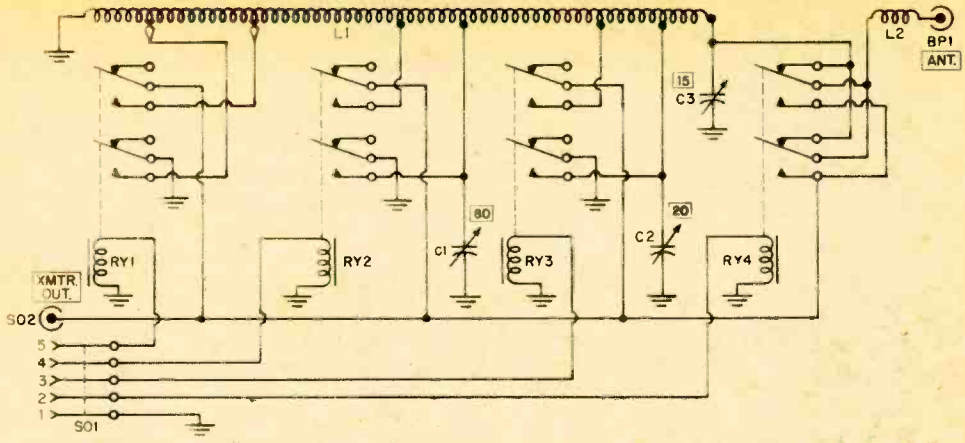


Photo at top is of underside of antenna section. Input coax connector is at left; output is binding post at right. Note in photo at right how coil is held between strips of Lucite which are supported by 2-in.-high porcelain standoff insulators.

Use photos for parts placement and pictorial for connections. Parts marked gnd. go to chassis ground.





Contacts of energized relay short out turns to left and connect appropriate tap on coil to antenna line.

PARTS LIST

BP1—five-way binding post
C1,C2,C3—5.7-75 $\mu\mu$f variable capacitor (E. F. Johnson 167-4. Allied 43 B 3780 or equiv.)
L1—Air-Dux coil: 2-in. dia., 8 turns per in., No. 14 wire. (Illumitronics No. 1608T. World Radio Labs., 3415 W. Bway., Council Bluffs, Iowa 51501. Stock No. 20D101. $2.70 plus postage)
L2—Air-Dux coil: 5/8-in. dia., 10 turns per in., No. 18 wire (Illumitronics No. 510T. World Radio Labs. No. 20D069. 69¢ plus postage)
NL1—NE-2 neon lamp and holder
PL1—five-prong plug
R1—100,000 ohm, 1/2 watt, 10% resistor
RY1,RY2,RY3,RY4—DPDT relay 6 VAC coil (Potter & Brumfield KA11AY. Allied 41 B 5159)
S1—SPST toggle switch
S2—1-pole, 12-position non-shorting rotary switch (Mallory 32112J. Allied 56 B 4351)
SO1—five-prong socket
SO2—SO-239 coax connector
T1—Filament transformer: secondary: 6.3 V @ 0.6 A (Allied 54 B 1416 or equiv.)
Misc.—2 x 5 x 7-in. aluminum chassis, 4-in. wide sloping-panel cabinet, Micro-gator clips (Allied 47 B 5178), five-conductor cable

Tune-up. Connect the antenna and ground system to the antenna section and start tune-up on the 10/40 meter band. Turn switch S2 and check that the relays close in the proper order. Set S2 so the 10/40 relay is closed, fire up the transmitter and check the system's SWR.

If the SWR is high, disconnect the coax transmission line at the antenna and, using a GDO (grid-dip oscillator), zero in on 40 meters by adjusting coil L2. (Use more than ten turns and remove them one at a time.) Then connect the coax and check SWR again. If necessary, tune L2 for minimum SWR. Next, tune-up on 15 meters. Try moving the tap on L1 until you get lowest SWR and the best plate-loading setting. Similarly, adjust for minimum SWR on 20 and 80 meters.

When adjusting L1's taps, always adjust the associated capacitor so that minimum SWR coincides with proper transmitter loading. Under certain conditions if the capacitor adjustment isn't made you can obtain a low SWR but insufficient transmitter loading.

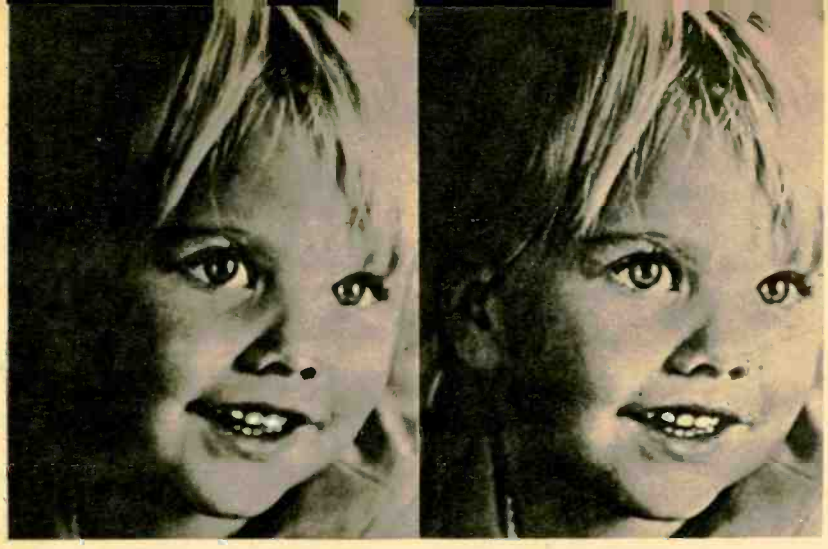
Keep in mind that the tune-up should be done carefully because subsequent adjustment on a higher band will require readjustment on the lower bands.

For example, assume you have completed the entire tune-up and then find you are not getting quite enough transmitter loading on 10 meters. If you readjust L2 for 10-meter operation you must go through the entire tune-up for 80, 20 and 15 meters. Remember, any adjustments made for 15, 20 and 10/40 meters means retuning L1 for the lower-frequency bands.

After you are satisfied you have a good tune-up, install and seal the relay unit's cover. A good watertight seal is obtained by applying a heavy strip of RTV adhesive around the area of the cover flange. Place the cover in position and press it down firmly so the RTV squeezes out around the edges. Then install the cover's retaining screws.

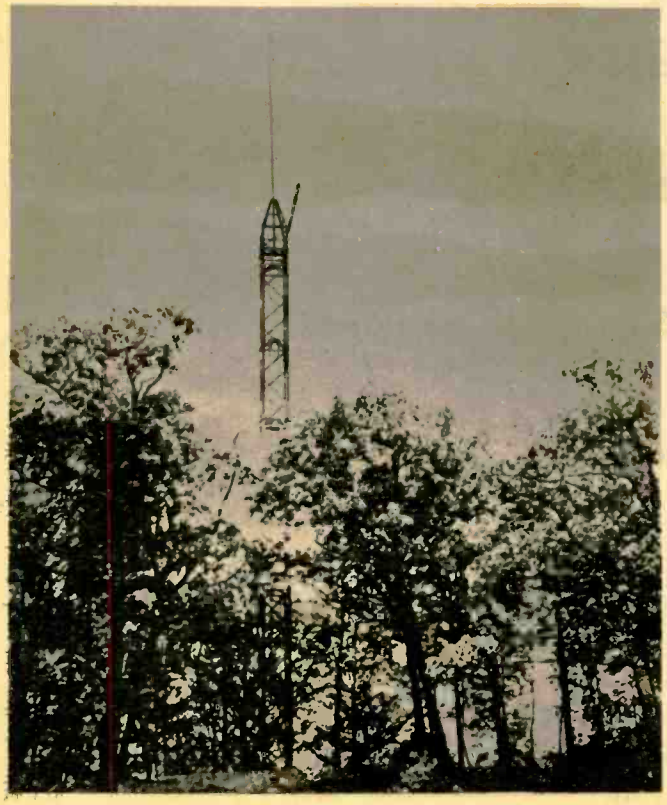
If you feel you will have to get at the relay unit you can prevent the cover's screws from rusting by covering them with a small drop of RTV. When you want to remove the screws simply peel away the rubber RTV from the screw slots.

When installing the connecting cable, take care to avoid having it rub against a metal surface such as the edges of rain gutters and downspouts.

