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ELECTRONICS ILLUSTRATED

By the Publishers of MECHANIX ILLUSTRATED

SEPTEMBER 1967 • 50¢

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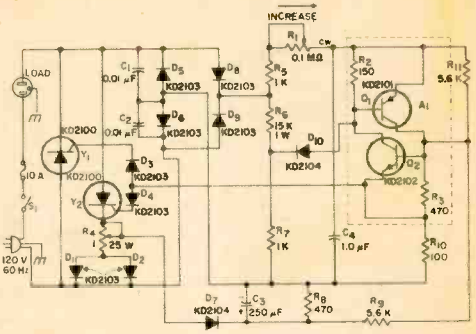

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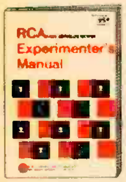

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SEPTEMBER, 1967 A Fawcett Publication Vol. 10, No. 5

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ELECTRONICS ILLUSTRATED is published bi-monthly by Fawcett Publications, Inc., Fawcett Bldg., Greenwich, Conn. 06830. Second-class postage paid at Greenwich, Conn., and at additional mailing offices.

EDITORIAL OFFICES: 67 W. 44th St., New York, N.Y. 10036 (phone 212-661-4000). Contributions must be accompanied by sufficient postage and will be handled with care, though the publishers assume no responsibility for return thereof.

ADVERTISING OFFICES: 67 W. 44th St., New York, N.Y. 10036 (phone 212-661-4000); 101 E. Ontario St., Chicago, Ill. 60611 (phone 312-DE 7-4680); 1532 Guardian Bldg., Detroit, Mich. 48226 (phone 313-WO 2-4860); 2978 Wilshire Blvd., Los Angeles, Calif. 90005 (phone 213-DU 7-8258); 681 Market St., San Francisco, Calif. 94105 (phone 415-EX 7-3441); 1430 W. Peachtree St., N.W., Atlanta, Ga. 30309 (phone 404-TR 5-0373); James B. Boynton, 370 Tesquesta Dr., Jupiter, Fla. 33458 (phone 305-746-4847); 123 S. Broad St., Philadelphia, Pa. 19109 (phone 215-PE 5-3636).

SUBSCRIPTIONS: $3 per year (6 issues) in U.S. and possessions and Canada. All other countries $4 for 6 issues. All subscription correspondence, including changes of address (Form 3579), should be addressed to ELECTRONICS ILLUSTRATED, Subscription Dept., Fawcett Bldg., Greenwich, Conn. 06830. Foreign subscriptions and sales should be remitted by International Money Order in U.S. funds payable at Greenwich, Conn.

PRINTED IN U.S.A. BY FAWCETT-HAYNES PRINTING CORP., LOUISVILLE, KY. 40201. Microfilm copies of current and back issues are available from University Microfilms, 313 N. First St., Ann Arbor, Mich. 48103.

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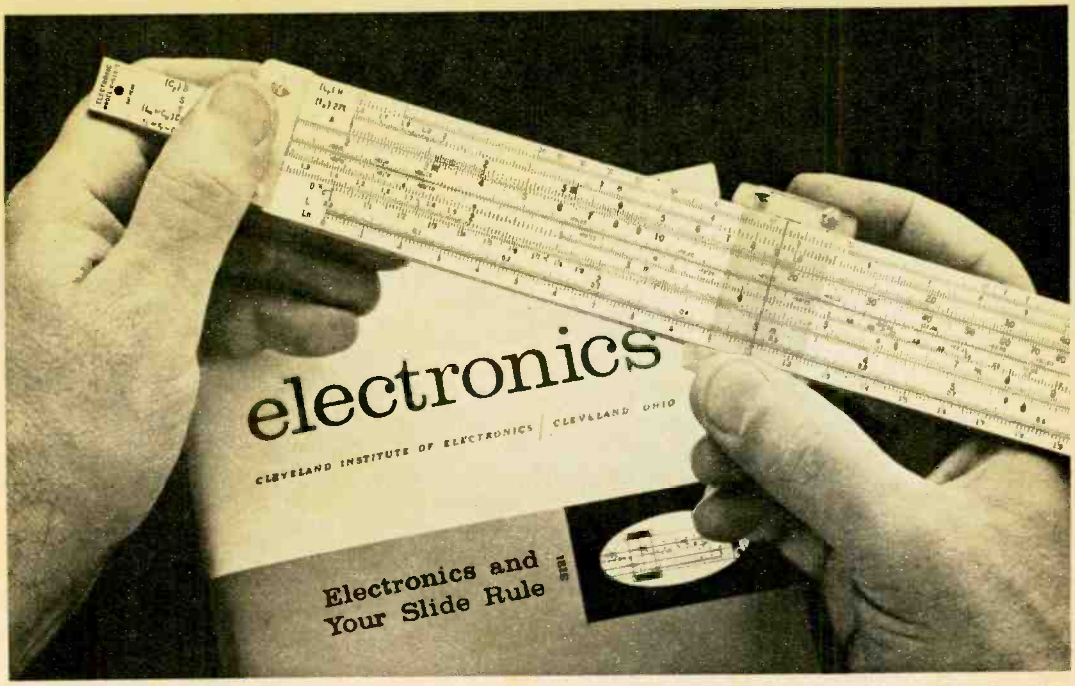

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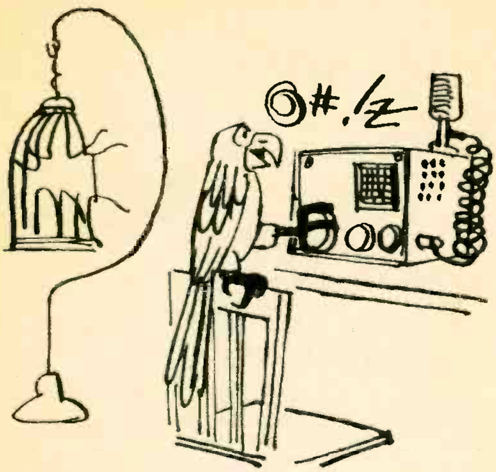
• CHOICE OF WORDS



I've received a violation notice from the FCC claiming that I use improper language on my CB rig. What makes them think it was me? I never say anything I wouldn't want my teen-age daughter to hear.

Mrs. D.G.
Bronx, N.Y.

Forget teen-agers, Mom. How about you?

• RADAR-ROBBER

How about an article on a short-range radar-jamming device using ultrasonic sound (which the FCC cannot control) aimed at defeating police radar traps? Speakers operating at the traffic-control radar frequencies should make police recorders go clear off the graph. It is common knowledge that shrill sounds upset radar accuracy. Horns will cause blips—likewise, even the jingle of keys within a certain range. So directional ultrasonics should wipe it out completely.

I seriously believe the American public is entitled to fight fire with fire and should be licensed by the FCC to operate radar-jamming devices from cars—but, lacking FCC authority, should do so with any means available. I've never had a speeding ticket—so this is not sour grapes.

H. Eugene Norbit
Troy, N.Y.

How about green apples?

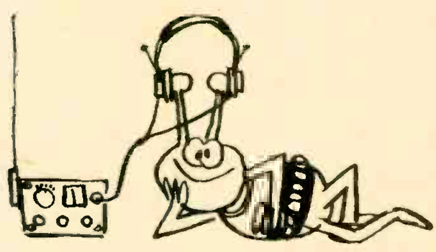
• THUMBS DOWN

Is Alan Levesque [The Truth about CB Clubs, May '67 EI] a sorehead dropout from a poorly organized CB club? Probably he couldn't run the club as his narrow mind wanted it to be so he has a biased opinion of all CBers.

W.L. Darou
Dapauville, N.Y.

You missed the point, W.L. We all know what CB clubs are supposed to be and the article pays tribute to REACT and the many clubs that do what they say they have set out to do. The same author has more to say on the subject of the good guys in Setting up Your CB Club for Emergencies in this issue. But the truth is that not all CB clubs are what they're supposed to be.

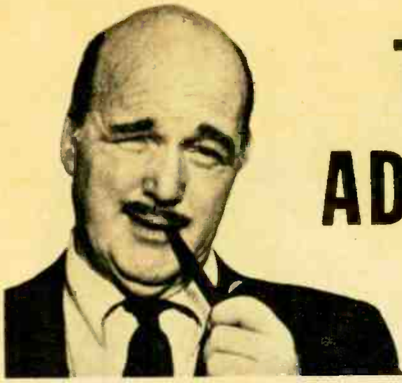
• LOOKING UP



I'd love to DX outer space but how could they ever get a QSL card back to me?

W.H.A.
Electron, Wash.

Fallout. ◆



TOM McCAHILL ADVISES SATURDAY MECHANICS

If you're a Saturday mechanic, my guess is you can fix the screen door, build lawn furniture, overhaul the kid's bike, and rotate your own tires.

It's a different story when that fancy electric coffeemaker stops perking or the push-button automatic washer quits halfway through a cycle. You might spend an afternoon admiring the coffeemaker's innards before giving it a permanent vacation on the top kitchen shelf.

As for the automatic washer, after the Little Lady shouts "Do something!" you'll end up phoning an Appliance Serviceman across town. He shows up in 3 days and has the washer going in one-fourth the time it took you to study the coffeemaker. He also presents you with a ticket for 30 bucks. When you consider he could make twice that selling you a new machine, you got off easy.

Maybe you never realized it, friend, but you have more Appliances around your hacienda today than you did five years ago. If you count power tools, your wife's hair dryer, an air conditioner, plus the standard stuff like vacuum cleaner, toaster, refrigerator, freezer and so forth, you probably have well over a dozen.

These electrical gadgets nowadays represent a pretty good chunk of your hard earned dollars. Did you ever stop to think it could pay you in savings and convenience to know how to fix these things? Also, it could be a great source of extra income if you're inclined to tackle the few thousand broken Appliances right in your own neighborhood.

The Appliance Repair business is easier to learn than you imagine. The National Radio Institute's Appliance Division has a downright interesting, low cost course you can take in your spare time. It covers every type of Appliance you can think of plus air conditioning, refrigeration, house wiring, electric motors — even small gas engines. There's a worthwhile section on farm and commercial appliances too.

NRI starts you with the basic principles of electricity to give you a solid background. Using clear-cut picture diagrams, they show you how various types of Appliances work, separating each into groups. Included with the course is a topnotch, professional Appliance Tester for fast troubleshooting.

Easy to read, bite-size lessons are loaded with photos and cutaway drawings so you see how each Appliance comes apart, and more important — goes back together in working order.

Whether or not you agree that knowing Appliance Repair could help you, I recommend you see for yourself. The coupon below will get you a free book that fully describes this unique home training. No salesman is going to call.

Do yourself a favor and mail the coupon today.

TOM McCAHILL

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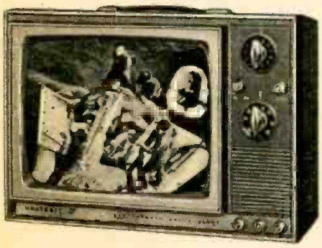

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NEW Heathkit 150-Watt Solid-State AM/FM Stereo Receiver

Kit AR-15 $329^{95} (less cab.)

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Kit GD-107 $49^{95}

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Kit HW-16 $99^{50}

Who Said Getting Started In Amateur Radio Is Expensive? Check this new low cost Heathkit CW transceiver. Covers 80, 40 and 15 meter CW bands only. Features full break-in operation, provision for using HG-10B VFO; 50 to 90 watt adjustable power input; grid block keying; highly stable crystal controlled heterodyne receiver with RF stage; crystal lattice filter for 500 Hz selectivity; outputs for speaker or headphones; handsome gray-green cabinet. 23 lbs.

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UNCLE TOM'S CORNER

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

By TOM KNEITEL, K2AES/KBG4303

★ *A few years back there was all kinds of drum pounding for something called a microwave stove that cooked food by radio waves. Nothing much has been heard of this during the past ten years so what was all of the shouting about?*

Bert Conrad
Kenosha, Wis.

Such a unit shortly will be test marketed in the $450 price range. What nobody is talking about is the fact that certain foods don't change color when cooked by microwave. Imagine wrapping your molars around a bright-red well-cooked steak. We hear that this drawback will limit the microwave feature to use as an optional extra on regular electric ovens.

★ *I'm going to a military school where I can't put up an outside antenna so I'm limited to something that can't be seen. What about the old spy trick of a bedspring antenna?*

Ed Napoleon, KQAØ612
East Norwalk, Conn.

It's cot to be better than nothing.

★ *Will this work or won't it? For those extra speakers (hi-fi, guitar, etc.) why not eliminate unsightly wires by painting conductors on the wall with a metallic paint and then retouching over them with wall paint? Molly screws could be the terminals.*

Gary Nelson
Swift Current, Sask.

If you try this trick make sure that the first thing you play is the 1812 Overture. Possibly you can synchronize the cannons in the music with the explosion of your output transformer.

★ *Among the first stations I picked up on my new receiver was a powerhouse with the call-sign YMN3 (on 16455 kc). The call-sign seems to be from Turkey. However, the signal strength was withering. I can't find it listed anywhere. Can you track it down?*

Herb Columbo
Baltimore, Md.

Oops! You've stumbled on the station operated by the Turkish embassy in Washington, D.C. They use it to send confidential messages to Ankara and wouldn't appreciate sharing them with you. Other Washington embassies you shouldn't listen to are Poland (station KNY20 on 14649, 15804 and 19458 kc) and Czechoslovakia (station KNY23 on the same frequencies).

Confidential to the FCC. Havertown, Pa., has the unique distinction of having at least five bootleg broadcasting stations, each running about 15 watts. Some of the stations have even had promo announcements custom made for them by a governmental agency (by writing on fake letterheads and simply asking). This is going on right under the noses of your Philadelphia office and only 100 miles from your Laurel, Md., monitoring station. Wha hoppen, baby?

★ *Here's a puzzler. I'm a tapespondent and have many overseas friends. I sometimes get complaints that my outgoing tapes are received blank. I have also received several reels of blank tape. The packages haven't been opened. What's wrong?*

Mike Tandler
Little Rock, Ark.

[*Continued on page* 12]

UNCLE TOM'S CORNER

Continued from page 10

Postal inspection is sometimes carried out by X-ray so that packages don't have to be opened. Since the process can wipe the tape you could try wrapping it in metal foil or marking the package "THIS IS A TAPE RECORDING—DO NOT X-RAY." Or both.

★ *Last July you made the remark that people who see, talk to, hear, smell, or sense flying saucers are only a few steps from the funny farm. To say this is to say that almost all of the United States is one big insane asylum.*

Wayne Ruple
Int'l Aerial Research Phen. Org.
Steele, Ala.

Interesting point.

Flying Saucer Dept. One of the major topics mentioned in letters to this column is flying saucers. Why so many people are concerned with whether or not I believe in them is beyond me; let's just say that I have yet to see the slightest conclusive proof that these pies in the sky are from outer space.

Frankly there are so many weirdo things going on right here on terra firma that I'm shocked that they are pushed into the background because of flying saucers. For instance, did you know that every month at least one cargo vessel mysteriously vanishes at sea, crew and all? Each year some 600 crewmen disappear!

The Coast Guard is baffled and doesn't seem too eager to publicize these facts. Only last December the steamer Castillo Mountjuick, with 37 souls aboard, pulled a disappearing act immediately after radioing that she was safe and only 400 miles from land. No distress call was ever heard; no flare was seen; no wreckage or debris was found. The ship just vanished.

There's a story somewhere in these vanishing ships and I'm sure that it beats hands down the imaginary men from Saturn.

★ *You recently said that Teflon does not give off a poison gas when heated. Nothing could be further from the truth. If Teflon is*

[*Continued on page* 14]

heated above 500° F. it gives off a flourine gas which is very toxic and caustic.

Michael Nowack
Grinnell, Iowa

At 1000° F. Teflon starts to burn and give off a gas that becomes poisonous when it comes in contact with the moisture in the air.

J. R. Steuernagle
Brockway, Pa.

Looks like it's safer to work with Teflon in Pa. than in Iowa.

★ *The only reason I can tolerate you and your column is that now and then you seem to be able to offer some juicy tidbits from the back hallways of the cloak and dagger boys. What's new, pussycat?*

Bennett Hartment
Olympia, Wash.

CIA people are shook up over reports that Red China now has a small fleet of subs (23,000-mile range) that can fire three Polaris-type missiles submerged. With nuclear warheads on the missiles these subs could cause a number of unpleasantries.

NASA is quite concerned about the Russians' Cosmos 146 satellite, a 23-ton job that was launched in four separate sections and assembled in orbit. NASA never made this information public because they didn't want Russia to know we took photos of the joining operation. Shortly before the Russian launch a book co-authored by Rear Admiral Chester Ward, USN (Ret.), claimed that the Russians are planning to attack the U.S. with gigantic H-bombs launched from an orbiting space platform. By the way, the general feeling is that Russia will be the first to drop a man on the moon.

The British Foreign Office is considering the launching of a private communications satellite that would permit the use of supercodes that cannot be broken. Unfortunately, it will be very easy to jam the signals. British Intelligence is buzzing with news that missing British frogman Commander Lionel Crabb (who vanished while underwater in Portsmouth Harbor in 1956) may be training frogmen in East Germany.

CIA people are bracing themselves for the next Senate investigation which may delve into the very sensitive area of U.S. and foreign clergymen being used to filter intelligence back to Washington from underdeveloped nations.

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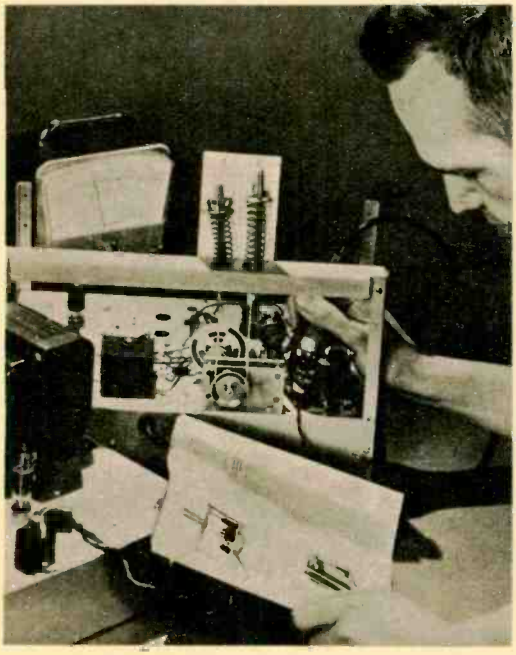

POWER PACK . . . The Knight-Kit KG-663 is a low-voltage DC power supply designed with an eye to the servicing of transistorized equipment. It delivers 0 to 40 VDC at up to 1.5 A, with output protected by a variable current-limiting control. Separate meters for voltage and current make it possible to monitor both simultaneously. An operate/standby switch allows voltage to be preset with load disconnected. Other features include fine and course voltage controls and rear-panel input for remote sensing. Ripple output of the unit is rated below 0.6 mv at maximum load. Idling power consumption is 20 watts. The circuit uses six transistors, 11 diodes. Kit $99.95; wired $149. Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680.

ELECTRONIC MARKETPLACE

Side Bander . . . The SB-401 SSB transmitter for the ham bands on 80 through 10 meters is an updated version of the SB-400. A new feature is a control switch enabling operation either as an independent transmitter or in conjunction with the SB-301 receiver (which is also updated, having improved RTTY capability and automatic noise limiting). $285 (SB-301 $260.) Heath Co., Benton Harbor, Mich. 49022.

Stand-up Speaker . . . The Cavalier 4000-M is a compact version (25 in. high, 18 in. wide) of the Grenadier, a speaker system well-known to audiophiles. Size reduction is accomplished by using a 10-in., high-compliance woofer with a 2-in. voice coil, together with a combined midrange/tweeter. Cabinet is walnut with a marble top. Empire Scientific Corp., 845 Stewart Ave., Garden City, N.Y. 11530.

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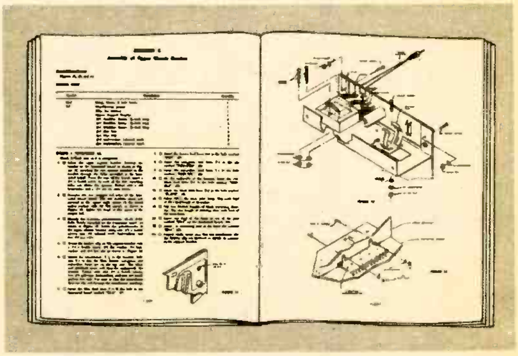

Each sub-assembly is described in a separate section with illustrations applying to that sub-assembly available at a glance. No cross referencing necessary.

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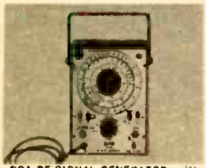
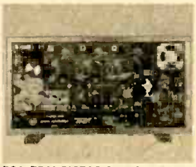


RCA RF SIGNAL GENERATOR, with sweep features. WR-50B(K). Kit price: $45.00*

RCA TV BIAS SUPPLY. For RF, IF alignment in TV sets. WG-307B(K). Kit price: $11.95*



RCA TRANSISTOR-RADIO DYNAMIC DEMONSTRATOR. For schools. WE-93A(K). Kit price: $39.95*

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MARKETPLACE

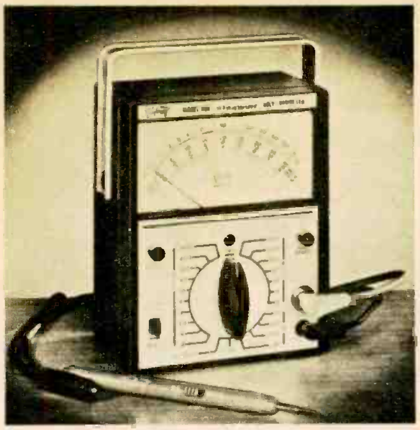
Portable . . . Every sound system that can be lugged around with the aid of some vitamin pills gets called portable. The Mark 7 really is —it weighs under five pounds. It can be slung

from a shoulder strap and carried around like a camera if you want. The dynamic microphone can be used with as much as 100 ft. of extension cable; extension speaker can be placed up to 350 ft. from the amplifier. $159.50 ($169.50 with larger amp). AudioWave, Inc., 4541 Furman Ave., Bronx, N.Y.

VHFer . . . The Patrolman is an unusual product. It looks like just another transistor pocket radio at first glance. And it does serve that func-

tion. But it also tunes VHF to bring in marine weather forecasts or monitor police, fire, CB, emergency, mobile phone and other VHF transmissions. This model tunes 147-174 mc on the VHF setting (the Jetstream, at $21.95, tunes 108-135 mc). Batteries are included. A jack for AC operation is provided and an accessory AC adapter is available. It weighs 1 lb. $24.95. (AC adapter less than $5.) Radio Shack Corp., 730 Commonwealth Ave., Boston, Mass. 02215.

Servicing . . . The Model 600 VOM features an FET amplifier circuit providing an input impedance of 11 meg. It has 11 DC ranges (up to



1600 V), eight AC ranges (up to 800 V) and six resistance ranges (up to 100 meg.). Other features include a polarity reverse switch for DC, single arc for both AC and DC readings and an aluminum handle that doubles as a stand to hold the unit at a 25° angle for easy viewing. The transistorized circuitry holds accuracy to ±3 per cent of full scale. $78. Triplett Electrical Instrument Co., Bluffton, Ohio 45817.

Gold digger . . . The week-end adventurer, says the manufacturer, is a man who will go for the Commander Model 720 metal locator. And at less than 4 lbs. it can go adventuring in locales inaccessible to some of its heavier competitors. Its all-weather construction features encapsulated operating circuits and a coiled cable sealed within the telescoping handle. The detector head can be swiveled through 180° and is mounted on handle that telescopes from 38 to 25 in.

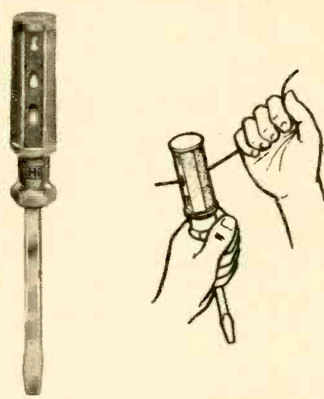
The single control acts as on/off switch and sensitivity control to compensate for salt-saturated or high mineral-content soil. The presence of metal is indicated by a meter, used in conjunction with a speaker or headset. The manufacturer states that it will spot silver dollars buried at a depth of 8 to 12 in. or large metal objects as much as 5 ft. below the surface. Even a bullet can be detected at 3 in., they say. The control compensates for highly conductive soils. $149.50. Goldak Co., Inc., 1544 W. Glenoaks Blvd., Glendale, Calif. 91202.

MARKETPLACE

Modulation . . . AM-301 is the model number of an epoxy-encapsulated preamp module for use with magnetic phono cartridges. Its two-transistor circuit matches standard cartridge im-

pedance of 47,000 ohms and delivers a gain of 36db with maximum output of 2.2 V. It operates on 9 VDC. The module has screw-type terminals and measures 3¾ x 2 x ¾ in. $3.49. Olson Electronics, Inc., 260 S. Forge St., Akron, Ohio 44308.

Stripper . . . It's a screwdriver and a wire stripper, all in one. The screwdriver handle contains three blades that will remove the insulation from solid or stranded wire, Nos. 20 through 12. Push the length of wire you want stripped into the ap-



propriate slot and pull upward and out. That's all there is to it, says the manufacturer. Available in four models (270 through 273) with 3/16- or ¼-in. blades. Hardened tool-steel blades are 4 in. long; chrome vanadium steel blades are 5 in. long. Overall lengths are 8 in. and 8½ in. $1 and $1.49. Holub Industries, Inc., 413 DeKalb Ave., Sycamore, Ill. 60178.

BROADSIDES

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

A booklet entitled What Is an **Electronic Organ** discusses, feature by feature, the functions available in a completely-equipped organ. 25¢ per copy from the Schober Organ Corp., 43 W. 61st St., New York, N.Y. 10023.

Characteristic response curves for the DM70-500, DM10-500 and CDM80 **dynamic microphones** are presented in an unusual way in the manufacturer's literature. They are compared graphically to instruments, speech, hand clapping, footsteps. By matching the curve of the microphone with the frequency chart you can get a good idea which microphone is suited to your purposes. Free charts available from Sonotone Corp., Elmsford, N.Y. 10523.

Design characteristics, selection and uses of **nickel-cadmium batteries** is the subject of booklet A-422. For a free copy write Reader Service Sect., International Nickel Co., 67 Wall St., New York, N.Y. 10005.

A complete selection of several manufacturers' **citizens band equipment**—from transceivers to crystals—is contained in catalog 1107. Free copy from Echo Communications, Inc., Cedarburg, Wis. 53012.

Training for a **career in electronics** comes in all shapes and sizes. Technology-oriented correspondence programs are detailed in catalogs from Cleveland Institute of Electronics, 1776 E. 17th St., Cleveland, Ohio 44114 and Capitol Radio Engineering Institute, 3224 16th St. N.W., Washington, D.C. 20010.

A helpful booklet called A General Review of **TVI Causes, Effects and Solutions** includes a pictorial guide as an aid to identification of interference causes. It is once more available free if you send a self-addressed 9 x 12 envelope with a 20-cent stamp to WTVIC TVI Aids, 3908 Lake Blvd., Annandale, Va. 22003.

In the constantly-changing electronics marketplace, hobbyists often have difficulty finding some types of gear. Three suppliers of **surplus equipment** that specialize in items you won't find in the window of your local radio store are: G&G Radio Supply Co., 75 Leonard St., New York, N.Y. 10013 (military and commercial surplus, catalog 25¢, refunded with first order); Herbach & Rademan, Inc., 1204 Arch St., Philadelphia, Pa. 19107 (industrial equipment, catalog free) and Barry Electronics, 512 Broadway, New York, N.Y. 10012 (tubes etc., catalog free).

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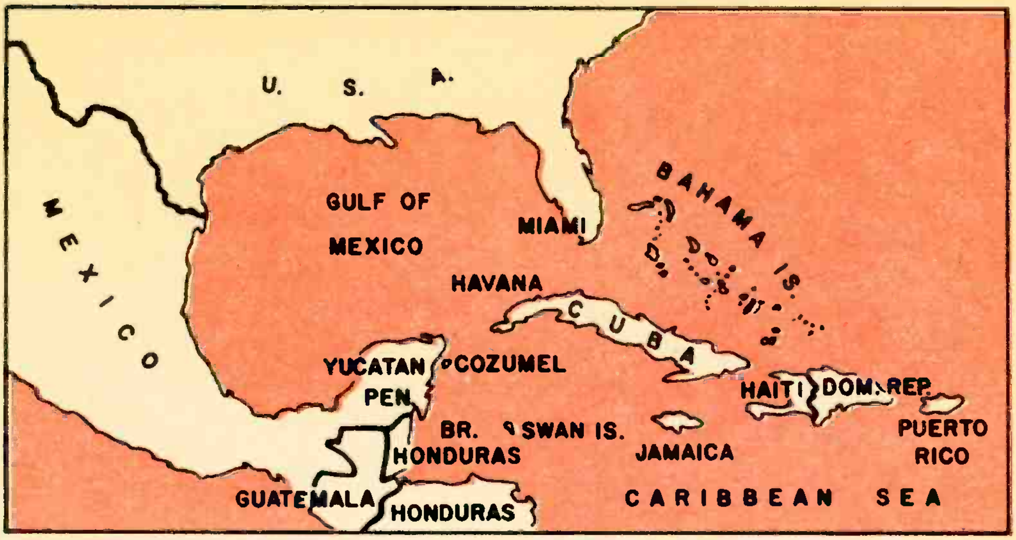


RADIO AMERICAS AND THE CIA

How our super-spy branch operates the Swan Island propaganda mill.

By TOM KNEITEL, K2AES

THE operation of the station now known as Radio Americas and formerly called Radio Swan on Swan Island in the Caribbean south and a little west of Cuba has been the subject of an immense amount of speculation in DX radio circles virtually since the transmitter went on the air. Rumor long has had it that R. Americas is run by the U.S. Government—of late, more specifically, by the Central Intelligence Agency.

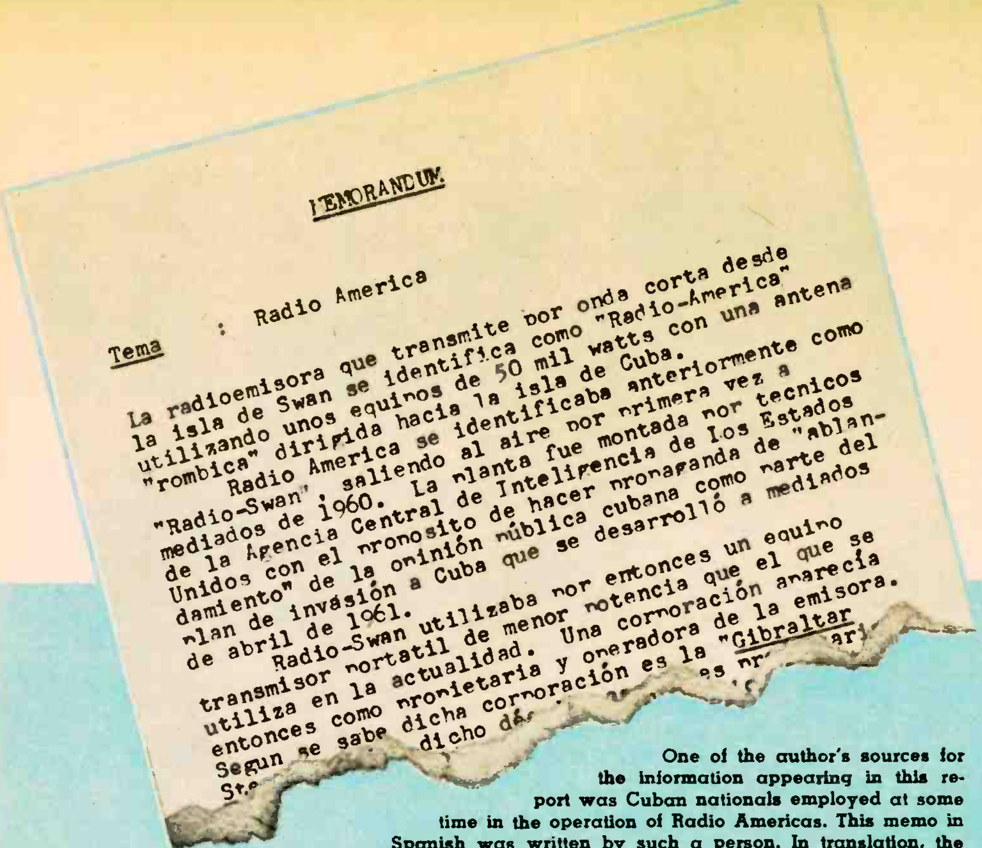
The station is operated out of offices in Miami, the winter playland of rich New Yorkers. The city, by coincidence, also is the focal point to which the largest number of refugees fled after Fidel Castro took over Cuba. At last count, Miami was temporary home to more than 120,000 Cuban nationals. Among these refugees are a sizable number of people who at some point in time were connected with the operation of R. Americas. Some of them are willing to discuss these experiences.

EI published an article on R. Swan/R. Americas last May. After that report appeared many volunteers came forward with additional details about the station. R. Americas itself has changed to some extent since that time. Short-wave transmission had been cut off and now there appears to be some evidence that medium-wave broadcasts also may be about to end, a point which we will discuss in greater length later in this article.

Miami itself has taken on something of a constant air of intrigue. Most of the Cubans there are highly sensitive politically and feelings against Castro run high. Again and again, groups or individuals busy in the hatching of plots against the Cuban dictator are arrested and their weapons, in some cases, are seized. It was in this emotionally-charged atmosphere that part of the information in this report was gathered. Some of it came from much less glamorous sources—Florida corporate tax records, for example, which are open to public scrutiny at any time.

To give our conclusion at the beginning, the station definitely is a so-called black (secret) operation of the CIA and the location *is* on Swan Island. Even the latter point has been in dispute several years.

When the station first showed up at 1160



MEMORANDUM

Tema : Radio America

La radioemisora que transmite por onda corta desde la isla de Swan se identifica como "Radio-America" utilizando unos equipos de 50 mil watts con una antena "rombica" dirigida hacia la isla de Cuba.

Radio America se identificaba anteriormente como "Radio-Swan", saliendo al aire por primera vez a mediados de 1960. La planta fue montada por tecnicos de la Agencia Central de Inteligencia de Los Estados Unidos con el proposito de hacer propaganda de "ablandamiento" de la opinión pública cubana como parte del plan de invasión a Cuba que se desarrolló a mediados de abril de 1961.

Radio-Swan utilizaba por entonces un equipo transmisor portatil de menor potencia que el que se utiliza en la actualidad. Una corporación aparecía entonces como propietaria y operadora de la emisora. Segun se sabe dicha corporación es la "Gibraltar St... dicho d...

One of the author's sources for the information appearing in this report was Cuban nationals employed at some time in the operation of Radio Americas. This memo in Spanish was written by such a person. In translation, the second paragraph says the plant (transmitter) "was constructed by technicians of the Central Intelligence Agency of the United States."

RADIO AMERICAS AND THE CIA

kc on the Broadcast Band and at 6000 kc on the 49-meter SW band in 1960 as Radio Swan it was listed as belonging to the Gibraltar Steamship Corp., a CIA front—or spook, as the CIA itself calls its front organizations—and the headquarters were in New York City. After the Bay of Pigs fiasco, Gibraltar moved to the Langford Building in Miami and changed the station name to R. Americas.

Eventually Gibraltar was succeeded by Vanguard Service Corp., which referred to itself as a firm of business consultants. Vanguard then turned over the station to another CIA front, Radio Americas, Inc., of 101 Madeira Ave., Coral Gables, Fla. Vanguard still exists as a corporation (headquartered in the law offices of Miami's Kelly, Paige, Black & Black in the Dupont Building) but seems to be inactive.

The president of RA, Inc., is Roosevelt C. Houser, a director of the First National Bank of Miami, who does business as the Florida Bond & Mortgage Co. and Houser Realty Co. Second man on the RA totem pole is Vice-President W. R. Maddux, who does business as Maddux & Co., real estate. The Secretary-Treasurer of RA is Walter S.C. Rogers, a lawyer who is president of Mr. Houser's Florida Bond & Mortgage Co.

These men seemingly play a minor role in the operation of RA. Cubans familiar with RA have little knowledge of them and define their function as being a respectable front for the station and for the channeling of CIA funds through their banking connections. Most officers of the station since its inception have had close banking or other corporate financial contacts.

The station actually is operated by two men. One, a Cuban-American named Robert J. Wilkinson, has been with the station since it first went on the air in 1960. Cuban-national sources identify him as the CIA agent in charge; his official title is listed as Program Director.

In Pre-Fidel Havana Bob Wilkinson was a well-known producer-actor for the CMQ

PERSONNEL DIRECTORY

Listed here are the companies concerned with the operation of R. Americas and predecessor R. Swan, along with the officers of these companies and, in some cases, their other business connections.

Gibraltar Steamship Corp. (1960; inactive)
Pres.: Thomas D. Cabot, Weston, Mass.
Director, 1st Natl. Bank, Boston
VP: Sumner Smith, Lincoln, Mass.
Owner of Swan Island(s)
Stockholder: Walter G. Lohr, Baltimore, Md.
Commercial Mgr.: Horton H. Heath, New York, N.Y.
Program Dir.: R. J. Wilkinson, Miami, Fla.
Operations Mgr.: Roger C. Butts, Miami, Fla.

