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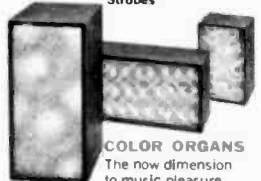
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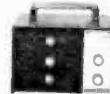
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CIRCLE NUMBER 8 ON PAGE 11

Uncle Tom's Corner

By Tom Kneitel, K2AES/KQD4552

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



★ *About nine months ago I purchased an AM-FM receiver and turntable. Four months later the unit seemed to turn into a CB receiver and every time a local CBer came on he would wipe out all AM signals. Right now the sets' not picking up much CB but I am concerned about the future.*

Gary Russo
Brooklyn, N.Y.

So are the CBers. When the band is so dead that you can't even raise a turntable in Brooklyn things are getting pretty bad.

★ *Whenever I drive under an overpass there is no effect on FM stations but all AM stations suddenly vanish. What should I do?*

F. R. Wolf
Abilene, Tex.

You'd better stay away from overpasses. You're a menace to AM broadcast stations.

★ *I have a four-band receiver on which I pick up New York City broadcast station WHN (1050 kc) on the primary frequency and also on 153 kc (long-wave band). Is this a new service of theirs?*

R. M. Preston
Yorktown Heights, N.Y.

Not one they intended to give. You've got an image of their 50-kw signal, either from front-end overload in your receiver or from mixing with another strong signal. Their transmitter is about 30 mi. from you and the signal pattern is aimed right at you.

Local Boy Makes Good Dept. Bruce Haack liked to tinker around with little tran-

sistor circuits. One day he put together a junkbox special, powered by three 9-V batteries, which he found could make unusual sounds. He built a modulator so that he could feed his voice into the gadget. It worked. From there, Bruce worked up some strange melodies to demonstrate his device. The result was so unusual that he took his demo tapes to Columbia Records. They dug the offbeat sounds and signed Bruce to a contract. You can judge for yourself at any record store. Bruce's record is called *The Electric Lucifer* (#CS-9991). Well done, Bruce!

★ *I have a 50-watt guitar amplifier which has two 8-in. speakers in its cabinet. What problems would I have in adding two more 15-in. speakers to this unit?*

Mark Chrisman
Bloomington, Ill.

Make sure that the net impedance of the speakers connected in parallel equals the output impedance of the amplifier. A slight mismatch won't create much grief and if you are playing rock, any distortion you can get probably will be a bonus.

★ *Why does everybody always try to put you down?*

Beverly Forrest
Big Sur, Calif.

At my size, it's easier than trying to lift me.

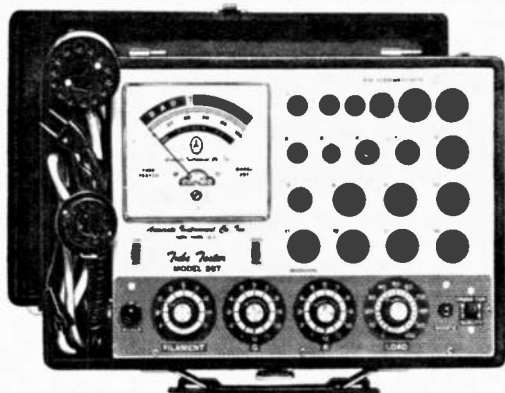
★ *Here's a hair-tearing problem. I have this old S-38 receiver which has burned out a fair share of rectifier tubes along with a quantity of resistors at the socket of the tube. The heater circuits check out and now I'm stumped.*

Mike McCollum, WN2LXX
Bellmawr, N.J.

First check out the 50L6 to see whether it is okay. Next, replace the three-section filter capacitor (60-40-40 μ f), then the .005 μ f capacitor at pin 5 of the 50L6.

[Continued on page 8]

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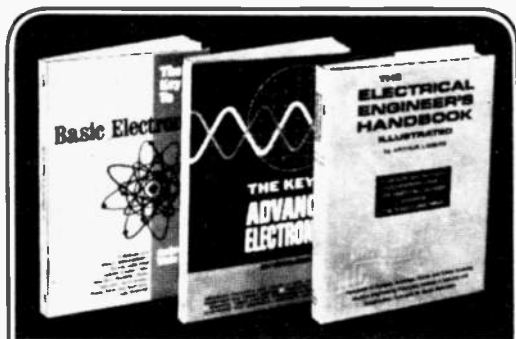
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CIRCLE NUMBER 7 ON PAGE 11

Uncle Tom's Corner

Continued from page 6

★ *You seem to delight in doing stories which announce the location of our secret radio stations. Why jeopardize their mission by revealing their locations? They must be hidden for a good reason.*

*Robert Holbrook
Plattsburgh, N.Y.*

If an amateur like me can unearth the locations of secret stations then how secret do you think they are from the bad guys with professional teams of espionage agents? Maybe they ought to be hidden better—eh, Bob?

★ *I have an old AM/SW push-button radio. One button is marked for station WEAF. I believe that this was a New York City station and I'm curious to know whatever became of it.*

*Rick Weibezahl
Washington, N.J.*

Rest your fears, Rick. WEAF is alive and well in New York. Over the years they have had a few call sign changes but now they call themselves WNBC. The station is the flagship of the NBC radio network.

★ *I built a CW transmitter from plans I found in an old ARRL Handbook. Whenever I try to transmit there are sparks jumping all over the place from the tank coil. I've checked and rechecked all of the circuits but I don't see anything wrong. Now where do I stand?*

*Alvin McReady
Bristol, Mass.*

About 6 ft. from the thing.

SWL Club Dept. Don't look now, Fred, but SWL clubs are falling on hard times. In the past year several have taken that long walk to the big QRT in the sky, while others seem to be dwindling away with each thinning monthly news bulletin. Problem is, for many years the whole SWL hobby has been carried along by a hard core of old timers—fellows who started the clubs in the 1930s.

The fellows who were SWLs way-back-when were in the hobby to stay. Today's kids are in and out in less than three years, drifting to ham radio, CB, or stealing hub caps. ☹

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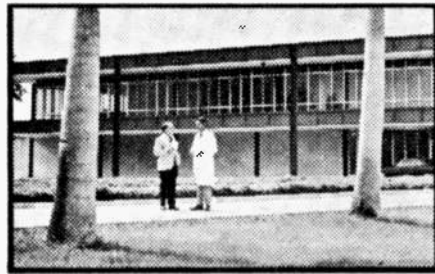
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CIRCLE NUMBER 18 ON PAGE 11

Broadsides

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

MOST hobbyists have a thing about collecting **gadgets** and the latest catalog from Edmund Scientific Co., should satisfy all their desires. It contains a veritable surfeit of material of every size, shape and description. Lasers, weather balloons, lighting equipment, telescopes and lenses are just a sampling of what is included. A free copy is available from Edmund Scientific Co., 701 Edscorp Building, Barrington, N.J. 08007.

If you are in need of **replacement semiconductors** a good place to turn for information is the recently released Cross Reference and Product Guide by International Rectifier. The guide details IR's line of substitutes for transistors, SCRs, diodes and capacitors in table form for quick selection of parts. The guide is free from International Rectifier, Semiconductor Division, Dept. 781, 233 Kansas St., El Segundo, Calif. 90245.

No matter how good your ham equipment is, you're not going to get far without a decent antenna. Cush Craft has assembled a colorful booklet showing their 50 various **antennas**, including high performances VHF yagis, dual and

quad arrays and HF monobeams. For a free copy write to Cush Craft, 621 Hayward St., Manchester, N.H. 03103.

To get the most out of what you have to say it is important to use a good **microphone**. Included in the latest Turner catalog is a section on how to choose mikes, along with a product listing of ham, CB, PA and broadcast microphones. The listing is available from The Turner Co., 909 17th Street, N.E., Cedar Rapids, Iowa 52402.

Getting schematic diagrams and repair information on obsolete equipment can be quite a task. Supreme Publications has a reference library of **service material** for radio, hi-fi and TV that covers almost all makes and models of sets ever manufactured in the U.S. This information is indexed in their 48-page Master Index which is available free from Supreme Publications, 1760 Balsam Rd., Highland Park, Ill. 60035.

If your wife's been telling you that you need a switch, look into the line of **switches** available from the Grayhill Co. The switches are displayed along with design information in their new catalog. Included are momentary and alternate-action push-button switches, key-operated rotary switches and spring-return rotary switches. Request Catalog G-306-A from the Grayhill Co., 561 Hillgrove Avenue, Le Grange, Ill. 60525.

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Feedback from Our Readers

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

● UNION LIFE

I read with interest your article on a career in a recording studio (HOW ABOUT A GLAMOROUS JOB IN A RECORDING STUDIO? Sept. '70 EI). You forgot one thing. How do you get in the union?

Pete Sanchez
New York, N.Y.

● BUBBLE BUZZER



The pool alarm (INTRUSION DETECTOR FOR BACKYARD POOLS, Sept. '70 EI) was a useful project. I have found an interesting application that I think your readers would like to know about. When I fill my tub at night I now use the detector to warn me if the water is getting too high. The only hitch that has to be worked out happens each time I get in the tub. The alarm goes off because of the sudden increase in volume.

Bruce Jencks
Duncan, Okla.

Eureka!

● SERVICE TIP

I was astonished to read your article BASIC TEST GEAR FOR COLOR TV SERVICING (Sept. '70 EI). Your description of the stuff sounds adequate enough, but the costs, oh my aching wallet. What about us once-in-a-blue-moon servicemen? Do we have to shell out that much to fix our own color TV sets?

Drew Lombardi
Chicago, Ill.

If you're in need of one-item service, take it to a serviceman who has already made the investment.

● FEEDBACK AT THE FCC

Wayne Green's column in the Sept. '70 issue made some valid points in relation to the FCC and hams. I have the feeling that the FCC would rather not deal with hams at all. Many of the commissioners on the FCC used to represent broadcasters legally. I have never heard of a commissioner representing a ham in private practice.

Paul Andrews
Heppner, Ore.

● WATCH THOSE KNOBS

I have just finished building the Heathkit color bar generator that you described in FOUR BAR GENERATORS FOR COLOR TV (Sept. '70 EI). In my model of the IG-28 there is no way to make adjustments of the IC counters. Did you guys get a different set than me? What's the story?

Dave Arlen
Portland, Me.

No Dave, we both have the same bar generator. We should have said there were no adjustments to the IC counters.

● GOTCHA KEMOSABE



That CB DIRECTION FINDER (Sept. '70 EI) was really wild. With a little practice in triangulation of map coordinates I was hunting down many accused CBers. The thing works so well that I have suggested that the FCC get one or two of them and start helping some of us out. How? By hunting down all of those Lone Rangers who give us all a bad name.

J. D. Reed
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El at Large

A Letter from Georgetown

GEORGETOWN, GRAND CAYMAN, B.W.I.