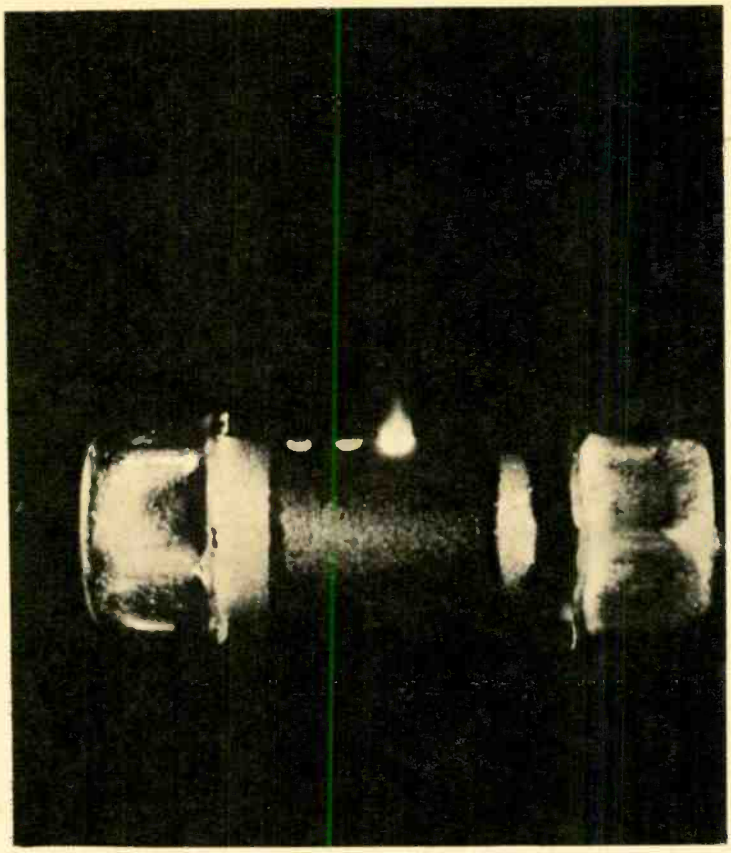


WHICH TWIN . . . Before-and-after shots issued by CBS Laboratories illustrate an electronic technique it says will increase the sharpness and detail of images on home color-TV receivers. That on the left represents normal transmission. Signal for the right-hand picture has been passed through image-enchancement device that compares three successive lines of picture information and emphasizes the differences, increasing local contrast and crispness.

Electronics in the News

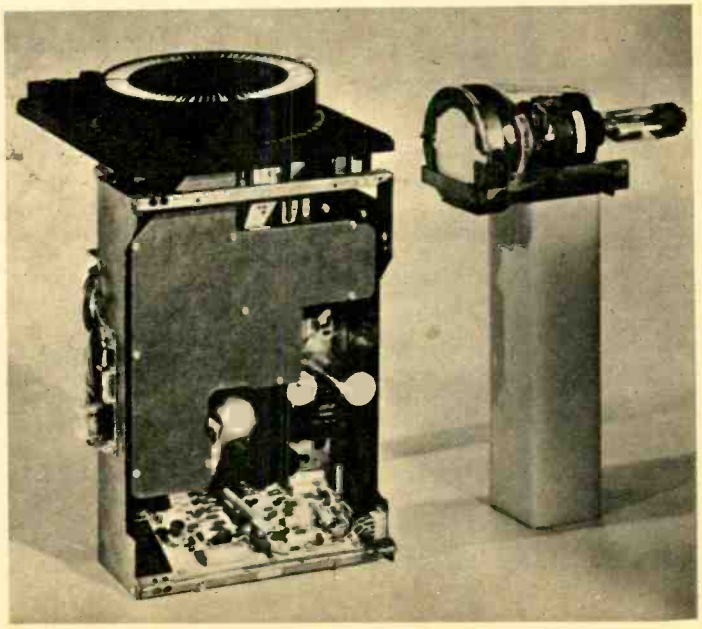


New Home . . . The antenna tower from which Edwin H. Armstrong transmitted the first FM signal has been moved from Yonkers, N.Y., to Todt Hill, Staten Island by Frank Gunther, W2ALS. Gunther is a director of the Armstrong Memorial Research Foundation and worked with Armstrong during the development of FM. It was from Yonkers that the first demonstration FM broadcast, for the benefit of startled IRE members in New York, emanated on Nov. 6, 1935. Scheduled FM broadcasts were introduced from the later Armstrong Tower in Alpine, N.J.



ZAP! . . . Time was when a trimmer resistor was adjusted with a screwdriver. Now Western Electric uses a laser. The hefty-looking object is the deposited-carbon element —actually about the size of a matchhead—of a glass-encapsulated resistor. Carbon is trimmed away by the laser until the precise value is obtained. Previous method required removal of carbon before encapsulation but heat used in encapsulation often (and unpredictably) altered the resistor's value.

In the Act . . . The last few years have seen fancy radiophono consoles grow into home entertainment centers with wider and wider capabilities. To records, radio and TV have been added facilities for audio and video taping, psychedelic lighting—even bars and fake fireplaces. Well, Sylvania has added color slides to the list, using this setup to display them on the color-TV console's screen. Slides are translated into video by the flying spot scanner at right. Automatic slide cuing and spoken commentary can be recorded on cassette tape deck built into the console.



CB Corner

By Len Buckwalter, KQA5012

Something Old, Something New

EQUIPMENT trends are tricky to predict in CB. Last year it seemed safe to prognosticate a rising tide of tiny transceivers and bigger antennas. But a recent visit to an electronic trade show proved that the seers should convert their crystal balls to stereo—they're getting only half the picture.

Big, sky-tickling antennas are the mainstay for base stations but mobile models are entering the age of specialization. Now there are quick-grips, gutter-mounts, trunk-grooves, window-lips, magnetic-bases, claw-mounts and even one called Flipper. Many of the new mounts, of course, let you fasten the whip without puncturing your precious Edsel.

You now can buy a Camper antenna. It has a special bracket that mounts nearly anywhere on a camper body. If you're a small-boat owner, you won't need a towering 18-ft. whip that'll knock trucks off bridges. New CB marine antennas drop below 10 ft. and make up missing length with a loading coil and matching transformer. Not only are they free-standing (no extra support bracket needed) but operate without a copper ground plate under the hull. For walkie-talkie operators there's a 15-in. loaded whip to replace the 5-ft. telescoping antenna.

The component hi-fi look of this new Pace base station might set a trend to house-broken styling.

As new models proliferate, old ones hang on. A leading CB antenna maker declares his hottest single seller still is the quarter-wave whip (about 8 ft. tall) on the rear of the car. Second-best seller turns out to be the shortened whip in the center of the roof. He also remarked that combination CB-AM antennas that replace a car's regular whip haven't enjoyed much popularity. Poorly designed models have given them a reputation for interfering with reception on the broadcast radio.

A new rig introduced by Pace could trigger a new generation of glamorous gear. At first glance the rig, with its walnut cabinet and computer-like front panel, could pass for a stereo FM receiver. Could it be that Pace shrewdly is playing up to the lady of the house?

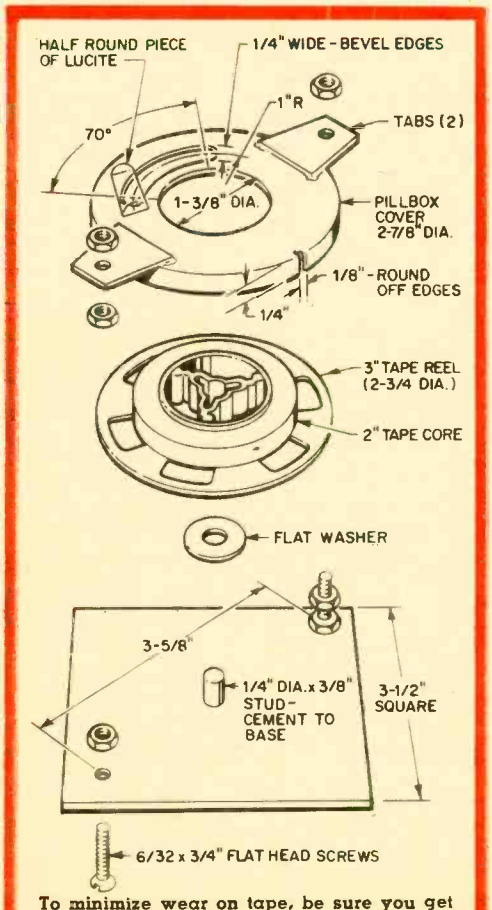
Smallest Transceiver Award this year goes to Amphenol. Its remarkable 750 Peewee CB is a full-power, six-channel job measuring only 4¾ in. wide, 2 in. high and 5½ in. deep. The 750 attracted considerable attention among dealers and is tagged at $79.95.