Vanguard Service Corp. (1962-Present; inactive)
Pres. & Treas.: Leon D. Black, Miami Shores, Fla.
VP: Robert R. Bellamy, Miami, Fla.
Investment broker
Secy.: Frank J. Kelly, Coral Gables, Fla.

Radio Americas, Inc. (Present)
Pres.: Roosevelt C. Houser, Coral Gables, Fla.
Director, 1st Natl. Bank, Miami, Fla.
VP: W. R. Maddux, Miami, Fla.
Maddux & Co., real estate
Secy.-Treas.: Walter S. C. Rogers, Coral Gables, Fla.
Pres., Florida Bond & Mortgage Co.
Program Dir.: R. J. Wilkinson, Miami, Fla.

Former Vanguard Officers
Pres.: William H. West, Jr., Millwood, Va.
VP, Farmers & Merchants Natl. Bank, Winchester, Va.
VP: James E. Hollingsworth, Palm Beach, Fla.
Director, 1st Natl. Bank, Palm Beach, Fla.
VP & Genl. Mgr.: Mr. Butts, then of Hollywood, Fla.
Former employee, W. R. Maddux
Secy.: Richard S. Greenlee, New York, N.Y.
Attorney
Commercial Manager: Mr. Heath
Program Dir.: Mr. Wilkinson
Office Mgr.: Frederick Fazakerly, Miami, Fla.
George Wass, address unknown

radio network. Wilkinson lives in Miami at 11800 S.W. 83rd Ct. (his phone is unlisted).

RA Program Coordinator is Orlando Alvarez, owner of important radio stations CMCH and COBH, popularly known as R. Cadena Habana, prior to Castro's takeover of all stations.

These two men head a staff of more than 30 persons in Miami—artists, newsmen and technicians. They also control the four Cuban newscasters and one American radio operator stationed on Swan Island.

RA programs are both live and on tape. the live broadcasts consisting of newscasts that are transmitted each half-hour by the staff on Swan Island. News material is derived from AP and UPI via short-wave radio.

The taped programs are partly original, consisting of soap operas, dramatic shows, comedy—all done with a not-too-subtle anti-Castro slant. They are recorded at a small studio in Miami Beach or at the Continental Sound Recording Studios, 2020 N.W. 7th St., Miami. Continental is operated by Aldo Vazquez, who supervises all of the recording work. Continental's second in command is Orlando Alvarez, Wilkinson's assistant at RA. In fact, RA by now may have bought out Continental. The recordings are directed by Angel Fernandez Varela, ex-director of the Havana newspaper Informacion. Many of the commentary programs are narrated by Cuban counter-revolutionary Luis Conte Aguero.

The remainder of the taped shows are recorded off the air from broadcasts of short-wave station WNYW, operated by R. New York Worldwide. This station, while it was still called WRUL, was identified as another CIA spook. The voices of Havana Rose and Luis Conte Aguero were picked up for re-broadcast by R. Swan and R. Americas from WRUL's transmitters at Scituate, Mass., now used by WNYW. When these transmitters were destroyed by fire last April (they were back on the air in eight days with rented equipment) we couldn't help wondering about the cause. But a station spokesman would say only that the cause of the fire was still under investigation.

The completed tapes are flown to Swan twice weekly in RA's own single-engine Piper Comanche, stopping for fuel in Cozumel, Mexico. The plane also flies the personnel back and forth to the island for rotation every few months.

On Swan, the transmitter (now 50 kw, replacing the original low-power portable unit) and other facilities are located in two trailers which recently were mounted on permanent cement piles. Electronic equipment used by the station is described as the best and is maintained meticulously.

The American radio operators on Swan don't have much spare time but are free to take a busman's holiday by using the RA ham station, FCC-licensed under the call-sign KS4CC. Most operators are hams and make good use of the station. Recent operators have included W4LVF, WØYKD, W6PEU and KH6BCB.

One interesting aspect of RA is that the operation costs some $30,000 per month to keep going. Bob Wilkinson is said to be pulling down a salary of about $14,000 per year and his assistant, Orlando Alvarez, supposedly earns $10,000. The people stationed on Swan also make good salaries.

Cost, of course, isn't something to haggle about when you've got an effective propa-

[*Continued on page* 116]

KIT EI REPORT

Eico 711

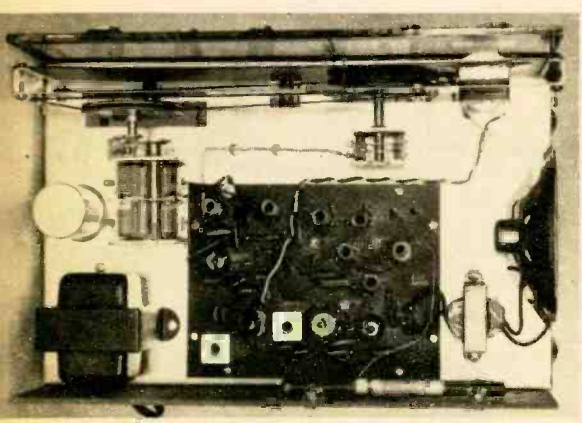
Budget All-Band Receiver

KNOWN as an all-American five short-wave receiver—because its circuit is fundamentally the same as an AC/DC radio's—the $49.95 ($69.95, assembled) Eico 711 is a good beginner's receiver for two reasons. First, it's a low-cost way to short-wave listening. Second, construction has been simplified by mounting most components on a printed-circuit board.

Like other budget receivers, the 711 tunes from 550 kc to 30 mc in four bands. It features a transformer power supply, S-meter, bandspread (uncalibrated), BFO, noise limiter, built-in speaker and headphone jack. The four-tube (plus solid-state rectifier) circuit consists of a convertor/oscillator, IF amplifier, detector/noise limiter/AF amplifier and AF power output.

Virtually all components—and all the critical ones—mount on a printed-circuit board which has an anti-run coating to prevent solder from flowing beyond the connection.

The 711 is not exactly an easy project for someone who has not built a kit before.



A lot of work is saved by mounting most of the parts on circuit board. Speaker (right) was temporarily mounted on chassis during alignment.

The average kit builder, however, will have enough experience and spare hardware around to make up the deficiences we encountered and to work his way around minor assembly-manual inadequacies. For example, Eico never gets around to telling you how to mount the controls' escutcheon plate. What looked like an adhesive backing wouldn't peel off so we simply let the controls' hex nuts hold the plate in place. More serious shortcomings, though, were in the diagrams. For example: the written instructions don't say how to orient tube V2's socket. We installed it the way shown but were wrong.

The chassis has a cutout for what appeared to be the speaker and for which the specified wire lengths would have been adequate. But the manual said it should be mounted on the case. Result: Removing the case without installing longer speaker leads was extremely awkward. The problems, though numerous were really minor. We had the 711 together in about 20 hours.

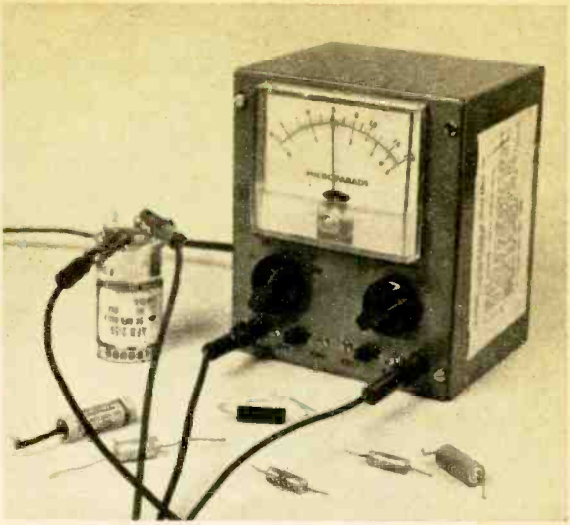
The coils are not pre-aligned and you must use a signal generator for alignment. The alignment instructions with our kit were not adequate for a beginner. We understand Eico is now supplying better instructions.

Performance of the 711 is comparable to that of similar receivers. From 1.5 to 30 mc the sensitivity for a 10db S+N/N (signal-plus-noise to noise) ratio is between 10 and 18 μv, depending on the frequency. Usable sensitivity below 10 mc for CW for a 100 mw audio output is from 8 to 10 μv. Typical of beginner's receivers, the sensitivity drops sharply above 10 mc.

Oscillator stability was relatively good, probably because the plate voltage is maintained on the convertor/oscillator tube in the standby mode.

The 711 is smartly styled; you wouldn't hesitate to leave it in your living room.

Micro Capacitor Checker



By A. A. MANGIERI

BET you three manhole covers that the capacitance of most electrolytics in your storage box is miles from what it should be. The markings on the cases, especially if the capacitors are old, only get you in the ball park. To know what the exact capacitance is you must measure it—and the cheap, easy and accurate way is with our Micro Capacitor Checker.

The Checker's five overlapping ranges of 5, 20, 50, 200 and 500 μf enable you to measure almost all popular electrolytics. A 3-V test voltage makes possible safe checking of low-voltage electrolytics. Only one calibration is required to make a meter scale for all ranges. Separate calibration controls for each range provide accuracy of better than 5 per cent.

Construction

Wiring is not critical. You may use any parts arrangement you want or you can follow our layout as shown in Figs. 1, 2 and 4. We built our model in 6 x 5 x 4-in. cabinet. An L-shape bracket (5 x 3½ in. with a 1½-in. lip) of 1/16-in. aluminum supports T1 and also serves as a heat sink for diode SR1. The chassis is held to the front panel by potentiometer R15 and range switch S1. Be sure to mount SR1 using the kit of insulating mica washers supplied with it.

The wipers of pots R1 through R5 are connected to the case. These pots get mounted on an upright aluminum plate which must be *insulated* from the chassis with a cardboard strip and fiber washers. We show how this is done in Fig. 2. To be on the safe side you could mount the pots on a piece of perforated board or bakelite.

A 3½ x 1¾ in. piece of circuit board, held by the meter terminals, supports R16, R13, R14, C1, and instrument rectifier D1-D4. Do not clip the wire leads coming out of D1-D4. The yellow leads are the AC input. The red lead is DC plus output and the black lead is DC minus.

Calibration

Calibration includes a meter scale and adjusting the calibration pots (R1-R5) for each range. If great accuracy is not required, cut out and cement the scale shown in Fig. 5 on the front side of the existing meter scale.

To remove the meter face, place the meter face down on a sheet of clean paper. Insert three metal wedges, 1/16 in. thick and ¼ in. wide into the slots behind the face snaps to spread the sides lightly. Gently remove the face. With meter face up and level, carefully remove the two very small screws holding the meter scale. Paste our scale on the reverse side, put back the scale and replace the meter face.

Greater accuracy over the entire scale is possible if you prepare a scale for the particular meter and rectifier you use. This requires only a single calibration on the 20 μf range using known-value capacitors.

Using another accurate capacitance meter, measure and label several capacitors includ-

Micro Capacitor Checker

ing values of .5 μf, 1 μf, 2 μf, four 5 μf, and 8 μf. Oil/paper types are best for these small sizes. For later use, measure an electrolytic whose value is between 400 and 500 μf and another between 150 and 200 μf and one between 40 and 50 μf.

Connect a parallel combination totalling 20 μf. (You add the value of parallel-connected capacitors.) Set *CAP.-ADJ.* pot (R15) to maximum resistance (counterclockwise). Set S1 to 20 μf, S2 to *CAL.* and close S3. Advance R15 until M1 indicates 50 microamperes—full scale. Set S2 to *TEST*. Connect the 20 μf capacitor to BP1 and BP2. Adjust R4 until M1 indicates full scale. Connect other capacitors to BP1 and BP2 and record capacitance versus current. Plot this on a large sheet of graph paper and draw a smooth curve through the points.

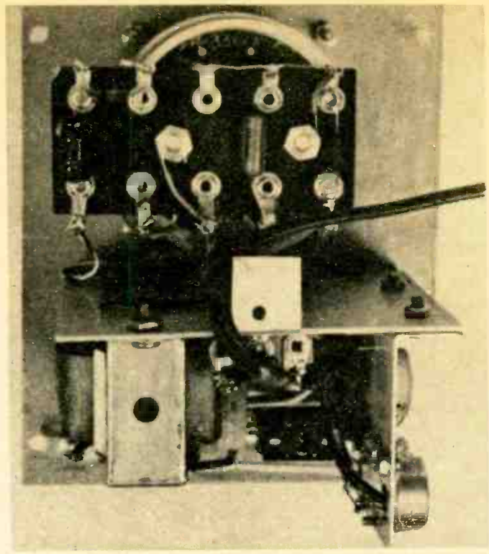


Fig. 1—Rear view of checker. Note how parts board is mounted on meter terminals. Chassis holds transformer (left), potentiometer plate (right).

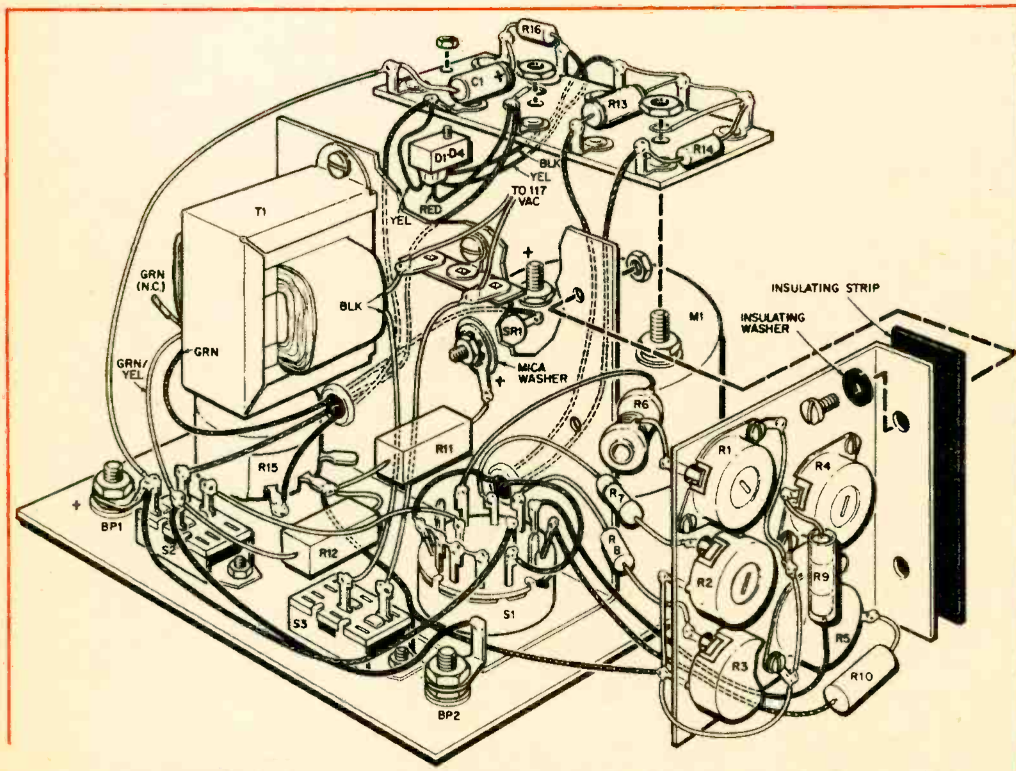


Fig. 2—To build Checker in 6 x 5 x 4-in. box, we suggest this layout. The main chassis, which is held to front panel by R15 and S1, is made from 4 x 5-in. piece of aluminum. Potentiometer bracket, lower right (which must be insulated from chassis), is made from 2½ x 2¾-in. piece of aluminum.

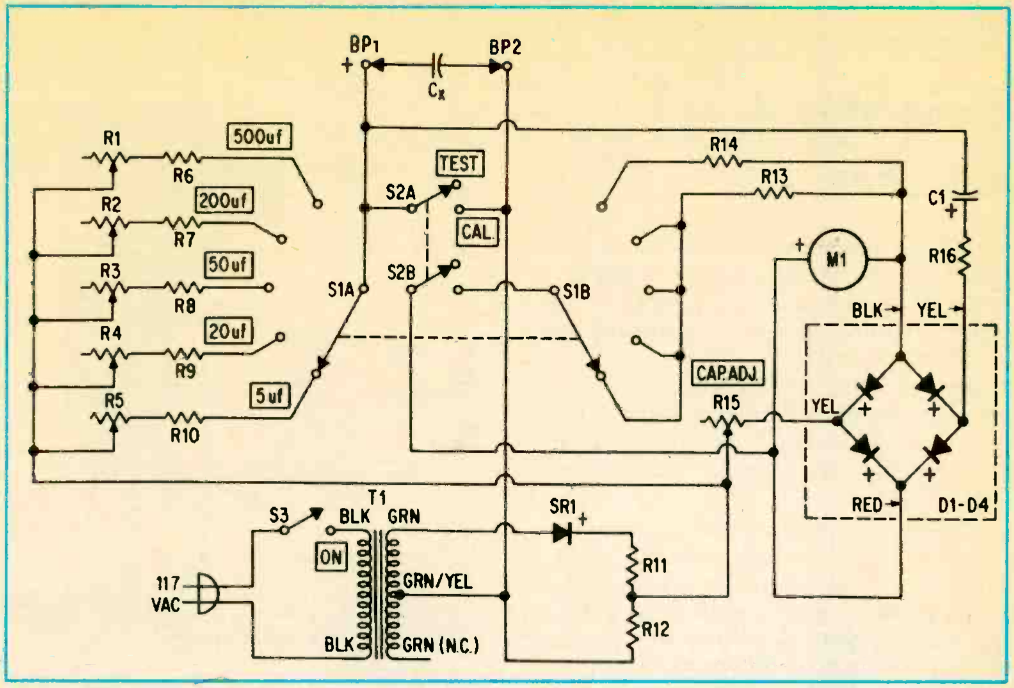


Fig. 3—Schematic. Circuit applies pulsating DC to capacitor under test (Cx). Current through Cx causes voltage drop across range resistor (R6-R10) which is rectified by D1-D4 and fed to meter M1.

From this graph read values of current for values of capacitance from 1 μf to 20 μf in 1 μf steps. Use this data to lay out a new meter scale card. The card may be either a replacement for the original scale or an overlay which fits on top of it.

To prepare an internal replacement scale, tape the original meter scale card face down on a large sheet of white paper. The scale arc center, or meter needle pivot location, is midway between the two holes on the card. Using a compass and rule, prepare an enlarged scale on the large sheet by using the tabulated currents read from the graph. Stick a pin at the scale arc center to guide the rule. Subdivide the major divisions on the large scale. Replace the original scale card with the one to be marked which should be cut exactly to size as the original. Using the enlarged scale on the large sheet as a guide, draw the scale on the meter card scale.

The 5 μf scale is merely the 20 μf scale divided by 4. Thus, place 1 directly under 4, 2 under 8, 3 under 12, etc. Check the pencilled scale for appearance and ink with India ink. For a professional appearance, mark the scale

PARTS LIST

BP1,BP2—5-way insulated binding posts
C1—50 μf, 15 V electrolytic capacitor
D1-D4—Full-wave bridge meter rectifier (Conant Type B. Lafayette 33 C 5505 or equiv.)
M1—0-50 μa DC microammeter, 3½ in. (Allied 52 A 7201 or equiv.)
R1—5 ohm, 2 watt wirewound pot; screwdriver adjust (Clarostat U39. Allied 46 A 7970 C or equiv.)
R2,R3—50 ohm, 2 watt wirewound pot; screwdriver adjust (Same part Nos. as R1)
R4—200 ohm, 2 watt wirewound pot; screwdriver adjust (same part Nos. as R1)
R5—500 ohm, 2 watt wirewound pot; screwdriver adjust (same part No. as R1)
R6—10 ohm, 2 watt 10% resistor
R7—22 ohm, 2 watt, 10% resistor
R8—100 ohm, 2 watt, 10% resistor
R9—220 ohm, 2 watt, 10% resistor
R10—1,000 ohm, 2 watt, 10% resistor
R11,R12—1 ohm, 5 watt, 10% resistor
R13—9,500 ohm, ½ watt, 5% resistor (connect 9,100 and 390 ohm resistors in series)
R14—6,800 ohm, ½ watt, 5% resistor
R15—10,000 ohm, 4 watt wirewound pot (IRC-CTS Type WP. Allied 46 A 5215 C or equiv.)
R16—1,000 ohm, ½ watt, 10% resistor
S1—2-pole, 6-position shorting-type rotary switch (Mallory 3126J)
S2—DPST slide switch
S3—SPST slide switch
SR1—Silicon rectifier; minimum ratings; 750 ma, 100 PIV
T1—Filament transformer; secondary: 6.3 V @ 1.2 A, center tapped (Allied 54 A 1419 or equiv.)
Misc.—6 x 5 x 4-in. cabinet (Bud AU-1029), perforated circuit board, knobs.

Micro Capacitor Checker

card with Letraset transfer type.

Next, set S1 to 5 μf and set S2 to *CAL*. Using R15, set M1 to full scale. Then set S2 to *TEST*. Connect a known-value capacitor to BP1 and BP2 (whose capacitance is near the high end of the range) and adjust R5 until the indication is 5μf. Proceed similarly on the remaining ranges adjusting the corresponding pot—R1-R4.

On the 200 and 500 μf ranges, the settings of R15, R1 and R2 interact slightly. Therefore, reset R15 (with S2 at *CAL.*) each time R1 or R2 is adjusted to its final position in several steps.

Finally, on the 500 μf range only, check the instrument accuracy around 150 μf. If the indication is too high or two low, respectively decreases or increase R14 by 500 ohms or so and repeat calibration for this range only. If any of the pots are set to their limit during these adjustments, increase or decrease the value the appropriate resistor (R6 through R10) or R16 as required.

When using the printed scale of Fig. 6, you must account for meter rectifier variations. Check instrument accuracy at 10 μf on the 40 μf scale. As explained in the paragraph above for R14, change the value of R13 if required, to obtain exact tracking of the scale.

Operation

After setting the range switch, set S2 to *cal.* and adjust R15 for full scale deflection on M1. Connect the capacitor to be measured to BP1 and BP2. Then set S2 to *test* and read the value of the capacitor directly from M1. (Observe polarity with electrolytics.) High-voltage electrolytics are not damaged by in-

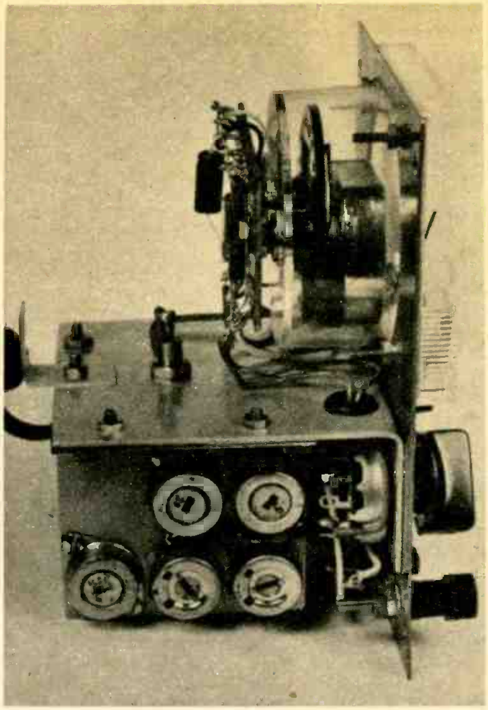
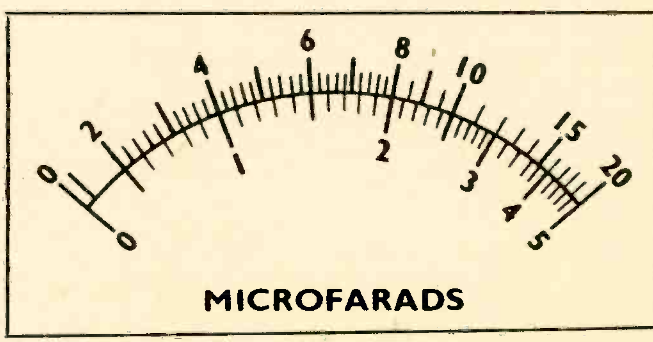


Fig. 4—Side view of Checker. As parts layout is not critical, you may use larger box to simplify construction. Note location of calibration pots.

correct polarity but low-voltage capacitors may be.

In-circuit tests are possible when the resistor in parallel with the capacitor to be measured is at least twenty times larger than the range resistor (R1, R6, say) for that range. Thus, on the 500 μf range, the resistor is parallel with the capacitor may be as low as 250 ohms. On the other ranges, parallel various-size resistors with a capacitor and note the effect on the indication. In transistor circuits, disconnect one lead of the capacitor.

Fig. 5—If you can live with the fact that the characteristics of our meter and meter rectifier may be slightly different from yours, paste this scale over the existing meter scale. For greater accuracy, we suggest that you follow the calibration procedure which is outlined in the article.



SETTING UP YOUR CB CLUB FOR EMERGENCIES

By ALAN LEVESQUE

ONE of the greatest assets to having a CB rig under the dash of your car is that it offers you instant help when you need it. All it takes is a push of the mike button to raise a REACT, HELP or MCEU monitoring station. In fact, you may be taking it for granted unless you're on the other end of these service operations.

Emergency work takes more than a pinch of planning and a bit of elbow grease. But the feeling of satisfaction you get can be worth the effort. Best first step in this direction is to contact REACT (Radio Emergency Associated Citizens Teams), a well-known national organization that encourages CB public service activities. (The address is 4401 W. 5th Ave., Chicago, Ill. 60624.)

The function of REACT is to advise local affiliated groups (known as *teams*) of the latest techniques and theories in serving the community via 27-mc radio, setting up emergency monitoring stations, coordinating with police and fire authorities, proper operating procedures and so on.

It's not impossible to do a creditable job as an independent, though. Biggest problem is the lack of available information on working it out. That's where this article will try to help.

Your Monitoring Command Post

The first rule is: *Listen*. Listeners are needed in nearly every community to eavesdrop on emergency frequencies and coordinate activities among group participants. Unfortunately, many CBers would rather talk

Using the portable groundplane antenna described in this article, the 5-11 Radio Club, Inc., of Pittsburgh, Pa., can be ready with a hefty signal in minutes. Plank base is kept in position by rear left tire of the car in foreground. The folding antenna fits in pipe attached to board like a flagpole in a holder.

This sign, posted with cooperation of local authorities near Newport News, Va., alerts traveling CBers to services available, reminds non-CBers of the advantage they are now missing.

than listen. Nearly half the frantic emergencies handled by CB operators could be simplified or even avoided if operators would just take the time to listen carefully before grabbing the mike button.

You're probably aware that channel 9 is the unwritten national CB calling and emergency frequency (although many clubs still use 11). As such, it should only be used for bonafide *service* purposes or for temporary contact to pick another channel for further conversation. There are always a few die-hards who insist that nothing will force them off channel 9 short of an FCC field monitoring crew. Don't let these people antagonize you. If no one talks to them they eventually will ante up for another set of crystals.

If you're serious about maintaining a top-notch communications listening post you'll want to have one receiver *constantly* tuned to channel 9. It's always good to have a standby transceiver as well. You can keep costs down by looking for a reliable second-hand rig. Some of the earlier tube sets that had provision for only one or two channels can be purchased dirt cheap, cleaned up and tied with a coaxial T-connector to the antenna feedline. (If you do this you'd better use a relay to cut the B+ to the standby rig when the main transmitter is fired up, and vice-versa.)

Some of the magazines have had inexpensive squelch circuits (if your rig isn't so equipped) and several manufacturers sell add-on adaptors that are dandy for upgrading second-hand gear. However you work it, though, make sure you have a squelch that will hold itself shut at a preset level consistent with the size of the area you plan to monitor.

Although it is advantageous to maintain a club monitoring post at the group's headquarters it is hard to get the station manned 24 hours per day. You may decide it is more practical to have four members strategically

MOBILE COMMUNICATIONS CENTER CHECKLIST

- ☐ Logbook
- ☐ Maps
- ☐ Compass
- ☐ Clock
- ☐ Extra Oil
- ☐ Station List
- ☐ Tools
- ☐ Paper
- ☐ Flares
- ☐ Extra Gas
- ☐ Spare Tubes
- ☐ Dried or Canned Food
- ☐ Stored Water
- ☐ Flashlights
- ☐ Coast Guard or Police Receiver
- ☐ Alternate Groundplane
- ☐ Pencils & Pens
- ☐ Plug-in 12-V Lamp
- ☐ Personal Items
- ☐ Matches
- ☐ Binoculars
- ☐ Emergency Telephone Numbers List
- ☐ Club Affiliation ID Card
- ☐ Pair of CH.-9 Walkie-Talkies
- ☐ Spare Auto Fuses
- ☐ Folding Plastic Raincoat
- ☐ Extra-Long Jumper Cables
- ☐ Spare CB Crystals
- ☐ Garage-Type Drop Light
- ☐ Small AC Generator or Auto Inverter
- ☐ Rotatable, Detachable Auto Searchlight
- ☐ Blanket
- ☐ Red Blinker Lights or 4-Way Flasher
- ☐ Fire Extinguisher
- ☐ First-Aid Kit

SETTING UP YOUR CB CLUB FOR EMERGENCIES

located in the county with well-equipped *home* stations. Then overall coverage can be split four ways and you frequently can get help from XYLs who enjoy spending a daily hour or two away from housework.

A good second-hand general-coverage short-wave receiver that tunes 2 to 30 mc can be a handy addition to the command post. But, unlike the second transceiver setup, it won't help when you need to talk-in motoring CBers to the scene of an accident while maintaining direct contact with the calling party on channel 9.

Should you elect to buy a separate receiver, look for a good all-purpose *communications* job rather than a transceiver with its transmitter conked out. It will let you monitor Coast Guard channels, the 2182-kc marine distress frequency, the special emergency channel and the host of other important service frequencies listed in our table.

Another must is an inexpensive VHF monitor receiver (Allied, Lafayette, Radio Shack, Regency, Squires-Sanders, Sonar, etc.). Their special frequency coverage makes tuning over the police and fire services possible, and allows you to eavesdrop on numerous special services. These receivers come in two versions—for the low band from 30 to 50 mc, and for the high band from 150 to 174 mc. If you're lucky you may be able to get your hands on a receiver that tunes both (such as the Utica Duobander). Add-on tuner front ends (such as those from Tompkins Radio Products) are fine for this use, too. Contrary to common belief it is *not* illegal to monitor police bands, although in certain areas regulations prohibit police receivers in autos.

To bypass the work of tuning in all the frequencies on our list you might phone local services and ask what frequency they use and how often (and during what hours of the day peak activity can be expected). Speak to the dispatcher, since he'll be inclined to be quite cooperative once you tell him your reasons for asking.

Or you might try local dealers in two-way communications equipment (look in the Yellow Pages). These outfits specialize in essential radio systems and often equip and maintain the very station you want to hear.

COMMAND POST MONITORING FREQUENCIES

AUTOMOBILE EMERGENCY

27.235, 27.245, 27.265, 27.275, 35.7, 35.98, 150.815, 150.845, 150.875, 150.905, 150.935, 150.955, 150.965, 157.470, 157.475, 157.485, 157.5 mc.

MARITIME EMERGENCY

2182 kc, 156.8 mc.

AIRCRAFT EMERGENCY

121.5, 140.58, 282.8 mc.

FORESTRY SERVICE

3187, 3219, 3250, 3253, 3261, 3273, 3325, 3357, 3397.5, 3445 kc.

RED CROSS

47.42 mc.

COAST GUARD

2182, 2662, 2670, 2678, 2686, 2694, 2702, 3123, 3241, 3253, 4403, 5695.5 kc; 157.1 mc.

NEWSPAPERS

173.225, 173.25, 173.275, 173.3, 173.325, 173.35, 173.375 mc.

ELECTRIC COMPANIES

27.265, 37.46 through 37.86, 47.7 through 48.54, 153.41 through 158.25 mc.

SPECIAL EMERGENCY

2726, 3201 kc; 27.235, 27.245, 27.275, 33.06, 33.1, 37.9, 37.94, 37.98, 45.92, 45.95, 46.0, 46.04, 47.42, 47.46, 47.5, 45.58, 47.62, 47.66, 47.76, 155.205 through 157.47 mc.

A great time-saver, though, is Bob Tall's PSIT List, a weekly sheet listing all *new* FCC FM assignments as they are made. You can get a sample copy for $1 (annual subscription rate is $50) and scan it for someone in your area. Chances are that if you find a new automobile emergency assignment nearby, for example, many others are presently using the channel. (Write Robert E. Tall, Industrial Communications, 396 National Press Bldg., Washington, D.C. 20004.)

The true CB emergency operator keeps two more items close at hand—a telephone book that includes a list of essential phone numbers (nearby monitoring stations, power and light company, police, fire department, highway patrol, local REACT headquarters, towing station, hospital, first aid squad, etc.) and an extension phone. If you're not willing to invest $1 a month for this necessity you might as well go back to SWLing.

All in all, then, the top-flight CB command post would have at its disposal two CB rigs, a communications receiver and one or more special FM monitor units. Naturally, adequate (and separate) antennas will have to be provided. A single long-wire suffices for the short-wave bands and you can buy complete groundplane systems for the VHF ranges for as little as $5.40 from Hy-Gain.

Bear in mind that no one expects any individual monitor to listen for 24 hours each day. If you try to spend every waking hour at the command post you'll soon tire of the whole thing. It is, in fact, a team effort with no room for big-time operators out to make a name for themselves.

Your Mobile Communications Center

If you live in a town boasting a prosperous civic-minded CB club you may also enjoy the benefits of a full-fledged emergency communications van—usually an old bus, milk truck or delivery van equipped with a half-ton of radio gear and full-size base station antennas. It serves as a temporary base station at the scene of an emergency. Station wagons can also be used. In fact, practically any second-hand U.S. car can fill the bill (make certain you don't get a 6-volter).

Basic advantages to having a club car, as opposed to someone's family heap, is that it can be taken out in all kinds of weather, equipped with heavy-duty snow tires year-round (for gravel and mud) and even painted an off color for distinctive recognition as an emergency vehicle. (It's advisable to avoid fire-engine red. International orange is both striking and functional, though a bit loud. Off-grays are popular.) Prime advantage is that you can mutilate the buggy without so much as a peep out of the XYL.

Although a two- or three-channel rig (with crystals for channels 9 and 11) can be used, a fully-operational 23-channel transceiver is unquestionably best for emergency use. Don't scrimp—get the best rig your finances permit. If it's a tube set, make sure you have a carefully-packed spare set of tubes at all times. The success of your mobile center hangs for the most part on the performance of your equipment.

Though most Detroit beasts can take a good deal of abuse, few second-handers can take much electrical drain. Idling is perhaps the most critical point, since the generator must be charging the battery, supplying the engine, keeping the CB rig on the air and perhaps running emergency lights—all at the same time. Best bet when you expect to be idling for some time is simply to park in the coolest spot you can find and raise the hood to allow a bit more ventilation. Keep a sharp eye on water levels in radiator and battery.

Pamper the electrical system wherever possible. Set the idle faster if necessary. Replace the battery at the first sign of weakness. Replace the generator with a professional-installed alternator system. Assign vehicle maintenance to various club members on a rotating basis.

Several clubs rely on small gasoline-driven AC generators, switching to portable power whenever prolonged, stationary use is required. A warning, though: generators (like auto engines) must be shielded, since they are just as liable to generate noise as VWs and Fords. Even more annoying are the loud popping noises that come from the generator's exhaust. Use heavy outdoor extension cords built for carrying 117 VAC to power tools and keep the generator as far as you can from the CB rig without introducing appreciable line losses. If the generator is club-owned a few dollars can be invested in shielding components and a muffler. A rain-cover is also advisable.

True emergency setups don't use conventional CB mobile whips. The more knowing groups go straight for full-size groundplanes which do wonders for the 5-watt rigs under the dash. Get a groundplane of the folding type, designed for rapid installation. If necessary, have the elements snapped off halfway down and fitted with folding couplings.

RG58/U coax is flexible enough to be rolled into a return feeder like those on many tools and vacuum cleaners. You can store up to 100 ft. of feed line without worry of tangling or knotting.

Now obtain a length of plywood at least ½ in. thick and measuring about 6 x 24 in. At one end of the board secure a pipe flange and fit it with a 6-in. threaded pipe. Insert the antenna mast into the pipe and secure the plank by driving one wheel of the car over the unadorned end. Presto! Instant antenna! All that remains is to guy it three ways to convenient posts, trees or telephone poles. The whole thing can be done by one man in less than eight minutes—but it's a heck of a lot easier with two.

There are a few points worth remembering: Always seek out the highest possible point to locate your antenna. This may mean hiking a hundred yards to the center of activity but you'll find that the added range will be well worth the trip. If your mobile communications center must be on a main road pull as far as possible onto the shoulder to avoid tying up traffic or getting hit, yourself. If signal levels appear a bit down in the

[*Continued on page* 115]

THE HAM SHACK

BY
WAYNE GREEN
W2NSD/1

GROUNDWORK . . . Every now and then someone with money to burn decides it would be nice to invest in a poll of amateur radio. One recent example used a sample so small the results may be a little wide of the mark—probably for want of funds to do a more careful survey. A few years back I ran a similar survey with about five times the sample size. They both provide some interesting information.

We have about 260,000 amateurs in the U.S. today of which about 60 per cent (some 155,000) are what might be called active. The number of licensees reached a peak of about 275,000 but is now dropping off.

The median age has been increasing, indicating waning interest in amateur radio among younger men. It is now about 41 years. Ten years ago it was 36 and 12 years ago it was 35. This is an interesting phenomenon. I wonder if it will continue.

Over 60 per cent of amateurs are working in electronics or engineering and almost 90 per cent of these credited amateur radio with influencing their choice of career. This is only logical for an interest in amateur radio gives a youngster a decided advantage over others of his age going into electronics.