A COUPLE of years ago El mounted an expedition to fabled Radio Americas, the suspected CIA-run station on Swan Island. Swan lies some 185 mi. southwest of this Maughamish tropical isle and we used Georgetown's airport as a kind of staging base from which Tom Kneitel and I made our final assault on the secret hideout, dropping out over the emerald-green Caribbean in an ancient DC-3. We carried a bottle of scotch in each hand as peace offerings.



The main drag at waterside in Georgetown.

The scene in this part of the world (south of Cuba and westward from Jamaica) has changed considerably since then. R. Americas, which began life as R. Swan just before the Bay of Pigs invasion, folded its tents in mid-1969 and has disappeared. Swan's census once amounted to 40 but at this writing stands at no more than 14, though at peak periods (when nobody is ill and away or on leave) it may hit 16 or 17.

Frank Roulstone, Jr., an American who operates the U.S. Weather Bureau in Georgetown, went with Tom and me. It was his first visit to Swan. There followed a year of State-side duty and then he came back to take charge again at Georgetown. Some surprising information followed. Swan is to be given to Honduras late this year.

[Continued on page 20]

CIRCLE NUMBER 17 ON PAGE 11

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CIRCLE NUMBER 15 ON PAGE 11

November, 1970

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CIRCLE NUMBER 19 ON PAGE 11

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CIRCLE NUMBER 5 ON PAGE 11

A Letter From Georgetown

Continued from page 14

The U.S. took possession of the island in the 1860s but Honduras always laid claim to it. Now we are in the process of turning it over to her. Swan and its uninhabited neighbor, Little Swan, lie not far off the Honduran Coast and don't perhaps compare in strategic importance with West Berlin or Northern Ireland, but the giving of any territory must be considered a large friendly gesture.

Both the Weather Bureau and the FAA have been hard at work on Swan since the future turn-over was announced. The FAA's light and radio beacons and other facilities are being put in first-class condition so the Hondurans will start out with their fingers on decent buttons. The omni station, with the callsign SWA on 407 kc, can be heard by aircraft all over the Caribbean and is important to air operations in this part of the world.

The Weather Bureau's work has more to do simply with improvement because it will continue to be run by the U.S. but will operate on leased territory (which may or may not include Swan's air strip).

Frank Roulstone was given responsibility for the operations at Swan (in addition to his work as head man at Georgetown) and since that first flight to the island with EI's adventurers has returned no less than 17 times.

Supply is terribly important to people like those on Swan, without air or sea service and not close to shipping lanes. R. Americas once had a deal with Bill Cook to fly his Piper Apache twin down from Miami twice a week but the feds have cut this to one round trip a month.

The little vessel Daydream used to call at Swan once or twice a month and still goes by there every 23 or 24 days but also calls at the Channel Isles off Honduras (Guanaja, Roatan, Utila) and sometimes at the mainland ports of La Ceiba and Puerto Cortes, as well as at Georgetown, so she has a lot to do besides worry about Swan.

The Daydream, which we last saw at anchor off Swan, happened to be in port in Georgetown during our visit. She landed a fat steer and some coconuts (the latter bound for Miami), took aboard a lot of cargo

[Continued on page 22]

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CIRCLE NUMBER 2 ON PAGE 11

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CIRCLE NUMBER 24 ON PAGE 11

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CIRCLE NUMBER 14 ON PAGE 11

A Letter From Georgetown

Continued from page 20

being sent out by Frank and disappeared one evening into the gloaming. Daydream now sometimes is joined by a second motor vessel, the Michella, but the general situation for getting people and cargo to and from Swan is a bit grim at present. Consequently, during our stay on Cayman the Weather Bureau in the person of Frank Roulstone was looking for a charter contract for a DC-3 or other large twin to fly twice a week or so between Georgetown and the grassy strip on Swan.

So life runs out for Swan as an American possession and a new existence with Spanish-speaking people begins. Intrigues and anti-Castro radio propaganda are but memories.

But rumors abound in the Caribbean.

The story that interested us most had to do with none other than a certain unnamed somebody who, obviously with a lot of backing, is putting up a big radio station over on Little Corn Island, another dot of tropical landscape just off the Nicaraguan coast. Little Corn and neighboring Great Corn, which are less than 100 mi. from the coastal city with the unlikely name of Bluefields, actually belong to Nicaragua but in 1912 went on 99-year lease to the U.S. So Little Corn is foreign territory controlled by us. If you happen to be a CIA type you can see all kinds of possibilities in that situation, such as being responsible yet not being responsible because somebody else owns the real estate.

Perhaps one of these days it would be worth El's while to try to invite itself for a visit to Little Corn.

Meanwhile, back here in Georgetown the relatively few American tourists (or tourists of any kind) realize that Grand Cayman's days as an almost-undiscovered island paradise are numbered. Regular jet service from Miami and available money to build resort hotels are bringing the island slowly into the Miami Beach-Nassau-San Juan whirl. Before long the little resorts along beautiful, white Seven Mile Beach, such as the Beach Club Colony where we stayed, will be asking you please to put on a shirt for lunch and even to wear shoes for dinner. But those days haven't come yet.

R. Americas types left a lot of laughs at Grand Cayman, where they used to be baited

[Continued on page 100]

**PERFORMANCE
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**NEW
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"Mag-Ten" is so indestructible that it's guaranteed for ten years! Exclusive Armorweave™ fiber glass is actually stronger than brass, aluminum, and even many steels! Takes up to 115 m.p.h. winds without damage. Immune to the effects of intense sun, heat, rain, or snow. Its pure white fiber glass won't fade or deteriorate. And non-conductive fiber glass eliminates many detuning and static problems. It's the most exciting Magnum antenna yet!

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Full 1/2-wave radiator encapsulated inside. Grounded for reduced receiver noise. 4 dB omni-directional gain makes 4-watt signal radiate like 13 watts!

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Magnum dual phasing coil provides an optimum impedance match, low SWR. It's inside the fiber glass mast* protected from rain, snow, and ice.

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R-102

CIRCLE NUMBER 21 ON PAGE 11

PACKED With Pep. The sky's no limit with Heath's new linear amplifier, Model SB-220. The amp employs two Eimac 3-500Z tubes in the grounded-grid final to produce as much as 2,000 watts peak envelope power input on single sideband transmission and 1,000 watts on CW and RTTY. It requires only 100 watts drive for complete output. A pretuned broad-band pi input delivers maximum efficiency and low distortion throughout the 80-10-meter ham bands. The SB-220 has a built-in solid-state power supply that can be wired for 120 or 240 VAC. Two panel meters give continuous indication of plate current plus switch selection of grid current, relative power and plate high voltage. \$349.95. Heath Co., Benton Harbor, Mich. 49022.



Master Measurement. Included in RCA's line of solid-state test instruments is the model WV-510A, also known as the Master VoltOhmyst. The instrument can be operated from internal batteries or from 120 VAC. The WV-510A measures from 0.01 to 1,500 VDC, current from 0.01 ma to 1.5 A, AC peak-to-peak voltage of complex waveforms from 0.5 to 4,200 V, and resistance from 0.2 ohm to 1,000 megohms. \$128. RCA Electronics, Harrison, N.J. 07029.

Electronic Marketplace

Sound Those Slides. Slide shows that talk will be a little easier with 3M/Wollensak's new slide filmstrip cassette recorder and synchronizer. Model 2550 uses a 60-cps tone to activate a tripping mechanism which changes slides. Narration and sync signal can be recorded independently or simultaneously. \$299.95. 3M Co., St. Paul, Minn. 55101.



Ranger Station. Courier's Ranger 23 is a tube-type base station CB transceiver designed to provide good results on all 23 channels. The Ranger 23 features a cascode front-end and low-noise nuvistor. Other bonuses in this rugged package are a modulation sampler, S-RF meter, modulation indicator, floating-gate squelch switch, 3.5-watt RF output, and automatic noise limiter. Crystals for all 23 channels are supplied by the manufacturer for this 19 tube rig. A 12-V mobile power supply is available for \$29.95. \$199.00. Courier Communications, Hillside, N.J. 07205.



Electronic Marketplace

Quite A Card. Conventional tuning falls by the wayside with the introduction of the Scott 433. The tuner utilizes a phase-locked loop, a digital programmable divider, an electronically-tuned RF section and an error correction



system that uses a quartz crystal standard to tune any one of the 100 channels in the FM band. The tuner is supplied with a complete set of cards for all of these broadcast channels. The punched information is read by the tuner which then switches to the designated frequency automatically and displays the result on a digital panel meter. The tuner will be available this fall for \$500-1,000. H. H. Scott, Inc., Maynard, Mass.

Test Sting. The Mosquito by Don Bosco Electronics has many applications when it comes to intergrated-circuit testing. It is a good trigger signal for computer-type integrated circuits. The Mosquito generates and injects puses in the



audio, IF and RF range. It operates on a AAA size 1.5-V battery. Total weight of the Mosquito is one oz. It can be used for troubleshooting radios and TVs, tape recorders, telephone circuits, amplifiers, tuners and pickups. The Mosquito costs \$14.95 and is available from Don Bosco Electronics, Inc., Bridgeport, Conn.

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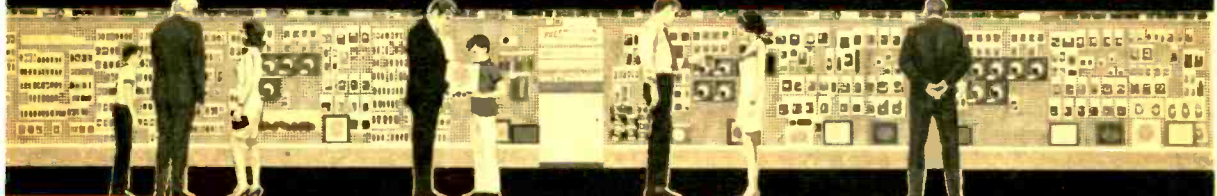
Phone _____ Age _____
(Home, Business, or Neighbor)

Year of high school graduation _____

Check here if eligible for Veteran's Benefits

Accredited by the NATTS and NHSC.

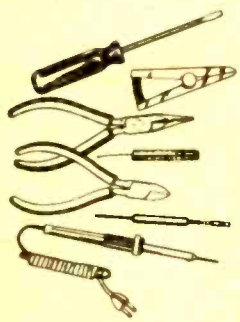
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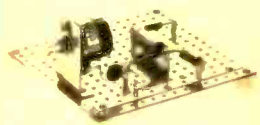
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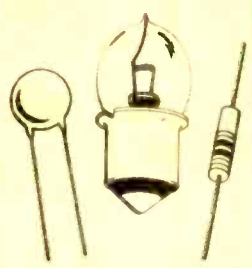
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CIRCLE NUMBER 4 ON PAGE 11



EXCEPT for the most expensive executive models, just about every intercom is the remote-call type. This means that only the master station can originate calls to other stations—the remotes. Remote stations can call only the master, not the other remotes. For a remote station to originate a call it must be a master complete with its own amplifier—and a price tag to match. A solution is for the master to have presetting—a feature that allows several remotes to be tied together. But then someone must be around to do the switching at the master.