Reports from Lafayette Radio indicate that tiny transceivers are hardly top banana for base-station operation. A company spokesman claims its best-selling base rig is the Comstat 25A, a large and imposing transceiver with 11 tubes. The trend reverses for mobile work, of course. Here, the best-seller at Lafayette is the HB-525, a 23-channel solid-state rig barely larger than a hand.

Among big, elaborate tube sets is Tram's 26-lb. Titan II at $482. The company reports the transceiver is outselling an earlier version by ten to one. The current set boasts sideband operation as well as regular AM. Although sideband has been off-again, on-again in the CB field, Tram thinks compatibility is the answer. Unlike some earlier sideband rigs, this one can communicate with any other CB set. An additional 5 or 10 mi. of range can be expected during sideband operation. The company also is coming out with a solid-state mobile sideband set that will go for $400-450.

Want to bet on next year's models? Nothing could be more appropriate—the show will be held in Las Vegas.

CONTINUOUS PLAY TAPE CARTRIDGE



To minimize wear on tape, be sure you get the correct sizes, angles and locations of all cutouts in the round plastic cover.

STUDY in a foreign country, they say, if you really want to learn the language. But why travel if you can do almost as well at home using a method called sleep learning? The process involves your listening to something play over and over again while you're in the twilight zone before deep sleep. And the way to do this is with our Continuous Play Tape Cartridge.

Put it on your tape recorder and you're on the way to a second language. At 3¾ ips, the cartridge will keep playing a 3½-minute tape. If you're a ham you can use the cartridge to send a CQ call repeatedly.

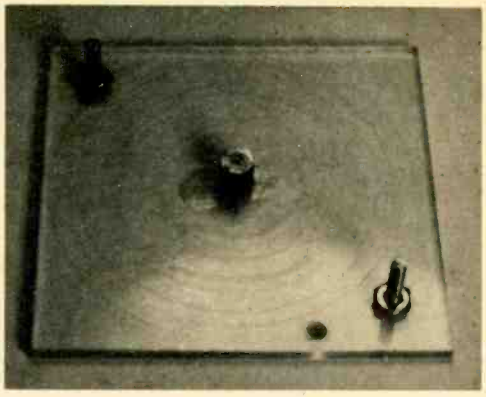
Construction

The cartridge shown on the tape recorder is made of readily-available plastic materials which will require some fabrication on your part. Start off with an ordinary 3-in. tape reel. (This is the same size reel processed 8mm movie film is returned on.) Remove the flange from one side of the reel and file the hub smooth.

Build up diameter of the hub to 2 in. with ¼-in. acetate tape. Keep the oxide coating inside and wind tightly. When the diameter is 2 in., anchor the end with splicing tape. Saturate the tape with the MC-26 EDC plastic cement specified in our Materials List. This cement is a solvent for acetate-base plastic and will dissolve the tape partially causing the individual layers to form a solid core.

The base of the cartridge is a 3½-in.-square by ⅛-in.-thick piece of plexiglass.

Increase diameter of reel hub to 2 in. by winding on acetate-base tape, oxide side in. Secure end with splicing tape, then saturate with EDC cement.



Base is 3½-in.-square piece of Lucite ⅛ in. thick. In center is cemented 5/16-in.-dia. rod over which tape reel is placed. Screws hold the plastic cover.

CONTINUOUS PLAY TAPE CARTRIDGE

Using epoxy, cement the 5/16-in.-dia. rod to the center of base, being careful not to let the cement spread on the surface. After the epoxy hardens insert the 6-32 x ¾-in-long flat-head screws into the diagonally located holes in the base. Secure the screws with 6-32 hex nuts.

Take a look at our diagram. Find the center of the plastic cover and scribe a circle large enough to clear the reel hub. Cut out the center hole with a jeweler's saw with a medium blade. Then cut out the radial slot and the rim slot in the cover where shown. Smooth all edges with a file so they won't interfere with the movement of tape.

Put the 5/16-in. (inside diameter) flat washer over the center post. Place the 3-in. tape reel over the post then put the cover over the reel. Center the cover over the reel hub.

Next thing to do is attach the plastic tabs on the cover. But before cementing the tabs in position, put a 6-32 hux nut on each screw. The purpose of the tabs is to support the cover just above the reel. Recenter the cover and then cement the tabs on it. Enlarge the screw holes in the tabs, if necessary, to center the cover over the reel if alignment was disturbed during tab assembly. To check mechanical operation, raise or lower the nuts under the tabs until the reel turns freely under the suspended cover.

Winding the Tape

The best tape to use is 1-mil mylar base.

MATERIALS

Plastic cover; minimum inside dia.: 2⅞ in. x ¼ in. high
Small bottle MC-26 EDC cement
Above plastic material available from Industrial Plastic Supply Co., 324 Canal St., New York, N.Y. 10013 and elsewhere.
6-32 x ¾ in. flat-head machine screws
6-32 hex nuts
5/16-in. ID flat washer
5/16-in. dia. x ½-in. long metal rod
¼-in. dia. x ½-in. long plastic rod
Epoxy cement
Acetate-base recording tape

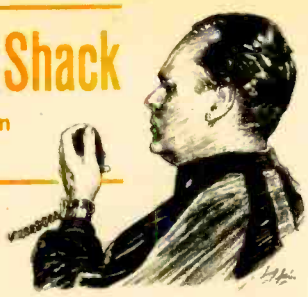
The maximum amount the cartridge will hold will run for about 3½ minutes. Do not use a thinner tape.

Put the 3-in. reel on the recorder's take-up spindle. Place a reel of raw tape on the feed spindle leaving a few inches sticking out, and wind about 60 ft. of tape on the hub of the 3-in. reel. Then place the reel on the base's center rod and put the cover over the reel. Secure the cover in place with two more 6-32 hex nuts. Before tightening the nuts, make sure the reel turns easily. Having clamped the cover, pull the beginning of the tape at the hub through the radial slot. Pull the other end through the rim slot. Leave about 3 in. on each end then splice the tape ends.

Before using the cartridge install a half-round piece of Lucite on the top of the cover with a few drops of plastic cement as shown in our diagram. The Lucite rod reduces tape rubbing as the tape comes out of the cartridge. Tape must feed *out* of the radial slot and *into* the rim slot.—*Irving Karmin.*

The Ham Shack

By Wayne Green
W2NSD/1



HAM conventions can be lots of fun and I try to get to as many as I can. The manufacturers' exhibits usually are interesting with new models on display and representatives there to give an ear to your personal woes with their gear. The technical talks can be a crashing bore but a careful reading of the program should show which are worthwhile. Old buddies abound and for the first time you get to meet many of the fellows you've contacted with on the air.

Some of them grumble that people aren't building anymore. Balderdash, say I! Creative building still is going on hot and heavy. Thirty years ago, of course, there were almost no commercial transmitters—we *had* to build our own. But most hams had only the vaguest idea of what they were doing. They had to turn to a local ham who *did* understand what he was doing to get the bugs out of the rig.

The complexity of transceivers may have passed most of us by as far as building is concerned but about 80 per cent of the active hams turn their hand to building gear described in the ham magazines. Integrated circuits have come upon us in profusion and it's now possible to build complicated equipment on the kitchen table in a short time. Things like commercial frequency counters were prohibitively expensive to buy and took too long to build for the average experimenter. Now they can be built in a few hours using $1 ICs.

DXing is one of the major hobbies among amateurs. Until about three years ago there were a thousand or so amateurs around the world devoting a good deal of time to keeping up with every new country that got on the air. I've been critical of this phase of amateur radio because of the pressure it put on new amateurs in rare countries. It's prevented chances for them to have meaningful talk with other amateurs, tying them down to rapid-fire exchanges of signal reports and massive QSL problems. Few amateurs find this fun for any length of time and many an operator in a rare spot has been chased right off the air by avid DXers.

Then Don Miller jumped around the world, operating from one place one day and, seemingly, from the opposite side of the world the next. There's a good deal of controversy going on over his actual whereabouts during some 40 to 50 operations but it may unwind in some of the court battles that seem to be shaping up. (Don has entered a couple of suits recently—one of them against me.)