Amateurs, as might be expected, have a relatively high median income: about $10,000 a year. This is up from an $8,800 average eight years ago. Everything is up, I guess.

When asked which bands they preferred, hams answered about as you might expect with some 20 per cent liking the big three: 20, 40 and 80 meters; 10 per cent for 15 and 10 meters; 15 per cent for the 6- and 2-meter bands; 2½ per cent each for UHF and 160 meters. Frankly, the 40-meter figure surprised me a little, though this high number may be due to some bias in the poll itself. I would have given a little more weight to 20 and 80, judging from experience. Of course, this will change rapidly now that 10 meters is opening up so beautifully and we are able to work just about anywhere in the world with relatively low power and antennas that are not too huge.

The current gross sales of ham gear was estimated at about $40 million. This is consistent with the $30 million estimate for eight years ago, though it may be a bit high in view of the severe depression in amateur sales reported by leading distributors and manufacturers. Certainly the market *should* be running $40 million. But sales have dropped so obviously that for the first time there has been a rallying of the amateur-radio industry into an association to try to do something about it.

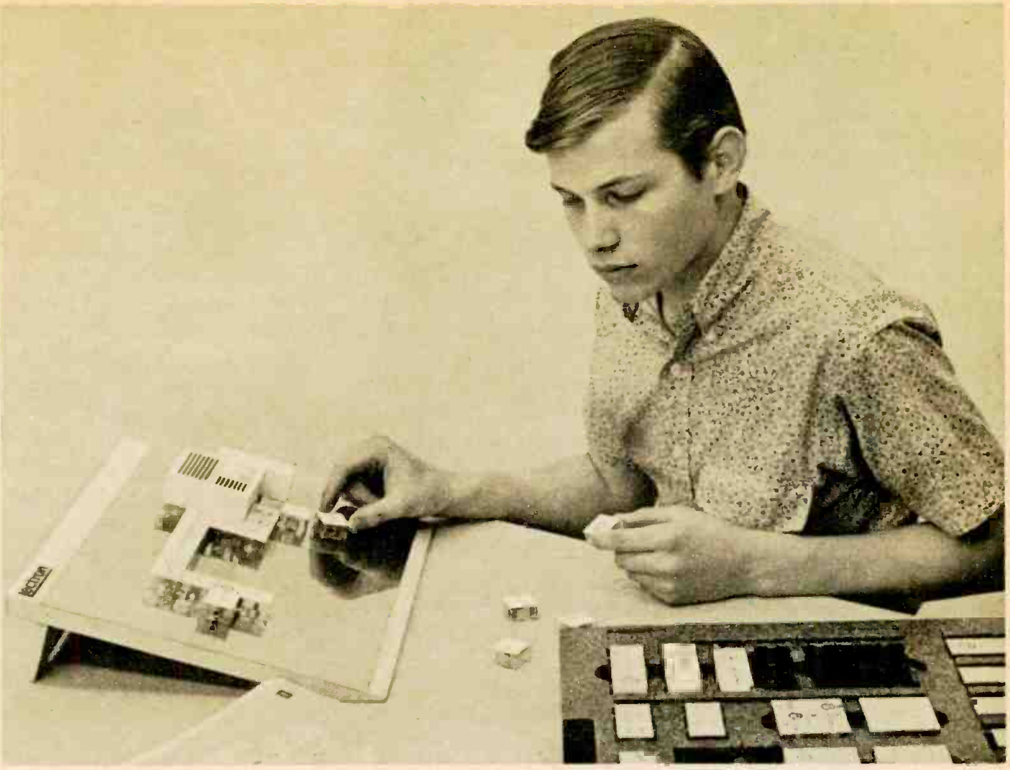
Figuring that the average amateur spends $350 a year for the first two years and then $200 a year from then on and that he has been licensed for 14 years (all these are averages) he must have an investment of $3,000 in his hobby. A good deal of this has depreciated with use and by now it probably is worth, at best, about half that amount.

It has been my contention that no country can develop without electronics and communications—and that these cannot develop unless amateur radio is encouraged, for it is the amateur population that provides the largest source of indispensable technicians and engineers. This is clearly backed up by a survey made by the Stanford Research Institute for the Agency for International Development.

For this reason I feel that it is basic for the U.S. to do everything it can to encourage and support the growth of amateur radio in the emerging countries. I'd like to see this reflected in U.S. AID programs, the Peace Corps and other do-good schemes. There are few ways that our country could do so much to help others to help themselves in the long run.

In the past I have made myself unpopular with the short-wave-listening crowd by maintaining that the audience for short-wave broadcasting is small and that the amount of time, money and frequencies wasted on it is out of all proportion to the results obtained. Well, Stanford seems to agree with me. It points out that one prominent nation that broadcasts quite a bit in English admits they get about 20 letters a week in response. The report goes on to say that a single amateur can do a lot better than this in reaching the people of another country—and without the

[*Continued on page* 125]



ELECTRONIC DOMINOES

INSTANT is the word of the jet age. Time grows more valuable every day. Once we spent six days in leisure travel from New York to California by train. Now we can't wait for a supersonic jet to get us there before we leave. And so it is with electronics. There's a mountain of information to learn in what always turns out to be too little time.

To help grease the skids of learning basic electronics and get your hands into practical working circuits, there's a new kit of domino-like plastic electronic boxes. Now, this isn't just an electronic game. It's *the* way to instant learning.

Big drag when studying electronics is putting circuits together. It's time-consuming to cut and twist component leads, connect them, solder them, support them and keep them from shorting. You have enough to do just learning how a circuit operates. And then think of the mess when you take everything apart for another experiment. Solder drippings, burned finger, broken leads, sloppy layouts, heat-damaged semiconductors—all of this makes you wish you'd never started.

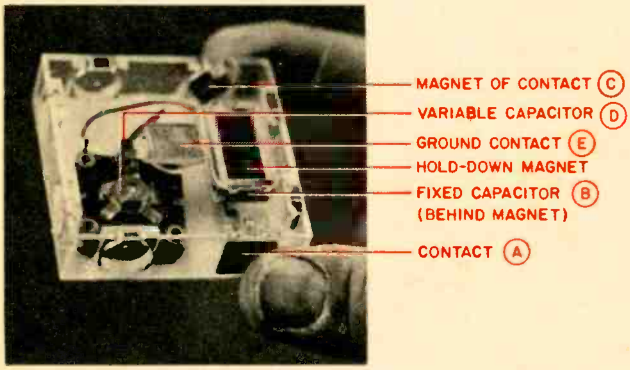
But now it can be as much fun to put electronic circuits together and to learn fundamentals as it is to put words together when you play Scrabble. The Egger-Lectron Model 8400 learning aid is imported from Germany and will be distributed by the Macalaster Scientific Co. (a subsidiary of Raytheon), 186 Third Ave., Waltham, Mass., 02154. In this country they will be called electronic dominoes.

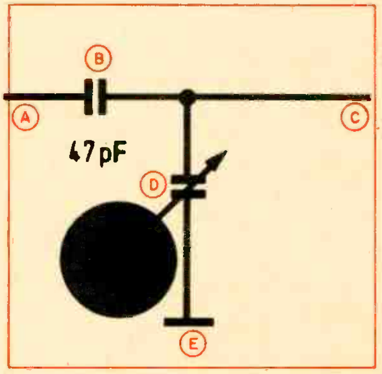
Just about anyone can put together an operating circuit as easily as they could play real dominoes. Each of the plastic boxes contains one or more electronic components or an interconnecting part. The kit supplied to us by Raytheon contains a carefully-selected collection of components, all neatly done up in plastic boxes bearing a schematic symbol of the contents, a manual of experiments and two work boards. Even a 9-year-old child can match the marked dominoes with those on the schematics to build and demonstrate a light meter, electronic thermometer, tone generator or radio—to mention a few of the 90 experiments in the manual that accompanies the complete set. For the high school student, there are more advanced projects such as a three-transistor reflex-AM radio, metering circuits, transistor-testers and simple computer flip-flops.

The three-transistor reflex-AM radio and several smaller circuits were put together in about an hour the first evening we worked with the set. And that included time for experimenting—which is at least half the fun of building the circuits. Of course, if you want to snap the boxes together really fast, give the circuit a quick test, then pull it apart and snap together another circuit. You could do eight or ten circuits in an hour.

The set we show here contains 108 plastic boxes. Sixty-five contain such components as resistors, capacitors, transistors (with and without a bias resistor), a meter, a relay, a thermistor, potentiometers, rheostats, RF transformer, speaker, push-button switches, diodes, variable capacitor, photocell and battery packs. Eight are blanks in which there are small contacts that accept the leads of resistors, capacitors, inductors or transistors for supplying values not included in the set. Jacked boxes will accept special inputs or test leads, for example. Other boxes contain connectors to join boxes to boxes or to ground a component to the work board.

How Does It All Work? In vaudeville they used to say it was all done with mirrors. In Dominoes it's all done with magnets. Instead of using clips, binding posts, or springs to hold parts together, each box is equipped with small magnets at the points where it is to contact another box or the board. The sides and the





Underside (left) of individual domino is transparent, allowing a view of actual components. (Shown here is variable-capacitor module used in AM radio, among other things.) Top of box (right) is opaque white with a schematic of its contents in black. When a circuit is assembled, the entire schematic can be read from above. Magnets behind the springy metal contacts hold them together. Since dominoes are made in Germany, standard European symbols and units are used. If demand is great enough in this country Raytheon plans to have standard American designations substituted on the stock they import for sale here.

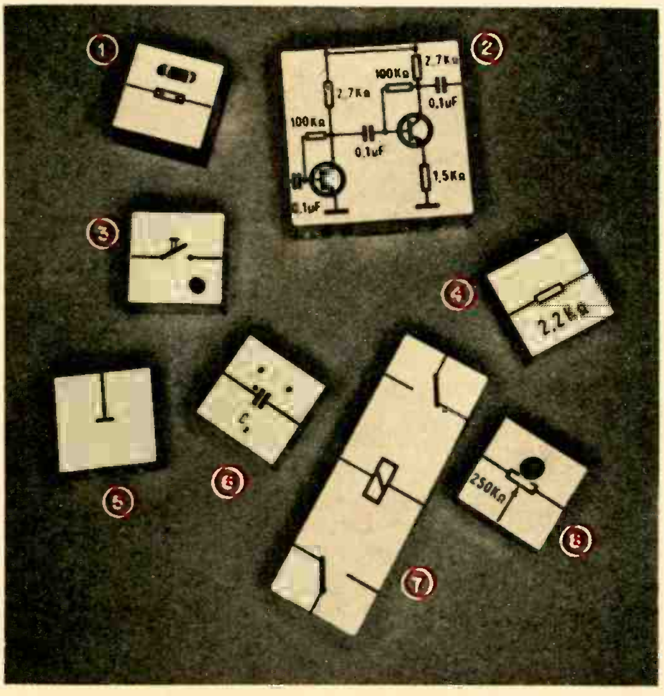
bottom of each box are made of clear plastic so you can see what's inside. The top of each box—carrying the schematic symbol—is opaque white.

Some of the circuits can, incidentally, be a little touchy. Squeeze a little here, apply some pressure there and suddenly the circuit works like a charm—a light blinks, the meter needle moves or the speaker sounds. The longer we used the set, however, the less we seemed to have contact problems.

The work surface of each of the 13 x 15½-in. work boards is covered with a plated ferrous metal sheet forming the ground or common connection for all the circuits, just like a radio chassis. Since two battery boxes and two work boards were included in the set, it is possible to put together two circuits at the same time—provided you don't have too many components in each circuit. The concept has great potential as a teaching tool. In only a few seconds it is possible to set up a practical circuit that would only be schematic symbols in a textbook. The work boards can be propped up on their built-in stands or hung on the wall so that a whole classroom can see the demonstration. Components in any circuit can be changed instantly to show their effect on circuit performance. Special experiments in the manual demonstrate the characteristics of components—resistance, inductance and capacitance; how tuned circuits affect radio reception; effects of base current on emitter-collector current flow and other electronic principles.

Okay, let's open the manual and see what we can learn. Believe it or not, the first experiment is a multivibrator flasher made with 21 boxes. Now this is hardly the sort of experiment you'd pick to start off a course in electronics. But the purpose of this experiment and the 19 that follow is simply to give you a taste of some of the interesting things to come.

Experiment No. 21 is about as simple as you could want. It consists of a bulb, battery and switch in series. This is basic. In the next two experiments you put resistors in series with battery and lamp to note the effect of adding resistance in the circuit. The lamp, of course, gets dimmer. From there the experiments



While sizes vary, all boxes have a modular size relationship so that they fit together neatly. Here are some representative samples: 1—Photocell. 2—Two-transistor AF amplifier stage. 3—Push-to-close switch. 4—2.2-K resistor. 5—Grounding contact. 6—Box with top contacts to accept an external capacitor, used for experimenting with values not included in the standard set of boxes. 7—DPDT relay. 8—250-K pot.

go on through multivibrators, audio, photocell applications, relays, etc., ending with a burglar alarm.

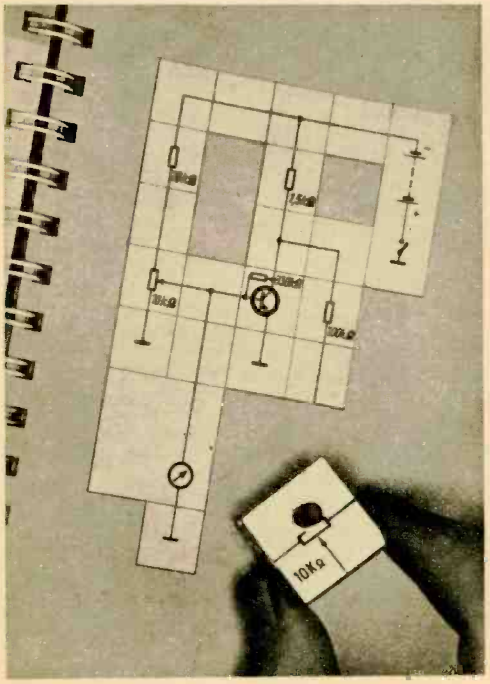
Everybody who has seen the dominoes has found it hard to keep his hands off them. Their arrival in our New York office threatened to play havoc with production schedules, in fact, until some killjoy remembered that they had been designed for kids. So we sheepishly carted them off to a household that included a bright 14-year-old. He was delighted.

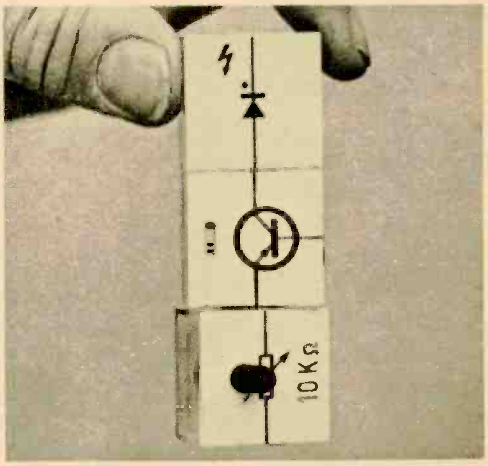
First project on the agenda was, of course, the AM radio circuit—even though that's toward the back of the book. It worked and he was hooked. He and his father (who was also hooked by this time) were having a grand time trying circuit after circuit when the eight-year-old kid sister showed up and wanted to play, too. Now this is not quite cricket, according to Raytheon, because the dominoes are geared to high-school instruction. Nothing daunted, she abandoned her numbered painting and pitched in.

It's a good thing that battery packs and work boards supplied in pairs in the set they were using. Otherwise we would have been responsible for introducing dissension into a happy home. As it was, both kids ended up pushing Dad aside and going their own, merry, electronic ways. Numbered painting? Who needs it?

Next of the privileged junior set to get his grubby little hands on the dominoes was a five-year-old. Now we were really on unspoiled ground since this boy had never even heard of a circuit. We tried experiment No. 21. The chocolate-smeared finger gleefully pushed the button of the push-to-close switch while the bulb flashed on and off. Fine—audience participation! But what was he getting out of it, we wondered. Next he wanted to see the meter work so we set up the battery-tester circuit with the same push-to-close switch. More delight.

The experience of a five-year-old can't be expected to add up to a hill of beans, electronically speaking. But it does demonstrate [*Continued on page* 116]





Constructing circuits from the manual couldn't be simpler. Boxes can be matched visually with the diagram (left) even if you can't read. When they are placed on the work board in the arrangement shown in the manual the contact magnets hold them together for good electrical connections. Magnets are strong enough to hold several boxes together, dangling in a string as shown above. Lightning symbol (top) indicates high-voltage diode.

POCKET CB CONVERTER

By CHARLES GREEN, W6FFQ

Take one transistor, add a few parts then tune the Citizens Band on any broadcast radio.

THE original purpose of CB—to make two-way radio available to almost anyone who needed it—has been served. But there are often times when only one-way communication is required. For example: suppose you regularly have to call the children in from the ballfield for dinner. In this situation it is only necessary that you get a message out to them. They do not have to reply.

Let's say you now have a 5-watt-station set up—one rig's at home and the other is in the car. Naturally the mobile is going to be used by the man of the house during the day. It can't be conveniently taken to the game and operated from a storage battery.

At least you have a transmitter at home to get the call out. But how are the children to hear you? You could provide them with a walkie-talkie, but if it has any kind of sensitivity to pick up your signal it will cost at least $25.

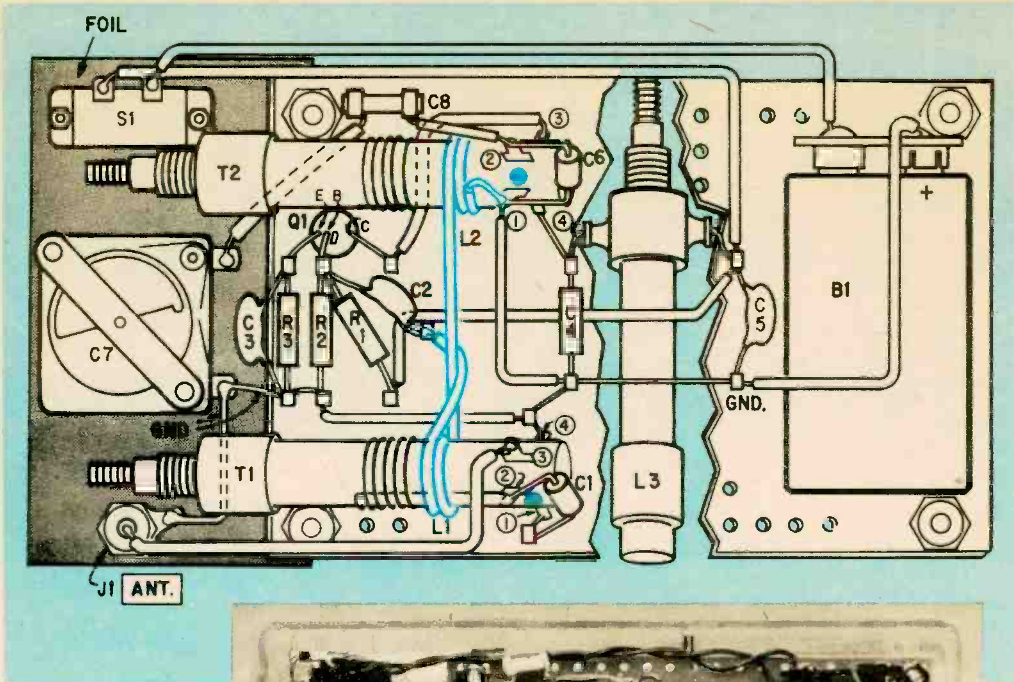
Now most kids these days carry a transistor radio with them at all times. It's as much standard equipment as the flask was to the flappers in the roaring twenties. If you could only use that 5-watt rig at home to call them on their radio. That is, if there were only a way to be able to pick up a 27-mc CB signal on any broadcast radio.

It can be done and without modifying your 5-watt rig or the radio. You use an electronic middleman called a converter. Our converter is a simple one-transistor, one-evening project which will set you back less than $10. Combined with a transistor radio (or, for that matter, any radio, it will do a better job of picking up your signal than most walkie-talkies with superhet receivers. Here's the way it works.

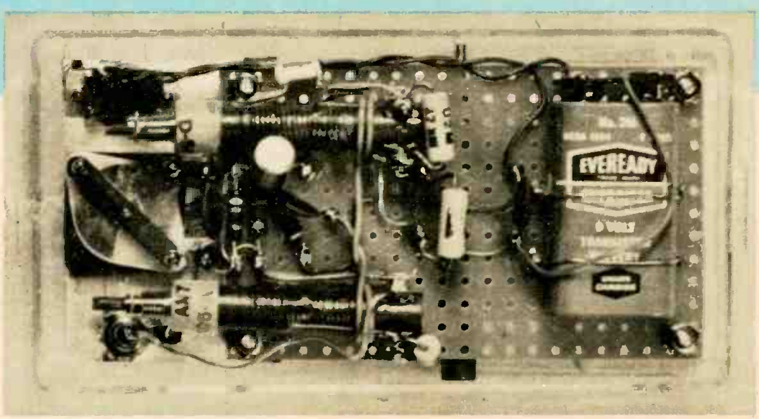
You tune the radio to a spot on the dial where there's no station, place the radio on top of the converter and you're in business. You do not have to make a connection between the converter and the radio as the converter radiates its signal into the radio. All you need is an antenna; the converter is battery-powered for portable operation.

The converter can be tuned to receive any CB channel. As we said, you merely set your radio to any quiet spot on the broadcast dial and do the tuning on the converter.

If you do not have an application for one-way communications as we suggested, using a converter and a radio is an easy and inexpensive way to just monitor the band while you use your 5-watt rig for regular communications.



POCKET CB CONVERTER



First, cement a 1¾ x 2½-in. piece of aluminum foil at left end of case cover. Then install S1, C7 and J1. Next, mount other parts on 4 x 2½-in. piece of perforated board. Only L3 goes on back of board. Use ⅜-in. spacers between board and cover. Be sure you wind L1/L2 coils over T1 and T2 exactly as shown.

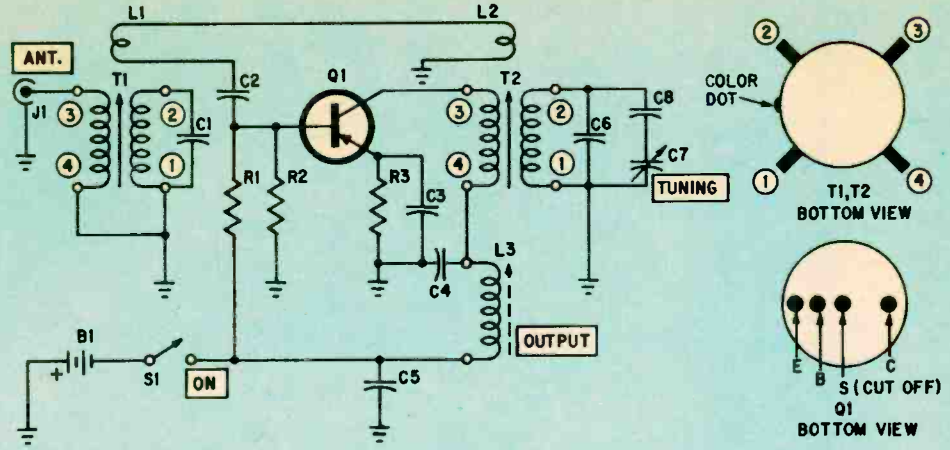
The Circuit

Take a look at the schematic. Signals from the antenna are coupled via jack J1 to the primary winding of transformer T1. They are tuned by fixed capacitor C1 which is connected across T1's secondary. (T1 is tuned to the center of the Citizens Band by C1). The 2-turn coil (L1) couples the signals via C2 to the base of transistor Q1. The base of Q1 is also coupled via the other 2-turn coil (L2) to oscillator transformer T2. T2 is tuned by C6, C7 and C8 so the oscillator operates approximately 1 mc above the frequency of the incoming signal. The IF signal is produced by mixing the incoming signal with the oscillator's signal.

Construction

Our converter is built in a 5¾ x 3 x 1½-in. plastic box. A wood or bakelite box can be used, but you must not use a metal box as it will prevent the RF from getting out to the radio.

All of the components except C7, J1 and S1 are mounted with flea clips on a 4 x 2½-in. piece of perforated board. Before installing the board on the cabinet cover, mount coil L3 on the rear of the board by soldering its lugs to two flea clips. Space the



Incoming signals go to the primary of transformer T1, which is tuned to center of Citizens Band by C1. L1 couples signals via C2 to base of Q1 which is also coupled by L2 to oscillator transformer T2. As T2 is tuned about 1 mc above incoming signal, an IF signal is produced. It's radiated by L3.

board above the box's cover with ⅜-in. spacers mounted at the board's corners.

Install the parts exactly where shown as the wiring and spacing of components are critical. Before mounting any parts on the cover cement or tape a piece of aluminum foil on the inside at one end of the cover. This will minimize the effects of hand capacitance when you bring your hand near C7 to tune. Connect the foil to the circuit ground with the mounting nuts and bushings of C7 and J1. Cut off the shield lead of Q1.

Wind coils L1 and L2 next. They are each 2-turns of No. 22 hookup wire wound on T1 and T2 as shown in color in the pictorial. Keep the turns just to the left of the coil lugs. If you wind the turns too close to the existing windings there will be over-coupling which will prevent oscillation.

PARTS LIST

B1—9 V battery
Capacitors:
C1,C6—47 μμf, 600 V tubular ceramic
C2,C3,C5—.002 μf, 1,000 V ceramic disc
C4—100 μμf, 600 V tubular ceramic
C7—10-360 μμf variable (Lafayette 99 C 6217)
C8—10 μμf, 600 V tubular ceramic
J1—Phono jack
L1,L2—2 turns No. 22 hookup wire wound over T1 and T2 (see text)
L3—Ferrite antenna coil (J. W. Miller No. 6300. Lafayette 34 C 6705)
Q1—2N1180 transistor (RCA)
R1—4,700 ohm, ½ watt, 10% resistor
R2—2,700 ohm, ½ watt, 10% resistor
R3—1,000 ohm, ½ watt, 10% resistor
S1—SPST slide switch
T1—Antenna coil, 12-36 mc. (J.W. Miller D-5495-A. Lafayette 34 C 8720)
T2—Oscillator coil, 12-36 mc. (J.W. Miller D-5495-C. Lafayette 34 C 8722)
Misc.—5¾ x 3 x 1 3/16-in. plastic box (Lafayette 14 C 4403), perforated board.

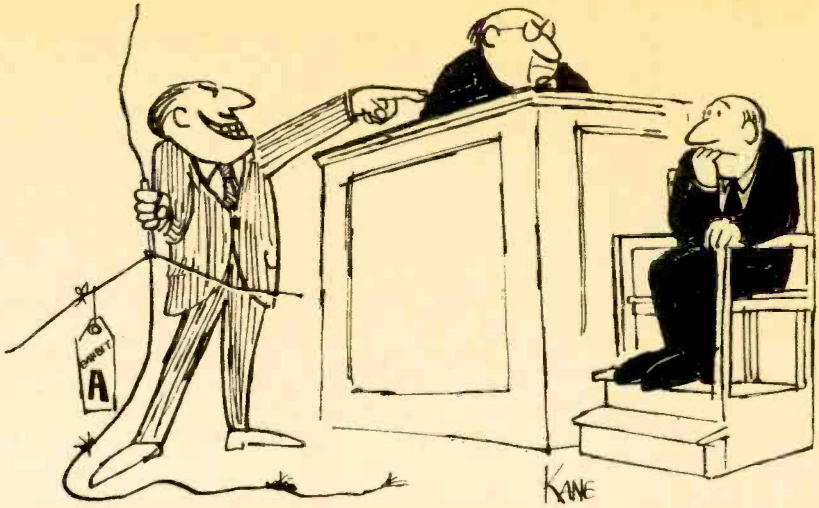
Alignment and Operation

Turn T1's slug-adjustment screw so ¼-in. of the screw is out of the form. Set T2's slug-adjustment screw so it is ⅛-in. out of the form. Set L3's slug-adjustment screw so it is ½-in. out of the form. Set C7 to full capacity (full counterclockwise) and place a transistor radio on top of the converter so the radio's loopstick antenna is directly above and parallel to L3. Set S1 on *on* and tune the radio to a quiet spot near 1200 kc.

Connect a signal generator set up to feed a 26.96 mc modulated signal to J1. Tune T2 until you hear the signal in the radio and adjust T1 and L3 for maximum volume.

Keep the level of the signal from the generator as low as possible for best alignment. Repeat the adjustment several times. Cement a dial on C7's knob then calibrate the dial.

Disconnect the signal generator from J1 and connect a good antenna to J1. For strong local signals, a 5- or 6-ft. length of wire will work. For best reception, a high outside antenna is better. Find a strong signal in the center of the band and peak up T1 for best reception. Other frequencies can be used on the radio instead of 1200 kc, but this will require peaking L3 and T2 again.



WANNA BET YOUR ANTENNA IS LEGAL?

SHORT-WAVE listeners and radio amateurs put up countless long-wire antennas and tuned dipoles each year and heartily claim their right to do so by what they take to be the law of the land—a sort of Freedom to Listen. (If you're going to have Free Speech you have to have someone to listen to it.) Hams have claimed that their stations and antennas are licensed by the FCC and therefore cannot be restricted by local laws. Almost all radio hobbyists profess that the airwaves belong to every citizen. And so on.

Well, it's not that simple. Fact is that many laws, both Federal and local, are passed to protect citizens against themselves. In that spirit, the National Fire Protection Association has included a whole section on antennas in its National Electrical Code. And local governments throughout the United States have incorporated the code into their ordinances. While these ordinances in no way affect short-wave listening or amateur operation they do regulate construction sites. The courts, even at the Federal level, have enforced the ordinances. So let's take a look at what the code has to say.

What size wire? In the good old days antennas used for short-wave reception were made from almost anything available. Nowadays, antennas (and their lead-ins) must be of hard-drawn copper, bronze, aluminum alloy, copper-clad steel or other high-strength, corrosion-resistant material. Soft-drawn or medium-drawn copper wire may be used for the *receiver* lead-in conductor provided the maximum span between supports is less than 35 ft.

Transmitting antennas should never be made of wire finer than No. 14. In unsupported lengths over 150 ft. the size should be increased to No. 12 for wire made of copper-clad steel, bronze or other high-strength materials and to No. 10 for hard-drawn copper or aluminum alloy. Lead-in wire should be the same size as that of the antenna. Receiving antenna specifications are a little more complicated. Taking first the high-strength materials, you should use No. 20 for spans up to 35 ft., No. 17 for up to 150 ft. and No. 14 for longer spans. In hard-drawn copper or aluminum alloy, sizes become No. 19, No. 14 and No. 12, respectively.

These wire sizes do not take into account ice loading or high winds experienced in many northern areas of the United States and Canada, where you should plan to use the next larger size. Size increases as wire number decreases (No. 12 is thicker than No. 14). Heavier wire costs a bit more, but it is the cheapest insurance you can buy to keep your antenna up.

Splicing should not be used in main spans of antenna and lead-in wires. Where you must splice and solder, make a good mechanical connection first. To make the old Western Union splice, overlap the two ends by a few inches, twist each end tightly around the standing part of the other wire and solder.

What about grounding? Grounding must be made of copper, aluminum, copper-clad steel, bronze, or other corrosion-resistant wire that is *uninsulated.* Wire size must be as large as the lead-in wire from the antenna but not smaller than No. 10 copper wire or its aluminum equivalent, No. 8. The ground wire must be kept as short as possible and run in as straight a line as is practical for maximum lightning-damage protection. Lightning riding a wire to ground is like a speeding mustang—it can't take the turns. If you jog to avoid the chimney, masonry will blast free at the first lightning stroke.

The ground wire must be securely fastened to the building or tower. On a wood surface, ordinary staples will do. But remember the neighbors' kids! Hide the wire along the building's trim so it won't invite tampering.

Ground wire is inexpensive. You can pick up 50 ft. of No. 8 aluminum wire for $1.50 and the Sears catalog lists a copper-clad steel wire for 17¢ per foot. Be sure you purchase enough to do the job in one run *without splicing.*

Many SWLs and hams connect ground directly to cold-water supply pipes (much to the water company's dismay—electrolysis destroys pipes, you know). The cold-water pipe ground is excellent. Non-metallic piping joints make hot water plumbing a poor ground and gas mains are too dangerous, even for the pros. Steel building frames make very good grounds but you will have to chop through plaster or concrete to get at the beam.

Where you can't get at a water main for an exterior ground you might want to drive a rod electrode of steel or iron into the ground. This is risky business unless you know what you are doing. You need a site that is always moist; stay away from sand. Drive a ⅝-in. solid rod into the ground to a depth of 8 ft. Ground rods can be purchased at electrical supply stores or from electronic parts suppliers. Grounding electrodes should always be at least 6 ft. apart if you have more than one.

Ground-wire specifications for inside and outside the home for transmitters differ from those for receivers. To avoid confusion in remembering and interpreting very detailed specifications follow these recommendations: Use either No. 10 copper, bronze or copper-clad steel wire or No. 8 aluminum ground wire. (Remember—no insulation permitted.) If your lead-in wire is larger use matching or still larger ground wire.

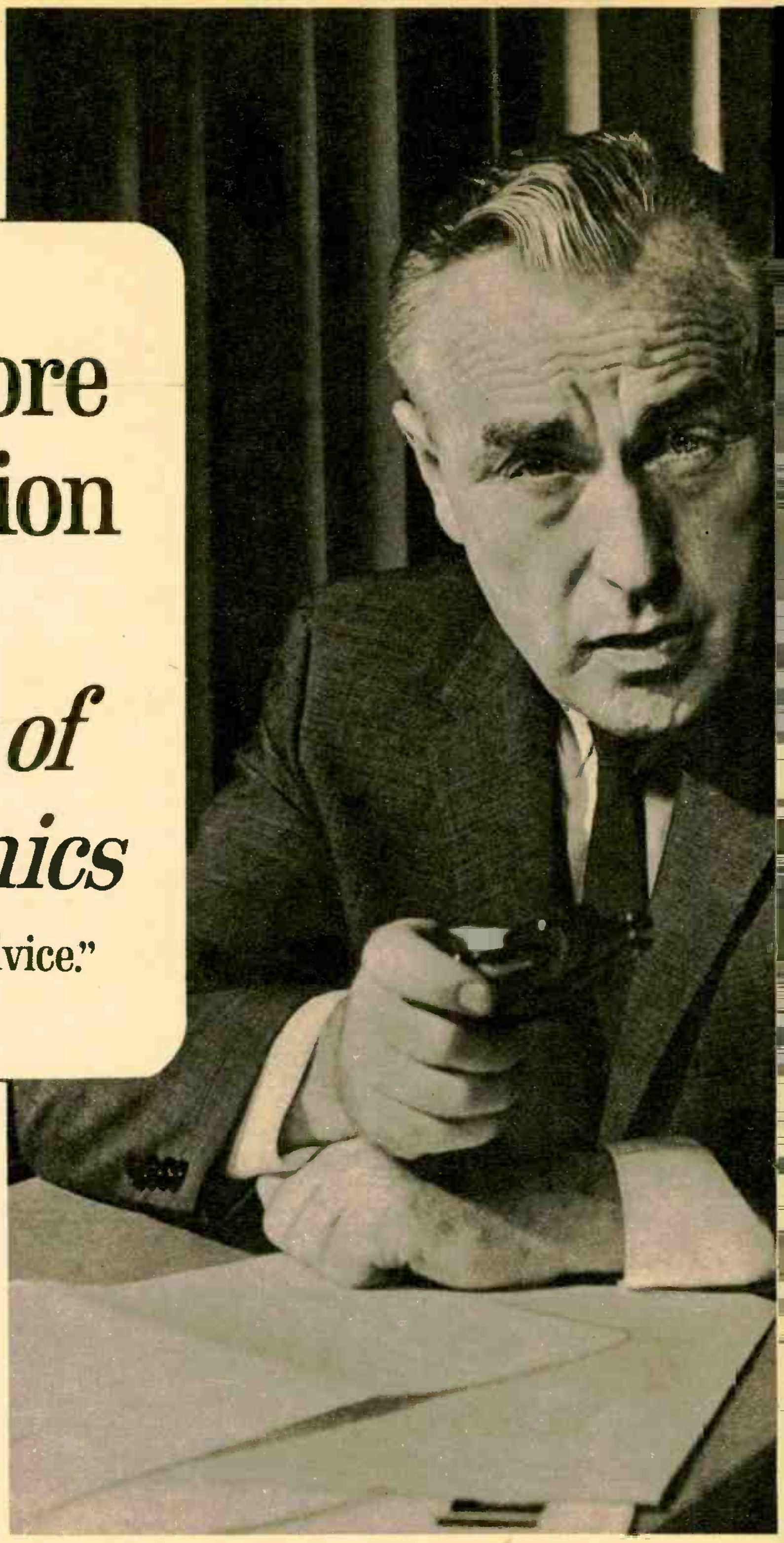
Any other rules? It takes at least one tower or mast to keep an antenna up but don't use the power company's poles, please! And don't attach your antenna or lead-in to poles carrying 250 V or more between conductors. In fact, if you don't own the pole, *keep off!* Power and telephone companies have darn good lawyers. One rule you must always live by: Don't pass antenna and lead-in wires *over* power lines or electric light circuits even if you own them. If you can't avoid passing *under* or near a power line allow a clearance of at least 2 ft. Vertical antennas should be placed so that if they fall they can't topple onto a power line.