With modular solid-state equipment it is possible to design an intercom with a central master amplifier that can be on all the time. Tuck the master deep in a closet or basement (with solid-state equipment there's no heat to worry about) and you can eliminate all electronics in the individual stations. Each remote becomes a master station capable of calling any other station or even answering the door.

Such an all-master intercom system is shown above. The three stations are capable of calling each other or any other stations in the system. Each can also listen and talk to a door station with total privacy—no other station mote can monitor or hear the door conversation. Figures 1 and 4 show the master amplifier which consists of a power supply and a one-watt modular amplifier.

There's room, too, for your own customization. For example, the

All-Master Intercom

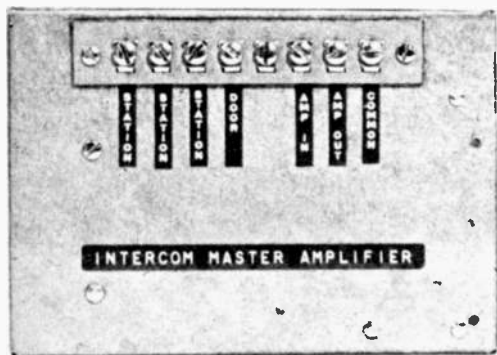


Fig. 1—Master amplifier at far left is built in 7 x 5 x 3-in. Minibox. Remote station is built in Bakelite utility case but may be housed in any enclosure you wish to use. Door station is just a speaker in box which has no switches.

schematic in Fig. 3 shows three stations plus door capability, but there's no limit to the number of stations you can use. There are extra switch terminals, so all you must add is larger terminal strips to handle the extra station connections.

The master amplifier also has room for customizing. The module specified provides the volume level of a typical transistor table radio. For greater power you can substitute an amplifier of higher power. The basic construction and wiring must still be followed for both the remote and master amplifier.

Construction

The station in Fig. 1 is assembled on a pre-drilled aluminum panel that is supplied in the Lafayette 99 E 63380 Panel Kit. This panel is drilled for a 2½-in.-dia. speaker. Temporarily position a 16-ohm speaker no smaller than 2½ in. (preferably 3 in.) over the holes and mark the mounting locations for all other panel components. Switches S2 and S3 can be any DPDT spring-return type, either push-button or slide.

Drill the holes for the panel components and then cement the speaker in position with a contact adhesive such as Touch-n-Glue. Mount level control R1, selector switch S1, control switches S2 and S3 then the terminal strip. The terminal strip is mounted with 1-in. standoffs so its lugs clear all other components. If it looks as though terminals 5, 6 and 7 will touch the back of the speaker, bend the terminals up toward the strip as far as possible. To avoid feedback loops between the amplifier's input and output leads, install the switch wiring exactly where shown.

Switch S1 should have enough contacts

to handle all the stations, though the door(s) is not counted as a station—it has its own switch. We show the wiring for three stations; 12 stations are possible using the switch specified in the Parts List. Connect to the terminal strip numbers shown to avoid confusion. For clarity, we show the terminal numbers out of order in the schematic.

The master amplifier is built in the main section of a 7 x 5 x 3 in. Minibox. Note that the power supply for the specified amplifier is 9-10 V negative; the positive output is connected to the chassis (ground). Not all the supplied amplifier wires are used. Cut off the black input and output leads. Then, using as little heat as possible, solder a 5-in. lead to the metal rivet to which the supplied green input lead is soldered. The 5-in. lead should be cut to size when connected to

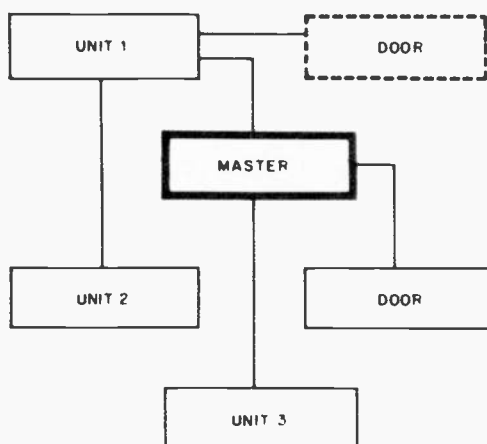


Fig. 2—System interconnections. You can connect station to station, or station to master, but at least one station must be connected to the master.

All-Master Intercom

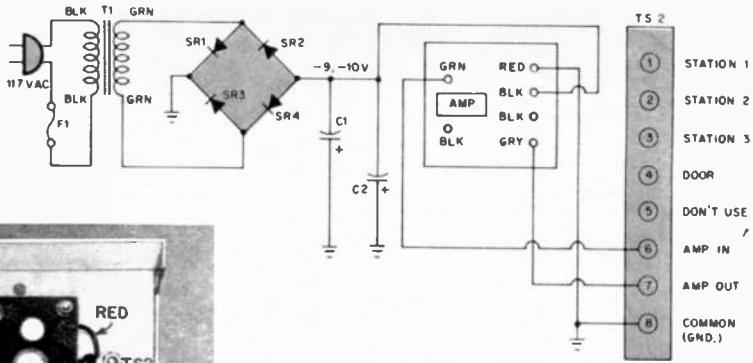


Fig. 5—Schematic of master amplifier. Only lugs 6,7 and 8 are active. Others are tie points. Connect lug 8 to external ground (water pipe).

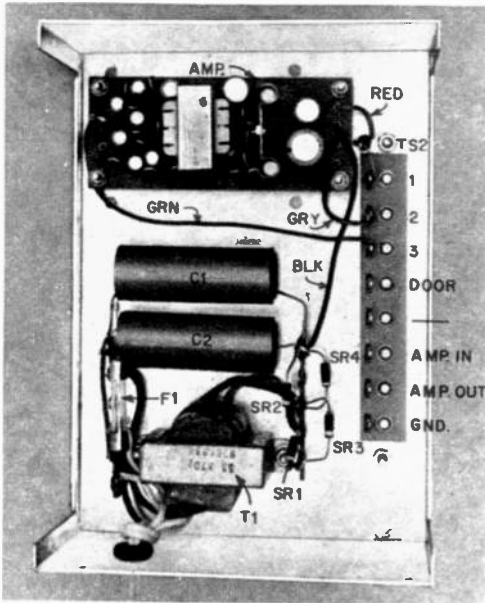


Fig. 4—Master amplifier is built in main section of Mini-Box. Mount amplifier with standoffs so back of its board doesn't touch the cabinet.

PARTS LIST

- AMP.—1 watt modular amplifier (Lafayette 99 E 90979)
- C1,C2—2,000 μ f, 15-V electrolytic capacitor
- Door Spkr.—16 ohm, 2½ or 3-in. speaker (see text)
- F1—1 A pigtail fuse
- R1—20 ohm speaker fader (Lafayette 99 E 61384)
- S1—Single pole rotary switch (12-position Mallory 32112J used, see text)
- S2,S3—DPDT spring-return toggle or slide switch
- SPKR.—8 or 16-ohm speaker (see text)
- SR1-SR4—Silicon rectifier; minimum ratings: 750 ma, 25 PIV (Lafayette 19 E 50021 or equiv.)
- T1—Filament transformer; secondary: 6.3 V @ 1 A
- TS1,TS2—Eight-screw terminal strip
- Misc.—Bakelite utility case (6¾ x 3 3/16 x 1¾ in. Lafayette 99 E 62721), panel kit (Lafayette 99 E 63380), 7 x 5 x 3-in. Mini-Box, multi-conductor intercom cable

a number to the station and connect a jumper wire from terminal 5 to the terminal that corresponds to the station number. For example, station 1 would have a jumper from terminal 5 to terminal 1. Station 2 would have a jumper from terminal 5 to terminal 2. The jumper provides the connection which allows any station to call any other regardless of what station the called station is switched to.

Any method can be used to interconnect all stations of the system. As shown in Fig. 2, the cables can be connected in any combination of station to station or station to master amplifier as long as at least one cable connects from one station to the master amplifier. The door station(s) can connect to another station or the master amplifier as shown.

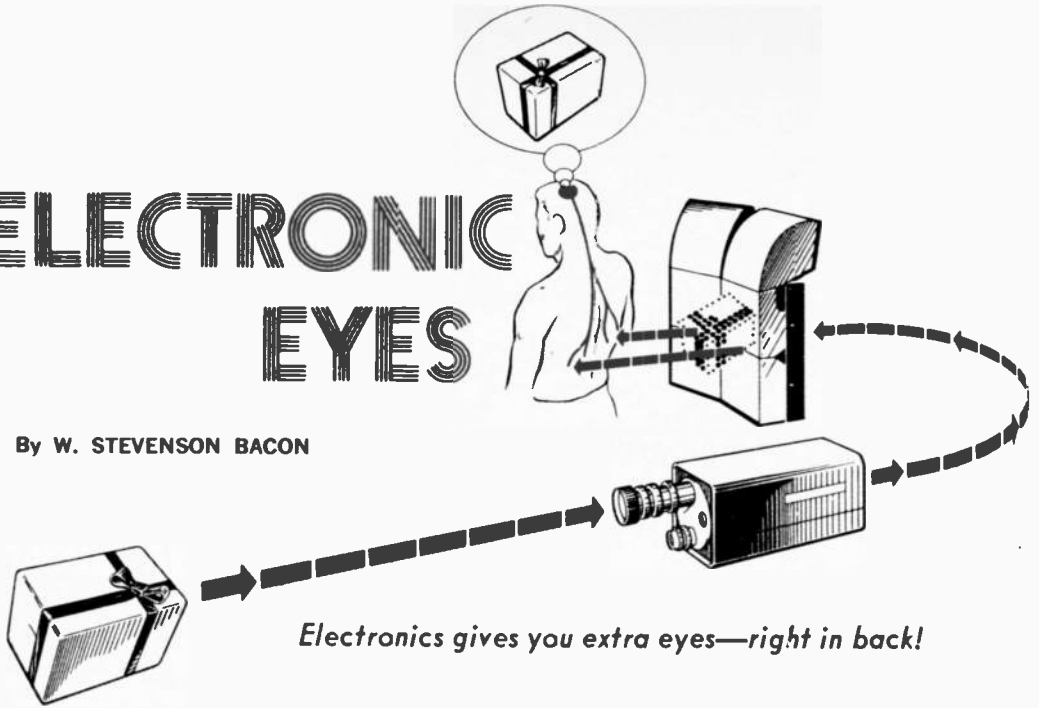
For safety's sake, we strongly suggest that regardless where the master amplifier is mounted, terminal 8—the chassis ground—be connected to an electrical ground such as a cold-water pipe.

The master amplifier's power supply is on at all times; power consumption is extremely low on standby; therefore, an on-off switch is not needed. To initiate a call simply set S1 to the appropriate station, press S3, and talk. As with all intercoms, identify your station so the receiving station will switch to your number. When S3 is released you will hear the called station when he presses talk switch S3.