The DX-minded fraternity flipped when Miller started turning a deaf ear to many of the high-ranking DX-chasers. He claims either he didn't hear them or they were operating poorly and he skipped them. They feel he punished them for not donating enough to his expedition fund.

As a result of the Miller shuffling of the QST DX Honor Roll, interest in contacting new countries has dropped markedly. DXing is not the life-and-death pursuit it used to be. This, to me, is a good result—whatever the means may have been.

The UFO-reporting net is meeting Wednesday nights at 2000 EDT on 14300 kc. Check-ins have run from 50 to 100 so far but interest is growing and our goal of a net reaching into every corner of the country is within reach. A second net is in operation on 75 meters, meeting at the same time on 3950 kc on Thursday evenings.

With the abolishment of the FCC being called for by some of the commissioners, amateur radio is in for a period of uncertainty. Any change probably would be for the best, since the FCC has taken little interest in amateur radio. But things usually get worse, not better, where the government is concerned.

One certainly could wish for a national group with offices in Washington and representatives in touch with Congress to speak for amateur radio. But this we don't have.

We also need representation on an international level to cope with the International Telecommunications Union's growing pressure for basic changes in the frequency bands allocated to amateur radio. We're not doing well there either. What few efforts are being made largely are being tied up in local partisan politics.

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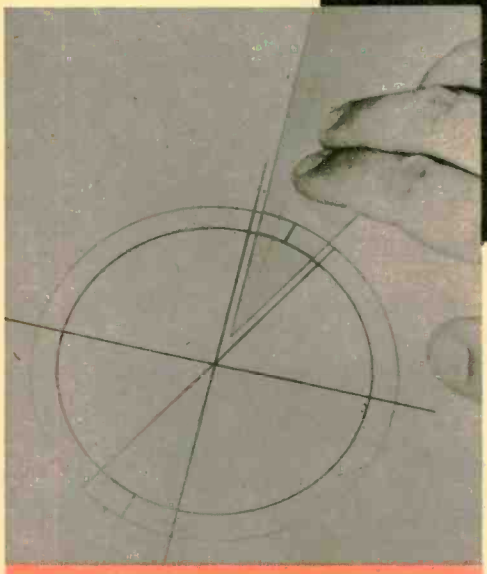
Would You Believe a 2-Faced Clock?



Top: divide each quadrant into three segments with 30° angle. Below: to bisect each 30° angle draw arcs of same dia. from points on each side of angle. Draw line from arc intersection to circle's center.

YOU can throw away those confusing time-conversion charts if you take a few simple materials and build your own 24-hour clock to indicate both local and Greenwich Mean Time (GMT). By the way, GMT still is GMT and still has the same relationship to local times around the world, despite Great Britain's recent decision to go on summer time the year around. Only British time was affected by that move.

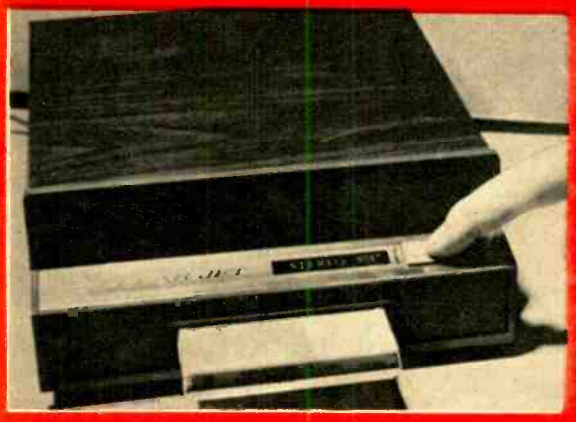
On our clock the 12-hour face remains for telling local time. Because the clock's hour hand revolves once each 12 hours, you make a special face to allow for two such revolutions in 24 hours.

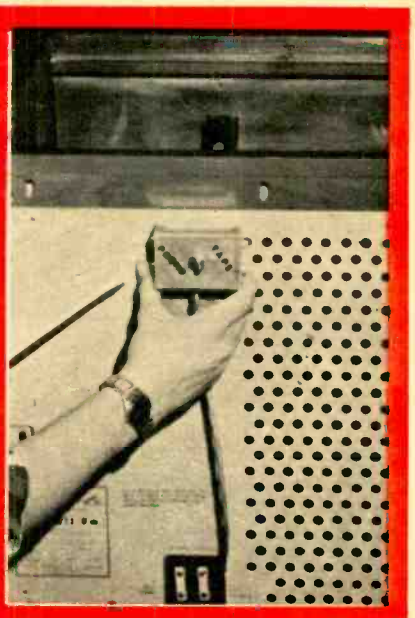
On the face shown above (designed for Mountain Standard Time), the interval between 12 o'clock and 1 o'clock on the 12-hour face represents 0700 GMT *and* 1900 GMT. Shading of the 12 and 24 numbers keeps you from getting mixed up.

On cardboard, draw two circles with a compass. Make one the same size as the outer diameter of your clock's face and the other about 1 in. larger. Using a triangle, draw a line through the diameter of both circles. Then draw another line perpendicular to the first. Now divide each of these 90° segments into three equal segments, using the 30° angle of a triangle.

Next, place the pivot point of the compass at the 12 o'clock position and draw an arc outside of the face. Without changing the setting of the compass, place the point on

[*Continued on page* 110]





How to Hook a Tape Player to Your Phono

IT may be a fine record player and its FM reception could be quite good, too, but if that stereo console doesn't play tapes, it's only doing two-thirds of its job.

To play tapes through your console you need some kind of tape player. The unit we installed was a Lear-Jet Stereo-8 tape deck. (Its output is variable from 5 millivolts to 1 V at an impedance of 1,500 ohms.)

Because most stereo consoles don't have jacks, you will have to add external jacks. What you do is install them in a small Minibox along with a slide or toggle switch. You then plug into the jacks the output leads from the record changer and the tape deck. A pair of leads from the switch box goes into the phono inputs on the console chassis. You use the switch to select either the tape deck or the record changer as the program source.

First thing to do is remove the record-changer plugs from the chassis and decide where you want to mount the switch box. (Note in the photo where we mounted our switch box.)

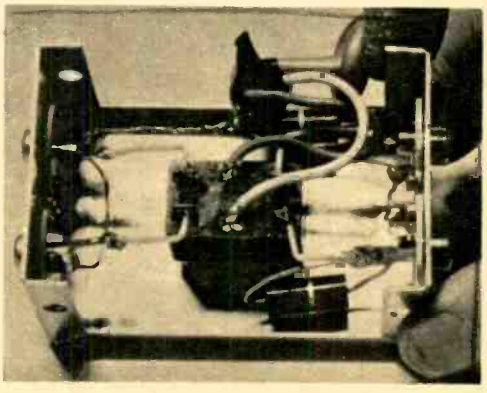
Next, take a 3¼ x 2⅛ x 1⅝-in. Minibox and drill holes in it for four phono jacks, the selector switch and two output cables. Drill and mount the parts where shown in the photo.

Mount the switch box on the rear of the cabinet with wood screws and run two shielded wires from the box to the phono-input jacks on the chassis.

The tape deck shown already has two phono plugs on it which will match the phono jacks on the switch box. Simply plug them and the plugs from the record player in the switch box.

After all cables have been connected play a tape then a record and listen for hum or noise caused by poorly-soldered connections. Finally, adjust the output-level pot on the tape deck so when you switch from records to tape you won't be blasted.

Homer L. Davidson



Phono-input jacks are mounted on left side of main section of Minibox; tape jacks are at the right. Resistors provide additional attenuation.

2-Faced Clock

Continued from page 108

the 1 o'clock position and draw a second arc crossing the first arc. Draw a line from the intersection of the arcs and the center of the circle down through the 6 and 7 o'clock positions. Follow this procedure with all the other segments.

The following explanation is for MST. Follow it through to get the idea of how to make a clock face for your time zone. In the MST zone, 0000 GMT corresponds to 5 p.m. MST. Therefore, put the number *0* in one of the two segments that are between 5 and 6 on the 12-hour clock face. With this as a start, you can see that 1200 GMT comes at 5 a.m. MST, therefore, the number 12 goes in the right space in the 5 to 6 segment of the 12-hour clock face. Now darken slightly the 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 segments corresponding to the GMT hours of 0100 through 1200.

When local time is between 6 p.m. up to but not including 6 a.m., read GMT from the darkened segments. From 6 a.m. up to, but not including, 6 p.m., read GMT in the light segments. Minutes and seconds are read from the 12-hour face.