Transmitter lead-ins must pass through the outer surface of the home to get inside to the transmitter and receiver. Coax lead-ins are no problem provided the outer shield is connected to the ground system. Otherwise, pass the lead-in through a rigid, noncombustible, nonabsorptive, insulating tube or bushing—or through an opening in which the lead-in is firmly secured at a clearance of at least 2 in. (it's a bit drafty this way)—or through a drilled window pane. The last method is very popular with hams since the building can be

[*Continued on page* 123]

"Get more education or *get out of electronics*

...that's my advice."



Ask any man who really knows the electronics industry. Opportunities are few for men without advanced technical education. If you stay on that level, you'll never make much money. And you'll be among the first to go in a layoff.

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APPROVED FOR VETERANS ADMINISTRATION TRAINING

Go-Go Reverb for Guitars

By RAY SAVILLE

OKAY, the band hasn't been drawing big crowds to the club lately. Face up to it. The guitar probably needs a good dose of the mod sound *reverb-b-b-b-b*. Without it, a guitar is like a hipster with a crew cut—positively square.

No need to buy a new amp. Just connect our reverb between your guitar and amp and you'll have the best go-go sound on the block. They'll think you're playing at the bottom of Howe Caverns (maybe you should be). The reverb can be keyed in and out with a foot switch without clicks, pops or snaps.

Unlike some other add-on reverbs, our is AC powered, which means no batteries to run down in the middle of a session. Heavy power-supply filtering keeps the hum level down. And the reverb does not have overwhelming gain. Its output level, which is just slightly more than that of the guitar itself, is determined by the transistors used. Some models will have no gain while others might provide about 6db. Either way, you won't have to run the amplifier's gain control just cracked open.

The heart of the reverb is the spring delay line shown in Fig. 6. One end of the spring is supported within the magnetic field of an input transformer. The other end of the spring is in the field of an output transformer. An audio signal is fed to the input transformer and sets the spring in motion. As the sound waves travel down the spring they are delayed. At the other end of the spring, the movement of the spring in the output transformer's field induces a current in the transformer.

Simultaneously, the sound waves are reflected back and forth along the spring causing the same sound to arrive several more times at the output end. Each time they're delayed a little with respect to first sound. The small time differences between succeeding reflections are what cause the echo.

Construction. Our reverb is built in the main section of a 10 x 3½ x 6-in. Minibox. This is a portable version. If you want to use a larger cabinet by all means do so as it reduces the chance of hum pickup from power transformer T2 (more on this later).

Most parts are installed on a 2⅝ x 5⅛-in. piece of perforated circuit board. Vector T28 terminals may be used for tie points. To avoid possible feedback, try to duplicate the layout in Fig. 1. Note the use of a ground buss (in Fig. 1) which is connected to the cabinet at input jack J1 *only*. While SR1 can be virtually any silicon diode, the Motorola 1N4001 is recommended because it is very small.

Do not drill any cabinet holes until the board is completed. Mount the board temporarily in the cabinet (Fig. 5) using an L-bracket made from scrap aluminum. Then mark the position for the cabinet components (Fig. 4) making certain none of the board components touch them. Remove the board, drill holes for and install the cabinet components then reinstall the board. Do not drill for or mount T2 yet.

Position the delay line at about a 25° angle, as shown in Fig. 5, with the *output* terminals near the controls. Make certain the delay line's shield does not touch any parts, particularly S2. Then mount the delay line permanently using ⅜-in. rubber grommets under the rubber shock mounts already permanently attached to the delay line.

Except for T2, make all connections between the circuit board and cabinet parts. You *must* use thin shielded cable between the delay line's output terminals and R11, and from R11 to R12. Note that R11's ground lug is not connected to its case. The wire shield(s) are connected to ground *only* at the board's ground buss.

Temporarily complete the wiring by connecting T2 (with very long leads) into the circuit. Connect only output jack J3 to your amplifier's input and turn on your amplifier and the reverb. Advance the amplifier's gain control to its normal setting and listen for hum—you'll hear it. The hum from T2 is picked up by the delay line's output transformer.

Position T2 on the back panel approxi-

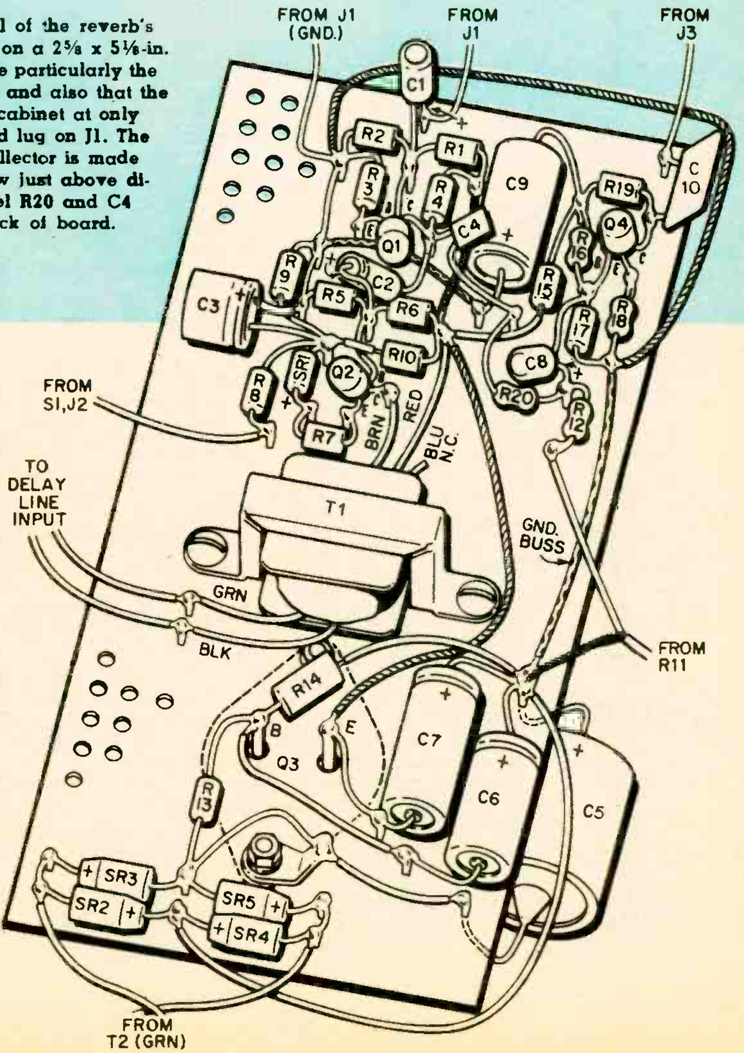


Fig. 1—Practically all of the reverb's components are built on a 2⅝ x 5⅛-in. perforated board. Note particularly the use of a ground buss and also that the buss connects to the cabinet at only one point—the ground lug on J1. The connection to Q3's collector is made at the mounting screw just above diode SR5. In our model R20 and C4 were installed on back of board.

Fig. 2—Our model's control end. Multiply dimensions here by 3.14 to scale cabinet.

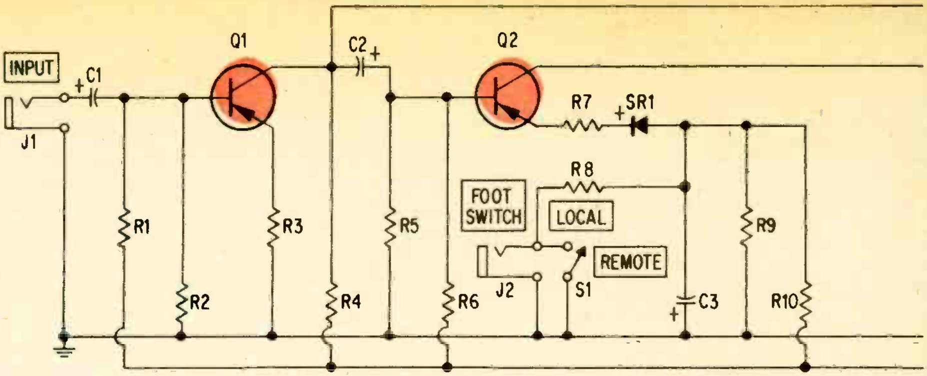
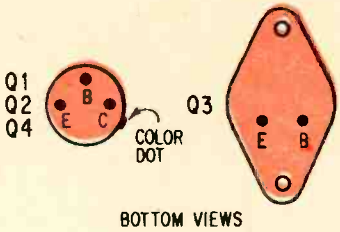


Fig. 3—Transistor Q1 is low-gain amplifier whose output goes to delay-line driver Q2 and output transistor Q4. Q4 combines and amplifies echo signal from delay line and direct signal from guitar fed from Q1 via C4 and R20. SR1, R9, R10 and C3 provide clickless keying of reverb. When S1 is open, SR1's anode is negative with respect to cathode and Q2's emitter circuit is open. Hence, nothing gets through Q2. Close S1 and R8 (whose resistance is much lower than R9) causes SR1's anode voltage to become positive with respect to cathode. Transistor Q2 now conducts. C3's slow charge and discharge time prevents sharp on/off clicks and snaps.



Go-Go Reverb for Guitars

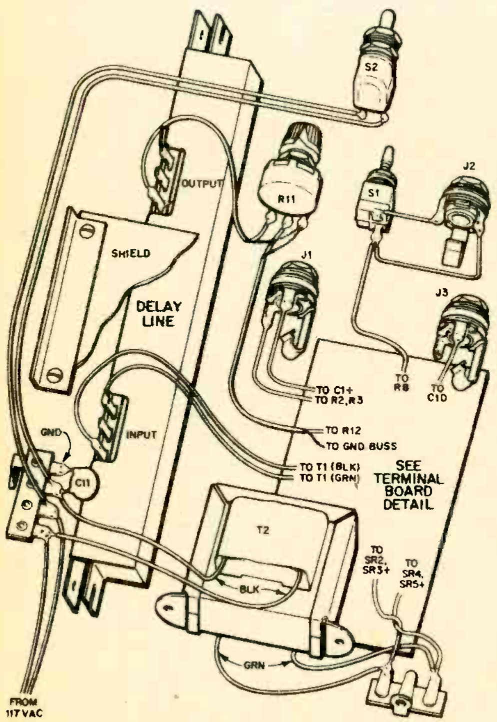


Fig. 4—Pictorial shows cabinet-mounted components. J1,J2,J3,R11,S1 and S2 go on 3½ x 6-in. side of cabinet. Parts at left go on the 10 x 6-in. side.

PARTS LIST

Capacitors: 15 VDC, or higher, unless otherwise indicated

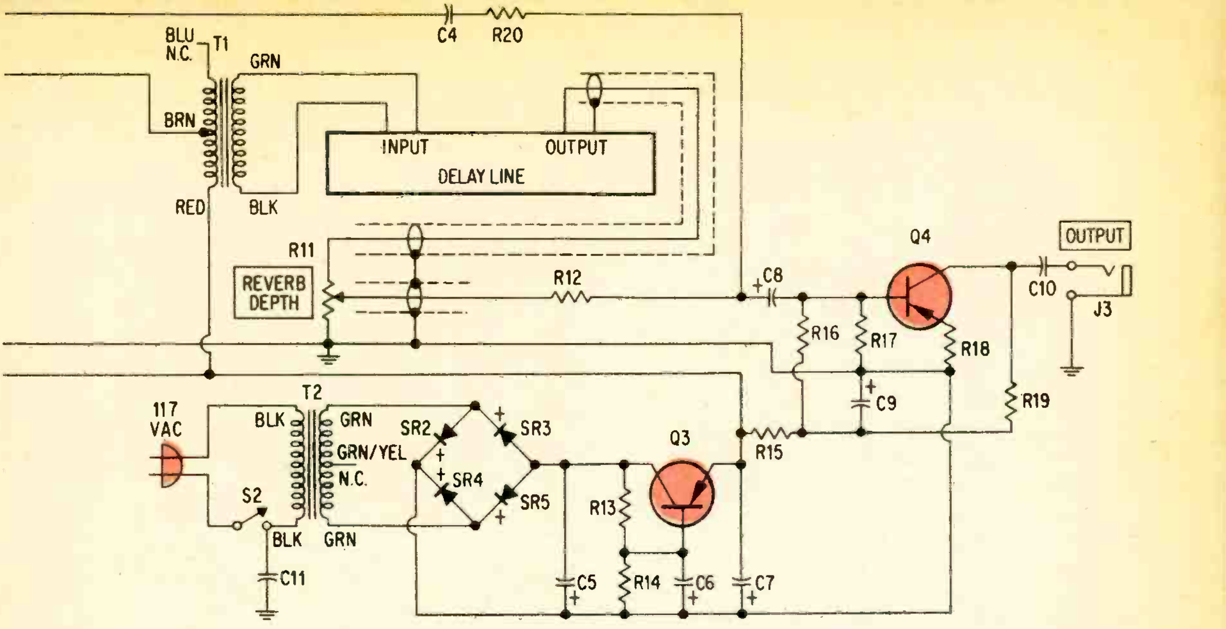
C1—10 µf, 6 V	C2—2 µf
C3—100 µf, 6 V	C4—.01 µf
C5—160 µf, 25 V	C6,C7—160 µf
C8—2 µf, 6 V	C9—100 µf
C10—.1 µf	C11—.005 µf, 500 V

J1,J2,J3—Phone jack
Q1,Q2—SK-3004 transistor (RCA)
Q3—Power transistor (Lafayette 19 C 1507 or equiv.)
Q4—2N2613 transistor (RCA)

Resistors: ¼ watt, 10% unless otherwise indicated
R1—100,000 ohms
R2,R5,R10,R17—10,000 ohms
R3—470 ohms

R4,R19—4,700 ohms	R6—39,000 ohms
R7—100 ohms	R8—47 ohms

R9—3,900 ohms
R11—10,000-ohm, linear-taper potentiometer
R12—2,200 ohms
R13—1,200 ohms, ½ watt
R14—2,200 ohms, ½ watt
R15—270 ohms
R18—15 ohms
S1,S2—SPST switch
SR1—1N4001 diode (Motorola)
SR2,SR3,SR4,SR5—Silicon rectifier; minimum ratings: 25 PIV, 500 ma. (Lafayette 19 C 5002 or equiv.)
T1—Transistor output transformer; primary impedance: 1,000 ohms, center tapped. Secondary impedance: 8 ohms (Argonne AR-137, Lafayette 33 C 8550. Do not substitute)
T2—Filament transformer; 12.6 V @ 2 A (Allied 54 A 1420 or equiv.)
Delay line—Model RE-6 (Available from Electronics Unlimited, P.O. Box 189, Great Neck, N.Y. $9.45 price includes postage and handling. No foreign orders. N.Y. State residents add appropriate sales tax)
Misc.—10 x 6 x 3½-in. Minibox, terminal strips, shielded wire



mately as shown in Fig. 5 and *very slowly* position it for *minimum hum*—you will not be able to eliminate all the hum. Mark the holes, turn off power and mount T2. If you have used a larger cabinet you will have no hum since T2 could be placed far away from the delay line's output transformer. In the size cabinet we used you must add a shield to eliminate the remaining hum. Cut a 6¾ x 2⅞-in. shield from a *steel* chassis bottom plate. Attach an L-bracket for mounting as in Fig. 5.

Position the shield between the delay line and T2 at about a 30° angle as shown in Fig. 5. While listening for hum, carefully adjust the shield's position for lowest hum, then mount it permanently. While you may notice some hum in the silence of your shop, you won't hear it when the amplifier level is set to produce normal guitar volume.

Using the Reverb. Plug your guitar to J1 and connect J3 to your amplifier's input. Plug a normally-open foot switch (such as the Linemaster Model T51-S) in J2. Set S1 to *local, reverb depth* control R11 full counter-

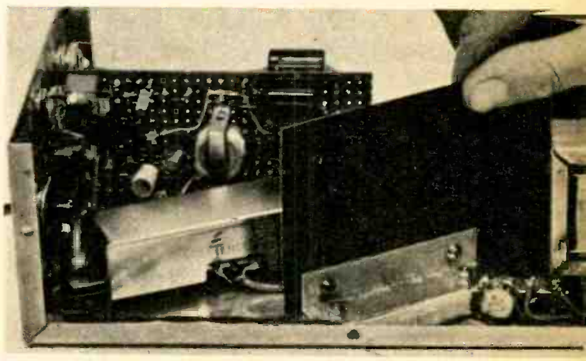


Fig. 5—You're looking into top of unit which is lying on side. Delay line is mounted at about 25° angle. Shield is installed at 30° angle.

clockwise and power switch S2 to *on*. Set the guitar's volume control to its usual position and play. As you play, advance R11—the reverb should vary from off to full on.

The reverb can be muted by either setting R11 full off or by setting S1 to *remote*.

[*Continued on page* 123]

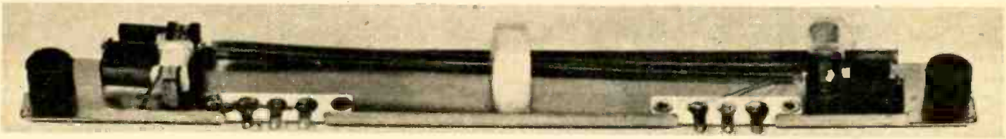


Fig. 6—Delay line without cover. At output end, be sure to connect shielded-wire braid to the left lug.

KIT EI REPORT

Heath/Magnecord Stereo Tape Deck

BACK in the early 1950s when tape was getting started the first really professional, portable tape recorder on the scene was the Magnecord. Every serious tape enthusiast wanted to own one. But because the price tag was so high then, most people just dreamed.

Names have come and gone in tape recorders but Magnecord still is with us and manufactures outstanding professional and semi-professional machines. And as disposable income of audiophiles has risen, the possibility of owning such a recorder has grown closer to reality.

The cheapest semi-professional Magnecord on the market now is the $570 Model 1020. This is a lot of bread but if you are willing to assemble the $399.50 Heathkit version, it becomes a bargain. We built it in slightly under 25 hours.

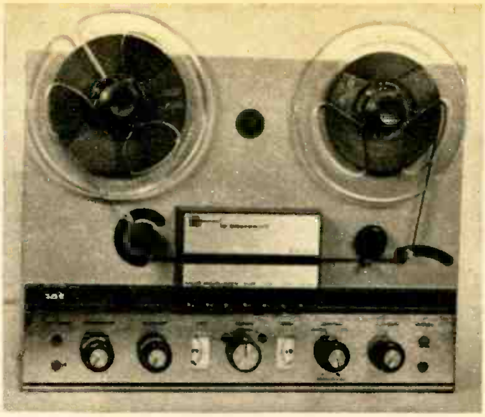
The only difference between the Heath AD-16 and the 1020 is that Heath replaced some equalization pots with resistors. This is a minor difference and does not affect performance.

In all other respects you get a Magnecord 1020 for about 30 per cent less than the assembled price. You have to build it yourself, of course, but how many dealers would knock 30 per cent off the $570 price of an assembled model?

Now a kit like this is a fair-size construction job—especially since the entire transport mechanism must be assembled. We were a little frightened at first at the sight of all those springs, arms, washers, motors, brake linings, levers, flywheels, solenoids, plungers and belts sitting on the table and staring us in the face.

This part of the construction job turned out to present no problem and it did have a decided benefit. Should the transport ever need adjustment, we would have no fear of getting our hands into it. Since we put it together we know how it works and aren't afraid of servicing it.

Optional accessories for the AD-16 are a

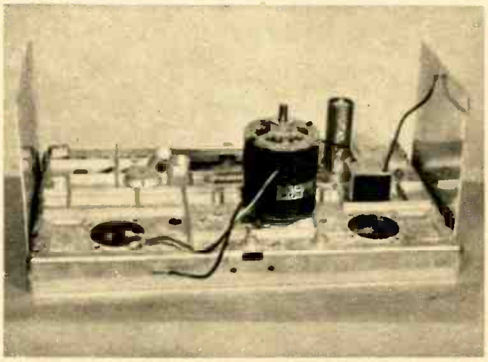


$19.95 walnut base, a $4.75 ring for wall mounting and $9.95 drawer slides for equipment-cabinet mounting.

The AD-16 is a two-speed (3¾, 7½ ips) four-track three-head, three-motor stereo (and mono) machine. Its features include solid-state electronics, two flywheels and push-button/solenoid operation. On the control panel there are jacks for microphones and two pairs of stereo phones. On the rear panel are line-input and output jacks.

Input and output level controls are the dual concentric type. Other features include provision for mixing mike and line inputs and space for 8¼-in. reels. And you can cue a tape. That is, press a button and the tape will be pushed against the heads but will not be pulled by the capstan. This enables you to locate, or cue, an exact spot on the tape by turning the reels by hand.

What's it like to assemble a kit containing 21 transistors, three motors a lot of mechani-



Note die-cast frame, which means rigidity and reliable transport operation. Motor is capstan drive. Post at right of motor is the capstan assembly.

cal components, a big circuit board and a seven-push-button subassembly? If you haven't successfully built several kits before, don't try it. But if you have chalked up a couple of fair-size kits and have an aptitude for handling mechanical parts, the AD-16 will be duck soup.

There were no problems in the assembly of the electronics portion—everything went smoothly, thanks to Heath's well-organized and well-illustrated manual. All wires are cut to length and dressed. When we got to the tape transport we slowed down to become accustomed to the unfamiliar parts.

At this point we became aware of two outstanding features of the machine—a rigid die-cast frame for the transport and the hysteresis-synchronous capstan motor. The hysteresis synchronous motor meant tape speed would stay on the nose. And of course separate feed- and take-up reel motors mean that the rewind and fast forward will be fast.

After the machine is assembled you first check it to see if it at least records and plays back. If it doesn't, lotsa luck. If it does, as ours did, the next steps consist of aligning the heads and setting the bias, using a test tape supplied by Heath. The procedure does not require test instruments. However, there *is* an instrument alignment procedure for those who want it.

We aligned with the test tape in about 45 minutes. But as careful as we were, we found when later checking-out the machine that the bias settings were incorrect. This caused the record/playback response at the high end to be considerably out of spec. When we set the bias using instruments, the machine's performance was better than claimed by Heath.

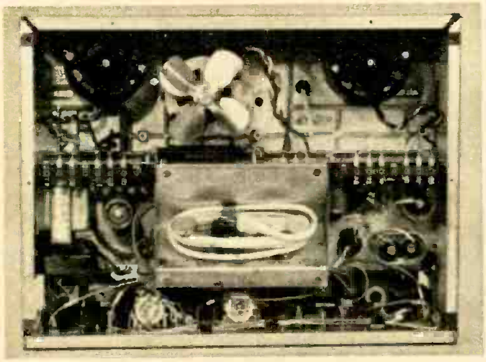
The moral of this is that you can't be too careful when setting bias. It is extremely critical and determines distortion and the machine's high-frequency response.

Anyway, after putting the AD-16 through its paces in our lab, we were delighted by its performance. At 7½ ips the play response of both channels met Heath's spec. (Matter of fact the machine works out to 27 kc!)

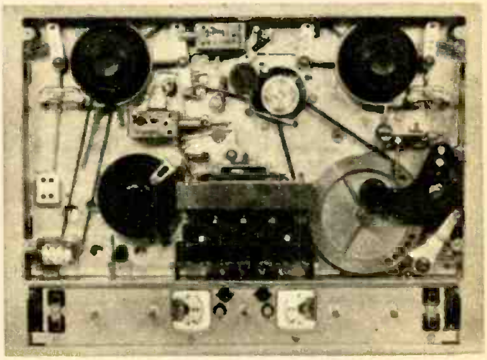
The record/play response of the right channel at 7½ ips was within ± ldb from 50 cps to 20 kc. However we found the record/play response of the left channel was within ± ldb out to 2 kc. Then it started to rise very slightly and reached a maximum of 6db at 10 kc. Then it fell and was up about 1db at 20 kc. With more critical adjustments this could be made as good as the right-channel's response. Record/play response at 3¾ ips was within spec. Signal-to-noise ratio was 52db. Wow, flutter and distortion were also within spec.

One thing bothered us—non-linearity of the VU meters at the low end of their scales. That is, feed a signal in and set the level control for a O VU indication. Drop the level of the input signal 10db and the VU meters will indicate about −15db. Under some conditions this could be a problem, but since most of the time you're not recording with the meter needle down around −20db the problem isn't so bad. The reason for this is the meters; they're inexpensive imports.

All in all, we think the AD-16, that is, the Magnecord 1020, is an excellent machine. It handles tape gently, is easy to operate and performs exceedingly well. We consider it one of the best machines around now for the money.



Rear of machine. Electronics circuit board is at bottom. Line input and output jacks are mounted on plate in center in which power cord is stored.



Top view with cover plate removed. It may look complicated, but after you've built it you would not be reluctant to fix it. Note two flywheels.

Gene Frost was "stuck" in low-pay TV repair work. Then two co-workers suggested he take a CIE home study course in electronics. Today he's living in a new house, owns two good cars and a color TV set, and holds an important technical job at North American Aviation. If you'd like to get ahead the way he did, read his inspiring story here.

IF YOU LIKE ELECTRONICS—and are trapped in a dull, low-paying job—the story of Eugene Frost's success can open your eyes to a good way to get ahead.

Back in 1957, Gene Frost was stalled in a low-pay TV repair job. Before that, he'd driven a cab, repaired washers, rebuilt electric motors, and been a furnace salesman. He'd turned to TV service work in hopes of a better future—but soon found he was stymied there too.

"I'd had lots of TV training," Frost recalls today, "including numerous factory schools and a semester of advanced TV at a college in Dayton. But even so, I was stuck at $1.50 an hour."

Gene Frost's wife recalls those days all too well. "We were living in a rented double," she says, "at $25 a month. And there were no modern conveniences."

"We were driving a six-year-old car," adds Mr. Frost, "but we had no choice. No matter what I did, there seemed to be no way to get ahead."

Learns of CIE

Then one day at the shop, Frost got to talking with two fellow workers who were taking CIE courses... preparing for better jobs by studying electronics at home in their spare time. "They were so well satisfied," Mr. Frost relates, "that I decided to try the course myself."

He was not disappointed. "The lessons," he declares, "were wonderful—well presented and easy to understand. And I liked the relationship with my instructor. He made notes on the work I sent in, giving me a clear explanation of the areas where I had problems. It was even better than taking a course in person because I had plenty of time to read over his comments."

Studies at Night

"While taking the course from CIE," Mr. Frost continues, "I kept right on with my regular job and studied at night. After graduating, I went on with my TV repair work while looking for an opening where I could put my new training to use."

His opportunity wasn't long in coming. With his CIE training, he qualified for his 2nd Class FCC License, and soon afterward passed the entrance examination at North American Aviation. "You can imagine how I felt," says Mr. Frost. "My new job paid $228 a month more!"

"CIE training helped pay for my new house,"

says Eugene Frost
of Columbus, Ohio

Currently, Mr. Frost reports, he's an inspector of major electronic systems, checking the work of as many as 18 men. "I don't lift anything heavier than a pencil," he says. "It's pleasant work and work that I feel is important."

Changes Standard of Living

Gene Frost's wife shares his enthusiasm. "CIE training has changed our standard of living completely," she says.

"Our new house is just one example," chimes in Mr. Frost. "We also have a color TV and two good cars instead of one old one. Now we can get out and enjoy life. Last summer we took a 5,000 mile trip through the West in our new air-conditioned Pontiac."

"No doubt about it," Gene Frost concludes. "My CIE electronics course has really paid off. Every minute and every dollar I spent on it was worth it."

Why Training is Important

Gene Frost has discovered what many others never learn until it is too late: that to get ahead in electronics today, you need to know more than soldering connections, testing circuits, and replacing components. You need to really know the fundamentals.

Without such knowledge, you're limited to "thinking with your hands" ...learning by taking things apart and putting them back together. You can never hope to be anything more than a serviceman. And in this kind of work, your pay will stay low because you're competing with every home handyman and part-time basement tinkerer.

But for men with training in the fundamentals of electronics, there are no such limitations. They think with their heads, not their hands. They're qualified for assignments that are far beyond the capacity of the "screwdriver and pliers" repairman.

The future for trained technicians is bright indeed. Thousands of men are desperately needed in virtually every field of electronics, from 2-way mobile radio to computer testing and troubleshooting. And with demands like this, salaries have skyrocketed. Many technicians earn $8,000, $10,000, $12,000 or more a year.

How can you get the training you need to cash in on this booming demand? Gene Frost found the answer in CIE. And so can you.

ENROLL UNDER G.I. BILL

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

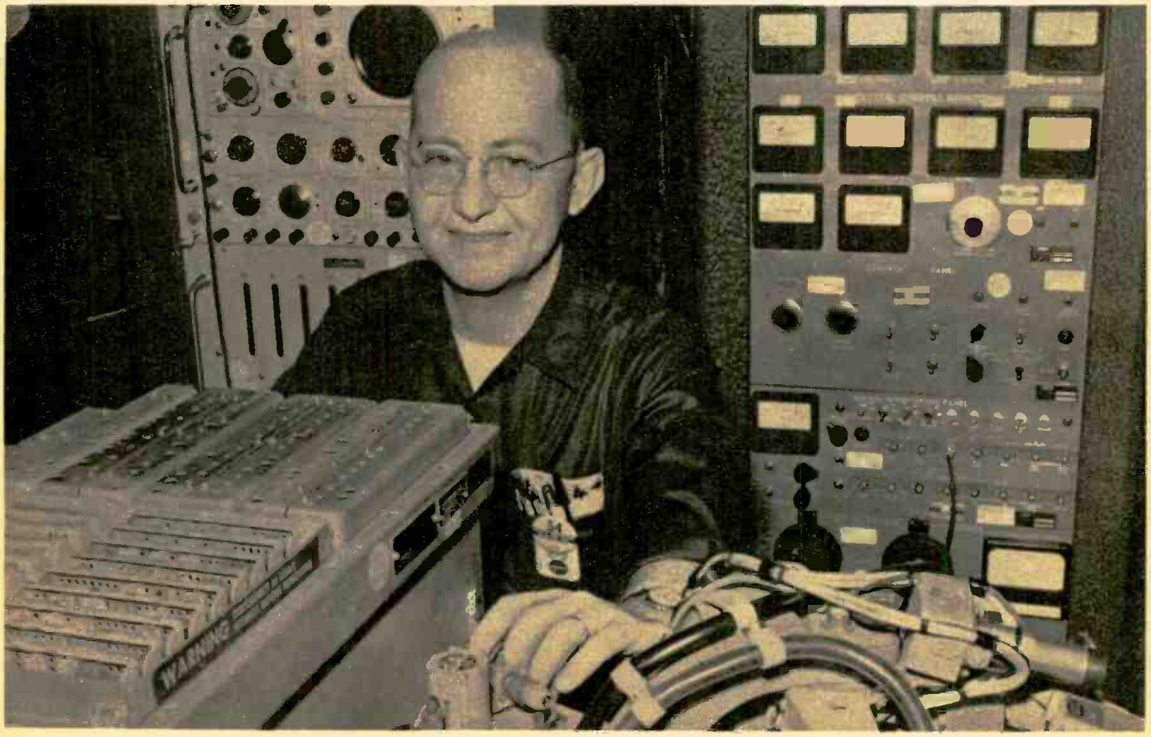
Send for Free Book

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

If you'd like to get ahead the way Gene Frost did, let us send you this 40-page book free. With it we'll include our other helpful book, "How To Get A Commercial FCC License." Just fill out and mail the attached card. Or, if the card is missing, write to CIE at the address below.

CIE
Cleveland Institute of Electronics
1776 E. 17th St., Dept. EI-71
Cleveland, Ohio 44114

Accredited Member National Home Study Council



GOOD READING

By Tim Cartwright

RADIO HANDBOOK (17th Edition). By William I. Orr. Editors and Engineers, New Augusta, Indiana. 847 pages. $12.95

The radio amateur's bible has several testaments and the Radio Handbook is definitely one of them. It's a vast, reliable, comprehensive collection of information on just about every subject of interest to the ham operator—with excursions into such fringe areas as FM. This edition puts special emphasis on keeping up with SSB developments and the constantly growing role of transistors in RF equipment. Coverage of current equipment for various purposes, while not supplying a step-by-step construction-project approach, is more than comprehensive enough for anyone who wants to build-it-himself. Definitely a must for reference.

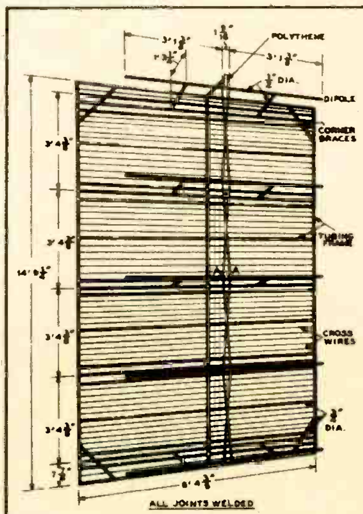


Figure 15

DETAIL OF LAYOUT AND DIMENSIONS OF SCREEN-BEAM

Clear, informative illustration is typical of those in the Radio Handbook.

THE RADIO AMATEUR'S HANDBOOK (44th Edition). Edited by Byron Goodman. American Radio Relay League, Newington, Conn. 640 pages. $4.00

This, of course, is one of the other testaments and too much of a must for most hams to require comment. It has a bit less theory in some areas than the preceding book and a bit more of an orientation to the working ham. Definitely a standard, it's also a bargain.

BROADCAST ANTENNA SYSTEMS HANDBOOK. Edited by Verne M. Ray. TAB Books, Thurmont, Md. 158 pages. $7.50

While TV stations are the province of the very-well-heeled entrepreneur, radio stations—particularly the FM variety—are still within reach of the man with little cash and a bit of ambition. A series of books from TAB apparently aims at owners and would-be owners of small radio stations. This one, although somewhat unadventurous in the theory department, is a good reference for local-station engineers, with a sizable helping of reasonably up-to-date information—all of it oriented toward the day-to-day operation of a station. Included is a treatment of the increasingly important subject of polarization.

SERVICING TV RECEIVER CIRCUITS. By the editors of Electronic Technician. TAB Books, Thurmont, Md. 224 pages. $6.95

A good little text aimed at the service technician who sits up nights trying to conquer the tough dogs on the repair bench, this book combines common sense and operating theory. It provides some fairly easy ways of identifying and solving some esoteric problems. Half of the book is devoted to color TV and, while not the last word on today's phenomenal spread of color circuits, it does supply a good deal of pertinent and accurate information.

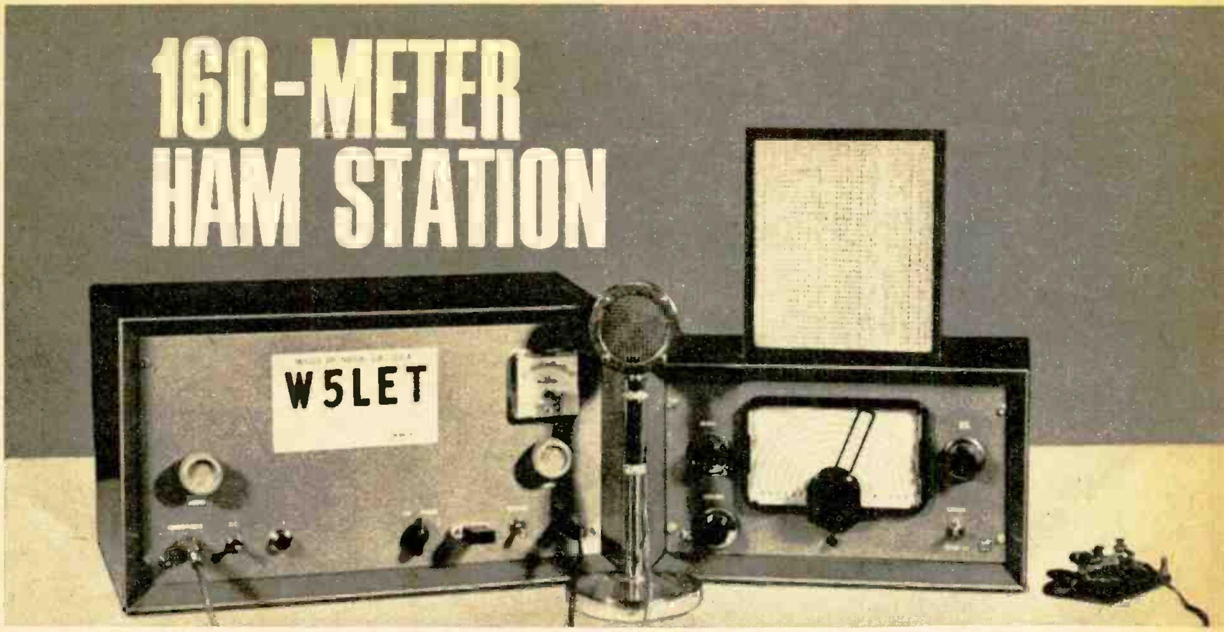
And make note of . . .

SILICON POWER CIRCUITS MANUAL. RCA, Harrison, N.J. 416 pages. $2.00.

ELECTRON TUBES. By Royce Gerald Kloeffer. John Wiley & Sons, New York. 262 pages. $5.95

HAVING FUN IN ELECTRONICS. By Leo G. Sands. Howard Sams, New York and Indianapolis. 160 pages. $3.25

160-METER HAM STATION



This issue... THE TRANSMITTER

By JIM WHITE, W5LET

FOR challenging operating on the almost forgotten 160-meter ham band we started plans for a complete station in our July, 1967 issue. We presented plans for only the receiver in that article. By now you should have done some listening and may be ready to start the transmitter. And you may also be convinced there is a better chance of QSOs on this band than there is on 80 or 40. Okay, so there was some Loran interference, but there were still some quiet spots.