To answer the door, push S2. You will hear the door station regardless what S1 is set for. Also, press S2 when talking to the door. The door circuit is private and no other stations will hear you or the door unless they press S2.

ELECTRONIC EYES

By W. STEVENSON BACON



MAN sometimes thinks of his eyes as the only way to see the world around him. However, medical science has developed a system of visual perception that will make your eyes just a small part of your seeing apparatus. The system, technically called tactile television, has been undergoing tests at a West Coast hospital and has successfully demonstrated that the blind can "see" objects at a distance. The system will eventually allow sighted persons to perceive things that would have previously been missed by the naked eye.

The system came about because of a desire on the part of two scientists, Drs. Carter Collins and Paul Bach-y-Rita, to provide a practical replacement for the eyes that are lost to the blind.

Tactile television operates on a basically simple principle—all parts of the body send nerve sensations to the brain. For instance, if you step on a ball in your bare feet you know that the ball is round although you cannot see it.

Collins and Bach-y-Rita discovered in their studies that the skin of the back was especially sensitive to these sensations and could be used as a receptor. The skin of the back would then be used in place of the eye's sensors. What would be used in place of the cornea, lens and retina? The doctors borrowed an idea from TV and decided to use a regular closed-circuit TV camera to replace these human parts (Fig. 1). The vidicon camera offers many of the facilities of the eye in that it can focus and perceive varying brightnesses of light. It also offers the mobility that is necessary to see a wide area.

A majority of the task had been accomplished; however, there remained the problem of converting the televised signal into a form that could be impressed on the back. This is where Collins and Bach-y-Rita have made their significant discovery. In order to fully understand the method, a short explanation on how the eye functions is necessary.

Reflected light of an object is focused by the eye's lens in an inverted manner. At the back of the eye are thousands of tiny receptors similar to photocells. Depending on the intensity of light, each cell sends a different amount of energy to the brain. The image that you see is a picture that has been assembled from this information. In other words, the brain is your decoder and monitor.

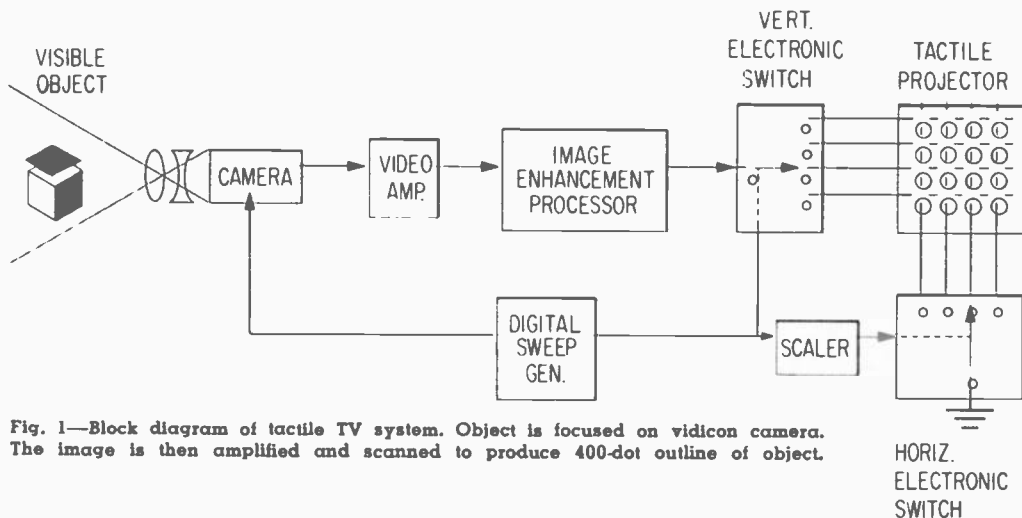


Fig. 1—Block diagram of tactile TV system. Object is focused on vidicon camera. The image is then amplified and scanned to produce 400-dot outline of object.

ELECTRONIC EYES

The doctors reasoned that information transmitted from the sensitive area of the back could, with sufficient training, be assembled in the same manner that the brain assembles messages from the natural eye.

As a matter of economy, the researchers decided to work with a projection device on a simple scale. In the back of a dentist's chair (Figs. 2 and 3) they installed 400 electromagnetic stimulators. These stimulators are solenoids with Teflon-tipped shafts. When a person rests his back against the chair, the stimulators move back and forth to strike the skin at a 60-cps rate as each of the individual magnets is energized. Each stimulator in this crude array represents one point in a picture composed of 400 dots.

In order to have the TV portion of the system produce a picture composed of only 400 dots, it is necessary that the electron beam sweep the photosensitive surface of the vidicon tube and sample the video at 400 pre-selected points. The solenoids are controlled in such a manner that light levels above a certain threshold will produce a pulse of constant duration.

It might seem that the subject is receiving nothing but pressure points with little definition on his back, but remember much of this information will be enhanced by the brain.

Shades are produced by this system, for each sweep the light might one time activate a solenoid, and another time not. Hence the subject feels a lighter grade of light.

Later in their research the scientists dis-

covered that more of a complete picture could be produced by utilizing additional electronic hardware. They discovered that it is helpful to the subject to feel outlines of objects rather than a solid mass. To construct these outlines Dr. Collins uses what is called quasi-random sweep. With this system all of the points of the picture are swept from all four diagonal directions. With signal processing the end result is an image outline that



Fig. 2—Tactile TV in lab. Note converted dentist's chair with electromagnetic probes on back.

is free from extraneous subtleties that would confuse the subject.

In experiments the scientists have found that people who have been blind since birth can discern such objects as a telephone (Fig. 3, bottom) and a human face.

With these encouraging results, the future promises to be even more exciting. If the skin can be stimulated with barely perceptible shocks, the bulky vibratory array in the dentist's chair can be eliminated. Pictures having a much better resolution will become feasible—having as many as 10,000 dots. An enormous number of lightweight electrodes could simply be woven into a garment to be worn next to the skin, something like a seeing-eye sweater. For the blind, use of such a garment in conjunction with a miniaturized camera could restore their lost sight.

Experiments have provided all the necessary parameters for electrical stimulation. The sensation is completely unlike anything you might expect. We are accustomed to think of electrical shock as painful and dangerous.

The researchers all agree that the sensation—whether they feel it as a vibration, buzz, tickle or touch—is quite pleasant. From a scientific standpoint, the important things are that it is painless, well-localized, and can be applied for at least three hours without fading of sensation.

For the sighted, the horizons are broad. Pilots and astronauts may have tactile TV radar pictures projected on their skin while they perform other duties requiring their attention. Messages—alphabetical and numerical—as well as visual information could be transmitted to controllers in airport towers, to battlefield commanders or even motorists where communications demands overload the input capabilities of the eye.

The average person might have a system that would allow him to see in a 360° arc so that nothing would be missed while his back is turned.

More flexibility is offered in scientific estimates when it comes to using tactile TV for the sighted. Instead of replacing eyes, as is necessary with the blind, the system is increasing the versatility of the human eyes for the sighted.

The sweater described above could be adapted to receive regular TV broadcasts giving one the ultimate in portable TV. A continuous flow of entertainment and information could reach the individual regardless of his location or nearness to a power source.

The research continues at an accelerated clip as Dr. Collins, now working alone, strives to give humans what amounts to an extra set of eyes—with electronics. —

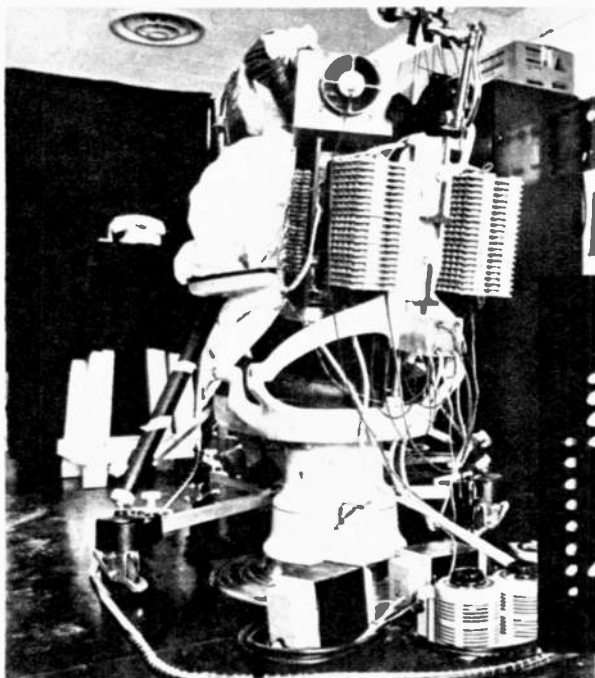


Fig. 3—A patient who has been blind since birth uses the tactile TV system. Her electronic eyes impress telephone image on her back. She senses a pattern similar to array shown in photo below.

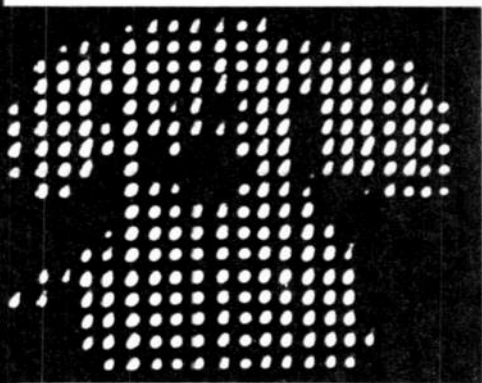
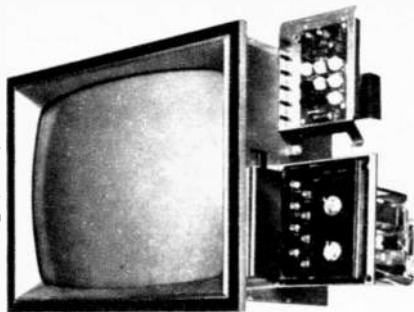


Photo courtesy of IEEE

New Heathkit® Solid-State

Design and performance features add up to one-of-a-kind superiority.

Over five years were spent in research and development to achieve the notably superior performance, improved convenience features, and ease of service now embodied in the new GR-270 and GR-370. They are premium quality receivers in the truest sense, and, we believe, the finest color TV's on today's market. Here's why...



Compare these features:

- Modular plug-in circuit board construction.
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- Premium quality bonded-face etched glass picture tubes.
- Choice of 295" or 227" picture tube sizes.

Exclusive solid-state circuitry design... total of 45 transistors, 55 diodes, 2 silicon controlled rectifiers; 4 advanced Integrated Circuits containing another 46 transistors and 21 diodes; plus 2 tubes (picture and high voltage rectifier) combine to deliver performance and reliability unmatched by conventional tube sets.