—Marshall Lincoln

CB Jamboree Swing

Continued from page 93

When the exhibitor agrees on these arrangements it is time to request (not demand) donation of a door prize. Potential exhibitors include manufacturers, distributors and vendors of CB products, CB publications, even clubs and REACT teams. And don't overlook any printers willing to accept QSL-card orders. In fact, if you're planning a souvenir program of the jamboree you may be able to get it printed free in exchange for display space. The souvenir program also increases your income by letting you sell advertising space to equipment repair shops or other enterprises that would have little to gain by taking exhibit space.

Exhibitors must be made to sign a contract outlining the terms that have been agreed upon. A deposit of at least 50 per cent of the exhibitor fee should be paid at the time of signing with the balance due *before* the exhibit is set up. The deposit is non-returnable if the exhibitor fails to show up.

When you have determined the exact number of exhibitors, you can set about obtaining tables, partitions, electrical extensions and other quartermaster items.

As for the jamboree itself, plan on some zany contests—best QSL, oldest or most distant operator to attend, a beauty contest for Miss CB, largest club attendance or best CB tall tale—with inexpensive trophy prizes. (Don't forget that a great many kids and non-CBer XYLs will show up. Some special events to keep them amused might be in order, too.)

The QSL-card contest is a snap to set up. All you need is a large slab of plywood and a hundred thumb tacks. As CBers pass the board they post their cards for the contest. At judging time, the board is shown to the judges and the prizes awarded.

A popular jamboree activity is a seminar or Q&A session with FCC people or an engineering representative from one of the exhibitors. While FCC people are pressed for time they do manage to attend some jamborees and contribute considerably to the activities. Exhibitors almost always are happy to donate an expert.

If you play music over the PA system keep it pleasant background music. Loud, distorting or rock-and-roll sound drives away your guests and annoys exhibitors. Put one person in charge of the PA system for programming and paging announcements.

A few members should be appointed as a security force to patrol the parking area (with all those prized mobile units). If a jamboree is indoors and lasts more than one day the security patrol would post a member at each door at night, with one or two patrol members on duty inside to protect the goodies.

You'll need a reliable photographer (maybe from the newspaper) to take photos of all exhibits and events. The local broadcasting station may do a remote program from the jamboree as a public service and goodwill gesture.

Through it all, the head jamboree organizer must be on the scene troubleshooting any problems, checking with exhibitors to make certain everything is going well, keeping events on schedule, assigning club members to the many jobs that pop up.

When the jamboree is over, a cleanup committee must be available for the very unpleasant task of policing the jamboree site to tidy up the mess and restore the place to its original condition. All tables, decorations, signs and special equipment have to be removed promptly and road direction signs along the highways taken down.

Of course, we can't guarantee that if a club follows the suggestions presented here it will have a smashing sensation on its hand. The thing will stand or flop depending on the enthusiasm, imagination, organization and elbow grease behind it. In back of every successful jamboree are frayed nerves, missed suppers, angry wives, disappointments beyond belief, gremlins and trampled egos.

Still want to give it a try? Good luck!

The Secret of Sayville

Continued from page 44

were flying that German newspapers had known in advance that the Lusitania would be sunk, and where. The Berne correspondent of the London Morning Post wrote that they had received the news by wireless from New York in advance of the sinking and had their stories already written. In New York, Carl Schurz, Jr., spokesman for German interests, told the New York World that the Germans had been alerted by wireless to the presence on the Lusitania of war supplies for Britain when the ship left New York on May 1.

[*Continued on page* 112]

The Secret of Sayville

Continued from page 111

Schurz explained that, in light of the hostilities, Germany only had been protecting herself in sinking the ship.

If the reports were right there was only one way the U-boats could have gotten the word—from Sayville. The next day, such anti-German newspapers as the Providence Journal, Brooklyn Daily Eagle, New York World and New York Times were calling for the closing of Sayville—or at least much stricter control over its activities.

Meanwhile, the mysterious sounds continued to be heard. After establishing contact with Nauen, the operator would begin sending so fast that the message became unintelligible. But not all transmissions fell into this category. Between 11 p.m. and 5 a.m. Sayville sent a full schedule of commerical messages at normal speed. The Providence Journal stationed a crack telegrapher at its experimental station at Point Judith, R.I., with instructions to transcribe every word sent out by Sayville.

By the end of June, Navy Secretary Daniels ordered three lieutenants into Sayville as censors. They reported nothing wrong but almost immediately rumors began circulating that the German operators simply waited until the censor on duty went out for a smoke or took a coffee break before sending the coded messages. One of the censors, a Lt. Clark, was quoted to that effect. He spent the next day denying it.

On July 1, the Providence Journal lowered the boom by publishing the first in a series of Sayville transmissions. Specifically, the Journal charged that Nauen had been requesting more repeats of messages lately, allegedly due to faulty reception. But when the repeats came they often were rows of numbers that had nothing to do with any previous transmission. Prices from the New York Stock Exchange and Cotton Exchange bore no relation to actual transactions. The cotton orders, the newspaper reported, were concealed reports of troop movements in Europe.

But the Providence paper was not alone in turning an attentive ear toward Sayville. Charles E. Apgar of Westfield, N.J., was a ham operator and something of an experimenter. He had developed a device he called an Ampliphone that permitted him to record

signals off the air on an Edison dictating machine. On the night of June 7 he had made his first cylinder of the mysterious bumble-bee sounds. He was unable to make any sense from the transmissions, though, until one night the Edison machine began to slow down as he was playing a cylinder. Apgar listened intently as the bee drone resolved itself into dots and dashes. Taking a pencil, he wrote down what he heard, then got a German-English dictionary.

What he found sent him hurrying the next morning to the offices of L.R. Krumm, the Chief Radio Inspector of the Bureau of Navigation's New York office. Apgar showed him the messages and played a few of the cylinders. Krumm was not a man to be alarmed easily but he hurriedly sent for William J. Flynn, head of the U.S. Secret Service. Together the three men listened to the cylinders as Apgar tried to slow down his machine. Although none of them knew it at the time they were listening to a Telegraphone used as its inventor had envisioned.

It wasn't until after the war that anyone disclosed what Apgar had recorded. Even then, nobody was providing complete texts. As an example, however, a spokesman cited what appeared to be a commercial message reporting that a cargo of sugar had been shipped on a particular vessel and bills of lading were going forward by hand. Another message announced the birth of a baby, the date, and the fact that the child had been christened Mercedes. The Secret Service determined that there was no sugar aboard the ship mentioned. But the ship did have a passenger named Mercedes and when the ship docked in Liverpool Mercedes was met by two men. British police arrested all three and confiscated the documents ("bills of lading") Mercedes was carrying.

On July 6, Captain W.H.G. Bullard showed up at Sayville with orders from Secretary Daniels to seize the station. Nobody was more surprised than the three Navy lieutenants who had been on duty there. But the Atlantic Communication personnel evidently weren't surprised. A Brooklyn Eagle reporter who had camped in a field across the railroad tracks the day before reported that cartons and crates were trucked out after dark on the 7th. Some were described as too large and heavy to contain papers or files. The Navy men said they hadn't noticed anything unusual during their entire tour of duty.

[*Continued on page* 115]

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

KNIGHT T-60 transmitter. Want ham gear or camera. Seymour Balsenbaum, 9424 Ave. A, Brooklyn, N.Y. 11236.

CLEGG THOR 6, AC power supply. Want Heath SB-200, 610, 620 or Collins 30L1B. Richard M. Jacobs, WA0AIY, 4941 Tracy, Kansas City, Mo. 64110.

HEATH DX-100 transmitter—160-10 meters. Want Yashica, Miranda, Pentax or similar single-lens reflex camera. Stan Nafziger, RR#1, Mackinaw, Ill. 61755.

HALLICRAFTERS HA-1 automatic keyer with vibrokeyer. Want amateur transmitter. Gary Bowes, 129 Woodward Ave., Lockhaven, Pa. 17745.

SURPLUS BC-474A transceivers. Want 2-meter equipment. Roger Kolakowski, 51 Center St., Wethersfield, Conn. 06109.

HOMEBREW 100-watt CW transmitter with power supply. Want Heath Twoer or best offer. Jeff Morton, WN2EEA, 8 Beachwood Dr., Elnora, N.Y. 12065.