We now present plans for the transmitter portion of the station. Just in case you've forgotten, the transmitter runs 100 watts input on AM phone or CW. In the RF section of the transmitter, there are three tubes. A 6AQ5A is a crystal oscillator and the final stage is a pair of reliable old 807s. By the way, you should be able to pick up 807s on the surplus market for very little. If you can't, you'll find them in the special-purpose tube section of electronics parts distributors' catalogs. New, they run about $3.50 each.

The audio section of the transmitter consists of a 12AX7A mike preamp followed by a 6BQ5 modulator. The power supply is solid state.

The transformer in our power supply was taken out of an old scrapped TV set. If you can get one from an old TV, too, you'll save yourself almost $18. The voltage ratings are in our Parts List.

Construction. The transmitter should be built on a 3 x 7 x 15-in. aluminum chassis. Begin by attaching the front panel to the 3 x 15-in. side of the chassis with two screws. It is a good idea to raise the panel ½ in. above the chassis bottom. By doing this and placing the chassis controls slightly higher than normal, the front flange of the shadow

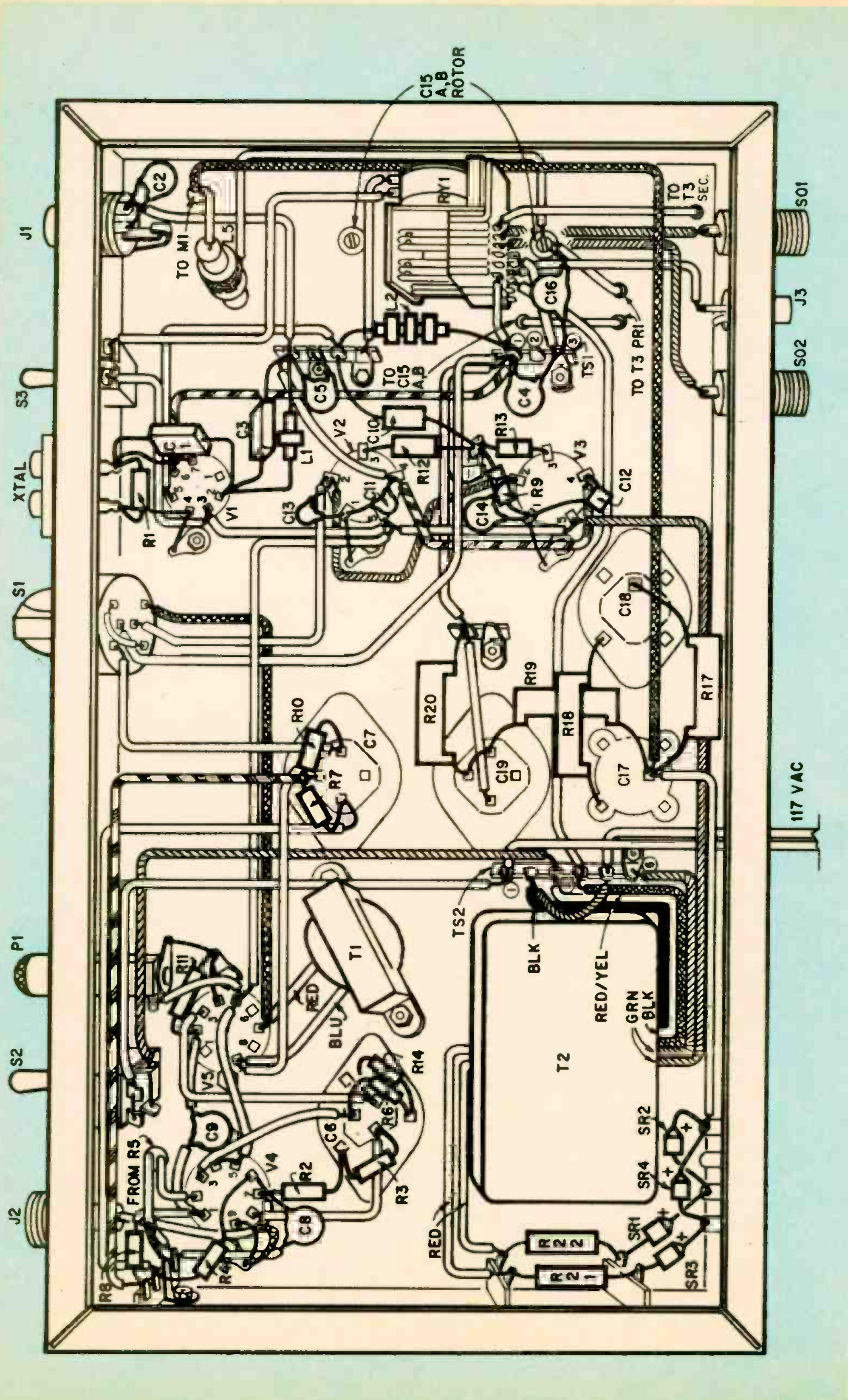
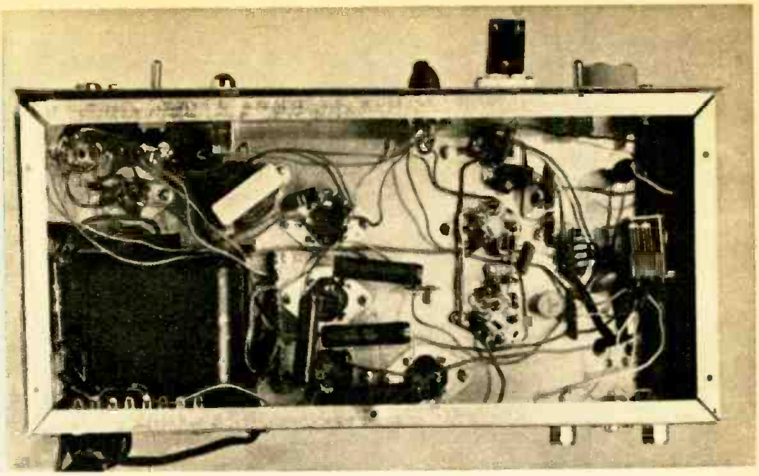

C15 A,B ROTOR
J1
TO M1
C2
RY1
TO T3 SEC.
SO1
J3
SO2
TO T3 PRI
TS1
C16
L2
TO C15 A,B
C4
C5
S3
XTAL
C3
L1
V2
C10
R13
V3
R12
C12
R9
C11
C13
C14
V1
R1
S1
C18
R19
R20
R17
R18
R10
C7
R7
C19
C17
117 VAC
TS2
BLK
RED/YEL
GRN
BLK
T1
RED
BLU
P1
R11
T2
R14
S2
V5
R6
C9
C6
SR2
SR4
FROM R5
V4
R2
R3
J2
C8
RED
R22
R21
SR1
SR3
R8
R4

Fig. 1—Note in pictorial of underside of chassis (left) where relay RY1 is mounted. Refer to Fig. 2 below for connections to RY1's lugs. Although not critical, try to duplicate our layout. Cut off the enameled-wire secondary leads of T1 as they are not used. Knob in upper right corner in photo, right, is on C15. Color coding of leads of T2 is for a standard transformer. Color of leads of TV transformer may differ.



THE TRANSMITTER

cabinet will not interfere with anything. This also results in a neater looking job.

After the panel is in place locate the position of each control, mark the location and drill a hole large enough for each control's bushing. Locate and cut the meter hole along with its four mounting-screw holes. The location of these holes can be determined by examining closely the photographs above and Fig. 5. Some variation from the original layout will not affect performance adversely.

Next, examine the pictorial in Fig. 1 and the photo of the underside of the chassis to see the location of the major parts. Layout the chassis and punch and drill the necessary holes. After these holes are made, mount the parts. Be sure that you use the fiber insulating plate that comes with C17 when you mount this capacitor. The can must not touch the chassis. And put an insulating sleeve on this capacitor's can to keep it from being a shock hazard. The negative side (can) of C18 *is* grounded to the chassis so no such precautions are necessary.

When wiring the transmitter, most of the small parts, such as resistors and capacitors, should be mounted close to the tube sockets. Orient the tube sockets as shown in Fig. 1 so that the leads to the socket will be direct and short. Be sure to use shielded wire to audio gain control R5 as well as from mike jack J2 to pin 7 of V4.

The plate-tuning capacitor (C15A and

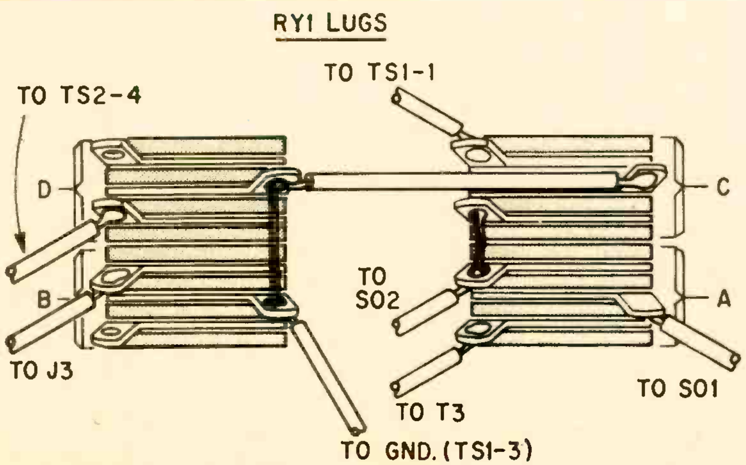


Fig. 2—The relay specified in the Parts List comes in two parts: the coil and the contacts. After assembling them connect hook-up wire to lugs shown here. Force spaghetti on leads and lugs to prevent shorts. Mount relay where shown in pictorial at the left.

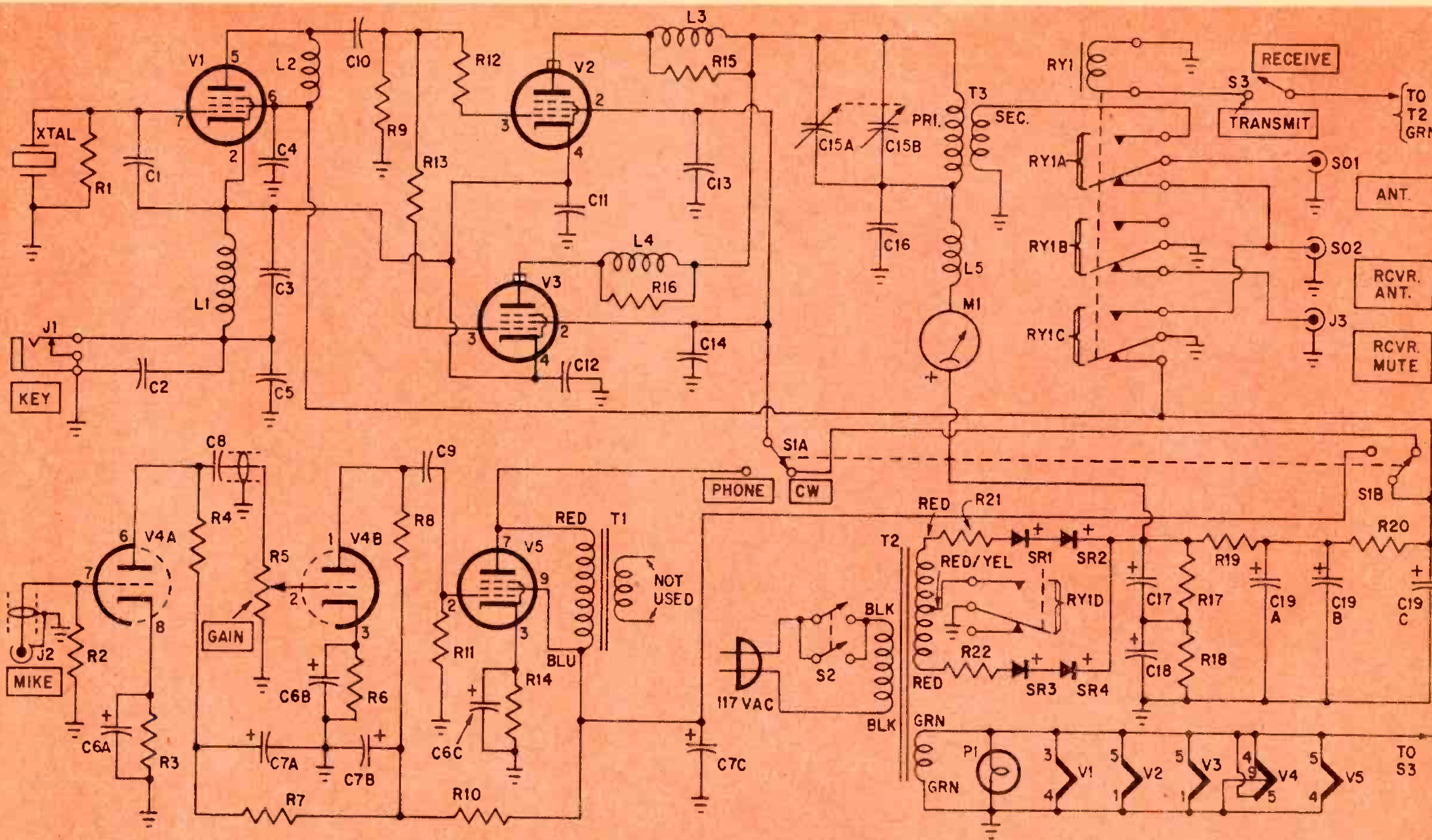


Fig. 3—RF portion of transmitter consists of crystal-oscillator V1, which drives parallel-connected finals—a pair of 807s. V4 is speech amplifier; V5 is modulator. When S1 is in phone position, modulation is applied to screens of 807s via S1A. S1B applies B+ to V4 and V5. When S1 is in CW position B+ is removed from V4 and V5 by S1B and is applied by S1A to screens of V2 and V3. RY1 is shown in receive mode. In transmit, RY1's wipers move up. Note RY1D near T2.

C15B) frame *must be* insulated from the chassis and panel. To insulate it from the chassis use three flat fiber washers along with fiber shoulder washers. Use an insulated coupling along with a shaft extension to insulate the shaft from the panel.

It is a good idea to connect and solder the leads to RY1's lugs before you mount it. Follow the diagram in Fig. 2 for the connections. Some of these leads are so close to each other that it will be necessary to slip spaghetti over them where they connect to the lugs.

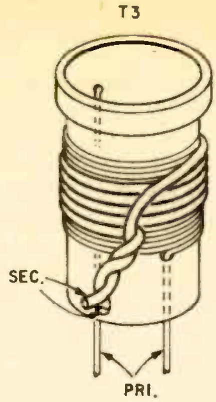


Fig. 4—T3 in detail. After removing prongs, wind primary which consists of 25 close-wound turns of No. 18 enameled wire. Then wind secondary, consisting of 7 turns of No. 20 solid hookup wire, directly over primary. Primary leads go out through prong holes.

PARTS LIST

Capacitors:

C1—75 μμf, 500 V silvered mica
C2,C4,C8,C9—.01 μf, 1,000 V ceramic disc
C3,C10—150 μμf, 500 V silvered mica
C5—.05 μf, 1,000 V ceramic disc
C6A,C6B,C6C—40/40/40 μf, 150 V electrolytic (Sprague TVL-3440 or equiv.)
C7A,C7B,C7C—20/20/20 μf, 450 V electrolytic (Sprague TVL-3780 or equiv.)
C11,C12—.001 μf, 1,000 V ceramic disc
C13,C14—470 μμf, 1,000 V ceramic disc
C15A,C15B—15.5-467.8 μμf, two-gang variable capacitor (Allied 43 A 3528 or equiv.)
C16—5,000 μμf, 3,000 V ceramic disc (Lafayette 33 C 2407 or equiv.)
C17,C18—150 μf, 350 V can-type electrolytic
C19A,C19B—40 μf, 450 V can-type electrolytic
J1—Closed-circuit phone jack
J2—Chassis-type microphone connector (Amphenol 75-PC1M. Allied 47 A 1965 or equiv.)
J3—Phono jack
L1—180 μh peaking coil (J. W. Miller 6180. Lafayette 34 C 8863 or equiv.)
L2—2.5 mh RF choke (National R-50. Allied 54 A 1161 or equiv.)
L3,L4—Choke: 7 turns No. 20 enameled wire wound on resistors R15,R16
L5—2.5 mh RF choke, vertical mount (National R-300U. Allied 54 A 1511 or equiv.)
M1—0-500 ma DC milliammeter (Emico Model RF-2¼C. Lafayette 38 C 3136 or equiv.)
P1—6.3 V pilot light and assembly (Dialco 502-8136. Allied 60 A 7969 or equiv.)

Resistors: ½ watt, 10% unless otherwise indicated

R1—47,000 ohms
R2—1.5 megohms
R3,R6—1,500 ohms
R4—150,000 ohms
R5—500,000 ohm audio-taper potentiometer
R7—15,000 ohms, 1 watt
R8—220,000 ohms
R9—6,800 ohms
R10—4,700 ohms, 1 watt
R11—470,000 ohms
R12,R13—47 ohms
R14—150 ohms, 1 watt
R15,R16—47 ohms, 1 watt
R17,R18—50,000 ohms, 20-watt wirewound
R19,R20—1,000 ohms, 20-watt wirewound
R21,R22—10 ohms, 10-watt wirewound
RY1—4-pole, double-throw relay, 6-VAC coil (Potter and Brumfield type GPA coil; Lafayette 30 C 8715. Contacts: Potter and Brumfield GP17-4PDT. Lafayette 30 C 8727)
S1A,S1B—2-pole, 2-position non-shorting rotary switch (Mallory 3222J)
S2—DPDT toggle switch
S3—SPST toggle switch
SO1,SO2—SO-239 coax connector
SR1,SR2,SR3,SR4—Silicon rectifier; minimum ratings: 750 ma, 750 PIV
T1—Output transformer; primary: 10,000 ohms, secondary: 4 ohms
T2—Power transformer; secondaries: 620 V center tapped @ 240 ma, 6.3 V @ 6 A. (Stancor P-8331. Allied 54 A 4413 or equiv.)
T3—Antenna transformer wound on Amphenol 1¼-in. dia. coil form No. 24-6P. (Allied 47 A 6697) Primary: 25 turns No. 18 enameled wire. Secondary: 7 turns No. 20 solid hookup wire.
V1—6AQ5A tube
V2,V3—807 tube
V4—12AX7A tube
V5—6BQ5 tube
XTAL—160-meter crystal

Misc.

Crystal socket (National CS-6)
Plate caps for 807 tubes (Millen 36002)
3 x 15 x 7-in. aluminum chassis
9½ x 17 x 11-in. cabinet (Bud SB-2142)
Insulated shaft coupling (Allied 47 A 2405)
Panel bushing (Lafayette 32 C 6407)
6-in. shaft extension (Lafayette 32 C 6408)
Flat and shoulder fiber washers
Grommets
Terminal strips
7-pin miniature tube socket with shield base (Amphenol 147-914)
9-pin tube sockets (Amphenol 59-407)
5-prong ceramic tube sockets (Amphenol 49-RSS5)

THE TRANSMITTER

There is only one coil to wind—T3. Both the primary and secondary are wound on a 1¼-in. dia. standard polystyrene form. The form specified in the Parts List has six prongs. Clip these off and drill out the remaining stumps. This will leave six holes in the closed end of the form. Two of these are used for mounting the form to the chassis. The leads from T3 to tuning capacitor C15 pass through two other holes. These leads must be covered with spaghetti.

The primary winding consists of 25 closewound turns of No. 18 enameled wire. The secondary consists of 7 turns of No. 20 solid hookup wire wound over the primary as shown in Fig. 4. Twist the ends of this winding together to hold it securely. These two leads terminate in a terminal strip on top of the chassis. This terminal strip is in front of the coil in Fig. 3.

Be sure to use rubber grommets where the 117 VAC lead goes through the chassis and also where the meter leads pass through the chassis. The lugs of power switch S2 are wired in parallel to increase S2's current-carrying capacity.

Relay RY1 has a 6-VAC coil and is controlled from the front panel by S3. One thing that might seem strange in the wiring of the relay is the connection from SO2 to a contact on the relay (RY1C) which grounds the receiver antenna when the transmitter is transmitting. This prevents RF from getting into the receiver.

The power transformer we specify in our Parts List is a TV replacement type. You may have an old TV set around which has just such a transformer. Be sure that the current and voltage ratings do not fall to much below those shown, or you will not able to run 100 watts. If the color coding is not the same as ours, measure the secondary voltages with a VOM.

Tune Up. The transmitter is simple to get going. With the tubes, crystal and AC power plug in, *phone/cw* switch S1 in the *cw* position and S3 set to receive, connect a good antenna cut for the 160-meter band (or via antenna tuner if it's not the correct length) to SO1. Now flip S3 to the transmit position and quickly dip the final with C15. If things are okay, the final should load up to about 210 ma. If it doesn't you may have to play with the secondary of T3 or even add a turn or two. *Be sure power is off before you do this.*

We strongly recommend a good antenna tuner which will greatly facilitate loading. Unless you are extremely lucky you probably do not have enough room for a full-size 160-meter half-wave antenna.

To operate the transmitter on phone it is only necessary to flip S1 to phone and turn up audio gain control R5. When you speak into the mike the needle in plate-current meter M1 should just move a little.

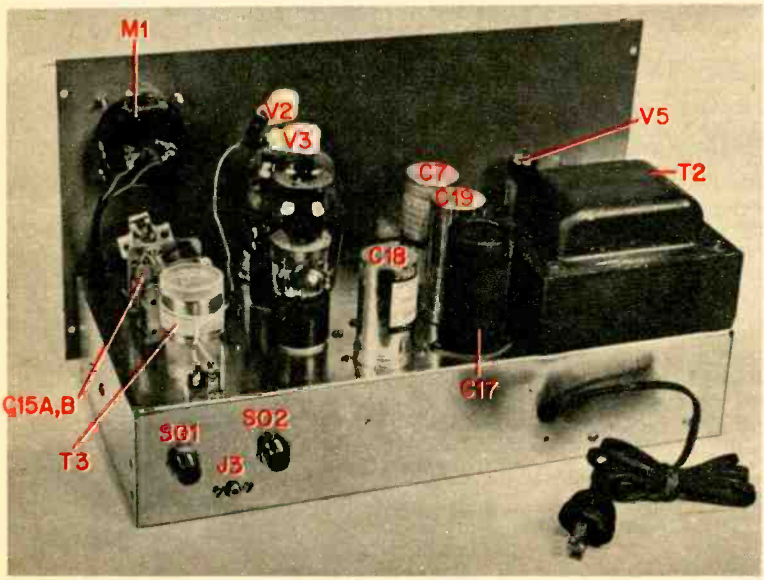


Fig. 5—View of rear of transmitter. Note where T3 is mounted and how secondary winding is connected to terminal strip. Because metal case of C17 is above ground potential and is a shock hazard, it is covered with cardboard tube. L3, L4 and resistors on which they are wound, are installed at tube plate caps.

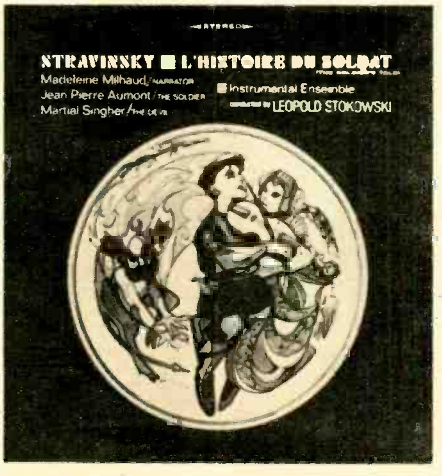
HI-FI TODAY

By John Milder

The Dolby Box

OF all the terms in the hi-fi lexicon, none sounds duller at first hearing than *signal-to-noise ratio.* To engineers, though, S/N ratio always has been a critical subject. And a new gadget for professional recording engineers, the Dolby Audio Noise Reduction System (made in England), is going to make critical audiophiles talk about it as never before. I've just heard the first two LPs produced by American companies with the help of the Dolby and I think we're on the threshhold of a quiet (pardon it) revolution.

The Dolby is a black box (no controls, no adjustments) designed for use with a master tape recorder. It is connected to the inputs for recording and to the outputs during playback. It reduces all forms of noise—tape hiss, crosstalk, print-through, tape scrape and others—by a phenomenal 10db to 15db. The result isn't just a quiet recording with increased dynamic range. It's a *clarity* that, on good equipment, is simply incredible in comparison to the best achieved so far in this direction.



First release to be recorded in this country using the Dolby box comes from Vanguard (above). Nonesuch also has one, recorded in Europe; London has Dolboys in all studios.

This isn't just another volume-compression device. Instead of clipping the peak levels in recording and then restoring them in playback it boosts all quiet signals (below a predetermined level) prior to recording and chops them back exactly to their original size during playback. In the process, it peels off all the significant noise added during recording by the tape machine. It works independently over four different segments of the frequency spectrum so that signals strong enough to override the circuit in one range won't prevent noise suppression in other ranges.

Moreover, the Dolby works—where other gadgets haven't—for a couple of very good reasons. First, it uses semiconductors (over a hundred of them) whose performance parameters do not change over a period of time (Dolbyizing and de-Dolbyizing can be performed even years apart). And, equally important, it works because the circuit design is truly elegant and based on tampering *only* with the lowest-level signals.

The Dolby is going to be used, without any doubt, by quality-conscious record companies. English Decca (London) has already installed them throughout its recording studios and companies like Vanguard and Nonesuch (producers of the two Dolbyized records I referred to) will help push the slower-acting giants into experimenting.

The first two issues employing the Dolby process are Vanguard's recording of Stravinsky's L'Histoire du Soldat and the Nonesuch disc of Kodaly and Rachamaninoff 'cello sonatas. The absence of all the subtle forms of noise that usually drop a slight veil over the recording produces a really startling clarity. But the Dolby system costs $2,000 so don't expect to pick up one for your hi-fi.

FOR some listeners, short-wave provides a window on the iron-hard world of international politics. For others it means exciting toe-to-toe competition with fellow SWLs. A third group seeks escape from the humdrum through pure DX. If you fall into this last category—even occasionally—then those romantic islands of the South Pacific certainly beckon.

Oceania—the collective name for the Pacific's far-flung dots of land—counts as the equivalent of one continent in DX circles. Logging it would be pretty rough for beginners if Oceania did not also include two somewhat less exotic countries: Australia and New Zealand. R. Australia is the only Pacific station to beam transmissions our way. Programs for North America are aired at 0715-0815 EST on 9580 and 11710 kc, then again at 2000-2200 on 15220 and 17840. R. New Zealand, meanwhile, can be heard almost every morning after 0100 EST (2200 PST) on 9540 kc. During our winter months (summer down-under) 11780 kc is also used at that time.

Another, more-exotic spot that any listener should be able to hear with a little patience is Hawaii. Although a U.S. state, it counts as at least one separate DX country because of its separation from the North American continent (see The Listener, July '67 EI). Challenging way to log Hawaii is on the BCB, 0300-0500 EST (midnight to 0200 PST). Try KORL, 650 kc, in Honolulu on Monday mornings. On Tuesday mornings try KUAI, 720 kc, Eleele, Kauai Island, at the extreme western end of the chain. Medium-wave reception from Hawaii, of course, will be considerably easier west of the Mississippi.

All of the stations mentioned so far broadcast in English. Moving to more exotic fare, another station, R. Tahiti shows up (often with good signals) on

SOUTH PACIFIC DX

By ALEX BOWER

EI'S GUIDE TO SOUTH PACIFIC DX

FREQ. (kc)	STATION	LOCATION	TIME (EST*)
3230	Fiji B.C.	Suva, Fiji Is.	from 0200
3335	R. Wewak	Wewak, New Guinea	from 0500
3355	R. Noumea	Noumea, New Caledonia	from 0300
3385	R. Rabaul	Rabaul, New Britain	from 0500
3905	R. Port Vila	Port Vila, New Hebrides	from 0115
3925	Australian B.C.	Port Moresby, Papua	from 0400
3995	Solomon Is. B.S.	Honiara, Guadalcanal	from 0245
4890	Australian B.C.	Port Moresby, Papua	from 0400
4912	V. Tarawa	Tarawa, Gilbert & Ellice Is	from 0130
5044.5	R. Cook Is.	Rarotonga, Cook Is.	from 0300
6135	R. Tahiti	Papeete, Tahiti, Society Is.	from 2200
11825	R. Tahiti	Papeete, Tahiti, Society Is.	from 2200

* For PST, subtract 3 hours from times indicated.

11825 kc around 2200 EST. It can also be heard down on 6135 after 0130. Programs are in Tahitian and French with plenty of authentic South Sea island music. But now things get tough. All other Pacific islands blessed with SW broadcasts operate way down on 60, 75 and 90 meters—and you must listen for them during the wee hours, with peak reception in spring and fall.

Probably the most consistently-heard of 60-meter Pacific stations would be the Australian Broadcasting Commission's VLT4, 4890 kc, Port Moresby, Papua Territory on the island of New Guinea. It can be logged after 0400 EST almost any time of year. The island of New Guinea, incidentally, poses a ticklish question for DXers. Generally, its western end (the Indonesian territory of West Irian) counts as Asia while Papua and the Territory of New Guinea itself count as Oceania. The latter territory is a UN trust and, although under Australian administration, counts as a separate country from the Australian territory of Papua. Two 90-meter stations are available: R. Rabaul on 3385 kc and R. Wewak on 3335. Try them around 0600 EST (0300 PST). The A.B.C. also operates a transmitter on 3925 kc from Papua—VLK3 which, because of ham QRM, is a considerably better catch than VLT4. However 75 meters *is* broadcast territory in the Pacific (except Hawaii, of course) and you should also watch for the Solomon Islands Broadcasting System, VQO2, on 3995 kc. This one sometimes appears as early as 0245 EST.

All of the Pacific stations are excellent verifiers except the Fiji Broadcasting Commission. This one operates on a variety of frequencies and a couple years ago was receiving almost as many reports as big SWBCers. Because F.B.C.—like most stations in Oceania—is strictly a local [*Continued on page* 125]

CB CORNER
BY LEN BUCKWALTER KBA4480

TYPE CASTING

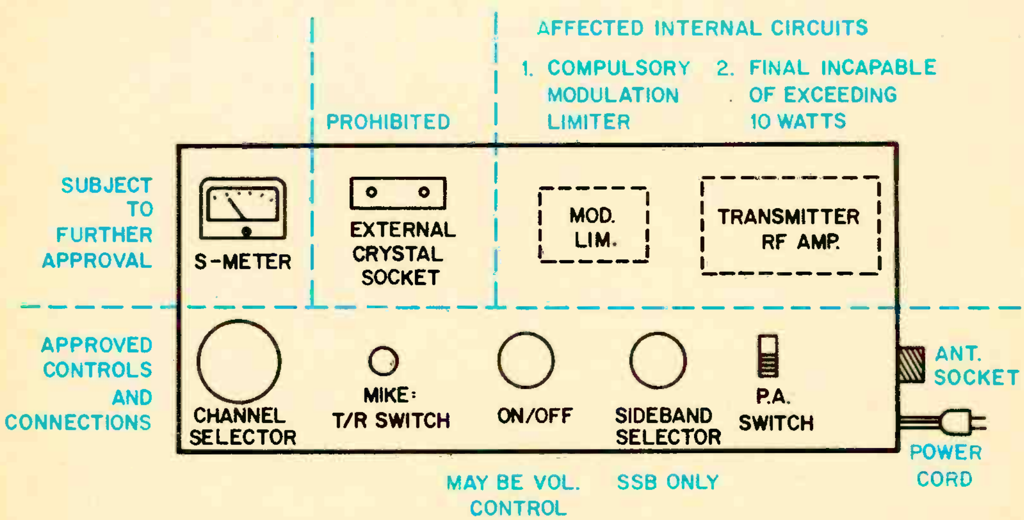
AFTER roasting on the legal hot seat for nearly ten years, CBers finally can move over and make room for company. Now it's the turn of the CB manufacturer. He's the target of new regulations designed to rid the marketplace of shifty, overpowered equipment. Catch-phrase now buzzing around industry circles is *type acceptance*. It's the nub of the new FCC rules, a technical straightjacket that'll probably go through with little opposition.

For good guys of the industry, type acceptance will mean little more than a letter and some time at the test bench. A manufacturer runs technical checks on a unit and submits the data to the FCC. He must certify that results were developed accurately by a qualified engineer. It's as simple as that. Rarely does a unit have to be sent in for checkout. (It's not nearly as tough as type *approval*. Here, the unit itself is sent to an FCC lab in Laurel, Maryland, to be subjected to high humidity, wild temperatures and much electronic higgledy-piggledy.) Until now, type acceptance has been purely voluntary so precious few manufacturers bothered to obtain it. The new rules would make it compulsory.

What impact will it have on the CB operator? Some observers believe type acceptance is a step forward, but hardly salvation. Reputable CB manufacturers had pointed out to the Commission that many transceivers were overpowered or overmodulated or possessed defects that created needless interference on the band. Type acceptance will probably prod lax producers into patching up the sloppy engineering behind these faults. But if this alone cures the interference problem, it will come as a surprise to critics who feel the problem to be one of people, not parts.

Most promising aspect of type acceptance is the measure of protection it may afford the CBer. Present rules are loaded with specifications, but there's nothing to hold a manufacturer responsible for selling an illegal transceiver—the CBer alone must suffer the consequences. Type acceptance may change that. Few manufacturers, it's believed, would

[*Continued on page* 122]



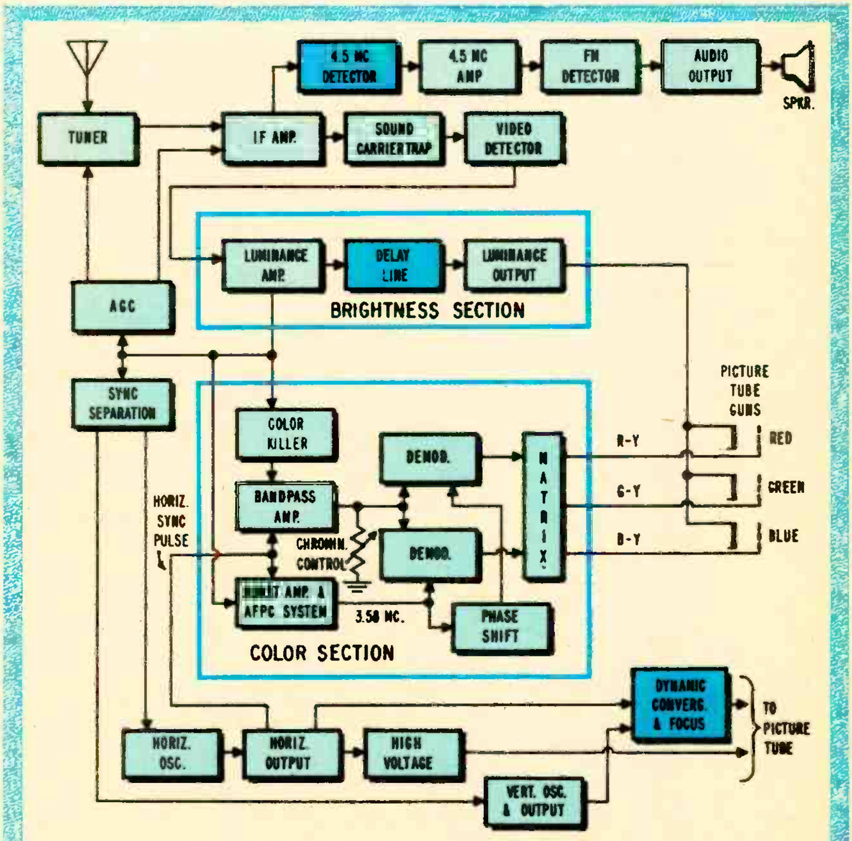
Proposed new FCC rules for CB service would make these changes in transceivers before they could qualify for type acceptance—to be mandatory. Aim is to discourage or make impossible illegal operation.

the ABCs of COLOR TV

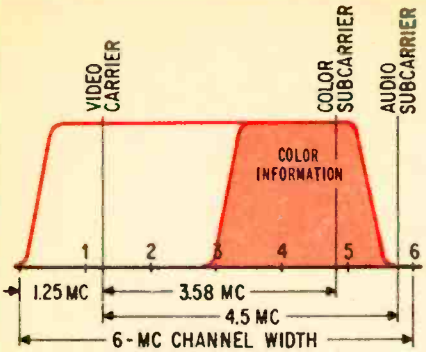
By JOHN T. FRYE, W9EGV

PART 5: COLOR RECEIVER

WITH our discussion of color TV entering the home stretch, let's take stock. We've learned how a B&W system functions, the rudiments of colorimetry, how a color picture tube works and the nature of a transmitted color signal. In fitting all this information together we will see how a



COLOR TV RECEIVER
FIG. V-1



SIGNAL DISTRIBUTION
FIG. V-2

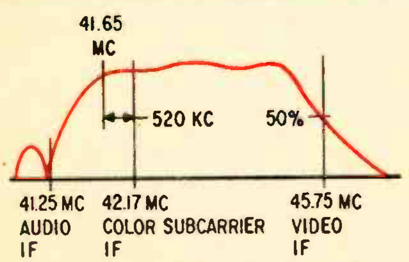
color receiver differs from a B&W receiver and, by understanding the *how* and the *why* of the added circuitry in the color receiver, see how a color receiver can either extract color information from a signal to reproduce a color transmission or make a B&W telecast appear without unwanted color.