Exclusive design solid-state VHF tuner uses an MOS Field Effect Transistor for greater sensitivity, lower noise, and lower cross-modulation... gives you sharply superior color reception, especially under marginal conditions. Gold/Niobium contacts give better electrical connections and longer wear. Memory fine tuning, standard. Solid-state UHF tuner uses hot-carrier diode design for increased sensitivity.

3-stage solid-state IF has higher gain for better overall picture quality. Emitter-follower output prevents spurious signal radiation, and the entire factory-aligned assembly is completely shielded to prevent external interference.

Automatic Fine Tuning — standard on both sets. Just push a button and the assembled and aligned AFT module tunes in perfect picture and sound automatically... eliminates manual fine-tuning. Automatic between-channel defeat switch prevents tuner from locking in on stray signals between channels. AFT can be disabled for manual tuning.

VHF power tuning... scan through all VHF and one preselected UHF channel at the push of a button.

Built-in automatic degaussing keeps colors pure. Manual degaussing coil can be left plugged into the chassis and turned on from the front panel... especially useful for degaussing after the set is moved some distance.

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Premium quality color picture tubes. Both the 227 sq. in. GR-270 and 295 sq. in. GR-370 use the new brighter bonded-face, etched glass picture tubes for crisper, sharper, more natural color. And the new RCA HiLite Matrix tube is a low cost option for the GR-370. See below.

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Easy, enjoyable assembly... the Heathkit way. The seven-section manual breaks every assembly down into simple step-by-step instructions. With Heath's famous fold-out pictorials and simple, straightforward design of the sets themselves, anyone can successfully complete the assembly.

Heathkit Solid-State Modular Color TV represents a significant step into the future... with color receiver design and performance features unmatched by any commercially available set at any price! Compare the specifications. Then order yours today.

Kit GR-270, all parts including chassis, 227" picture tube, face mask, UHF & VHF tuners, AFT & 6x9" speaker, 114 lbs. \$489.95*

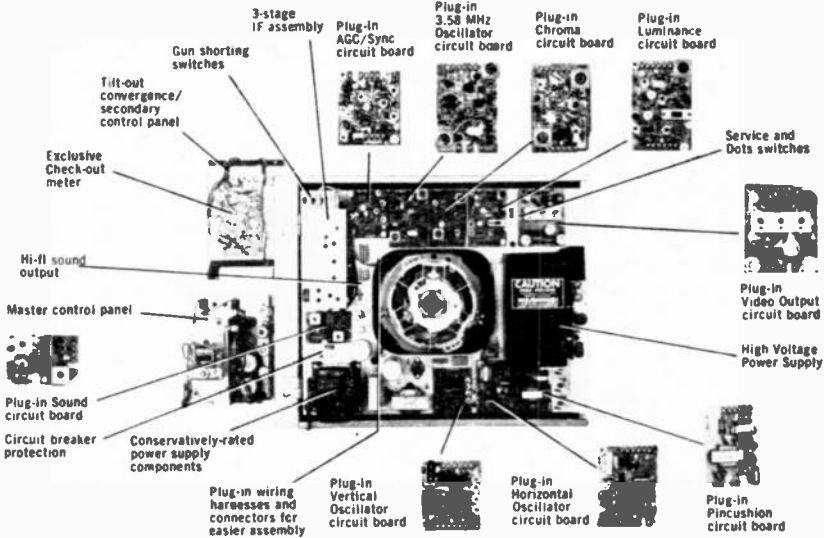
Kit GR-370, all parts including chassis, 295" picture tube, face mask, UHF & VHF tuners, AFT & 6x9" speaker, 127 lbs. \$559.95*

Kit GR-370MX, complete GR-370 with RCA matrix picture tube, 127 lbs. \$569.95*

GR-270 AND GR-370 SPECIFICATIONS — PICTURE TUBE SIZE: GR-370 Approximate Viewing Area: 295 Sq. In. GR-270 Approximate Viewing Area: 227 Sq. In. DEFLECTION: Magnetic, 90 degrees. FOCUS: Electrostatic. CONVERGENCE: Magnetic. ANTENNA INPUT IMPEDANCE: VHF 300 ohm balanced or 75 ohm unbalanced. UHF: 300 ohm balanced. TUNING RANGE: VHF TV channels 2 through 13. UHF TV channels 14 through 83. PICTURE IF CARRIER: 45.75 MHz. SOUND IF CARRIER: 41.25 MHz. COLOR IF SUBCARRIER: 42.17 MHz. SOUND IF FREQUENCY: 4.5 MHz. VIDEO IF BANDWIDTH: 3.58 MHz. HI-FI OUTPUT: Output impedance — 1 k ohm. Frequency response — ±1 dB 30 Hz to 10 kHz. Harmonic distortion — less than 1% at 1 kHz. Output voltage — 0.3 V rms nominal. AUDIO OUTPUT: Output impedance — 4 ohm or 8 ohm. Output power — 2 watts. POWER REQUIREMENTS: 110 to 130 volts AC, 60 Hz, 240 watts. NET WEIGHT: GR-370, 114 lbs.; GR-270, 101 lbs.

Modular Color Television!

Exclusive Modular Design... Circuit Boards snap in and out in seconds for easy assembly, simple servicing



New Expedited 48-Hour No-Charge Warranty Service Plan for Solid-State TV Modules! Special service facilities have been established at the factory and all Heathkit Electronic Centers to expedite service and return of Solid-State TV circuit modules within two working days. During the 90-day warranty period, TV modules will be serviced or replaced with no charge for labor or parts. After the initial 90-day warranty period expires, TV modules will be serviced or replaced at a fixed charge of \$5.00 per module for labor and parts for a period of two years from date of original kit purchase.



Add extra convenience and versatility to your new GR-270 or GR-370 Solid-State Color TV with this new ultrasonic remote control kit. Lets you turn the set on and off, adjust volume, change VHF channels and adjust color and tint from the comfort of your chair. Assembles and installs complete in just a few hours and the built-in meter on the receiver makes final adjustment a matter of minutes.
Kit GRA-70-R, 6 lbs. \$64.95*

Choose One Of These Handsome, Factory Assembled Cabinets

3 models in 295 sq. in.

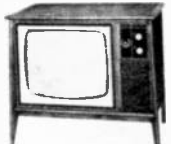
Luxurious Mediterranean Cabinet... factory assembled of fine furniture grade hardwoods and finished in a flawless Mediterranean pecan. Statuary bronze trim handle. 30-1/32" H x 47" W x 17 3/4" D. Assembled GRA-304-23, 85 lbs. \$129.95*



Deluxe Early American Cabinet... factory assembled of a special combination of hardwoods & veneers and finished in classic Salem Maple. 29-21/32" H x 37 1/4" W x 19 3/4" D. Assembled GRA-303-23, 67 lbs. \$114.95*



Contemporary Walnut Cabinet... factory assembled of fine veneers & solids with an oil-rubbed walnut finish. 29-17/32" H x 35-13/16" W x 19 1/4" D. Assembled GRA-301-23, 56 lbs. \$74.95*



3 models in 227 sq. in.

Exciting Mediterranean Cabinet... assembled using fine furniture techniques and finished in stylish Mediterranean pecan. Accented with statuary bronze handle 27-31/32" H x 41 3/4" W x 19-9/16" D. Assembled GRA-202-20, 70 lbs. \$114.95*



Contemporary Walnut Cabinet and Base Combination. Handsome walnut finished cabinet sits on a matching walnut base. Cabinet dimensions 20-31/32" H x 31-7/16" W x 18 5/8" D. Base dimensions 7 3/4" H x 27 3/4" W x 18 5/8" D. Assembled GRA-203-20 Cabinet, 45 lbs. \$49.95* GRA-203-0 above cab. w/ matching base, 58 lbs. \$59.95*



Nifty Roll-Around Cart and Cabinet Combination. Features the GRA-203-20 walnut cabinet plus a walnut-trimmed wheeled cart with storage shelf. Assembled GRA-203-20 Cabinet, 45 lbs. \$49.95* GRA-204-20 Roll-Around Cart, 18 lbs. \$19.95* GRA-203-0, Cart & Cabinet Combo, 58 lbs. \$59.95*



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CIRCLE NUMBER 3 ON PAGE 11

Hi-Fi Today *

By John Milder

Four-Channel Noise

THIS is one of those times when, to paraphrase Casey Stengel, everything is happening slowly but fast. That is, practically every day brings announcements of revolutionary new concepts and products, but putting these ideas into their practical place is a process which is agonizingly slow.

The latest example of this situation is all of the noise being made about four-channel sound. It comes in four varieties—two different versions from RCA, Motorola and Phillips of straight four-channel. Then there are two different versions from Scheiber and Dynaco of encoded or matrixed four-channel, which derive four separate channels from a two-channel recording or broadcast format. If I had to bet right now, I'd put my money on the Scheiber or some still-to-be announced matrixing system. I think that straight four-channel will prove far too expensive and cumbersome for a wide market, unless it's cheapened terribly.

The role of Japan in audio was given an interesting twist by the announcement that British Industries, until now the American marketer of English audio products (Garrard, Wharfedale), is branching out with a line of amplifiers, tuners and receivers made in Japan. The brand name, a bit cumbersome, will be BIC/LUX—from the combination of British Industries Corporation with LUX, a Japanese engineering and manufacturing group. The gear will combine Japanese design and manufacture with Anglo-American notions of what the equipment ought to be like.


If the BIC/LUX tag seems formidable, so does the equipment—including two receivers with \$500 and \$600 price tags. There will be things such as computer tuning, which provides total muting when a station isn't tuned dead-on, an adjustable threshold that won't mute weak stations and human engineering that logically groups control and input functions.

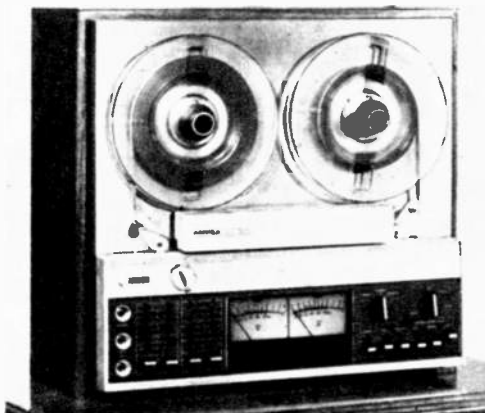
The arrival of the super-cassette deck has been confirmed by the appearance of the Advent 200 tape deck (about \$250), the Harman-Kardon CAD-5 (about \$200) and the \$199.95 Fisher RC-80.

What all these units have in common, of course, is the Dolby System of noise reduction to permit wide-range cassette recording for the first time, without noise.