VARIOUS ham crystals. Want CB transceiver. Michael Draheim, 1316 Pearl St., Belvidere, Ill. 61008.

CONVERTER for 6-meters—nuvistorized. Want 6-meter VFO or best offer. Howard Levine, 750 Hayworth Ave., Los Angeles, Calif. 90046.

EICO 720 transmitter. Want tape recorder, stereo components or best offer. William F. Schulte, 2480 Westlake Ave., Oceanside, N.Y. 11572.

SHORT-WAVE LISTENING

HEATH GR-81. Want tape recorder, walkie-talkie or best offer. Ted Larson, 560 Central Ave. S., Milaca, Minn. 56353.

LAFAYETTE KT-135 general-coverage receiver. Want Comstat 9 transceiver or similar. Bill Houston, 506 S. Gilbert, Powell, Wyo. 82435.

HALLICRAFTERS SX-99. Want amateur transmitter, receiver. Warren Tucker, Box 26, Ochlochnee, Ga. 31773.

HALLICRAFTERS S-72 receiver—0.55-30 mc. Want Ameco R-5 receiver or best offer. Glenn Hansen, Rt. 2 Box 128B, Burton, Wash. 98013.

SURPLUS BC-342N receiver. Want Eico 460, Heath 10W-12, Knight KG-635 or similar 5-in. scope. Kevin Abernathy, WN4HLM, 118 Maple Dr., Hendersonville, Tenn. 37075.

HALLICRAFTERS S-38C receiver. Want Heath 10-12, 10-21 or similar oscilloscope. Richard Clark, 4302 Obispo Ave., Lakewood, Calif. 90712.

KNIGHT Space Spanner. Want Heath Twoer. Ian Cassell, Fanton Hill, Weston, Conn. 06880.

LAFAYETTE HA-225 receiver. Want sun zoom lens or similar. Mark Gross, 1261 Ocean Ave., Brooklyn, N.Y. 11230.

HALLICRAFTERS S-38E receiver. Want Heath HR-10 receiver. Rick Goebbel, Rt. 5 Box 813, Gales Ferry, Conn. 06335.

KNIGHT R55A receiver. Want surplus 115-V receiver. Kirt Fanning, 6021 Edgewood, La Grange, Ill. 60525.

EMERSON SW/BCB receiver. Want Lafayette Comstat 25 or similar 23-channel CB transceiver. Bill Dale, 1741 Jacklin Rd., Hinckley, Ohio 44233.

ANTIQUE ELECTRONICS

ATWATER-KENT receiver, other antique gear. Want short-wave, CB or police-band gear. Scott Mitchell, 71 Summer St., Claremont, N.H. 03743.

ZENITH receiver, ca. 1940—covers BCB, 16-49 meters, 1.5-4.5 mc. Will swap for Lafayette Dyna-Com 5 or similar CB transceiver. Mike Capparelli, 4782 Boston Post Rd., Pelham Manor, N.Y. 10803.

ASSORTED ANTIQUE TUBES. Make swap offer. Tim Oren, Rt. 1, Box 8, Kokomo, Ind. 46901.

RCA 100A loudspeaker. Want VOM or best offer. Stephen Eskelson, RR #1, Box 85, Browerville, Minn. 56438.

STROMBERG-CARLSON 14A receiver, assorted tubes. Will swap for oscilloscope. Billy K. Hart, 32 Best Dr., Saraland, Ala. 36571.

ATWATER-KENT 55 AM receiver, F-2 speaker. Will swap for CB gear or make offer. J. L. Van Horn, RR 18, Box 152, Indianapolis, Ind. 46234.

ASSORTED TUBES, magazines, books. Need three variable capacitors for Crosley Bandbox-601 Neutrodyne receiver. D. Brownrigg, Chelsea, Que., Canada.

RCA Radiola III, tubes. Make swap offer. Ron Stuhz, Box 1190 VMI, Lexington, Va. 24450.

CROSLEY table-model radio, ca. 1920s, less musicone. Want Knight Star Roamer or other ham receiver. Everett Killman, RR 2, Box 151, Veedersburg, Ind. 47987.

RCA Radiola Grand, ca. 1930. Will swap for hi-fi speakers or best offer. Steve Stanfill, RFD, Toston, Mont. 59643.

READRITE tube and circuit analyzer. Want 3-4 mc receiver to use with T19/ARC-5 surplus transmitter. David A. Johnston, 92-GMS-DD6801, U.S.N.S.C., Mare Island, Vallejo, Calif. 94592.

VINTAGE TUBES—UV-201As, others. Want ham gear or best offer. Kirk Snyder, Box 131, Tonasket, Wash. 98855.

WEBSTER-CHICAGO wire recorder. Want oscilloscope. Jimmy Fariss, 403 Grove St., Lynchburg, Va. 24501.

SILVERTONE wire recorder/78-rpm phono/radio combination. Want Knight T-60 transmitter. Bill Gehrs, 1618 C Spartan Village, East Lansing, Mich. 48823.

SERVICE EQUIPMENT

SUPERIOR TV-60 Allmeter. Want Bogen 35- or 50-watt amplifier. Joseph Koss, 1130 Duss Ave., Ambridge, Pa. 15003.

HEATH 10-12 oscilloscope, EF-2 scope training kit. Make swap offer. C. E. Spitz, 1420 S. Randolph St., Arlington, Va. 22204.

GENERAL ELECTRIC TC-3 tube tester. Make swap offer. H. Anderson, 639 N. Wahsatch Ave., Colorado Springs, Colo, 80903.

HEATH IM-25 VOM. Make swap offer. D. J. Wunderley, 809 Elizabeth St., McKeesport, Pa. 15133.

KNIGHT KG-645 VOM. Will swap for 12-V power supply and battery eliminator or flyback tester. Forest N. Motto, 2240 Warren St., Petersburg, Va. 23803.

EICO 232K VTVM with probes, other gear. Want Edison cylinder-player (160 rpm). Kurt P. Kowal, 12330 Cedar Bend Dr., Dallas, Tex. 75234.

HEATH 10-12 oscilloscope, 337-C, PK-1 probes. Want two superhet walkie-talkies. C. P. Hill Jr., 904 Tyler St., Flat River, Mo. 63601.

RCA WO-88A oscilloscope. Will swap for ham transmitter or best offer. Rodger Koester, 1715 Walnut Dr., Woodstock, Ill. 60098.

EICO VTVM, other gear. Want stereo tape deck. Jeff Harris, 83-30 98th St., Woodhaven, N.Y. 11421.

SUPERIOR appliance tester, AC/DC meter. Want Electro-Voice 664 microphone or transistorized microphone mixer with VU meter. Lou Sabatini, 5820 W. 83 St., Oak Lawn, Ill. 60453.

AMPROBE RS-1 Induction-type AC volt/ammeter. Will swap for transistor tester or best offer. Edward J. Stone, 9613 Bristol Ave., Silver Spring, Md. 20901.

HEATH Q-multiplier. Want Hallicrafters S-40B or circular saw for Edelstaal lathe. Theodore Nadeje, 5101 39th Ave., Sunnyside, N.Y. 11104.

GROMMES 202 signal tracer. Want Eico 324 signal generator or similar. Matt J. White, 6867 Sheffield Ave., Baton Rouge, La. 70806.

SUPERIOR TC-55 tube tester. Will swap for stereo preamp or dynamic mike. Paul Snider, 1507 6th St., Coeur d'Alene, Idaho 83814.

EICO 232 VTVM. Will swap for Heath Q-multiplier or best offer. M. Wierzbowski, 31 Francis, Cheektowaga, N.Y. 14212.

LAFAYETTE VOM. Will swap for novice transmitter or best offer. Bobby Allen, 4053 Florida St., Zachary, La. 70791.

HICKOCK 670 5-in. oscilloscope. Will swap for best offer. L. S. Garner, Box 275, Kendall, Kan. 67857.

SERVICE EQUIPMENT. Will swap for Knight Star Roamer. Michael A. Barone, 1637 Steinhart Ave., Redondo Beach, Calif. 90278.

HEATH VTVM. Want Hallicrafters SR-42A transceiver, or Lafayette HA-350 receiver. Mark Dubay, 500 S. Gilbert, Fullerton, Calif. 92633.