Fig. V-1 is the guide we'll use in this wrap-up. It traces various components of the color signal (Fig. V-2) through a color receiver and identifies those sections of the circuitry peculiar to a color set. You can see at a glance that the color receiver is basically similar to a B&W receiver. Chief additions are circuits that separate and reproduce the color difference signals and those that supply the special electrical demands of the color picture tube. Let's take up the circuit sections one at a time.

A color *RF section*, or tuner, is very similar to a B&W tuner except that more care must be taken to see that the entire 6-mc bandwidth of a TV channel is converted to the IF frequency without distortion. If response in the high-frequency end of a channel is allowed to droop in a B&W tuner the only effect is a slight loss of fine detail in the picture; in a color signal these higher frequencies contain the color information and serious distortion here may impair the color or lose it altogether.

Response of the *IF amplifier* is likewise critical. The IF-amplifier response curve of a receiver demodulating the I and Q signals should look like Fig. V-3. It is difficult, however, to keep the color subcarrier and both its sidebands on the flat top portion of that curve and still attenuate the sound carrier sufficiently. This brings us to an important practical compromise:

I and Q signals are used to modulate color information on the subcarrier; demodulating these same signals should provide ideal color definition but in practice this system of demodulation introduces problems of time-delay matching (more on this soon) and critical alignment that offset theoretical advantages. Actual picture quality is about the same in receivers that demodulate the I & Q signals and those that demodulate the color-difference signals. So practically all modern receivers either demodulate the color-difference signals directly or produce another pair of chrominance signals from which the color-difference signals can be obtained.



IF RESPONSE FOR I AND Q DEMODULATION
FIG. V-3

Fig. V-4 shows the IF response curve of such a modern receiver. Note that the color subcarrier frequency is halfway down the left side of the curve and that the upper sideband is attenuated much more than the lower sideband. (Don't forget that frequency relationships in a TV channel are reversed when converted to an IF frequency.) But this deliberate distortion is corrected by the reverse response curve of the bandpass amplifier (Fig. V-4b) through which the chrominance signal passes after detection. The end result shown in Fig. V-4c is that the subcarrier sidebands are equally and uniformly amplified out to about 600 kc. To pull this off, of course, requires careful alignment of the tuned circuits involved.

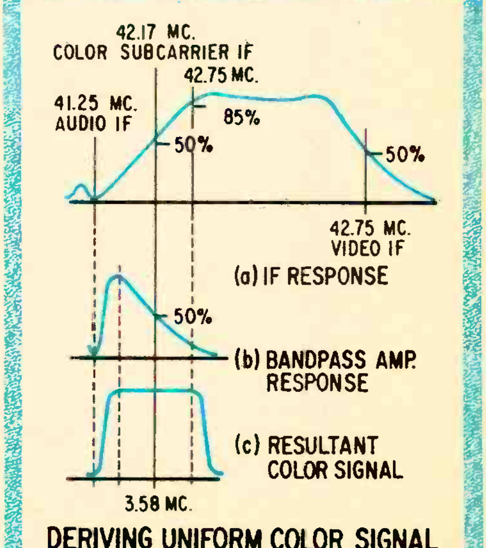
Now look at the audio circuitry in Fig. V-1. In a B&W receiver the 4.5-mc difference frequency between video and audio carriers generated in the video detector is taken off after the detector and amplified in the 4.5-mc audio IF amplifier. But in a color receiver the audio carrier must not be allowed to reach the video detector where it would form a 920-kc difference beat frequency with the subcarrier, which will produce an annoying interference pattern in the picture.

So the IF signal is split at the plate of the last IF tube and one portion is fed to the video detector through traps and filters that eliminate the sound carrier. The other portion goes to a separate *audio detector,* often a crystal diode, where the 4.5-mc intercarrier beat frequency is developd and fed to the audio IF amplifier. The receiver must be correctly tuned if the audio carrier is to fall at the bottom of the filter notch—that's why correct tuning of a color receiver is indicated by minimum cross-hatching in the color areas. Otherwise the color and B&W audio systems are identical.

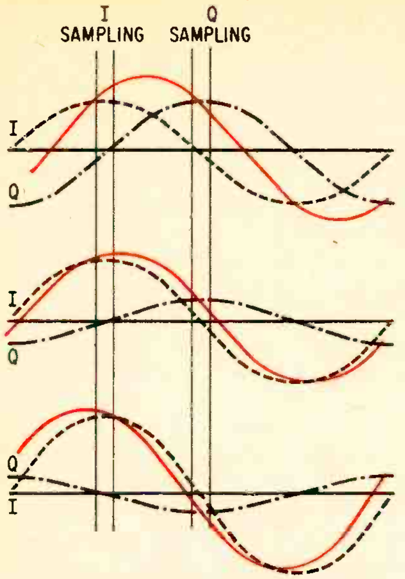
The B&W video amplifier is called a *luminance amplifier* in a color set because it handles the brightness portion of the color signal. A *delay line* is inserted in this amplifier ahead of the output stage. This is a short piece of coaxial cable especially constructed to have the properties of a much longer transmission line, and it delays the passage of all frequencies through it by about one micro-second. This delay is necessary because the Y signal travels more rapidly through its wideband amplifier than does the chrominance signal through the narrower *bandpass amplifier.* Remember: the narrower the passband, the slower the signal travels.

But brightness and chrominance information must arrive at the picture tube simultaneously if hue and brightness components are to be properly related on the tube screen. This is the job of *time delay matching.* If the I and Q signals are demodulated, incidentally, an additional delay line must be used with the I signal (which is 1.5 mc wide) to adjust its timing to that of the slower Q signal (0.5 mc wide). When R-Y and B-Y signals are demodulated no additional delay line is necessary because both signals have a 0.6-mc bandwidth.

The DC components of both the brightness and luminance signals must be preserved and delivered to the picture tube. This is done either by direct coupling in the video amplifiers or by employing some form of DC restoration at the picture tube.



DERIVING UNIFORM COLOR SIGNAL
FIG. V-4



COMPONENT DETECTION FROM CHROMINANCE SIGNALS
FIG. V-5

The luminance signal is fed simultaneously to all three picture-tube-gun cathodes connected in parallel. The separate grid and screen voltages of the three guns are set to produce a white raster with an input signal. Then the Y signal simultaneously modulates all three gun currents with the brightness information to produce a picture in shades of gray. Since the three gun currents always maintain their proper, pre-set relative proportions at all brightness levels the three stimulated phosphors always combine to produce white light. The entire color section is inactive when the receiver is handling a B&W telecast.

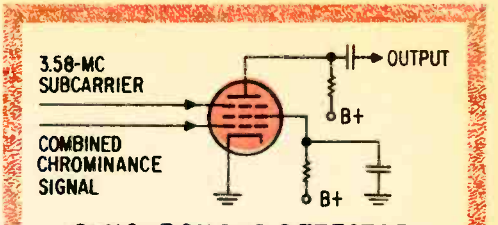
The *luminance amplifier* serves as the distribution center for three other portions of the color video signal. Let's follow each one.

First the sync signals are stripped from the remainder of the video. They are separated from each other and each is fed to the proper horizontal or vertical oscillator. Amplitude of the sync pulses is measured at regular intervals by a *keyed AGC* system to establish the value of an *automatic gain control* voltage that continually trims the gain of the RF and IF amplifiers to the strength of the received signal.

The color burst signals, riding piggy-back on the horizontal sync signals, are fed to a narrow-band, tuned *burst amplifier* that only operates at the instant each burst signal arrives. It is cut off the remainder of the time but is keyed into conduction at just the right instants by pulses from the horizontal deflection circuit. These amplified burst signals are supplied to the 3.58-mc *AFPC (automatic frequency and phase control)* system and control the local 3.58-mc oscillator so its frequency and phase are held precisely in step with that of the subcarrier oscillator at the transmitter.

The chrominance sidebands, meanwhile, are fed through another amplifier, usually with a bandwidth of 1.2 mc, called a *bandpass amplifier*. This amplifier separates the chrominance portion from the remainder of the composite video signal and amplifies it. We've already seen how this amplifier may also correct distortion in the color portion of the signal introduced in the video IF amplifier. Gain of the amplifier usually can be adjusted manually with a *color saturation* control, often called the *chroma control*. In the extreme counter-clockwise position, this control cuts off the amplifier and no color appears in the picture. Turning it clockwise increases the amplifier gain and the vividness of the colors.

When a B&W telecast is being received the bandpass amplifier is cut off by bias obtained from a *color-killer* stage. This stage reacts to a color burst signal—only present in a color telecast—cutting off color-killer bias in the presence of the burst signal, allowing it to reach the bandpass amplifier in the absence of the burst signal. Color-killing is necessary to prevent unwanted color fringes or colored snow in a B&W picture caused by color circuits sampling monochrome information near the subcarrier frequency or random noise in weak signals.



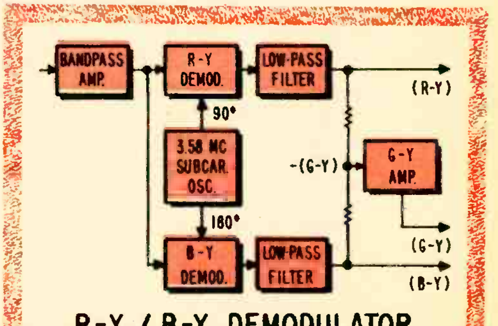
SYNCHRONOUS DETECTOR
FIG. V-6

Now let's tackle operation of the *chrominance demodulators.* You will remember that the chrominance signal was generated by using two signals, evolved from color-difference signals, for separate modulation of two quadrature-phased versions of the subcarrier. The two outputs were combined vectorially into a chrominance signal whose resultant phase could lie anywhere within 360° of the burst reference. Now we want to reverse that process. We want to resolve that chrominance vector into the two components from which it was generated: the modulating signals or the color-difference signals on which they were based.

The chrominance signal (in color in Fig. V-5) can be represented by two sine waves of the same frequency but 90° apart in phase (as shown by the dotted lines). Note in all examples that when either component wave is at a peak the other component is zero and that the amplitude of the resultant chrominance signal at that instant is determined solely by the peaking component. If we sample the chrominance signal only at those instants when one of the component waves is peaking, we can use these samples to reconstruct the modulation voltage determining the amplitude of those peaks without any interfering influence from the other component. In short, we can sort out the amplitude fluctuations of either component we want from the chrominance signal by precise timing of our sample-taking. And by taking two sets of samples we can resolve the chrominance signal into both of its original components!

Our sample collector is the synchronous detector shown in skeletonized form in Fig. V-6. A CW subcarrier frequency of a particular phase is applied to the suppressor grid and the complete chrominance signal is applied to the control grid. Plate current flows only during the extreme positive peaks of the CW signal. How much current flows during these brief pulses is determined by the control grid voltage which is a function of the instantaneous amplitude of the chrominance signal.

If frequency and phase of the CW signal at the detector are identical with that applied to the I modulator at the transmitter, short-time averaging of the plate pulses will reproduce faithfully the I voltage. Likewise, if the frequency and phase of the CW signal are identical with that applied to the Q modulator, the modulating Q voltage will appear at the plate of this synchronous detector. What's more, by shifting the phase of the CW signals applied to the detectors, we can detect the R-Y and B-Y signals—or signals lying on any other pair of axes we select. We will return to



R-Y / B-Y DEMODULATOR
FIG. V-7

this when we discuss the operations of the hue control of a color receiver.

Fig. V-7 is a block diagram of the demodulator section of a receiver designed to demodulate the R-Y and B-Y signals. The two identical low-pass filters prevent phase distortion that would occur if higher frequencies (and asymetric sidebands) were passed. The resistor network between the R-Y and B-Y outputs is called a *matrix*. Its function is to produce the G-Y signal from proportions of the other two. Since G-Y = -0.51(R-Y) -0.19(B-Y), we can combine 51 per cent of the R-Y signal with 19 per cent of the B-Y signal to get the negative value of the G-Y signal. Then all we have to do is pass this through a phase-reversing amplifier and we will have all three color-difference signals ready to apply to the control grids of the color picture tube.

With the luminance signal (or Y signal) applied to all three cathodes and with each color-difference signal applied to its respective control grid, addition of the Y signal to each difference signal take place in the electron beam both are influencing. Increasing the strength of the Y signal will, of course, *add* to the strength of the electron beam. Increasing the difference signal on the grid will *subtract* electrons. Working this out mathematically we find that for the red gun the beam strength will be Y-(Y-R) = R; for the blue gun it will be B and, for the green gun, G. Each picture tube beam current, in other words, is responding to just the output of its corresponding color-camera tube. And that's what we set out to accomplish.

By now you are surely aware how important it is to synchronize the local 3.58-mc oscillator in the receiver with the intercarrier frequency generated at the transmitter with regard to both frequency and phase. This is accomplished by feeding the separated and amplified color burst signal through a manually-controlled phase-shifting network to a phase detector. There the phase of the 3.58-mc precision oscillator is compared with the phase of the burst signal. If they are not identical a correction voltage is produced whose amplitude and polarity are a function of the error detected. A reactance tube translates this voltage into a variable capacitance that corrects the oscillator tuning. As the two signals reach the same phase, the correction voltages falls to zero and the system locks up in frequency and phase.

The phase-shifting *hue* or *tint control* allows the viewer to change hues by altering the phase of the burst signal. Since the local oscillator follows this change the hue control actually rotates the demodulation axes. When the phase shift between these axes and the transmitted burst signal is correct flesh tones look the most natural.

Dynamic convergence and focus voltages are obtained from the horizontal and vertical detection circuits as shown (Fig. V-1). The high-voltage power supply is similar to that of a B&W receiver except for the higher voltage and the heavier current needed to accommodate the three guns. Since a change in high voltage would affect convergence, a shunt-type voltage regulator is used to keep this voltage nearly constant under varying current demands and line voltages.

Let me make it crystal clear that not all TV receivers are like the one described here. There is a tremendous variety of circuitry, especially in the demodulator section. As a single example, late model RCA receivers employ X and Z demodulation axes that lie close to, but not on, the B-Y and R-Y axes—and the X and Z axes are not 90° apart in phase. But if you've followed this series closely you should have sufficient grasp of basic color TV techniques and working vocabulary to enable you to study present differences and future developments intelligently. At the very least, you should have a healthy respect for the complexity of color TV and you should know how to make the most effective use of chroma, hue, brightness and contrast controls—and know better than to fiddle aimlessly with the others!

The LISTENER

C. M. STANBURY II

WAY OUT . . . The Tass announcement on April 24th that the spacecraft of Vladimir Komarov had plunged to earth with fouled shrouds, killing the cosmonaut, brought to an end the era of absolute secrecy about any and all failures or setbacks encountered by the Russian space program. Also ended, it would seem, are chances for the speculation (often irresponsible) that has greeted past Russian space shots. Behind the curtain of secrecy, rumor had it, lay cases of men lost in space or, alternatively, faked signals to cover the inability of the Soviets to put a man in space! Let's look at the facts.

1. It would be impossible to fake a signal from an orbiting satellite. The real thing can always be identified by Doppler shift. (However, it would be possible, theoretically, to air fraudulent messages by relay techniques.)

2. Aside from professional observatories, the chief source of information on cosmonaut signals is not amateur radio (an error frequently made by the news media) but SWL organizations.

3. Voice messages from Soviet space capsules, when translated, sound like window dressing. They probably are. The real communications are carried on via CW (but not Morse Code). The CW messages — again readily identified by that Doppler shift—have been heard by several SWLs including your scribe.

4. CW transmissions would be unnoticed by most of the world's short-wave listeners (who are non-DXers) and thus could serve no propaganda purpose. (Much of the Russian space program is turned into propaganda.) The Central Radio Club of the USSR, nominally an amateur organization, even goes so far as to advertise Soviet space feats on its QSL cards. (See our illustration.) Therefore there seems to be no room for doubting that the Russians have really been putting men into orbit.

Back of QSL from the Central Radio Club of the USSR is used as a billboard to ballyhoo the Soviets' accomplishments in space—in this case, Yuri Gargarin's flight of 1961, in Vostok I.

5. While CW can be received more easily under difficult conditions, it is much slower than voice communication. It seems unlikely that the Russians would use code so extensively unless the motive were secrecy.

DXers should watch for CW space signals between 19995 and 20005 kc. These transmissions use A1 type modulation (carrier on and off) and should not be confused with space telemetry which uses A2 or frequency shift techniques. To find this narrow frequency range you can use WWV's 20-mc signal as a marker. (You must be sure of the frequency within a couple kc.)

Once your receiver is well warmed up you can make sure the signal is coming from space by turning on your BFO. Pitch of the resultant tone should change noticeably as you listen. Reception probably will last only a few moments; if it lasts longer your receiver may be picking up the image of an earth-bound transmitter. If WWV is audible turn off your BFO. The CW station will still create an audible heterodyne with WWV. If it shifts up and down in pitch as you move the dial ever so slightly back and forth, forget it—you have an image! A similar test can be performed with a built-in crystal marker or accessory calibrator.

Updating for Vietnam . . . SWL interest in Southeast Asia continues very high. But because of this area's complex politics accurate factual information also continues to be

[*Continued on page* 117]

HOW TO MAKE TAPES LAST LONGER

The right care gives recording tape almost unbelievable life expectancy.

By ROBERT ANGUS

RECENTLY I recorded the cries of a 12-day-old godson on a battery-operated portable. My recording will be a cherishable document for the family, perhaps, but will it still be good when he is old enough to go on Social Security?

Not all recordings are intended for posterity. Most of us record primarily so that, for the foreseeable future, we can hear what we want when we want. One of the sales pitches for tape says that it lasts longer than records. But does it?

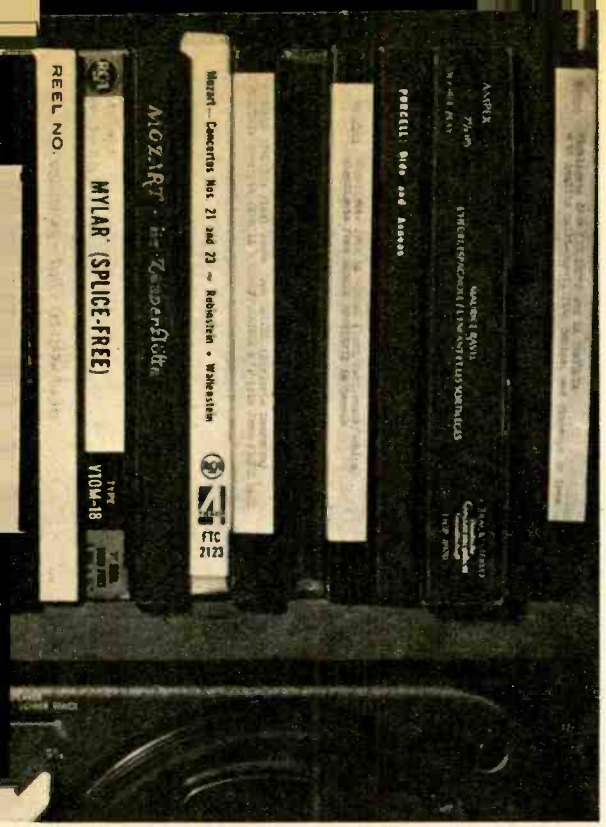
Take the case of folklorist Frederick Ramsey. One evening late in September 1948 Ramsey set up a newfangled tape recorder in his New York City apartment to record master folksinger Huddie Leadbetter (Leadbelly). Neither of them knew it at the time but these recordings were to be Leadbelly's last.

After several evenings Ramsey put his collection of paper-base tapes away on a shelf. There they sat. In 1953, when Ramsey took them down to play for Folkways Records' president Moses Asch, he discovered, sadly, that some tapes had lost their oxide coating.

On the other hand, only a few months after Ramsey's Leadbelly recording sessions Allegro Records began taping chamber music. Not long ago I watched as those Allegro tapes were dug out of battered cardboard boxes in a warehouse. By that time the acetate tapes were 16 years old and still going strong. Only problem: the original splices had dried out and needed replacement.

The vagaries of early tape manufacture created a number of ideas about tape storage, longevity and handling—some correct, some not so correct. It was assumed, for example, that acetate-base tape was good for about ten years before it would have to be scrapped. Another belief held that a sharp jolt would knock the oxide particles out of line and ruin a recording. A belief still common in Europe is that B-wind tape (oxide coating out) stores better than A-wind (shiny side out). A hold-over from two-track stereo days is the impression that recordings should be stored tail out for maximum life. There actually is more untruth than truth in these beliefs, as we shall see.

Three key factors affect tape life: the materials of which tape is made, storage environment and tape handling. When Allegro started, acetate tape had just replaced paper tape. Most industry insiders knew that paper



wasn't all it should be. Acetate, which had served long and honorably as a base for movie film, seemed a better choice. Like paper, acetate tended to absorb moisture, eventually aging and becoming brittle. Unlike paper, it also changed its dimensions as temperatures fluctuated. Some engineers were predicting that acetate could be counted on for only ten good years.

Polyester, introduced in the early 1950s, wouldn't oxidize, wouldn't change shape and was stronger than acetate. But it also was harder to coat and early polyester was noted for peeling. Over the last decade, however, the chemical manufacturers who supply tape producers with the basic film—DuPont, Celanese, BASF and Kodak—have made giant strides in the development both of acetate and polyester.

The first detailed study of longevity begun by the Library of Congress in 1954 reached the conclusion that the best possible medium for storage of sound was 1½-mil polyester tape, which might be expected to last forever if stored properly. This tape is stronger than any other type now on the market (though it will stretch under extreme tension, ruining the recording on it) and the base is thick enough to guard against print-through.

Print-through occurs when one layer of tape, recorded at high level and, therefore, having a strong magnetic field, magnetizes some of the particles in the coating of the turns of tape on each side of it.

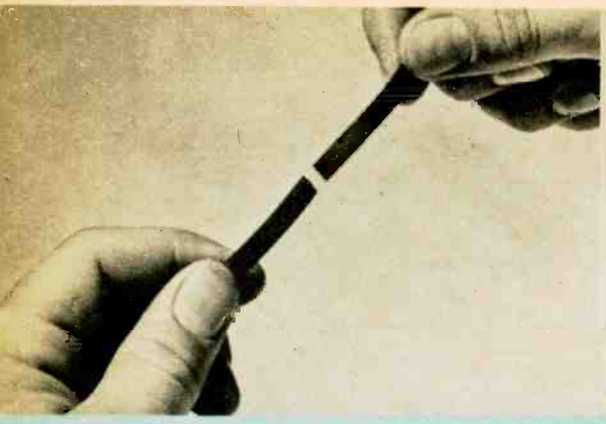
Since the area occupied by a loud burst is much larger with a full-track (or even half-track) recording than with quarter-track, and its magnetic field is much stronger, print-through is not the problem today that it once was. Therefore, concern over the thickness of the base separating the coating of one turn from its neighbors, is not what it was.

In 1955 acetate tended to dry out and flake, but improvements as well as changes in recording techniques have affected the arguments in favor of 1½-mil polyester. Today, according to Eastman Kodak, a good triacetate tape base under normal home storage conditions can be expected to last as long as the recordist himself. Polyester tapes, according to their developers, will last almost forever—as long as they're not abused.

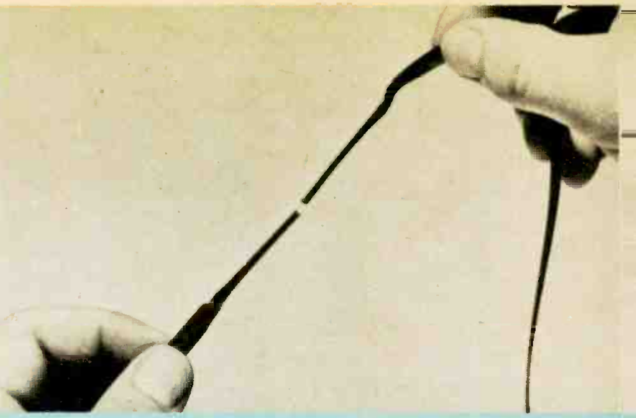
In between polyester and acetate comes polyvinyl chloride. Its backers say it combines the strength of polyester with the economy of acetate. Nobody really knows how long it will last, although there are rumors about PVC tapes recorded experimentally in Germany in 1936 still being in existence. PVC has been in common use in the United States only in the last two or three years—where it has been accepted for heavy-duty classroom use.

Before passing on to other matters, it should be noted that there still is some cheap

What not to do if you want maximum life from your tapes. Careless use of rewind and fast forward causes uneven winding. Note tape fold at right.



Acetate tape bases stretch little under tension and break with clean ends that often can be spliced together again almost as good as new.



Polyester bases have greater tensile strength than acetate bases of the same thickness but they will stretch irreparably before they will break.

HOW TO MAKE TAPES LAST LONGER

or old acetate film on the market that begins flaking almost as soon as the tape is used. This film is used in the manufacture of low-cost white-box tape, and is not easy to identify on sight. After a few plays, however, you'll find chips of tape here and there around your machine. None of the major brands use this type of film these days.

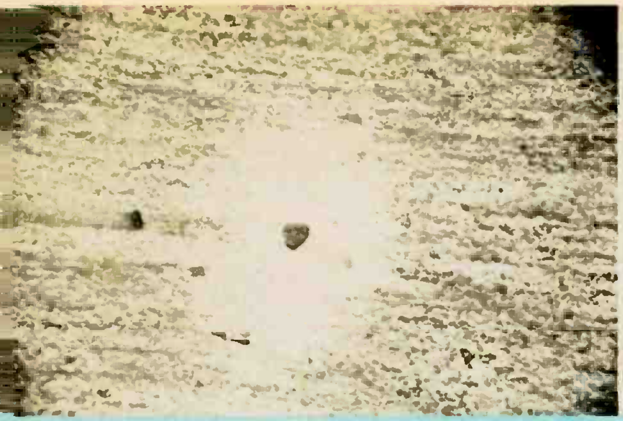
Binder and lubricant, two ingredients of tape coating, also help determine how long a reel of tape will last. While all the major tape manufacturers buy film from the same suppliers, each has his own formula for binder, oxide and lubricant—in most cases, a closely guarded formula. Since each manufacturer upgrades quality it's difficult to generalize about binders. Engineers today say the problem of making coatings adhere to polyester bases is largely solved. Binder quality also is so high it makes the difference between A-wind and B-wind meaningless, if not nonexistent.

Tape lubricant—some form of silicon—has been a standard feature of most manufacturers almost from the beginning. It enables the tape to glide smoothly past the guides and heads. Trouble is that some lubricants lose their slip, you might say, as the tape ages—leaving an abrasive surface that is not only hard on recorder parts but can help pull the coating off the base. Unlubricated tape also tends to squeal or even stop when it passes fixed points. There are on the market devices for applying new lubricant to the tape as it plays and these can provide first aid for extreme cases. A better solution is to use a properly lubricated tape in the first place.

Storage environment is a major factor in tape life. The Library of Congress investigators decided that, acetate or polyester, the best storage climate was a constant temperature of 60° to 70°F and between 45 and 65 per cent relative humidity. If the temperature gets too low it can cause brittleness in acetate, ice-crystal formation and failure due to the differing coefficients of expansion of constituent materials. Tapes, the Library felt, should be stored in airtight metal cans away from any magnetic or electrical fields.

So much for the optimum. Let's go back to those Allegro master tapes, stored in a damp warehouse down by the riverside. They were in the original cardboard boxes supplied by the manufacturer. No special care had been taken and no attempt made to control either temperature or humidity. Yet the tapes played satisfactorily more than 15 years after recording. For most purposes, a metal can affords little more protection than a cardboard box (although it maintains its good looks longer).

A spoiler of another color is electrical wiring (or any magnetic field). While tapes can withstand an amazing amount of temperature and humidity change, they cannot retain a recorded signal if stored within the magnetic field of a generator or power line. It's



Flakes of oxide from poor-quality tape damage recorder and other tapes. This is microscopic look at worn sample with lump in oxide coating.

Quality tape displays even distribution of grains under the microscope. Silicon lubrication helps keep these grains from acting as an abrasive.

even possible for an extension cord to create an electrical field strong enough to erase a tape.

But don't worry about physical shock and its fabled power to erase tapes. You'll break the reel first.

Slow rewinding (at normal playing speed) was recommended once every six months in the days when print-through was a real problem. It not only repositioned the tape and so reduced the chance of magnetic interference between layers, it also eased any tension that might have been created by expansion or contraction of the tape base. Although it no longer is the necessity it once was, slow, regular rewinding is still a good idea. For one thing, the successive layers will protect each other if they are evenly wound.

Do you store tapes head-out or tail-out? No tape hobbyist, even five years ago, would ever admit that he rewound a tape after playing it so that when he next took it out of the box it would be ready to play. Everybody knew that was not the way professionals did it. But it's a myth that professionals never store a tape that's been wound in fast forward or reverse. Nor do they run every tape slowly through the recorder at least once every six months. These master tapes stay on the shelf until they're needed—which may sometimes mean years. There seems to be little advantage to storing your tapes tail out.

For maximum tape life one thing you don't do is splice. "The moment you cut a tape, that cut becomes its weakest point," says Ralph Stein, creative services director of Connoisseur Records. "A fresh splice may be even stronger than the tape around it," Stein explains, "but sooner or later it will dry out. When it does, the splicing tape simply falls off and you have to resplice. If you want a reel of tape to last forever don't splice it."

Most experts agree that tapes take the greatest beating at the ends of the reel. To solve the problem, recording engineers use leader tape—strips of heavy-duty polyester or specially treated paper that are spliced to each end of the tape. In recent years, some manufacturers of raw tape (BASF and Irish, for example) have begun selling tape with leader already in place.

Dirt on a recorder may seem more harmful to the recorder than to your tapes. But buildup of oxide and dirt on the tape guides and heads can act as an abrasive on every tape you play. From every point of view, it pays to keep your recorder clean. It also pays to keep it demagnetized. Magnetized heads (which fortunately occur much less frequently than most writers on tape recording would have you believe) can erase the high frequencies from any tape you play.

What basic rules does all this boil down to? Few. If you want greatest mileage from your recordings, buy high-quality tape, keep it neatly wound and boxed, keep the recorder in good working order and avoid temperature and humidity extremes and, of course, magnetic fields. Modern technology has made unnecessary the elaborate rituals that early hobbyists went through. But if you want to be sure, why not try a ritual?

Notes from EI's DX CLUB

THE unheralded announcement by the VOA that it would no longer supply QSLs to DXers living within the U.S. is bound to leave many American SWLs in a mood to go fight City Hall. It's hard to imagine, though, how they can hope for success. Congress has never allowed U.S. distribution of VOA materials lest they be used for political ends (remember the Kennedy film?).

A nice Latin American catch is HCOT1, R. Zaracay, 3390 kc, in Santo Domingo Colorados, Ecuador. California's H. L. Chadborne reports reception at 1730 PST (2030 EST). Also watch for Ernesto Alvarado, TI2EA, on 40, 20 and 15 meters.

O.R.T.F. at Cayenne, French Guiana, is best heard Saturday nights when it stays on an extra hour, until 2100 EST. Frequencies include 3385 kc on 90 meters and, if you're lucky, 1500 kc on the BCB. All *correct* reports are now being verified promptly via form letter.

The Voice of Germany has received delivery of four brand new 250-kw transmitters which are to be set up at relay bases in Portugal and Central America.

Alvin Pollock (North Carolina) has received a most unusual QSL from a Venezuelan CBer, 5YX127, on 27205 kc (Channel 20).

Another nice catch, by John W. Brennan, K8HAB (Michigan), is 601AU in the Somali Republic. Watch for this one after noon on 15 meters.

From Bob LaRose (New York) we learn that R. Cairo is using 15360 kc for its transmission to Latin America at 1730 EST. It should provide pretty fair reception throughout the Americas this summer. Pro-Western Jordan now has a new frequency for its home service: 6045 kc with reception reported at 2230 EST. An even more important new Near East transmission is Benghazi, Libya, on 7167 kc. Bill Sparks has heard it at 2030-2300 PST (2330-0200 EST). Both these transmissions are in Arabic.

A new frequency for the Zambia B.C. is 3295 kc. California's Bill Sparks reports reception at 2000 PST (2300 EST) sign-on. (Prior to sign-on, Z.B. has a bird-call interval signal.)

For the first time in many years Venezuela has a representative in 25-meter territory. The station is R. Monagas, La Emisora Oriente, at Maturin on 11770 kc during evening hours.

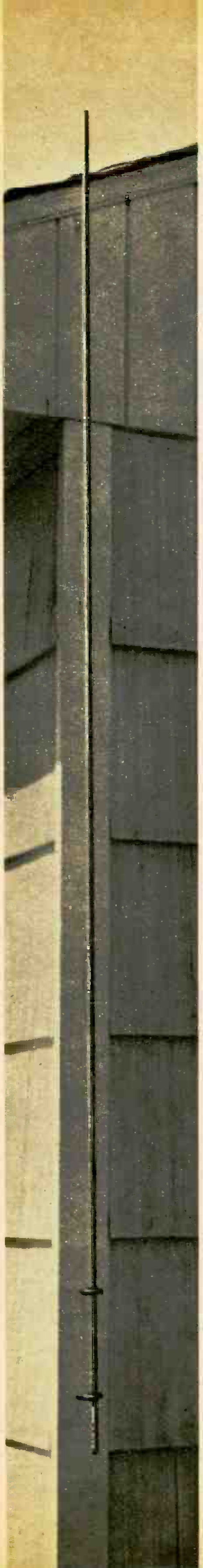
R. Thailand can now be heard on 11920 kc after midnight EST. This would be its new 100-kw transmitter.

R. Tirana, Albania, is now using 9710 kc for English to North America at 2130-2200 EST, then switches to Russian which is jammed by the Soviets.

Propagation: During the equinox months in years of high sunspot activity periodic ionospheric storms may disrupt short-wave communications for one to three days. During these storms signals are all but blacked out in the entire high-frequency range. Fortunately, storms are not frequent.

If a severe radio storm occurs it is often accompanied by a display of northern lights (aurora borealis). Some radio signals will propagate off the aurora and, should it take place, DX TV is possible for periods of up to three hours. CB and amateur 10-meter skip on auroral regions are also possible.

During normal short-wave conditions DX will be good to excellent. During the day all bands from 11 to 19 meters should offer possibilities varying from good to excellent; at night 49, 31, 25, and 19 meters should offer fine DX possibilities.



A Mini Vertical for SWLs

By LEN BUCKWALTER, K1ODH

BIG problem of many SWLs is the lack of a large backyard for an antenna. There's a simple way out of this dilemma which doesn't require you to purchase an acre of land. If you can't spread out horizontally, why not expand vertically? What we're getting at is a vertical antenna—one that's only 8-ft. from top to bottom and mounts easily outside a window. What's more, to help overcome its short length, it can be made resonant on any frequency in the short-wave bands.

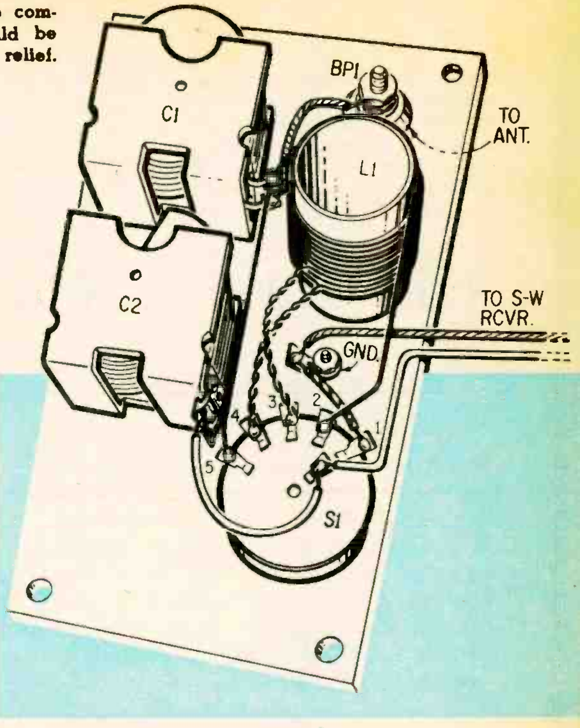
The tuning unit which you set up next to your short-wave receiver makes the antenna electrically a quarter-wavelength long at any short-wave frequency. In addition to its space-saving feature, a vertical is especially sensitive to skip signals arriving at low angles from overseas stations. Because of this, you may find yourself pulling in a lot more DX with a vertical than was possible with a horizontal.

Notice in the schematic in Fig. 5 that the tuning unit comprises two variable capacitors and a tapped coil which tune approximately 2 to 30 mc. When bandswitch S1 is in position 5, the vertical is connected directly to the receiver. No coil is needed at the tuner's highest frequency since the vertical's length is about correct for the highest short-wave frequencies. At the middle and lower bands, the switch inserts coil turns (inductance) to keep the vertical resonant at the incoming frequency. The two variable capacitors function on all bands for fine tuning adjustments. Capacitor C1 is for loading and electrically lengthening the vertical. The other, C2, matches the antenna's impedance to that of the receiver's input.

The first position of the bandswitch, marked *gnd.* shorts the receiver's antenna terminals to protect the receiver's input when the set is not in use. This prevents voltage buildup in the receiver if there's a nearby lightning storm.

Fig. 1—The antenna tuner should be placed next to the receiver. Variable capacitors and bandswitch are used to make the antenna resonant at the particular frequency you wish to tune. You'll see a difference on the S-meter.

Fig. 2—Underside of panel shows the position of the components. The leads to the short-wave receiver should be twisted. Put a large knot in them to act as a strain relief.



Winding the Coil. Wind coil L1 in accordance with the details in Fig. 4. Note that small holes get drilled ¾ in. apart in the coil form to retain the wire at top and bottom. Start the coil at the bottom, threading the wire through the holes, then wind four turns. You have come to the first tap. The tap is made by forming a loop in the wire. Twist the loop tightly, then scrape off the enamel at the end of the loop. This double wire is then soldered to the appropriate lug on switch S1. The other tap is made the same way.