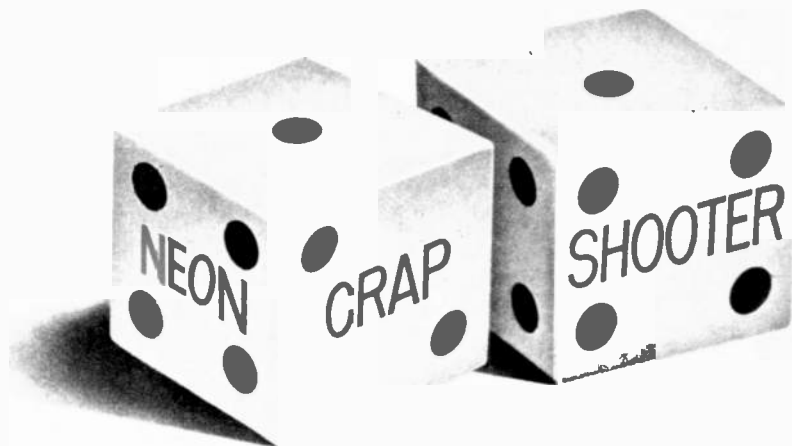
As far as I'm concerned, the presence of the new super-cassette machines will speed a trend already begun with a vengeance by mediocre cassette decks. Cassette recorders already have almost taken over the market for inexpensive tape equipment, pushing open reel recorders way into the background. Good cassette decks are likely to continue this. I'm sure that the future of open reel, whatever its eventual dollar sales, lies in the area of high-priced equipment.

Apparently, Ampex suspects this also. In announcing its new line of equipment, the company put its open-reel emphasis on two new and ambitious recorders—the AX-50 and AX-300 decks, at \$300 and \$650 respectively. With six heads as well as automatic reverse and dual-capstan drive, the AX-300 is obviously not for the casual recordist. It has a heavily professional look, underlined by linear slider controls and a pair of full-scale VU meters that function in both record and playback.

We'll have to wait and see the effect of this move. 



Ampex AX-300 recorder. The machine boasts six heads, automatic reverse and dual-capstan drive.



By HERB COHEN

Shoot a no-fix crap game with neon lamps! It's the In thing—unless you must hear the sound of bones hitting the backboard.

ELLOW shakers who have lost the faith: *cool it!* There's no need to get uptight about loaded dice. And there will be no more trick rolls, either. Get with it by just pushing two buttons on our Neon Crap Shooter. The rest is up to electronic chance. One of the oldest gambling games has had a touch of the modern computer added to it.

How can you make a dice game electronic? It's done with neon lamps in ring counters. The neon lamp is a versatile little device. Not only is it a light indicator, it is also a sawtooth generator, a memory element and a voltage regulator. Two of them make a bistable multivibrator.

In our game neon lamps are used as switches and indicators in two six-bit ring counters. Don't let the term *ring counter* put you down. It's really a simple computer circuit. The lamps are connected so each one couples to the next and then back to the first to form a ring. We use two groups of six lamps for the six sides of each die. Since there are two dice there are two independent ring counters.

How it Works

Take a look at the schematic in Fig. 2. Neon lamps NL2 to NL7 represent one die and NL9 to NL14 represent the other die. The circuit is designed so that a chain of pulses triggers the ring-counter lamps to flash on and off, and in such a way that the last lamp to light cannot be predicted when the pulses end. Triggering is accomplished by two other neon lamps, NL1, NL8, which are in a relaxation-oscillator circuit.

Let's first see how the relaxation oscillator works. When S1 is pressed lamp NL1 fires

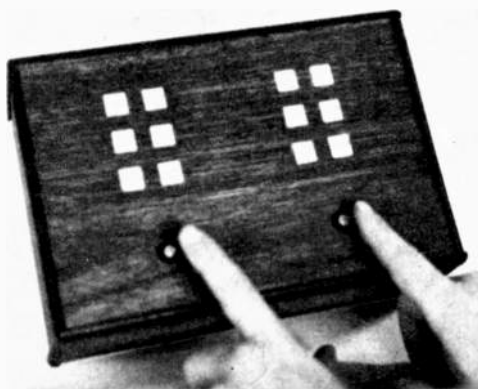


Fig. 1—To simulate each side of die, drill holes in cabinet and cover with translucent plastic. Roll here is 4 (upper left) and 6 (lower right).

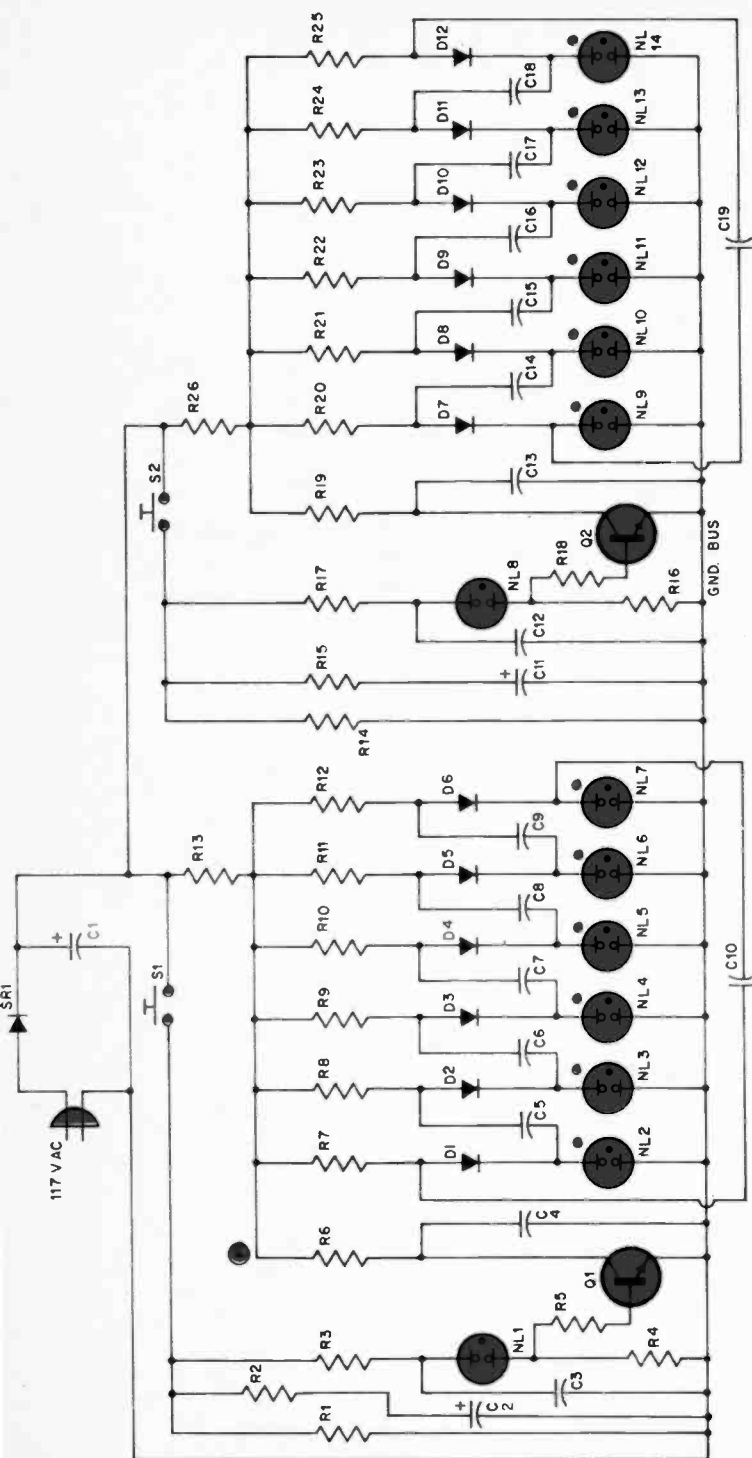


Fig. 2—Identical circuits are used for each die. Relaxation oscillators are NL1 and NL8. Ring counter configurations differ slightly, but their operation as described in detail in the text is exactly the same.

and discharges C3 to ground through NL1 and R4. The voltage across R4 causes Q1 to conduct and this puts a negative pulse at point A. Lamp NL1 fires at about 200 cps.

When S1 is released, NL1 continues to run because of the charge remaining on C2. As the charge decreases, NL1 runs slower and slower then stops. Resistor R1 sets the rundown time. By removing it the rundown can last for a minute.

Now to the ring counters to see how their neon lamps flash on and off. For this example we'll just deal with lamps NL2 and NL3. The lamps used in the ring counter are Signalite Type A257. (Other neon lamps won't work in this circuit.) They fire at 135 V. When they fire, the voltage across them drops to about 80 V.

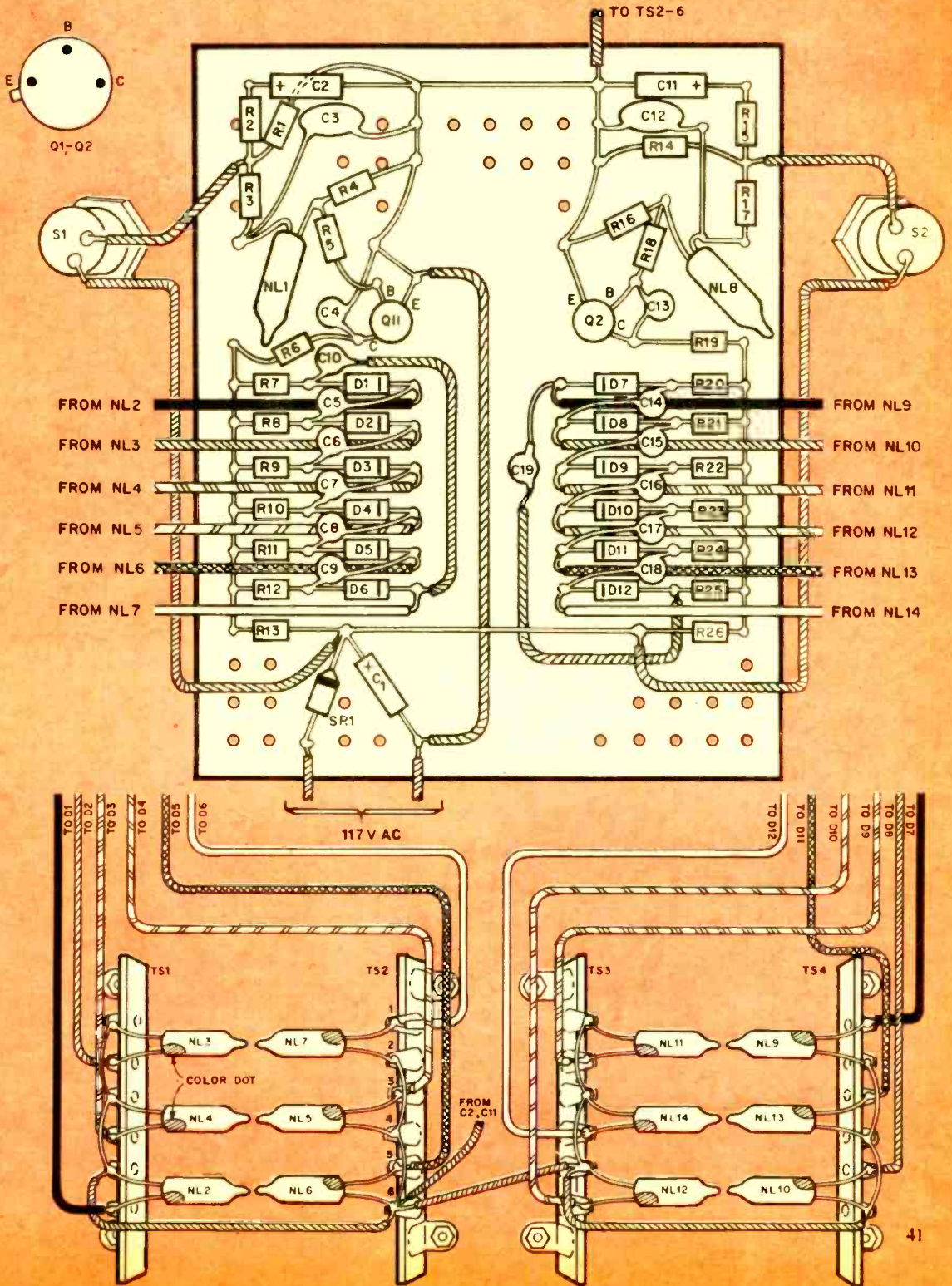
When DC power is applied to the circuit, only one of lamps NL2-NL7 fires. Say it's NL2. This brings the voltage at point A down to 110 V, which is below the firing voltage of the other lamps.