HEATH 5-in. oscilloscope. Want electronics books, RF Generator or best offer. Steven Russell, Box 117, Babbitt, Nev. 89416. [Continued on page 117]

The Secret of Sayville

Continued from page 113

Whether the Germans removed the Telegraphone that night is a secret lost to history because Captain Bullard's first official act was to impose on the site a security tighter than anything Atlantic Communication ever had On July 25 Bullard did release the news that the Navy was installing a 100-kw transmitter to improve service to Europe. Then on September 3, Tuckerton and Sayville stopped accepting any commercial messages for Europe, ending one of the most curious chapters in radio history.

The Listener

Continued from page 74

This same portion of the radio spectrum also is known as Medium Frequencies (actually the most common designation) and Hectometric Waves (advocated by the ITU). Despite the facts, some die-hard BCBers will do almost anything rather than admit that MW includes channels outside the 533-1605 kc band. Recently, one pseudo-scientific type even went so far as to quote the Russian standard of 150-1500 kc to prove that ORTF Reunion on 2446 kc isn't in MW territory.

The mere fact that all the frequencies between 300 and 3000 kc are designated as MW does not automatically mean that distant reception will be similar throughout the range; it just happens that way. And it is this similarity that separates MW from all other segments of the radio spectrum. On Short Wave (3 to 30 mc), by way of comparison, reception at the upper end bears absolutely no resemblance to low-end patterns.

This relative uniformity, in addition to providing a meaningful DX standard, is important to listeners interested primarily in the traditional 535-1605 kc band. For example, because it is almost as difficult to hear South Africa on 2378 kc (Springbok R.) as on, say, 782 or 1286 kc, 2378 will serve as a pilot for MW reception from lower Africa. In order to hear this area at all on MW, the path must be *abnormally* undisturbed and absorption *abnormally* low. If you can hear 2378, you know these conditions exist and therefore you have a chance of hearing lower Africa on the more crowded broadcast channels.

A Real Shoebox Speaker

Continued from page 31

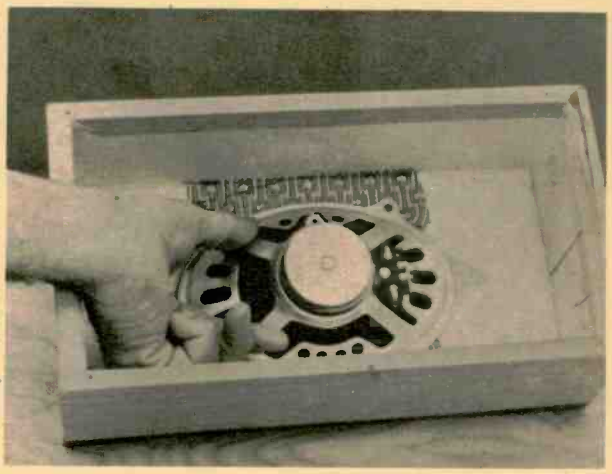


Fig. 8—Mount 5 x 7-in. speaker in cabinet, using flathead machine screws installed before fiberglassing. Stuff the cabinet with fiberglass wool.

or decorate as desired.

As we said, our enclosure is designed as a starter project. An ordinary shoebox, used as the form, is covered with Plyfoam which is glassed. Use our photographs as a step-by-step procedure for constructing the cabinet.

Temporarily install the speaker (ours is 5 x 7 in.) to determine the location of its mounting holes. Drill the holes and install flathead machine screws so they will be flush with the front of the cabinet. When assembled, sand the corners to break the sharp edges. Then brush on a coat of resin and cover with fiberglass cloth as shown.

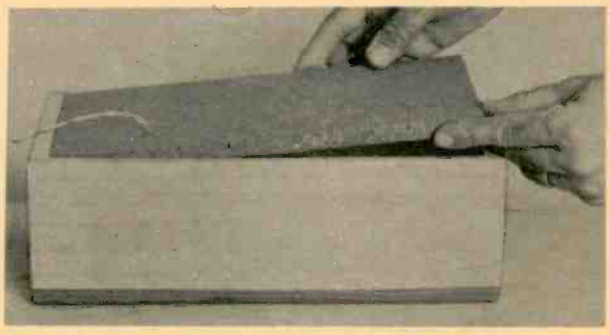


Fig. 10—Finally, cut back cover to fit inside cabinet and secure with brads. Give it a few coats of resin to harden it and to form tight seal.

Swap Shop

Continued from page 114

FENDER guitar and amplifier. Will swap for color TV or best offer. J. S. Hultman, 3225 Girard Ave., S. Minneapolis, Minn. 55408.

CITIZEN-SHIP R/C equipment. Will swap for 2-meter ham gear or best offer. Mark Dankoff, 1629 Clover St., Rochester, N.Y. 14618.

ASSORTED TUBES, SPEAKERS. Will swap for transistor CB transceiver or best offer. James Long, Montreal, Mo. 65591.

MISCELLANEOUS equipment. Will trade for oscilloscope. Doug Pongrance, WN3JBN, 316 Donnell Rd., Lower Burrell, Pa. 15068.

IMAGE ORTHICON TUBE type 7295. Want high-sensitivity vidicon or 3-in. image orthicon. P. Moffat, 31A-778 McMillan Ave., Winnipeg 9, Manitoba, Canada.

ELECTRIC GUITAR with amplifier. Will swap for CB transceiver. Chris Kelso, 675 Forest Blvd., Indianapolis, Ind. 46240.

ASSORTED PARTS. Will swap for best offer. Jack Shea, 4343 Ludwick St., Pittsburgh, Pa., 15217.

ASSORTED PARTS. Will swap for CB transceiver, walkie-talkie or best offer. M. Shively, 3146 Ellen Ave., Lansing, Mich. 48910.

ASSORTED TUBES. Will swap for communications receiver. J. R. Blackwood, 3764 Whittier Rd., Memphis, Tenn. 38108.

ASSORTED PARTS. Will swap for kits, service equipment or best offer. Steve S. Massey, 25517 Yale, Dearborn Hts., Mich. 48125.

HEATH Mariner MR-21A radio direction finder. Want 4-speed automatic turntable. John Weddle, Rt. 1 Box 87, Tonasket, Wash. 98855.

TV CAMERA. Want laser parts, service gear or best offer. Thomas Mayfield, Box 446, Yarnell, Ariz. 85362.

TRANSFORMERS—9 kv. Want CB transceiver or FM receiver. Kevin Hartley, 19256 Coventry, Riverview, Mich. 48192.

El at Large

A Real Do-It-Yourselfer!

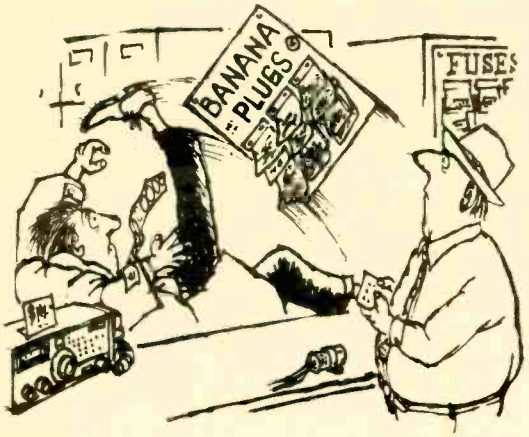
JAKE Knight was introduced to me as the fellow who had made the recordings we were listening to—recordings of the local church choir. I was surprised to find that he was still in his teens. His work wasn't exactly Phase 4—not even stereo—but, all things considered, it was good.

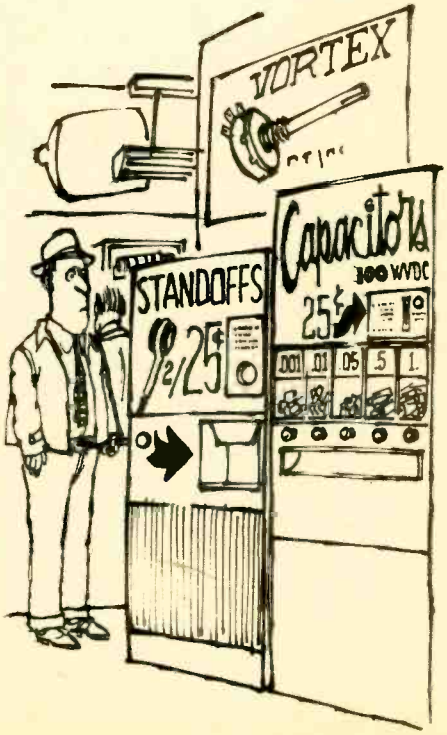
My surprise increased when he described his disc lathe, at Jake's left in our photo. He made it himself, building up an 80-lb., 27½-in. turntable out of slabs of ¾-in. chipboard. He salvaged a four-pole induction motor from an abandoned washing machine to drive the turntable, making his own rim-drive belt out of bicycle innertube. The worm gear that carries his cutter head (a Presto) across the record is powered by another salvaged motor, hooked to a variable pitch control setup that gives him 201 lines per in.—or less, depending on program levels. Likewise, a commercial pickup cartridge is attached to the home-brew arm just visible at the right side of the turntable. Originally he had planned to keep the acetate disc firmly in place with a vacuum hold-down system using a hole down the center of the spindle for evacuation. But, as the system raised noise levels several db, he scrapped it.