Mounting the Capacitors. The variable capacitors have threaded holes that accept 6-32 machine screws. But you'll have to be careful not to let the screws touch the tuning plates. This can be prevented by using screws no longer than ¼ in. You must first install nuts on the screws to act as spacers. They'll prevent the screw threads from touching the capacitor plates.

Receiver Connection. The wires from the tuner to your receiver should be twisted hookup wire of any length. If your receiver antenna terminals are marked *A* and *G* simply connect the *A* and *G* wires from the tuner to them. In some sets there might be a third antenna terminal marked with another *A*. If there is, connect a jumper between one *A* and *G*. This sets up the receiver for an unbalanced line which is what the twisted pair from the tuner is. Since a vertical antenna must have a very good ground, be sure there's

PARTS LIST

BP1—Insulated binding post
C1,C2—10-365 μμf variable capacitor (Lafayette 32 C 1103 or equiv.)
L1—Coil, No. 22 enameled wire wound on 1-in. dia. form (Millen form No. 45000. Allied 47 A 3219)
S1—1-pole, 5-position rotary switch (Mallory 3115J or equiv.)
Misc.—Bakelite utility case with aluminum panel (Lafayette 99 C 6272), No. 22 enameled wire, ⅜-in. aluminum rod, TV standoff insulators

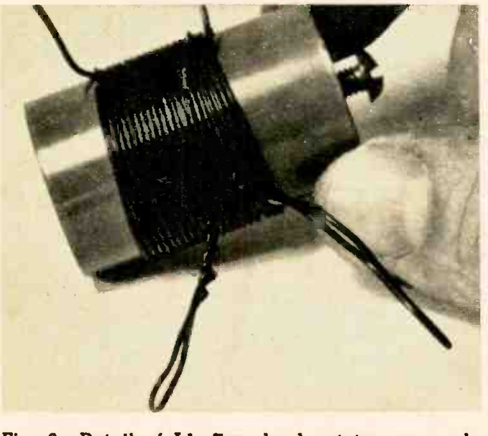


Fig. 3—Detail of L1. Two leads at top are ends of coil. Bottom leads are twisted loops that form coil taps. Screw at right mounts coil on panel.

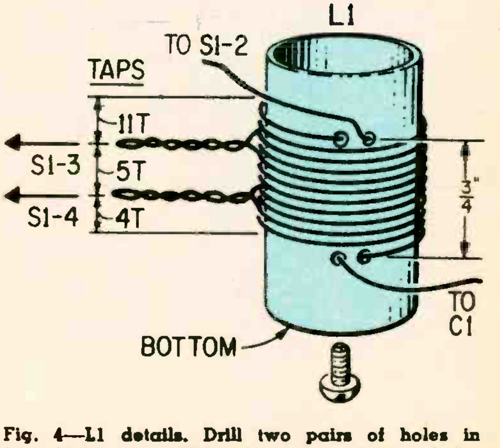


Fig. 4—L1 details. Drill two pairs of holes in form ¾ in. apart. Fish wire through bottom holes then start winding and pull out loops for taps.

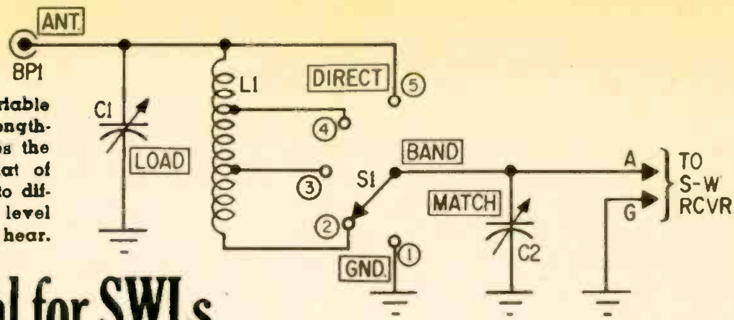


Fig. 5—Tuner schematic. Variable capacitor C1 electrically lengthens the antenna. C2 matches the antenna's impedance to that of the receiver. Set switch S1 to different taps on L1 to peak the level of the signal you want to hear.

A Mini Vertical for SWLs

a ground connection to the receiver, which can be a cold-water pipe.

We mounted the 3/8-in. dia. 8-ft. long aluminum rod on the side of our house. It's held by two screw-in type TV standoff insulators which not only hold, but insulate, the rod. If the rod won't fit into the plastic insulators, open up the metal loops slightly. Then use pliers to squeeze the loops so they hold the rod. A hole drilled at the bottom of the rod accepts a sheet-metal or other screw for fastening the lead-in wire to the tuner.

There are other possibilities for the vertical element. You may use wire and standoff insulators, for example. Just be sure to run the wire vertically and avoid close proximity to any masses of metal that could upset antenna operation.

The short-wave receiver should be located near the window where the lead-in enters. In no case should the combined length of vertical and lead-in wire be more than about 20 ft. This keeps the antenna behaving like a quarter-wave throughout the short-wave bands and sensitive to low-angle signals.

Operation. With everything hooked up and the receiver on, turn S1 to any of the four position above *gnd*. Although the positions are not marked, the tuner resonates the vertical on increasingly higher frequencies as the switch is turned clockwise. Try different positions and turn C1 and C2 until you get the highest S-meter indication for a signal you wish to hear. If the receiver has no meter, adjust the controls for loudest sound.

When you're through listening, flick S1 to the *gnd*. position. It won't help much in a direct hit by lightning, but it will drain away static charges that tend to accumulate during a thunderstorm.

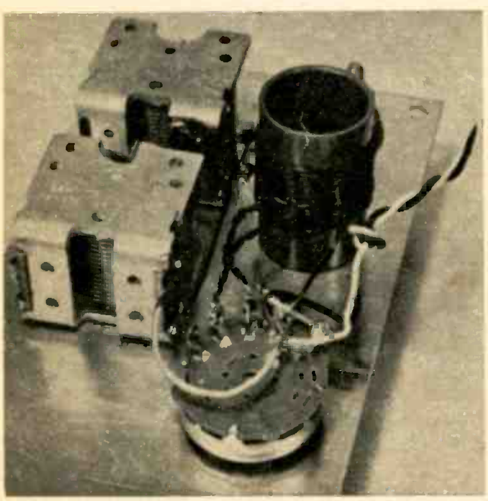


Fig. 6—Closeup of inside of tuner. All parts are mounted on aluminum panel supplied with cabinet. Twist the leads (right) to the short-wave receiver.

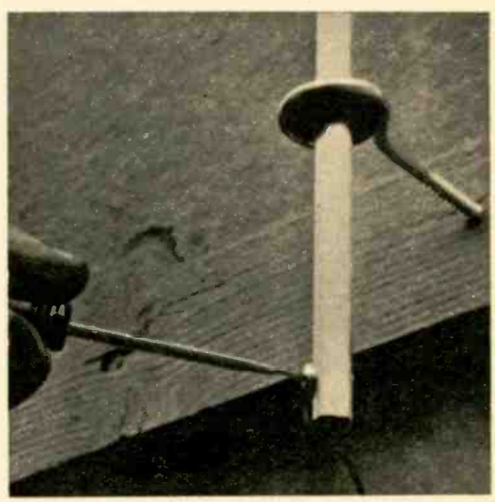


Fig. 7—Fasten lead-in wire to bottom of vertical element with nut and bolt or sheet-metal screw. TV standoff loop should be squeezed to hold rod.

HOW I KICKED THE HAM RADIO HABIT

By NICHOLAS ROSA
ex-W1NOA, ex-WB6JTJ

STAND by for the farewell of a ham who quit, after a quarter-century in amateur radio.

What's more, this farewell will have some *good* things to say about Citizens Band. Plug that into your final and try to tune it. Even the FCC sometimes has nice things to say about CB. Some of you hams may not have noticed but your hobby is in jeopardy.

Or rather, *our* hobby is in jeopardy. You see, I'm writing this because, somehow, I still care. A psychiatrist friend once called me a communications nut. "Busy as you are," he said, "you find time to be a writer. And talk to people. What's more, you even *listen* when other people talk. You dabble in languages. And you always tell me your girl *says* this, but *signals that*. Communications is an obsession with you."

At the moment he said that, all my ham equipment was crated and stored. When license-renewal time came up, I figured, it would still be crated. I would lose my license.

The doctor flicked his cigar. "When renewal time comes up," he prophesied, you'll find a way to renew even if you're frozen in a crevasse in the Antarctic."

Well, he was right. I threw a station together, strung an antenna on skyhooks and logged the required number of contacts just in time to renew—with the clock (not just the calendar) running out. Five years later, though, I literally forgot about it. A quarter-century of hamming just dribbled to an end. My license —the Advanced-Class ticket that I got ages ago when it was called Class A— went down the drain. Why?

I suppose the Alaska earthquake of 1964 was the last straw. Did you listen on the bands that week end? Cacophony! Great crackling patches of silence alternating with clots of gabble, gabble, gabble. Half the VFO champs in the country were piled up around the distress frequencies, just making big small talk about earthquakes and probing each other for news. What news could there be with the earthquake traffic smothered in the QRM?

Not to mention the W6 I heard on 75: "I don't care what's going on. I've worked this frequency every night for thutty years." And sad to say, some hams would even require an explanation of the outrage of this remark even though the frequency in question was carrying distress traffic.

While this kind of sore-headed irresponsibility has become the bane of the amateur bands it certainly is nothing new among hams in my experience. Back in 1950, when the New England states were battered by a near-hurricane and shoreline communities were flooded with ocean water, the hams in my town were just getting an Amateur Radio Emergency Corps started. We managed to dispatch three mobiles to the flood zone. None was more than 3 mi. from our base station (which I was operating) but we couldn't read them.

We could read some rag-chewing W5s in Texas, though. And how did *they* read *us?* "Some nuts up in W1 are having a silly drill and want us to get off this frequency. I say the heck with them." The W5s didn't move and we *couldn't* move. The mobiles were rockbound.

It worked out all right. Anywhere the ham mobiles could go, the police cruisers could eventually go, so all messages got through. But it sure made us look silly. Of course, my old AREC should never have been using ten meters for local emergency work in the first place. Two meters had long proved itself the optimum local band. But too many people in the outfit were at least ten years behind in their thinking.

It wasn't always thus. A dedicated handful of hams have transoceanic QSOs on two meters and higher—by moonbounce. They are showing what can be done by careful work. A few hams are building superb low-noise receivers, using a variety of approaches: parametric amplifiers, phase-lock circuits and so on. Such projects pay off—in personal satisfaction as well as in improved performance, better DX and more QSOs. Another inspiring minority is the Project OSCAR bunch. I knew many old-timers who sneered at the whole idea. But three OSCARS have flown in orbit and they worked fine. Pound for pound, watt for watt, they were several orders of magnitude cheaper than professional communications satellites.

It's time to put dreams back into amateur radio, the way the OSCAR and moonbounce people are trying to. It was amateurs' dreams that opened up the high frequencies (short waves) to world-wide communications—and amateur dreaming that opened up VHF and UHF, too.

Amateur dreaming also helped open up the important science of radio astronomy. Credit has to be shared here between the young amateur Grote Reber (now a noted radio astronomer) and the young Bell Labs engineer Karl Jansky, both working at the same time back in the 1930s. Reber, also an engineer but working alone as an amateur, had built a steerable, parabolic-reflector antenna (perhaps one of the very first) and was already mapping radio stars on VHF.

If hams of today claim that there are no new worlds left to conquer, hams in the 1930s were saying the same thing, since the oceans had been spanned a decade earlier. Meanwhile, Reber and Jansky were tuning in on the universe. At the same time, another handful of dreamers was taking the bases off the clumsy tubes of the day to get short RF leads so the tubes would oscillate and amplify at 60 mc. In short order, these hams were discovering tropospheric skip and other VHF propagation effects—all highly useful today. And they had conquered another world.

If our reservoir of ham talent—something over a third of a million in this country—could produce results like this every year it would have nothing to fear from the commercial and government interests the world over who covet its choice frequency bands. At every conference of the International Telecommunications Union (ITU) there is increased pressure to eliminate amateur radio entirely and let other interests move in. We have been saved every time but with each session the rescue gets cut finer.

What are the majority of hams doing to justify their occupancy of valuable frequencies? With so many hams, there should be no lack of facilities for communicating with any place under any conditions: storm, flood, fire, earthquake. Yet when disaster strikes, the hams on the scene are often stymied. This is because there is no pre-organized local network for *gathering* the information that has to go out. And local officials, needing help in a hurry, tend to turn to police radio, the National Guard, anything that has organization and method.

Here is where Citizens Band is proving its worth. It was several years ago that FCC officials—commissioners, mind you—began to note in public that CB men were quicker than amateurs to join Civil Defense nets, where they performed effectively. And as CB has grown its adherents have formed more and more service nets of their own for all kinds of emergencies.

The CB people, in and out of their nets, are great for rescuing stranded motorists. This is no small thing. I wonder how many red-faced hams, their cars crammed with high-powered gear that can't reach anybody who will lift a finger, have been rescued by CBers—as I have, myself.

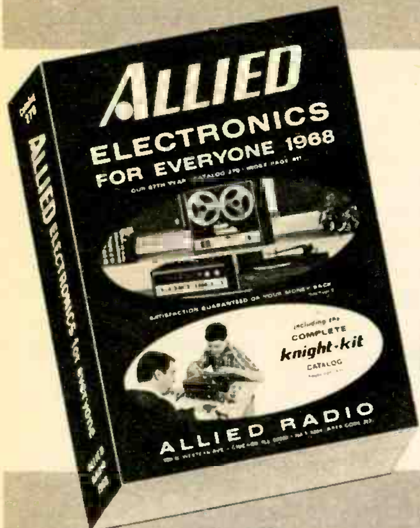
We hams always laughed at the 10-4 jargon. But CB jargon is no more ridiculous than ours and (unlike ours) gets useful things said with a minimum of fuss. We also tend to sneer at CBers as would-be hams who couldn't make it. But within the restraints imposed by their licensing conditions they manage to accomplish a great deal.

Hams are spoiled. They can go on yapping all they want; nobody turns them in to the FCC even if they yap right on top of earthquake traffic. In fact, hams are as close-mouthed about each other's shortcomings as the Mafia.

The example of CB is the final argument that sells me, for one, on incentive licensing. Perhaps if a full set of today's amateur privileges could only be won through increased technical proficiency and evidence of service ham radio would get moving again and put CB back in the shade. Remember the old FCC watchword, PICON (public interest, convenience or necessity)? If amateur radio doesn't make an effort to bring back PICON as a way of life the public interest, convenience or necessity may find better things to do with the ham bands.

I can hear the ham majority yelling now: "This is a hobby! We're in it for fun!" Golf is a hobby, too. I haven't met a golfer yet who didn't want to be a good golfer. The same goes for fliers who, like hams, have to take a government exam. Only amateur radio of all hobbies is plagued by such a sour-bellied spirit. ("A champ is a pain in the neck—he shows me up.")

Just thinking about all this has me so riled I'm tempted to get licensed again and start fighting—from the inside. But who needs ham radio? I don't certainly. No, I don't. I don't. . . . .



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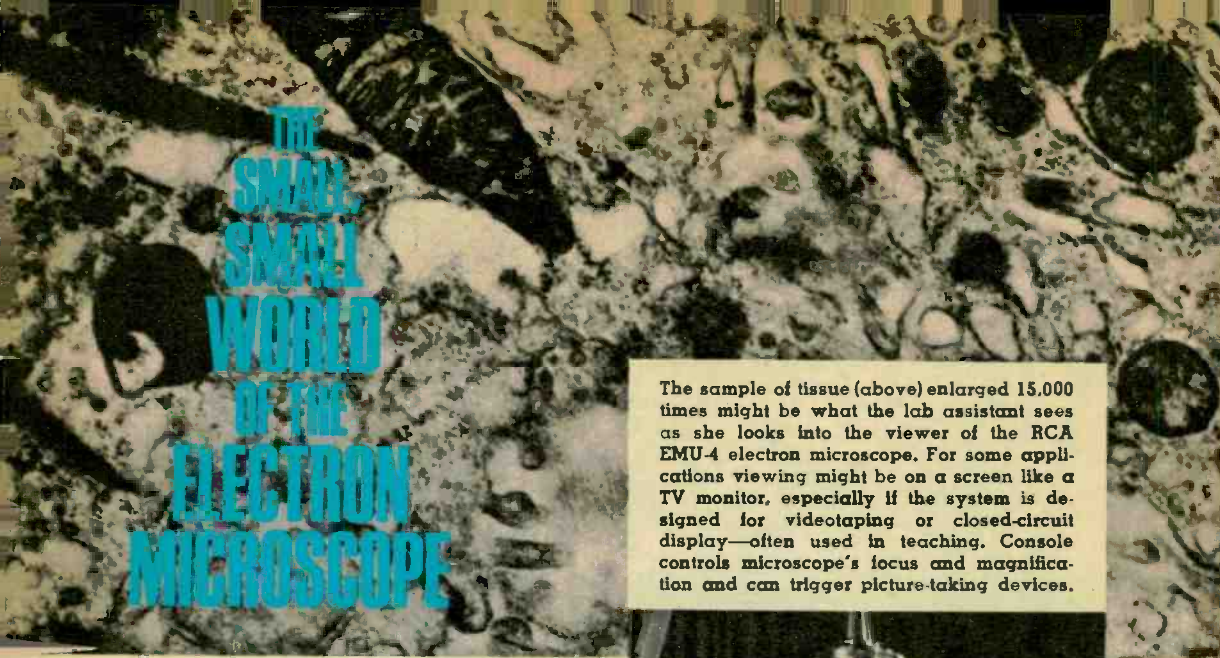


THE SMALL, SMALL WORLD OF THE ELECTRON MICROSCOPE

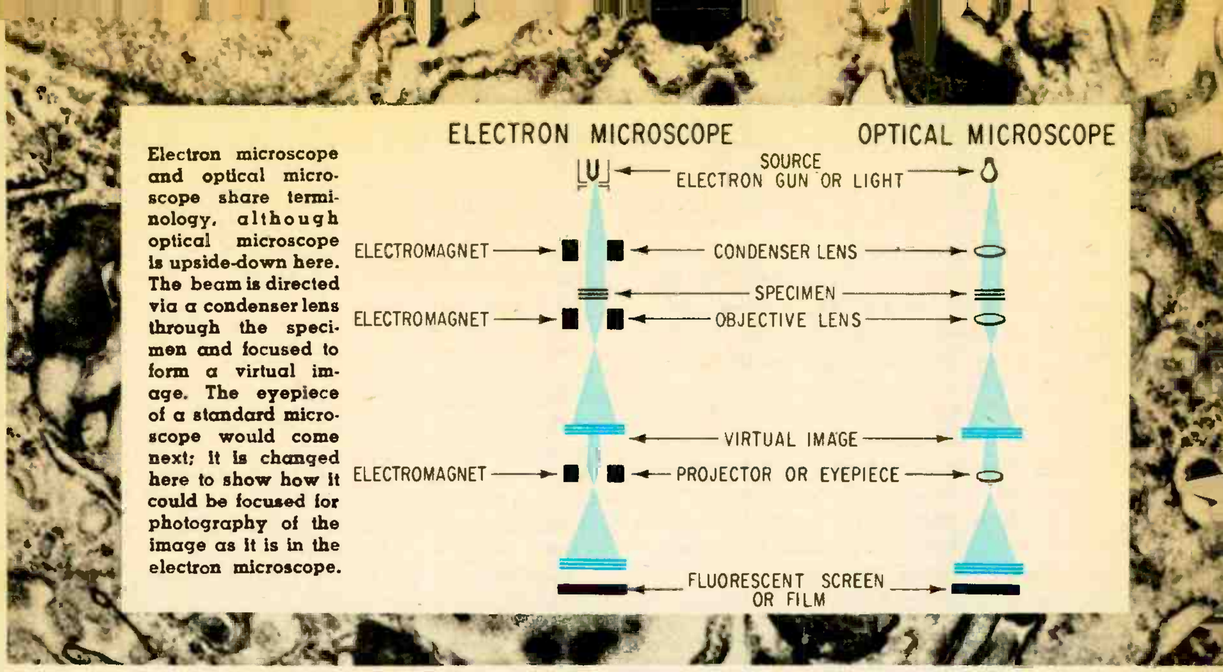
The sample of tissue (above) enlarged 15,000 times might be what the lab assistant sees as she looks into the viewer of the RCA EMU-4 electron microscope. For some applications viewing might be on a screen like a TV monitor, especially if the system is designed for videotaping or closed-circuit display—often used in teaching. Console controls microscope's focus and magnification and can trigger picture-taking devices.

By JAMES G. BUSSE

IT'S a commonplace today to say that we're seeing something man never has seen before. From beneath the world's oceans come fantastic images and hardly a month passes without a new photograph from space to help unlock tantalizing riddles. But no perspective of the world is more exciting in its unfolding details than the picture of the microcosm shown us by the electron microscope. With its help we are penetrating the basic mysteries of life and of matter.

The electron microscope as we know it is only about 30 years old. Before the development of the first, crude models in Germany in 1932, scientists' micro-vision had been limited by the optical microscope. The germs responsible for most of man's diseases, for instance, had never been seen. Long before 1900 the smallest possible dimension that could be seen through any visible-light microscope, no matter what its design, had already been calculated at 1/125,000 of an inch—or about 1,000 times the diameter of a good-size atom.

The ordinary optical microscope uses a series of lenses to magnify an image made up of light waves. As the size of the specimen shrinks to the point where it approaches the length of the light waves carrying its image, the image becomes fuzzy. It's sort of like a blind man trying to read braille letters with the palm of his hand. It's too big for the shapes he is trying to differentiate.



Electron microscope and optical microscope share terminology, although optical microscope is upside-down here. The beam is directed via a condenser lens through the specimen and focused to form a virtual image. The eyepiece of a standard microscope would come next; it is changed here to show how it could be focused for photography of the image as it is in the electron microscope.

One solution was to substitute ultraviolet, with its shorter wavelength, for visible light, allowing scientists to see objects barely half the size. But they had to record each image on ultraviolet-sensitive film or view it on a fluorescent screen. And ultraviolet can destroy living-tissue specimens.

Even with the increased magnification scientists soon reached the practical limits of their microscopes once again. They seriously considered the possibility of using X rays or even gamma rays from radium as a source of illumination. The extremely short wavelengths of these two types of radiation would seem to make them perfect for use in a supermicroscope. But an image composed of a beam of X rays can't be focused. Unlike both ultraviolet and visible light, X rays are not in the least affected by lenses. And this is also true of the more powerful gamma rays.

Then in 1923 French nuclear scientist Louis de Broglie discovered that electrons shooting through space behave like light waves. The focusing coil with which we control the electron beam in a cathode-ray tube, for example, acts as a kind of electronic lens, bending the fast-moving streams of electrons passing through it. Moving the coil back and forth or adjusting its field strength corresponds to lens adjustments in an optical instrument.

What's more, in demonstrating that an electron has a wavelength (just like light) de Broglie showed that it is related to the electron's speed. The faster an electron moves through space, the shorter is its wavelength. Scientists soon found they could vary the speed—and wavelength—of electrons by raising or lowering the voltage applied to the electron gun. With enough speed, electron wavelengths could be reduced to the point where magnifications over 100 times as great as those offered by the best optical microscopes would be possible.

The first electron microscope of 1932 worked. But its makeshift construction and the lack of modern precision-made electronic components kept magnification far below a good optical microscope, so it attracted little attention in the scientific world. Within a few years, however, the electron microscope had been improved enough to be capable of greater resolution than its optical counterpart.

By 1940 electron miscroscopes were being manufactured and sold by at least two German companies. Similar instruments had been built in Holland, England and Canada. The outbreak of World War II served to accelerate the pace as both sides recognized the potential value to wartime research. We now know, for instance, that the Germans used the electron microscope to develop a new type of quick-setting concrete with which they constructed the immense fortifications of the Siegfried Line.

Meanwhile, powerful electron microscopes were developed and produced by RCA in the U.S. These remarkable instruments, the first

HOW SMALL CAN WE SEE?

We all are aware that the miscroscope allows us to see objects too small to be resolved by the unaided eye. In those terms the electron microscope sees smaller than small. In this table of approximate values for the sizes we are talking of you will notice, for instance, that while a red blood cell is well within the capabilities of the optical microscope the flu virus lies out of range. But it would be a large object to the electron microscope whose limit of vision is an object only about four times the size of an atom itself.

Head of a pin	1/25 in.
Man's limit of vision	1/250 in.
Red blood cell	1/625 in.
Light microscope's limit of resolution	1/125,000 in.
Ultraviolet microscope's limit of resolution	1/250,000 in.
Flu virus	1/270,000 in.
Electron microscope's limit of resolution	1/25,000,000 in.
Ion microscope's limit of resolution	1/75,000,000 in.
Atom's external diameter	1/100,000,000 in.

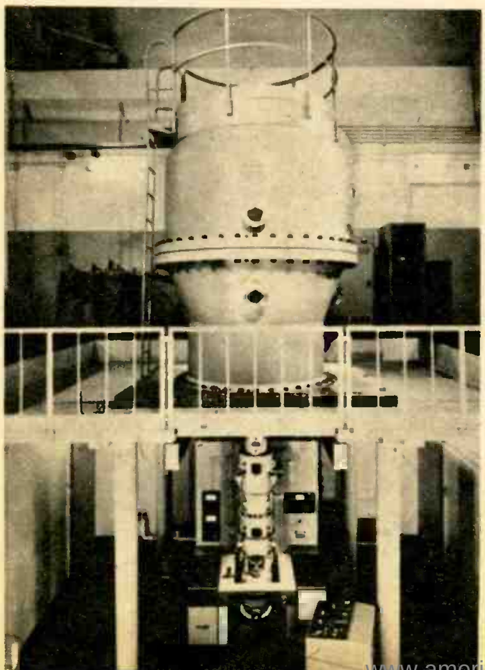
ELECTRON MICROSCOPE

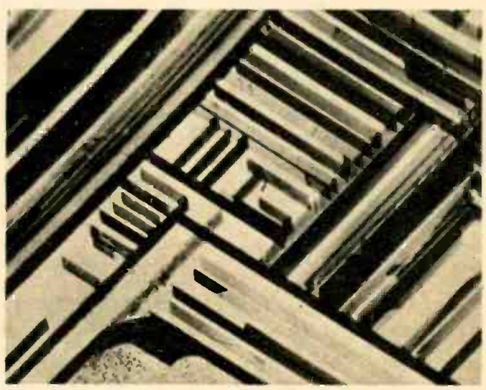
to be made commercially on this side of the Atlantic, assisted Allied scientists in development and production of vitally needed materials such as synthetic rubber, alloys for aircraft engines, synthetic fibers, plastics, vaccines, whole families of new synthetic drugs and catalysts with which to produce huge quantities of gasoline. The electron microscope also aided scientists in solving problems connected with the development of the atomic bomb.

Today's electron microscope consists of a source of high-speed electrons (provided by a hot filament electron gun operated at about 100 kv), three powerful electromagnetic lenses and a small viewing screen, stacked vertically in that order. Each lens is actually a coil of wire wound on a soft-iron core.

The fluorescent viewing screen, mounted below the lenses, performs the same function as the screen in a TV picture tube. It converts the image carried by the electron beam into a visible picture of the specimen. The entire microscope is encased in a tall metal cylinder. A high vacuum is maintained inside it to prevent electrons in the beam from colliding

[*Continued on page* 117]





Stainless steel looks like labyrinth (above) as enlarged 32,000 times by the electron microscope.

Huge Hitachi unit, developing one million volts, can penetrate thick specimen for metal research.

For Better Sound

TRANSISTORIZE YOUR PHONOGRAPH

By VICTOR KELL

HOLD it! Don't scrap that old phonograph that's been gathering dust in the closet. It's got the makings of a top-sounding record player. Replace its tube amplifier with our modern transistor amplifier and you'll get a lot better sound than you ever imagined the old platter-spinner was capable of.

Using line-powered transistors, our amplifier is an almost universal replacement for tube amplifiers used in most budget-price phonographs. Designed to work into a 3.2-ohm speaker, but sounding just as good with an 8-ohm load, the amplifier has a frequency response ± 3db from 100 to 10,000 cps. At the normal loud-listening level of 500 milliwatts, distortion is about 1 per cent.

The amplifier has both a tone control (actually a high-cut control) and tone-compensated volume control. If you don't want a tone control simply eliminate R2 and C1. Resistor R3 and capacitor C2, in conjunction with tapped volume control R4, provide bass boost at low levels.

Construction

To keep the line voltage off any metal parts which could be touched, there is no direct chassis ground. The common line-cord connection to ground is via capacitor C8, whose ground connection is made to the cover of volume control R4.

If your phonograph is one of those real oldies with a metal tone arm which is connected to ground, either remove the ground connection to the arm or replace the arm with a plastic arm.

Measure the distance between the existing volume and tone-control shafts and make an L-bracket from a piece of scrap aluminum. Follow the general layout shown in the pictorial in Fig. 3. If your phonograph has but one control, for volume, drill an additional

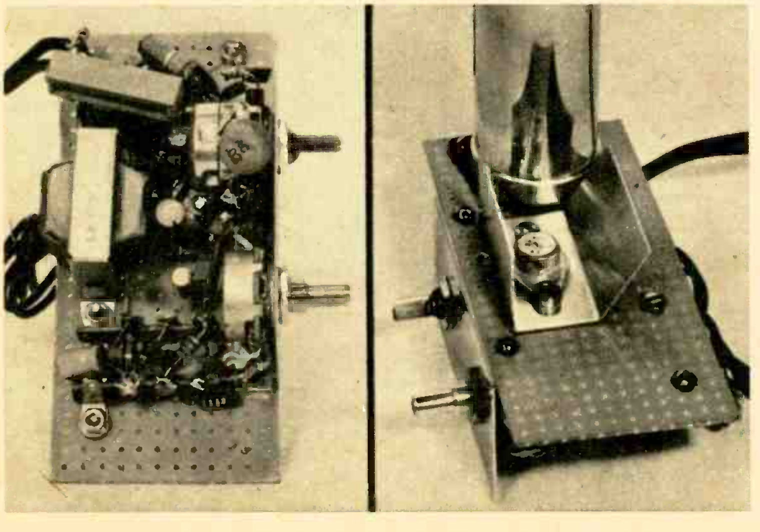


Fig. 1—Underside of completed amplifier, far left. Line-dropping resistor at upper left develops quite a bit of heat so it should be mounted away from other parts as shown. Top view of amplifier, left. Output transistor Q2 is supplied with heat sink attached. Its side has been bent out for clarity. Do not remove the heat sink—it is needed. The phenolic board dissipates virtually none of the heat.

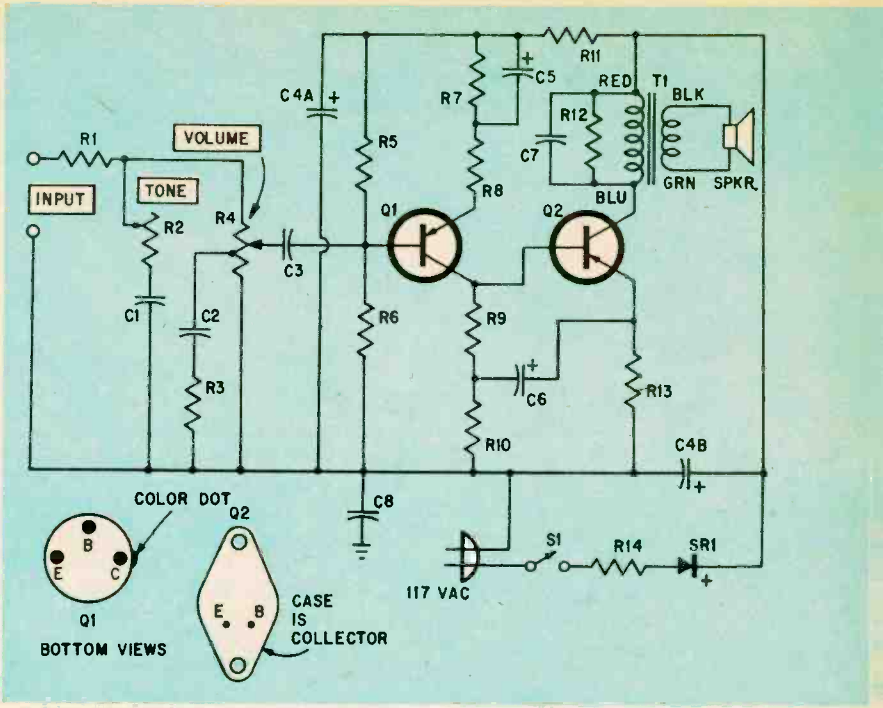


Fig. 2—Schematic. Resistor R1, whose value is 330,000 ohms, is used to increase amplifier's input impedance, which normally is about 3,000 ohms. Sensitivity would increase without R1 but low impedance would not match that of ceramic cartridge. If you don't want bass compensation provided by C2 and R3, eliminate them and substitute an audio-taper pot for R4.

TRANSISTORIZE YOUR PHONOGRAPH

PARTS LIST

C1,C2—.005 μf, 75 V ceramic capacitor
C3—.1 μf, 75 V ceramic capacitor
C4A,C4B—100/100 μf, 150 V electrolytic capacitor
C5,C6—30 μf, 15 V electrolytic capacitor
C7,C8—.01 μf, 1,000 V ceramic disc capacitor
Q1—40263 transistor (RCA. Allied, 40¢ plus postage. Not listed in catalog.)
Q2—40425 transistor (RCA. Allied $1.06 plus postage. Not listed in catalog.)
Resistors: ½ watt, 10% unless otherwise indicated.
R1—330,000 ohms
R2—100,000 ohm, audio-taper potentiometer with SPST switch. (Mallory U-39 or equiv.)
R3,R5,R12—10,000 ohms
R4—2 megohm potentiometer tapped at 900,000 ohms (Mallory UT-451 or equiv.)
R6—33,000 ohms R7—1,000 ohms
R8—68 ohms R9—470 ohms
R10—820 ohms
R11—27,000 ohms, 1 watt
R13—150 ohms
R14—200 ohms, 10 watts
S1—SPST switch on R2
SPKR—3.2-ohm speaker
SR1—Silicon rectifier; minimum ratings: 500 ma, 200 PIV
T1—Output transformer; primary: 2,500 ohms, secondary: 3.2 ohms
Misc.—perforated board, terminal strips

hole in the phono's top deck for the tone control.

Our amplifier's L-bracket is 3⅛ x 1¼ in. It has a ⅜-in. mounting foot. The spacing between centers of the control shafts is 1¾ in. Install the controls temporarily on the bracket and mount the bracket on the underside of the phono's deck.

Cut a 2½ x 4¾-in. piece of perforated board and position it so it will not interfere with the cabinet when the deck is installed. Mark the mounting holes for the perforated board, drill the board and L-bracket to match and attach the board to the bracket as shown in the pictorial. Lay out the holes for C4's mounting wafer, T1 and Q2. Make certain that Q2's heat sink does not touch C4's can. Remove the board from the bracket, cut the holes, install the components and attach the board to the bracket.

The rivets which hold Q2 to its heat sink must be drilled out. Remount the heat sink under Q2, then use 6-32 screws to mount Q2 and the heat sink on the board. When you receive Q2 you may find it marked 40424 instead of 40425. A 40425 *is* a 40424 with a heat sink. But do not use the 40424 because the phenolic board is not an adequate heat sink. Don't worry about Q2 getting quite

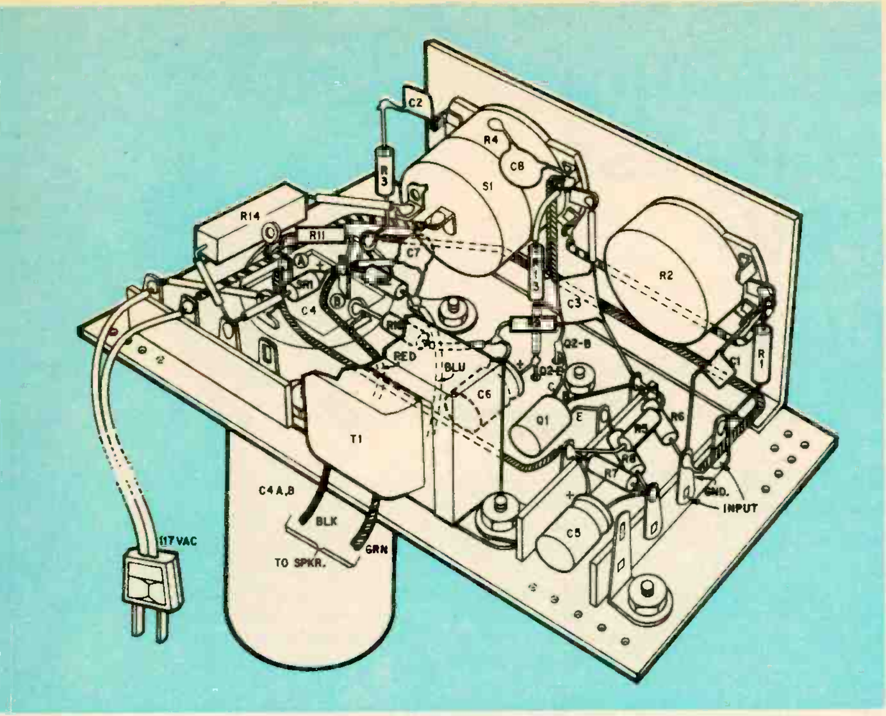


Fig. 3—Underside of amplifier. Input connections are the two lugs at the far end of the terminal strip at the right. Install power resistor R14 and output transformer T1 last to allow yourself plenty of working space. Circuit is connected to chassis ground by C8, which is soldered to R4's case.

hot. It is quite normal—even with a heat sink.