Let's start the action again by pushing S1 to activate pulse generator NL1. After we do this, you remember, C3 discharges and applies a positive pulse to the base of Q1, causing it to conduct. This pulls the voltage at point A below the sustaining voltage level of NL2 and NL2 goes off.

The trigger pulse is of short duration, and when it ceases the voltage at point A rises. When NL2 was off, the voltage drop across R7 went to zero. The voltage across C5 (it's 30 V below the voltage at

Neon Crap Shooter

Fig. 3—Parts layout isn't critical, but be sure install diodes DI-D12 correctly. And you must connect lead opposite green dot on NL2-NL7, NL9-NL14 as shown.



Neon Crap Shooter

point A), the coupling capacitor connected from NL2 to NL3, snaps back to the voltage at point A. This sends a 30-V pulse to the anode of D2.

Lamp NL3 up to now is off now and its anode is at the same potential as point A. But the 30-V pulse adds to the voltage at NL3's anode causing NL3 to fire. As the voltage at point A rises, the next trigger pulse turns off NL3, which in the same way fires NL4. And so it goes on to NL7, then back via C10 to NL2. (The second ring counter, activated by S2, operates the same way.)

Construction

Take a look at Fig. 3. All the circuit components except the ring-counter neon lamps are mounted on a 4 x 6-in. piece of perforated board. You can use push-in terminals or brass eyelets as tie points. The author's model used brass eyelets for tie points.

Circuit components are not critical except for lamps NL2-NL7 and NL9-NL14. The lamps have a green dot on them near the positive (anode) terminal. Be sure to install them as shown. If installed backwards, they may not work properly.

Our game was built in a 3 x 6 x 9-in. Flexi-

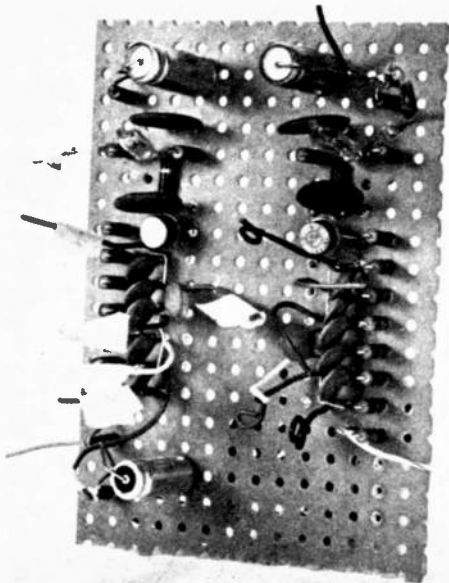


Fig. 4—On board built by author, parts are mounted vertically to save space. However, they may be installed as in Fig. 3 to simplify wiring.



Fig. 5—Indicator neon lamps are held by their leads which are soldered to terminal strips. Sponge-rubber strips prevent light spillover. Board mounts under lamps and is held by wiring to the lamps.

Cab metal cabinet (Lafayette 19 E 22533). To display the side of a die as in Fig. 1, we drilled holes through the top panel corresponding to the spots on each side of a die. We then covered each group of holes with a 1/2-in. square of translucent white plastic.

On the back of the panel near the groups of holes we installed four six-lug terminal strips (TS1-TS4) as shown in Figs. 3 and 5. We soldered the neon lamps' wires to the terminal-strip lugs then, as shown in Fig. 5, we glued small pieces of sponge rubber between the lamps. This prevented the light from one lamp spilling over to another.

PARTS LIST

- C1—10 μ f, 150-V electrolytic capacitor
- C2,C11—3 μ f, 150-V electrolytic capacitor
- C3,C4,C12,C13—.01 μ f, 1,000-V disc capacitor
- C5 through C10, C14 through C19—.001 μ f, 1,000-V disc capacitor
- D1 through D12—1N914 diode
- NL1,NL8—NE-51 neon lamp
- *NL2 through NL7, NL9 through NL14—A257 neon lamp (Signalite, see text)
- Q1,Q2—2N1893 transistor (RCA)
- Resistors: 1/2 watt, 10% unless otherwise indicated
- R1,R14—1 megohm
- R2,R4,R5,R15,R16,R17—1,000 ohms
- R3,R17—2.2 megohms
- R6 through R12, R19 through R25—15,000 ohms
- R13,R26—33,000 ohms
- S1,S2—SPST normally-open pushbutton switch
- SR1—Silicon rectifier; minimum ratings: 100 ma, 500 PIV
- Misc.—perforated board, line cord, cabinet
- *The Signalite A257 neon lamps are available for 55¢ each (postpaid) from Gailek Solid State, Inc., 434 Avenue of the Americas, New York, N.Y. 10011



Bugging the Fuzz

*Listening in on police calls makes
VHF radio the hotspot for SWLs.*

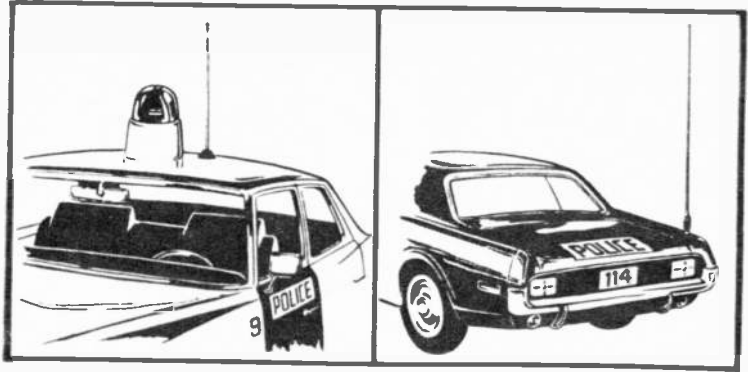
WHETHER you know them as cops, fuzz, flatfeet or bulls, the truth is that the police always have excited the imagination. They have populated everything from comic books to TV shows in an endless barrage of good cop-bad robber adventure stories.

Many SWLs have decided to forget the fiction and eavesdrop on police radio calls. With a little knowledge, good equipment and patience you can join this exciting hobby where the airwaves crackle with intrigue and drama.

The equipment that you need is of a fast-growing breed that tunes local police, fire departments and other emergency services. Thanks to a flood of low-cost gear in the marketplace this special equipment is comfortably within the budget of most SWLs. Until a year or two ago, the monitors were strictly in the professional class but price tags today can dip below \$20. Sales of these sets are booming.

Low and High. Police frequencies mainly fall within two sections of the VHF band (30-300 mc) and you should know which one your local agency is using before considering equipment. There's the low band, which runs from about 30-50 mc and a high band which extends from about 150 to 174 mc. Although both fall within VHF, you won't find one receiver that continuously tunes the whole VHF band. You'd run into a lot of unnecessary signals, mainly from TV channels 2 through 13. It's not difficult to identify the local band in use, or even to find out an exact

Fig. 1—Illustration of two types of police VHF antennas. In the drawing at the right is a spike antenna, about 1½ ft. tall covering 150-174 mc. In the drawing on the far right is the whip antenna covering the low band of 30-50 mc. Note mounting.



Bugging the Fuzz

frequency which must be known for crystal-controlled operation.

How do you know if a local service is on low or high band? A simple way is to look at the antenna on one of the mobile units. If it's sporting a whip antenna that measures about five or six ft. in height, it's advertising the low band. As you can see in Fig. 1, a low-band whip is often mounted at the rear and has a spring-loaded base.

Spotting high-band antennas is also easy since they're barely more than slim spikes jutting up from a car top or trunk deck. The length of the spike is about 1½ ft.

Simply knowing whether low or high band is in local operation is enough information to pick a receiver. To locate stations on the dial takes a bit of patience, but you should

be able to log various local services. (Expect to do some dial-tiddling because transmissions are short and easily missed.) Trial-and-error tuning is adequate for the occasional listener or hobbyist but it could prove annoying to people with more than a casual interest in monitoring and who want to hear specific frequencies. Many volunteer policemen wish to monitor their department's channels for example. To tune signals with a minimum of fuss you should choose a receiver capable of crystal-control and obtain a crystal of the exact frequency. It's easy to find out the frequency if you're a cop, fireman, or some other pro—just ask for it down at headquarters. If you have no friends at city hall, you can buy the information from the Communications Research Bureau, Box 56-EX, Commack, N. Y. 11725. They specialize in frequency listing by area and will send you a catalog on request.

The Receivers. Receiving equipment is quite varied in features and price so the best



Figs. 2 and 3—Photo at left is of the Hallcrafters Portamon portable VHF receiver. Both low- and high-band models are available with adjustable squelch control. Photo at bottom is the Realistic Patrolman which tunes low and high bands. It's \$99.95.





Fig. 4—Allied's Model 2660, a versatile portable/AC receiver covering AM and FM, short wave and two VHF bands. \$69.95.

place to begin is on the bottom rung. There you'll find the low-cost portable which picks up a single band. A model like the Allied A-2587 can tune the high band at just under \$20. (An equivalent model is available for low-band coverage.) The performance of simple portables usually boils down to this: they're fine for occasional listening if signals aren't too distant or crowded together. Dial calibration is very approximate and tuning is a touchy proposition because of little band-spread action in the tuning knob. Of course, there are none of the special features found in higher-priced models. But it's a start. (Allied Radio, as do others mentioned in this article, offers both simple and advanced monitors.)

Further up the scale, at \$33.50, is a unit like the Courier pocket-size monitor. Compared to the simpler set, this one has three differences worth noting. Instead of a continuous tuning dial, there are three crystal-controlled frequencies. This makes the unit a snap to tune on three channels, but less effective for casual listening over the whole band. Another feature is a squelch circuit which keeps the speaker silent when calls are not being received. Squelch on any set is a valuable feature if you're going to monitor over long periods and want to avoid annoying static. Finally, the Courier includes an AM section for entertainment so the receiver serves two purposes. There are many comparable models available including the Hallcrafters CRX-107, (Fig. 2).