The ultimate surprise came when I found he was building his own condenser mike—including the capsule! The case is a length of pipe (for plenty of shielding) and the circuit, derived from a magazine article, is powered by flashlight cells. The condenser capsule itself (whose metallic membrane vibrates with sound and changes capacitance accordingly) was the big problem. He had decided to try coating Mylar with minute aluminum particles in a vacuum chamber. *That's* doing it yourself!—*Bob Long*

Over and Out

rodrigues





How To Make Money

Continued from page 69

a straight amplifier that's generally well-made.

One beginning part-timer developed a profitable sideline as a Daddy's Helper. A CBer and audiophile without much technical knowledge beyond connecting hi-fi gear and installing antennas, he charges a modest fee to help do-it-yourself handymen select and install hi-fi equipment. And he uses his CB test set to help CBers hook up and tune antenna systems (really charging for rental of his test set).

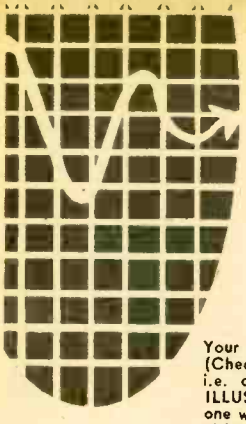
How much should you charge? Many part-timers feel that since they have no overhead they should undercut the established service shops. Others feel that a buck is a buck and whatever they can get is worth the effort. Both ideas are nonsense. Forget the established shop—he has his problems and you have yours. Since you are doing overtime work—moonlighting for yourself, so to speak—you should be getting between 1 and 1½ times what you would at your regular salary figured on an hourly basis. Also, you must allow for upgrading both the quality and versatility of your repair facilities. Too many pro shops are hacks at hi-fi servicing because they won't spend $500 for a lab-grade FM signal generator, for example. Established shops can get away with being hacks; the part-timer can't. And you must allow for hidden costs like the time spent driving to and from the job, wear and tear on the car, electricity and so on. All these are hidden in your basic cost of doing business.

Is there a need in your community for part-time service? Most likely, yes. Since we simply don't have enough service technicians there is plenty of room for a good part-timer who is willing to keep up with the state-of-the-art.

Hi-Fi Today

Continued from page 50

My strong feeling is that it's time we admitted that our economy is rich enough and diverse enough that no single system need to be shoved down anyone's throat as the one and only. There's a place for the cassette, the open reel tape, the Playtape, the 45 record and the LP disc. Detroit doesn't try to limit its production to hard-tops only.



Classified Ads

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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 March issue must be in our office by November 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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PLANS FOR 100 interesting electronic projects. Simple ways to test and identify 3000 transistors. Many construction hints. For beginner or advanced hobbyist. All in "How to Use Bargain Transistors." Profusely illustrated, only $2.95. Capstone Electronics Corp., Dept. E118, 9 Danbury Rd., Wilton, Conn. 06897.

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MUSIC LOVERS, continuous, uninterrupted background music from your FM radio, using new inexpensive adaptor. Free literature. Electronics, 11500-W N.W. 7th Ave., Miami, Florida 33168.

TREASURE HUNTERS! Prospectors! Relco's new instruments detect buried gold, silver, coins. Kits, assembled models. Transistorized. Weighs 3 pounds. $19.95 up. Free catalog. Relco-A19, Box 10839, Houston, Texas 77018.

POLICE-FIRE RADIO Station Directories. Frequencies, callsigns! Catalog, send stamp. Communications, Box 56-E, Commack, N. Y. 11725.

LAW ENFORCEMENT agents and legal investigators only. Free literature, latest electronic aids. Request must be on your official letterhead. R. Clifton, 11500-X NW 7th Ave., Miami, Florida 33168.

CONVERT ANY television to sensitive, big-screen oscilloscope. Only minor changes required. No electronic experience necessary. Illustrated plans, $2.00. Relco A-19, Box 10563, Houston, Texas 77018.

MAGNETS. ALL Types. Specials—20 disc magnets, or 2 stick magnets, or 10 small bar magnets, or 8 assorted magnets, $1.00. Maryland Magnet Company, 5412-F Gist, Baltimore, Maryland 21215.

HOBBYIST'S: SET Of 3 Precision Miniature Tools, Scriber-Triangular Scraper-Bent Prober. $2.85 Postpaid Minitool. 15076 Dickens Ave., San Jose, Calif. 95124.

INTEGRATED CIRCUIT Kits; Computer Circuit Kits; Others. New catalog free. Kaye Engineering, Box 3932-C, Long Beach, California 90803.

FREE CATALOG of unusual electronic items for the experimenter. Franks Scientific Co., P.O. Box 156, Martelle, Iowa 52305.

GOOD USED Books—List 10¢. Lakeland Book Center, Thornville, Ohio 43076.

INVESTIGATORS. FREE brochure latest electronic equipment. Witness Electronics, 228-12 141 Ave., Laurelton, N. Y. 11413.

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JEEPS TYPICALLY From $53.90 . . . Trucks From $78.40 . . . Airplanes, Typewriters, Boats, Clothing, Camping, Sporting, Photographic, Electronics Equipment, Used. 100,000 Bid Bargains Direct From Government Nationwide. Complete Sales Directory and Surplus Catalog $1.00 (Deductible First $10.00 Order). Surplus Service, Box 820-T, Holland, Michigan 49423.

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INVENTORS! WE will develop, sell your idea or invention, patented or unpatented. Our national manufacturer-clients are urgently seeking new items for highest outright cash sale or royalties. Financial assistance available. 10 years proven performance. For Free information write Dept. 59, Wall Street Invention Brokerage, 79 Wall Street, New York 5, N. Y.

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• • • MUSIC

POEMS, SONGS wanted for new song hits and recordings by America's most popular studio. Tin Pan Alley, 1650-EL Broadway, New York 10019.

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FUND RAISING Booklet tells how to organize P.T.A., church, scout, children's groups, carnivals, bazaars plus how to obtain toys, gifts, prizes all at wholesale prices. Send $2.00 to Jasbarr Co., 6928-C, Newcastle Ave., Reseda, Calif. 91335.

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Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the low price you pay. The Signal Tracer alone is worth more than the price of the kit.

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You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment.

Many thousands of individuals of all ages and backgrounds have successfully used the "Edu-Kit" in more than 70 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice troubleshooting—all in a closely integrated program designed to provide an easily-learned, thorough and interesting background in radio.

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You will receive all parts and instructions necessary to build twenty different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, hardware, tubing, punched metal chassis, Instruction Manuals, hook-up wire, solder, selenium rectifiers, coils, volume controls and switches, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C. Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

Progressive "Edu-Kits" Inc., 1186 Broadway, Dept. 598AE, Hewlett, N. Y. 11557

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Please rush my Progressive Radio "Edu-Kit" to me, as indicated below:

Check one box to indicate choice of model

- ☐ **Regular model $26.95.**
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Check one box to indicate manner of payment

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- ☐ **Ship "Edu-Kit" C.O.D. I will pay postage.**
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- MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • F.C.C. AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

SERVICING LESSONS

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

FROM OUR MAIL BAG

J. Statsitis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend $240 for a Course, but I found your ad and sent for your Kit."

Ben Valerio, P. O. Box 21, Magna, Utah: "The Edu-Kits are wonderful. Here I am sending you the questions and also the answers for them. I have been in Radio for the last seven years, but like to work with Radio Kits, and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

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

PRINTED CIRCUITRY

At no increase in price, the "Edu-Kit" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many Radio and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.

CIRCLE NUMBER 10 ON PAGE 13

Electronics is opportunity, action and NTS!

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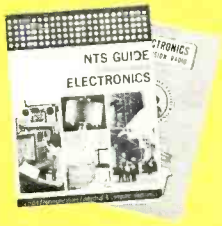

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