The connections to Q2's base and emitter are made directly to the wire leads.

Connecting the Amplifier

Mount the amplifier in the cabinet and connect the leads from the tone arm and the speaker. Since some of the lugs on the input terminal strip carry low B+ voltage, make certain the shield on the cartridge cable does not touch any other terminals. If necessary, wrap a few turns of tape around the shield near the terminal strip.

If the turntable motor is designed to operate on 117 V and was connected across the power line, connect one lead to the common side of the power line and the other lead to the junction of S1 and R14.

If your turntable's motor was used as the dropping resistor for the tube's heater, you will have to connect a resistor in series with the motor because its operating voltage is considerably less than 117 V. Here's how you go about determining the resistor's value. Suppose the tube was a 25C5. A manual tells you a 25C5 has a 25-V filament which draws 0.3 A. Ohm's Law, R=E/I, tells you that the 25C5's filament has a hot resistance of 83 ohms. Seventy-five ohms is the nearest standard value. Using the power equation (W=EI, 25 V x 0.3 A) you determine that the power which must be dissipated by the resistor is 7.5 watts. To be on the safe side use a 20 watt resistor. And be sure to keep this resistor away from the amplifier's parts and the cabinet. The resistor normally runs hot and could cause damage.

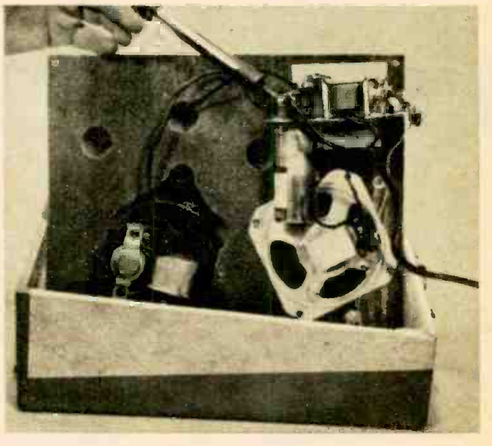


Fig. 4—Installed in the cabinet and ready to go. If motor is rated at 117 V its leads can be soldered directly to the AC line and the power switch.

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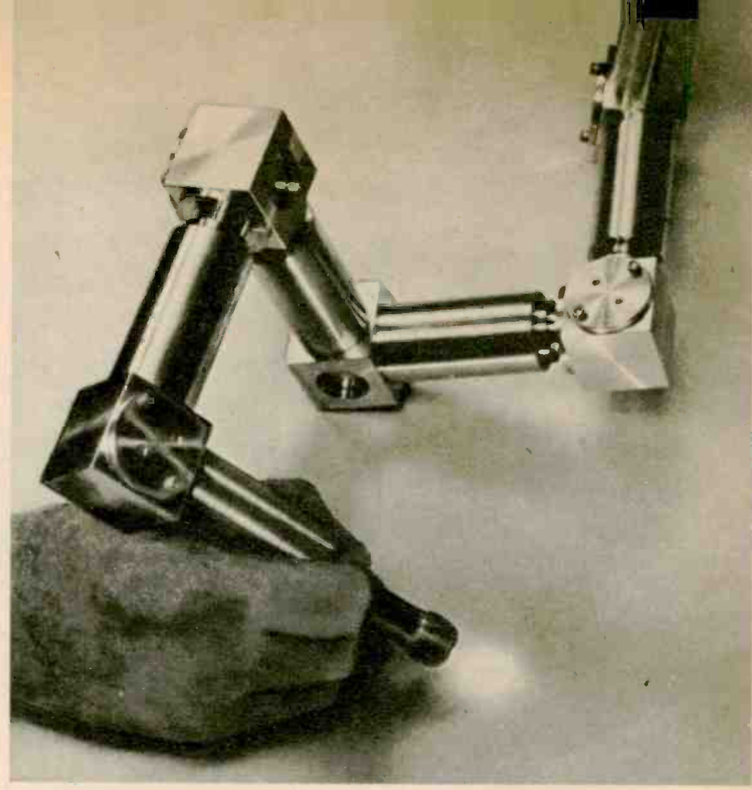
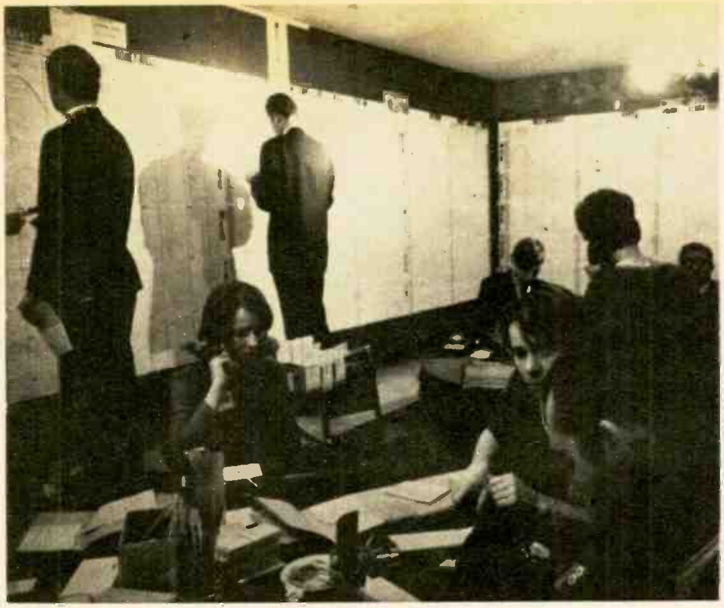
NEW TWIST . . . We hear a lot about the medical miracles we can expect from laser technology. The concentrated laser beam, we are told, can perform its tasks—ranging wound cauterization for blood-loss control to delicate surgical operations like the repair of detached retinas—with the last word in precision. Problem posed by unwieldy laser devices has been to get the beam where it should be. Bell Telephone Laboratories has designed the light-knife as a solution. In it, the laser beam is directed through a labyrinth of swivel joints, each containing a precisely-angled mirror for a 90° change in beam direction. The result is a tool something like a dentist's drill, as easy for the doctor to hold and direct (says Bell) as a fountain pen.



ELECTRONICS IN THE NEWS

Shocker . . . This man is holding a bare 117-V lead in one hand while he plunges the other into a basin of water. A moment ago, the bulb across the AC line was lit. The man has guts, you say? No, the man has Revas (saver, spelled backward, for those who like word games) and the man is Phil Jeffery of W. D. Gale, Inc., which makes Revas. It is a protective device that can cut off power in about 25 microseconds in the event of a short to ground—fast enough to suppress almost all sparks, according to Gale.



Big Job . . . This room, as frantic as Election Central when the returns are rolling in, was part of the scene during the IEEE convention in New York last spring. The candidates are looking for engineering jobs, though, not public office. Careers, Inc. travels around the country setting up centers like this to process applications and schedule interviews with recruiters from participating companies seeking technical personnel. Requests for interview appointments are phoned in and posted on scheduling sheets in background. Convention brought extremely heavy traffic.

On the Beam . . . Infra-red radiation is the transmission medium for information displayed on IBM equipment at several locations in Expo 67. Ticker reading will even be relayed live from the floor of the Stock Exchange in downtown Montreal and displayed on CRT readout like the one at right. Simulated voice readouts will translate visitors' speech or debate with them on pre-programmed subjects. Infra-red is invisible; the beam at top left was added by retoucher.

ELECTRONIC

SWAP SHOP

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

AMATEUR RADIO

LAFAYETTE HA-250 mobile rig for 6, 10, 11, 15 meters. Will swap for Utica model 650 6-meter transceiver. Stuart Morgan, 5 S. Walnut St., Carthage, Ind. 46115.

TRANSMITTER, ART-13. Want TX-62 or similar 100-watt CW transmitter. Dave Wientraub, WB2RSC, 29 Wyman Ave., Huntington Station, N.Y. 11746.

GLOBE Moboline 6-meter transceiver. Swap for tape recorder or best offer. Stephen Johnson, K9ZXW, 3009 Guilford Rd., Rockford, Ill. 61107.

HEATH Twoer. Swap for best offer. Joe Rock, Jr., WN3GLP, Box 162, Knoxville, Md. 21758.

ASSORTED HAM GEAR. Want speaker for Heath Mohican. Johnny Brown, G3LPB. Marlborough Farm, Falmouth, Cornwall, England.

HEATH HG-10 VFO. Trade for Heath 6-meter transceiver. Mike Wingfield, 612 Yukon Ave., Yukon, Okla. 73099.

RECEIVER, GR-64. Swap for transmitter. Steven Miller, 51-49 Almeda Ave., Far Rockaway, N.Y. 11691.

SURPLUS RECEIVER, BC-733DD. Want novice gear or code practice oscillator. Dennis Hasler, 300 E. 8th St., Clay City, Ind. 47841.

HEATH Sixer. Want microphone or best offer. Charlie Thompson, 1611 Crestmont Sr., Huntington, W. Va. 25701.

LAFAYETTE Explor-Air. Will trade for Heath Sixer, Twoer or best offer. Steven Christenson, 110 Elm St., Lisbon, N.D. 58054.

HAM STATION. Will swap for test gear or best offer. Tom Ginkel, WAØAHV, 832 S. Payne St., New Ulm, Minn. 56073.

HALLICRAFTERS S-40B. Swap for CB transceiver. Nicky Mueller, Box 64, Fenton, Ia. 50539.

TRANSMITTER, BC-610E. Will trade for best offer. Robert W. Webster, W4EVR, Rt. 1 Box 472, Tarpon Springs, Fla. 33589.

LAFAYETTE HE-45B 6-meter transceiver. Will swap for general coverage receiver. A/3C Brian D. Kassel, 3410 SQ. CMR5 Box 26334, Keesler AFB, Miss. 39534.

KNIGHT T-60 transmitter. Will trade for Knight KG-660 battery eliminator. Max Ramsey, 113 S.E. 6th St., Checotah, Okla. 74426.

NOVICE TRANSMITTER. Will swap for VFO or walkie-talkie. Thomas Treszow, 101 Cameron Ave., Toronto 15, Ont., Canada.

EICO 753 transceiver with power supply. Make swap offer. Guy Martin, Box 387, Sherman, Tex. 75090.

SURPLUS TRANSMITTER, BC-457, 3-4 mc. Will swap for BC-455, 6-9.1 mc. Jeffrey Kato, KH6FST, Box 271, Paauilo, Hawaii 96776.

JOHNSON Viking transmitter. Will trade for tape recorder or best offer. Karen Giroux, RD3 Maplewood Rd., Ithaca, N.Y. 14850.

HALLICRAFTERS receiver, 530 kc to 45 mc. Interested in Zenith Transoceanic receiver. G. R. Wise, Box 101, Irvine, Ky. 40336.

SHORT-WAVE LISTENING

ZENITH Transoceanic. Will swap for CB transceiver. MSGT James F. Haming, 832nd TAC Hospital, Box 108, Cannon AFB, N.M. 88101.

LAFAYETTE Explor-Air. Want Knight T-60 transmitter or Knight R-55A receiver. Wayne Link, 10051 Arnold, Detroit, Mich. 48239.

KNIGHT Ocean Hopper. Want CB transceiver or best offer. Howard Levy, 9211 Menard, Morton Grove, Ill. 60053.

ECHOPHONE receiver. Want Heath DX-60A or similar transmitter. J. Telshaw, Box 481, Bijou Branch S. Lake Tahoe, Calif. 95705.

HALLICRAFTERS S-38. Will swap for novice transmitter or best offer. Robert G. Forbes, 451 Pontiac Ave., Cranston, R.I. 02910.

KNIGHT Star Roamer. Will swap for 50- to 100-watt PA amp. L. Lindenbaum, 10320 Haywood Dr., Silver Spring, Md. 20902.

LAFAYETTE bridge. Want bridge for 6 meters. Lewis Brenner, WA3GNL, 1314 Fanshawe St., Philadelphia, Pa. 19111.

HALLICRAFTERS S-120. Want slot-car gear. Stanley Cepukas, 25 Golden Blvd., Welland, Ont., Canada.

KNIGHT Span Master. Want Knight T-60 transmitter. Robert Roaly, 321 Kenilworth Ave., Dayton, Ohio 45405.

DRAKE SW-4. Swap for Hammarlund HQ-180. Charles N. Coombe, 208 S. Clinton Ave., Trenton, N.J. 08609.

NATIONAL 190. Trade for 10-meter linear amplifier, CB rig, VOX. S. Krzak, 368 Main, Pawtucket, R.I. 02860.

CITIZENS BAND

LAFAYETTE HA-130 walkie-talkie. Want VHF, UHF ham gear. W. Pyne, 540 N. Locust St., Hagerstown, Md. 21740.

GENERAL ELECTRIC Y7040 walkie-talkies. Will trade for Knight G-30 grid-dip oscillator or similar. Bill Sitoshak, Rt. 7 Box 47, Durham, N.C. 27707.

SEARGEANT G-2 walkie-talkie. Want ham equipment or best offer. Wayne Kube, Box 333, Farwell, Tex. 79325.

LAFAYETTE HB-115A. Will trade for guitar amp. or VHF ham rig. Richard G. Abrams, WA1DUV, Bayne St., Norwalk, Conn. 06851.

REALISTIC TRC-X23A transceiver. Want short-wave or VHF receiver. Stuart Miller, 62 Leicester Rd., Marblehead, Mass. 01945.

TRANSCEIVERS. Want antique movie cameras. P. Pierucci, 23 Leroy St., New York, N.Y. 10014.

WALKIE-TALKIE. Will trade for short-wave receiver or novice transmitter. Dwight Weidman, Rt. 1, Hedgesville, W. Va. 25427.

TURNER 254C, 23 channels. Swap for Swan 2A, 2B or best offer. F. W. Turgetto, KOX3762, 4908 N. Fircroft, Covina, Calif. 91722.

BROWNING transceiver. Will trade for ham gear or best offer. N. Harkness, Box 182, Winnetka, Ill.

CB PARTS and CRYSTALS. Will swap for coin collection. Howard Keilholtz, 223-C Preston Ct., Catonsville, Md. 21719.

LAFAYETTE HB-444. Will swap for stereo gear. Ricky Kaminer, 59-45 160 St., Flushing, N.Y. 11365.

COMMODORE walkie-talkie. Trade for Lafayette mobile transceiver with antenna. Paul J. Cronk, 125 Second Ave., Brentwood, N.Y. 11717.

AUDIO & HI-FI

RECORD CHANGERS, 78-rpm and three-speed. Want Sony five-in. TV or test gear. Eric B. Olson, Rt. 1 Box 4, Kingsville, O. 44048.

WEATHERS turntable with base. Will swap for 40-watt mono amplifier. John O. Godshall, 512 Naysmith Rd., McKeesport, Pa. 15131.

WESTINGHOUSE four-speed record player. Make swap offer. Larry Robenstine, 2066 Hazel St., N.E. Hartville, O. 44632.

LAFAYETTE Truetest Stereo 8 amplifier. Trade for six- or two-meter ham transceiver. Walter Pyne, Catoctin C-5-A, Univ. of Md., College Pk., Md. 20740.

WEBCOR Compact Deluxe tape recorder. Swap for ham or CB gear. Bruce Creighton, WA5JVL, 8704 Belfast St., New Orleans, La. 70118.

MAYFAIR tape recorder. Want Knight Star Roamer or best offer. Ken Maxwell, 1804 4th St. S.E., Moultrie, Ga. 31768.

PHONO AMPLIFIER. Will swap for BC-454 or other ham gear. Owen Hayden, 225 S. Griffin, Bismarck, N.D. 58501.

LAFAYETTE LT-99 AM/FM tuner. Want VTVM, Lionel O-gauge train set or best offer. Peter Zawaly, 680 Lafayette Ave., Palmerton, Pa. 18071.

GENERAL ELECTRIC 4G052 mono cartridge. Want brand-name Mylar tape. L. Buddine, 1700 W. High St., Haddon Heights, N.J. 08035.

TAPE RECORDER. Swap for Hallicrafters SX-71 short-wave receiver or similar. Mike Halverson, 420 N. Chicago, Madison, S.D. 57042.

HEADSETS. Swap for best offer. Frank Miles, 438 N. Main St. Herkimer, N.Y. 13350.

AIWA TP-703 tape recorder. Trade for Heath AJ-53 or similar AM tuner. H. Papricki, 1889 Portland Ave., Rochester, N.Y. 14617.

Continued from page 41

mud move the car a few feet. If you know that certain stretches have dead spots take on-the-air trips over these highways during leisure hours to familiarize yourself with both routing and propagational factors.

You should also cover all the locations most likely to spawn emergency situations. When the time comes you will need to know *all* the access routes, so go over the ground beforehand.

Use our checklist as a guide in filling your communications vehicle with real essentials. Never travel without canned (or dried) food and a first aid kit. Likewise, always have a detailed county map on hand.

If you follow this program through intelligently you will wind up with a mobile command post that will outperform the $25,000 arks the Civil Defense people often invest in. The junior version can be several times more practical in actual use provided it is kept in tip-top condition and all operators are skilled in emergency-service communications.

Your CB-Alert Sign

Your monitor marker sign on the outskirts of town is your notification to the passing CBer that full motorist services are available at the flick of a switch. To the non-CBer the sign is another reminder of the services CB has to offer. Many CB clubs inscribe the name of their organization on the signs and make tie-in literature available at all truck stops and motels in the area.

When you start putting up signs you're going to face some local red tape. You must contact local officials if you don't want your sign torn down two hours after it goes up. But these same people frequently will help rather than hinder your efforts by suggesting ideal locations, sign painters who will contribute their efforts, sources of free materials and ways to get publicity—providing your official chum gets in the pix, natch. Start by approaching the local road department or police. You'll be surprised how fast you'll cut the red tape if you are a bonafide CB club working hand in hand with local police.

Even so, there are a few basics to be considered. You don't want your sign to resemble official traffic signs so stick to a square or rectangle with a white background and red, blue, or black lettering. The channel number should be the most prominent item on display. To be easily seen your sign should be at least 2 ft. square. Silk-screen or baked-enamel lettering on 24-gauge steel can be used if you plan to put up enough signs. In smaller quantities, hand lettering costs less. Supports can be *treated* wood or metal posts at least 9 ft. long—preferably even taller.

The post should be cemented into a large metal pail and sunk a minimum of 3 ft. into the ground amid tremendous fanfare with flashbulbs popping and emergency vehicles in plain view.

Important Considerations

Remember that no successful emergency club effort has ever operated independently. If you can't develop the enthusiasm necessary to get an emergency team off the ground, drop the idea and take up birdwatching. Nothing is more discouraging than putting your heart and soul into something nobody wants—or something everyone laughs at.

Enlist every serious-minded, licensed CBer you can find in the program. (People *do* get sick and take vacations and play golf, you know.) Full 24-hour service *must* be maintained if you intend to get this thing off the ground.

We can't over-stress the value of keeping an up-to-date log. These reports are often the only records made of minor incidents. Consequently, it is important to get the full names of all parties concerned, the date and location and the exact time during which you or your affiliated stations were involved.

Every emergency organization should have one person whose sole duty is to see that club efforts receive maximum publicity. He should be an active member not overburdened with responsibilities. Dozens of enthusiastic CB teams get radio coverage and magazine stories. A few have even caught the watchful eye of TV newscasters. While this whole thing may appear to be just so much hokum, you'll find it tends to sustain the membership and build community support.

Otherwise, you should take care to work quietly, behind the scenes. One West Virginia mobile communications center was literally run out of town by local authorities after it tried to hustle in on every accident on the main highway—whether it needed attention or not. Gaudy uniforms and screaming kids provide a kind of publicity that can be done without.

Electronic Dominoes

Continued from page 46

the appeal of the dominoes. It's hard to imagine any other means by which you could get across these basic concepts so quickly and so vividly. The fact that kids can put the parts in place themselves and see immediate results from their efforts beats fussing with Fahnestock clips and interconnecting wires all hollow—to say nothing of messing with soldering irons.

All this is fine in the school room. Homebodies may have reservations about the cost, however. A basic starter kit, the Mini Lectron, having pretty limited capabilities, is expected to sell for $19.50. While the way will be eased to bigger and better things by the availability of individual blister-packed add-on units, cost of a full set like the one we had will probably be $128. Two intermediate sets also are planned.

Still, considering the way the Lectron can put across ideas (even to our five-year-old, who corrected a mistake of his father's after only ten minutes with the darn thing), it's got to be one of the grandest educational toys, ever.—*Elmer Carlson*

Radio Americas and the CIA

Continued from page 29

ganda tool going for you in a trouble area. The $3 million that has been sunk into RA over a seven-year period would keep the Defense Department (with a 1966 budget of almost $56 billion) going for only half an hour. But reports from Cubans now living in Miami suggest that its effectiveness is meager.

Two things should be considered when evaluating the appeal of the station. First, RA pumps out an unending stream of hard-core anti-Castro propaganda. Second, Cubans tend to be a lighthearted people with a festive approach to life, a quick sophisticated sense of humor and a love of music and dancing. The average Cuban has to put up with endless hard-sell politics from his own government, though. So he has little interest in spending his leisure listening to more of the same.

In fact, Cubans pass up listening to RA (it's illegal to listen, anyway) in preference to the soft-sell VOA station in Marathon, Fla., which operates in Spanish only a few kc from the RA frequency. But there *are* avid RA listeners in Central and South America. There, it seems, listeners figure that if the U.S. is spending so much money to combat Castro he must be greater and more important to Latin America than it would otherwise appear!

The CIA feeling is now assumed to be that, realizing the failure of the RA concept, they must take a new approach. There appear to be several possibilities. One currently being speculated on is that RA may withdraw from Swan Island and combine forces with the mysterious station calling itself R. Libertad, La Voz Anti-Comunista de America. R. Libertad broadcasts from a carefully concealed location in or near the Bahamas or Lesser Antilles. The speculators have singled out Great Inagua and Andros in the Bahamas and a site in Venezuela as prime candidates.

Ties between the two operations are suggested by recent events, one of them concerning Roger Butts, one of the people who put the original R. Swan transmitter on the air and who stuck with the operation until recently. Although he has been listed as a salesman for the W.R. Maddux real estate outfit they say he is no longer employed there. The RA office confirms his employment until a few months ago.

Following the quiet disappearance of Butts from the Miami area the RA short-wave signal suddenly vanished from the air, and RA announced that the equipment was being repaired. Speculation is that both Butts and the missing RA transmitter have been relocated in preparation for the new operation. And R. Libertad recently has been logged on the former RA frequency.

Some of the people I spoke to feel that the entire idea of RA will be dumped altogether without any attempt to combine it with R. Libertad. They say that the station may be dismantled and the idea abandoned by the end of this year.

Why did it take seven years and $3 million to realize the failure of RA? Why was it established as a black operation rather than one out in the open (especially after its participation in the CIA's Bay of Pigs invasion)? What is the CIA's connection with the top secret R. Libertad? These are some of the questions that remain to be answered.

One answer came through loud and clear. Radio Americas may well be the propaganda faux pas of the century.

The Listener

Continued from page 83

scarce—no matter who operates a given station. For example, pro-Western Radiodiffusion Nationale Lao, long one of the most difficult SW stations to hear in North America, suddenly appeared on West Coast dials in March with consistent signals on 6199 kc (a new frequency) prior to sign-off at 0730 PST (1030 EST).

Meanwhile, according to both press and radio club sources, the Voice of America has operated at least one 50-kw transmitter in Vietnam on 760 kc every day for the past three years. Yet no DXer has reported reception since November 1965. The only Far-East station reported on this frequency is one identifying itself as R. Peking! This little survey, incidentally, includes DXers in New Zealand, Australia and Europe as well as North America.

Is a puzzlement!

The Electron Microscope

Continued from page 104

with air molecules, distorting the image.

Operation is fairly simple. Electrons boiled out of the hot filament are accelerated by high-voltage electrodes inside the electron gun at the top of the microscope. They pass through the hollow center of the first lens which (like the condenser lens in a photographic enlarger) focuses the electron beam squarely on the specimen mounted on a fine gold-mesh screen directly below the lens. After passing through the specimen, the electrons pass through the magnifying lenses. Finally a projector lens focuses the (now greatly enlarged) image of the specimen on the viewing screen at the base.

A small window near the base of the microscope enables its operator to view the sharply defined image on the screen. By pushing a button he can replace the viewing screen with a piece of photographic film. The electron beam then strikes the film, exposing it and leaving a permanent record of the magnified image of the specimen.

About half a dozen companies, including Hitachi, Ltd. in Japan, presently are manufacturing electron microscopes. RCA sold its original instrument for $9,500 but the price tag on a typical electron microscope today may read anywhere from $12,000 to over $75,000. Shortly after the war, General Electric introduced a stripped-down, low-power model for around $6,000 but it received little interest. Scientists wanted much more powerful electron microscopes. They still do.

RCA presently is building a $300,000 electron microscope for the University of Virginia. The instrument will use a 500-kv electron gun to accelerate the electron beam to 170,000 miles per second—about 90 per cent of the speed of light. At this fantastic velocity—nearly five times that of the beams in most electron microscopes—their wavelength will be substantially reduced. As a result, they'll be able to convey images of smaller objects. If the unit lives up to its designers' expectations it may show objects as small as 1/25,000,000 of an inch—less than half the size of the smallest object that can be viewed with the best electron microscope in use today.

Magnifications that will provide information about particles as small as 1/75,000,000 of an inch are already available in the ion microscope, an outgrowth of the field-emission microscope. These devices are related to the electron microscope—with one important difference: the specimen *is* the electrode. This (and other characteristics of emission microscopes) limits the materials that can be investigated. But since emission microscopes provide a different kind of information about the specimen (showing the atomic structure of its surface), they will not be replaced by the regular electron microscope even with equal resolving power.

Meanwhile, Hitachi, Ltd. recently unveiled a one-million-volt electron microscope. The two-story instrument weighs approximately 15 tons. Its more powerful electron beam, however, will not be used for greater magnification. Instead it will enable the electron to penetrate thicker specimens, necessary in metallurgical research.

The information these devices provide—much like the information derived from new techniques in astronomy—gives us new hope in the search for answers to basic riddles of the universe. But the electron microscope also offers more immediate, practical returns. With it we are finding out how to make new materials and how to fight old diseases, working on everything from a plastic-coated razor blade to cancer research.

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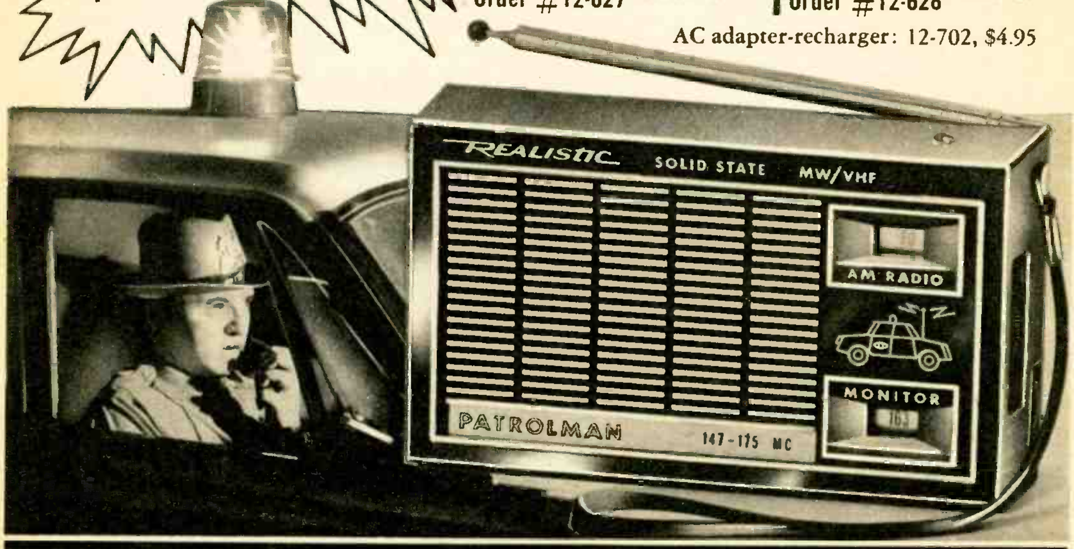

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UTAH — Salt Lake City
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WASHINGTON — Seattle

CB Corner

Continued from page 76

risk having their type acceptance lifted.

The new proposals will probably be mulled over for many months before becoming law. Then the following schedule should apply: You could continue to use your *present* equipment up to *five years* after the rule goes into effect. Any *new* equipment you purchase *six months* after the new ruling must be type accepted.

Whether type acceptance will boost the cost of CBing is uncertain. The new rules call for no major circuit change in transceivers other than the addition of a modulation limiter. Many other features, shown in the illustration, could probably be included with little disturbance to most current equipment. Manufacturing costs, though, could inch up slightly as producers beef up quality control along the production line. Type acceptance, after all, will be the manufacturer's ticket into the CB marketplace.

Higher Walkie-Talking . . . The move to oust unlicensed (Part-15) walkie-talkies, reported in our last issue, is a giant step closer to reality. Acting with surprising speed, the FCC has squelched rumor and speculation about the changeover by issuing a formal notice of proposed rulemaking.

You may recall that we reported the move would be to the neighborhood of 49 mc. That's confirmed, along with a sprinkling of details. Most important is the timetable: Manufacturers would have two years to phase out old equipment and introduce the 49-mc gear. If you now own a walkie-talkie you could continue to use it for several years. These schedules would begin *after* the new rules go into effect, possibly months from now.

Other items: The superregenerative receiver (mostly found in under-5-transistor models) would be outlawed as interference generators. There'd be tighter specs on transmitters, five operating channels, a limit of five (not two) ft. on antenna height and type approval required on all equipment. The Commission commented that new techniques (transistors, printed boards) should keep the new walkie-talkies inexpensive despite the tighter technical specifications.

Bet Your Antenna Is Legal?

Continued from page 51

restored to its original state by replacing the glass—a comparatively cheap repair.

Antennas and lead-ins for transmitters should be firmly mounted at least 3 in. from building surfaces on nonabsorptive insulators having at least 3-in. creepage and airgap distances. You can forget all about this paragraph if you use coax cable with the external shield ground.

Naturally, all lead-in conductors and outdoor antennas should be so placed that no one can touch them accidentally. A transmitting station should be protected against lightning either by an arrester or by a switch that grounds the antenna when it is not in use. The popular Cush-Craft Blitz Bug (Allied 17 A 8044) offers excellent coax protection. Nevertheless, install a shorting switch.

Antenna systems must be rugged and perfectly safe for the user, his equipment, his neighbors and their property. Above all, the antenna construction must conform to local ordinances. Let your only brush with the law be at the Policemen's ball.—*Jay Copeland*

Go-Go Reverb

Continued from page 59

When S1 is in the *remote* position the reverb can be keyed in and out by the foot switch.

When using reverb, keep one thing in mind—it's easily overdone. Best effect is obtained by using only a little.

In Case of Trouble. The total current measured from Q3's emitter to Q1, Q2 and Q3 is approximately 12 ma. It's 10 ma to Q2 and approximately 1 ma each to Q1 and Q3.

If the current is high, but not over 25 ma or if the current is around 12 ma but the unit is inoperative, check that capacitors C1, C2, C5, C6, C7, C8, and C9 are installed correctly (polarity, that is).

The DC voltage from Q3's collector to ground is approximately −15V. The voltage from Q3's emitter to ground is approximately −12V. The voltage from Q3's base to ground is about 0.6 V more than the voltage at the emitter.

If the normal (no reverb) sound is high pitched, the position in the circuit of C4 and C20 has been reversed; C4 *must* connect to Q1.

Remember the Burma Shave signs of yesterday?

Now! The best of Burma Shave humor reproduced on this matched set of four highball glasses!

Remember this Burma Shave sign? . . .

SHE KISSED THE HAIRBRUSH/BY MISTAKE/ SHE THOUGHT IT WAS HER/HUSBAND JAKE/BURMA SHAVE

Or how about . . .

HE HAD THE RING/HE HAD THE FLAT/ BUT SHE FELT HIS CHIN/AND THAT WAS THAT/BURMA SHAVE

Funny how those simple Burma Shave signs always made you smile and made driving such fun! Although the signs are off the road—they're back where you and your guests can enjoy them again and again!

Yes, the cleverest Burma Shave signs, with earthy wit intact, have been smartly reproduced on this set of highball glasses. Each glass displays five Burma Shave signs plus an antique Model "T" in handsome 2-color art—white and cherry red. They hold a full 12 oz. drink. Make fine cider and water glasses, too.

But full or empty, Burma Shave glasses add fun to any get-together. It's just magic the way they will warm up the party and get conversation started to those "good old days"!

They're certain to go fast so please get yours now to avoid disappointment. Order a few sets for yourself—and as gifts.

Examine Burma Shave Glasses In Your Home Without Risk!

The limitations of printing just can't do justice to the hilarious charm of these Burma Shave signs nor the sparkling quality of these impressive glasses. You have to see for yourself how they "break the ice" at any gathering! So send for them today. If not completely delighted, merely return the Burma Shave glasses and every penny will be promptly refunded in full.

HAMILTON HOUSE, COS COB, CONN. 06807

Set of 4 glasses only $3.25

plus 50c per set postage & handling

SAVE! 2 sets, $6.25

plus $1 postage & handling.

HAMILTON HOUSE, Dept. 63L-9
Cos Cob, Conn. 06807

Rush________sets of 4 "Burma Shave" Highball Glasses.

☐ 1 set $3.25 *plus 50¢ postage and handling*

☐ 2 sets $6.25 *plus $1. postage and handling*

Check or m.o. enclosed for $______

Satisfaction guaranteed or money back.

*Name*____________

*Address*____________

*City*____________

*State*________ *Zip*______

The Ham Shack

Continued from page 42

listener's discounting most of what is heard as propaganda.

If the governments of many countries take the Stanford report seriously they might be able to save millions of dollars now being wasted on short-wave broadcasting. This would in turn relieve demands on short-wave frequencies, one of the major threats to our current amateur-band allocations. But I suppose it would be too much to expect of a government that it take a little of the money saved and use it to build up the amateur radio service in its own country.

Take a country like Sudan, the largest in Africa. Here the government is discouraging amateur radio at every turn. And there, perhaps, lies a key to the essential difference between a backward nation and an emerging nation.

South Pacific DX

Continued from page 75

operation they were literally swamped. The last we heard they weren't answering any report at all. This policy could change at any time, especially as reception has now tailed off. The only frequency reported recently in North America seems to be 3230 kc. Start checking this channel around 0200 EST (2300 PST).

Another occupant of the 90-meter band recently has become tough to log. It is R. Noumea on the French island of New Caledonia. The station formerly operated up on 41 meters and was widely logged throughout North America. But now that they use only 3355 kc you really have to work for their QSL. Incidentally, O.R.T.F. is planning a powerful international relay for the island so you'd better go after R. Noumea while New Caledonia still counts as rare DX.

Finally, returning to 60 meters, we find two more goodies. VTW2, R. Tarawa, in the Gilbert & Ellice Islands, occasionally sneaks through Latin American and radioteletype QRM on 4912 kc around 0130 EST. Then, still further into the night, keep your ears open for R. Cook Islands on 5044.5 kc just prior to sign-off at 0330.

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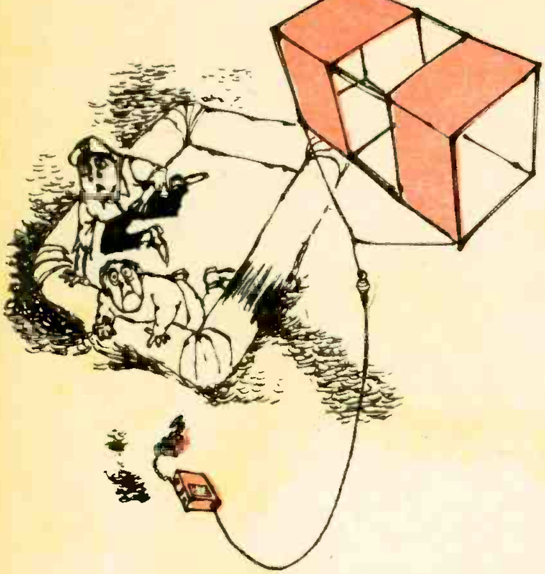
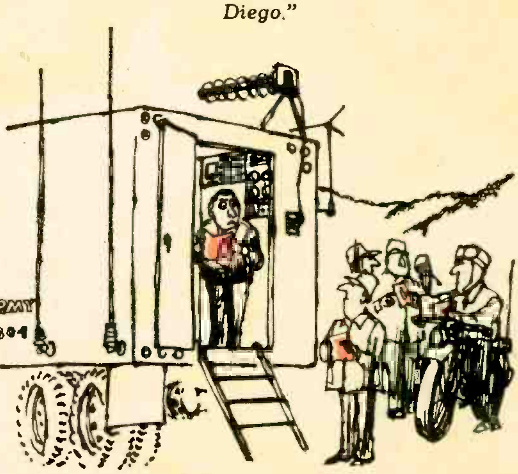
OVER AND OUT by Rodrigues



"I thought YOU were holding the transmitter . . ."

"It's no use, Major. The skips are in and all I can get is Mercury Parcel Delivery in San Diego."



"It's a letter from some guy in St. Louis. He wants a QSL card."

"Never mind, I got them on sideband. They can't read you because of the QRM."