You can combine the benefits of crystal



Fig. 5—The receiving robot, Regency's TMR-8. Receiver automatically searches for signals on selected frequencies with eight crystals.

and continuous tuning in a home-type receiver of the one-band variety. A selector provides both continuous tune and crystal positions. A crystal can be ordered for fixed-frequency reception at a cost of \$5.95 and about a four-week waiting time (since the rock might have to be ground especially to your frequency). With a price tag of about \$80, a receiver of this type can be expected to have good sensitivity and snappy squelch action.

These one-banders are fine, but let's say you live in a sizeable city and learn of interesting stations on both low and high band. This dilemma is neatly solved with a two-bander, like Radio Shack's Patrolman Pro-2 shown in Fig. 3 and the cost rises to \$99.95 for the additional coverage.

One recent trend in equipment is to beef up a conventional short-wave receiver with a couple of monitoring bands to satisfy almost any interest. The result is a model like Allied's 2660 a \$69.95 set that snatches almost anything out of the air (see Fig. 4). In addition to covering regular AM and FM broadcasts, it handles major short-wave bands between 5 and 24 mc (where most international broadcasting occurs). Then there are two bands marked PS for public service—another way of saying police-communications band.

Widespread listening to police broadcasts may be just a few years old, but it has already given birth to some highly specialized gear. One item that could win the prize for novelty is a *scanner*. Fitted with an impressive row of flashing lights, it's a receiving robot that automatically performs a remarkable num-

Bugging the Fuzz

ber of listening functions. Take the Regency TMR-8 (Fig. 5) as an example. After loading it with up to eight high-band crystals of your choice you turn it on and sit back. A row of eight red lights flash in sequence like a movie marquee. Suddenly, movement stops, one light remains on and you hear something like. . . . *Two characters walking down Main accompanied by suspicious looking orangutan . . .* (silence in the speaker and scanning continues) . . . *Respond to alarm at 44th and Sixth.* What the receiver is doing is searching out signals and holding open the speaker on each active frequency so you can hear the transmissions. Then it resumes scanning automatically after the transmission ends. Those buttons enable you to program any combination of channels and disable the ones you don't want to hear. Or you can monitor two sides of a conversation being transmitted on different channels.

Build-It, Too. The kit builder hasn't been overlooked by monitor designers. Heath Co. offers a receiver in kit form. The builder installs parts into a printed-circuit board and solders them to the foil, while the critical front-end is supplied prewired, assembled and aligned at the factory. The price of the GR-88 is \$49.95, which sounds high when compared to factory-wired equipment, but a look at the circuitry reveals such refinements as four IF stages, two local oscillators (for crystal and continuous tuning), amplified AGC and a multistage squelch circuit.

The advanced hobbyist might be interested in a group of experimenter modules offered by International Crystal. To construct a complete police converter for an AM radio, you choose three basic boards: an RF amplifier, a mixer and an oscillator. Assembly is on printed boards which may be housed in a cabinet, or even inside a regular receiver to extend frequency coverage. To build an operational unit costs about \$14, including one crystal for operation on any frequency between 3 and 170 mc.

Plucking a local police or fire signal out of the air can be done on the telescoping whip antenna built into most monitoring re-

[Continued on page 100]

The Associated Public Safety Communications Officers' (APSCO) and New York City Police codes shown in chart. Listen carefully and it will be easy with practice to break codes of other cities.

CODE	BREAK THE CODE	
	APSCO	NYPD
10-0	Caution	—
10-1	Change location	Call command
10-2	Signal good	Report to command
10-3	Stop transmitting	Phone dispatcher
10-4	Acknowledgement	Acknowledgement
10-5	Relay	Repeat message
10-6	Busy unless urgent	Stand by
10-7	Out of service	Verify address
10-8	In service	—
10-9	Repeat	—
10-10	Fight in progress	Investigate
10-11	Dog case	Bank alarm
10-12	Stand by	Pick-up case
10-13	Weather report	Assist officer
10-14	Prowler report	—
10-15	Civil disturbance	Verify stolen car
10-16	Domestic problem	Vehicle stolen
10-17	Next complainant	Vehicle not stolen
10-18	Quickly	—
10-19	Return to . . .	Other possible crime
10-20	Location	Robbery (past)
10-21	Call by phone	Burglary (past)
10-22	Disregard	Larceny (past)
10-23	Arrived at scene	Reported explosive
10-24	Assignment finished	Assault (past)
10-25	Meet in person	—
10-26	Detaining subject	—
10-27	License information	—
10-28	Registration info.	—
10-29	Check for wanted	Other crime in past
10-30	Unnecessary use of radio	Robbery in progress
10-31	Crime in progress	Burglary in progress
10-32	Man with gun	Larceny in progress
10-33	Emergency	Report of explosive
10-34	Riot	Assault in progress
10-35	Major crime alert	—
10-36	Correct time	—
10-37	Suspicious vehicle	—
10-38	Stopping vehicle	—
10-39	Use light, siren	Other crime
10-40	Silent run	—
10-41	Beginning tour of duty	3 Sgt. & 15 Pti.
10-42	Ending duty tour	3 Sgt. & 15 Pti.
10-43	Information	3 Sgt. & 15 Pti.
10-44	Permission to leave	3 Sgt. & 15 Pti.
10-45	Animal carcass at	4 Sgt. & 20 Pti.
10-46	Assist motorist	8 Sgt. & 40 Pti.
10-47	Emgcy. rd. repair	8 Sgt. & 40 Pti.
10-48	Standard repair at	1 Sgt. & 5 Pti.
10-49	Traffic light out	—
10-50	Accident	Disorderly person
10-51	Wrecker needed	Revsing hand
10-52	Ambulance needed	Noise or dispute
10-53	Road block	Street accident
10-54	Livestock on road	Ambulance case
10-55	Drunk driver	Ambulance case
10-56	Drunk pedestrian	Ambulance needed
10-57	Hit and run	Amb., 2nd call
10-58	Direct traffic	Assist ambulance
10-59	Convey or escort	Alarm of fire
10-60	Squad in vicinity	Precinct assign.
10-61	Personnel in area	Precinct assign.
10-62	Reply to message	Out of service
10-63	Make written copy	On assignment
10-64	Local message	—
10-65	Net message	Utility trouble
10-66	Message cancellation	Unusual incident
10-67	Not message	Traffic condition
10-68	Dispatch information	See complainant
10-69	Message received	Other incident
10-70	Fire alarm	Car & bus mob.
10-71	Advise nature fire	—
10-72	Report progress fire	—
10-73	Smoke report	—
10-74	Negative	—
10-75	In contact with	—
10-76	En route	—
10-77	ETA	—
10-78	Need assistance	—
10-79	Notify coroner	—
10-80	Chase in progress	Refer detectives
10-81	Breathalyzer report	Persons to station
10-82	Reserve lodging	Aided to hospital
10-83	Work school crossing	Dead on arrival
10-84	Missing ETA	Fire report
10-85	Delayed due to . . .	Need suit
10-86	Officer on duty	Female
10-87	Pick-up checks	Cancel
10-88	Telephone # of	Arrived at scene
10-89	Pick up prisoner	Condition corrected
10-90	Bomb threat	Other status
10-91	Bank alarm at	Unfounded
10-92	Improper parking	Summons issued
10-93	Blockade	Unnecessary call
10-94	Drag racing	False alarm
10-95	Prisoner in custody	Referred to court
10-96	Mental subject	Gone on arrival
10-97	Check signal	Handled by post
10-98	Prison/jail break	Resuming patrol
10-99	Wanted indicated	Other disposition



V E R T I C A L

AFTER deciding *which* antenna you want to put up, the next big problem that hits you is *where* to put it. If a backyard is small, a 33-ft. half-wave dipole for, say, 20 meters could present problems. Since the sky's the only limit, why not go straight up with a vertical?

As skyhooks go, the vertical is an excellent general-purpose antenna. It doesn't take up much space, it has an omnidirectional radiation pattern and the bulk of the energy radiated goes out at a low radiation angle. This makes it ideal for long-distance communications on the 10-, 15- and 20-meter bands. It also performs well on the Citizens Band. The cost is low and it couldn't be easier to erect.

The Design

The length of our vertical antenna is a quarter wavelength. It is fed at the base—a maximum-current, low-impedance point. To obtain a low vertical radiation angle it is necessary to have a good ground system, such as a radial-wire system.

For four-band operation you might think it necessary to use four separate antennas of different lengths. This isn't necessary with our design because a suitable matching system is used at the base to permit four-band operation even though the antenna's physical length corresponds to an electrical quarter wavelength on 15 meters.

A stub matching system is employed for operation on 10 and 20 meters and the Citizens Band. On 15 meters a stub is not required.

The antenna, with the beneath-ground radials, operates equally well on the Citizens Band, too. If the length of the vertical is reduced to 9 ft. it can be fed directly with 50-ohm coax. However, if the antenna is to be used for CB and ham operation (with a length of 10 ft. 11 in.), the shorting stub for CB operation should be 2 ft. long as shown in Fig. 3(B).

The Stub That Matches

When a quarter-wave shorted section of transmission line is attached to antenna terminals (Fig. 2), the impedance of the stub will vary from a maximum at the point of connection at the antenna to zero at the short. By

for CB + 10 + 15 + 20

By EDWARD M. NOLL, W3FQJ

connecting a transmission line at an appropriate point along the stub, a suitable match can be obtained. Furthermore, by varying the length of the stub so that it is more or less than a quarter wavelength, the stub can compensate for the antenna being longer or shorter than a quarter wavelength at a given frequency.

Construction

The practical antenna shown in the diagram in Fig. 1 takes advantage of these factors. It is a quarter wavelength long on 15-meters (about 11 ft.). Four 20-ft. radials provide the ground system to insure good low-angle radiation. Guy wires are not necessary. The vertical is supported by an 8-ft. 2 x 3, set 2 ft. in the ground. U-bolts hold the vertical firmly to the 2 x 3.

A 4-ft. metal fence post should be driven into the ground right beside it

VERTICAL

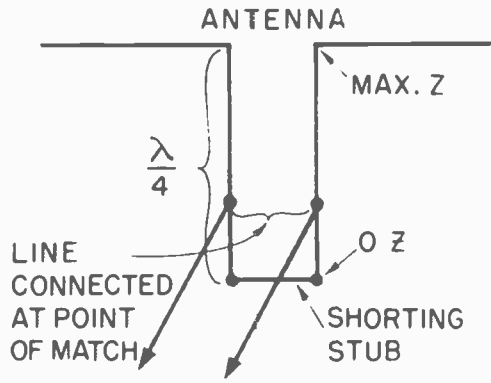
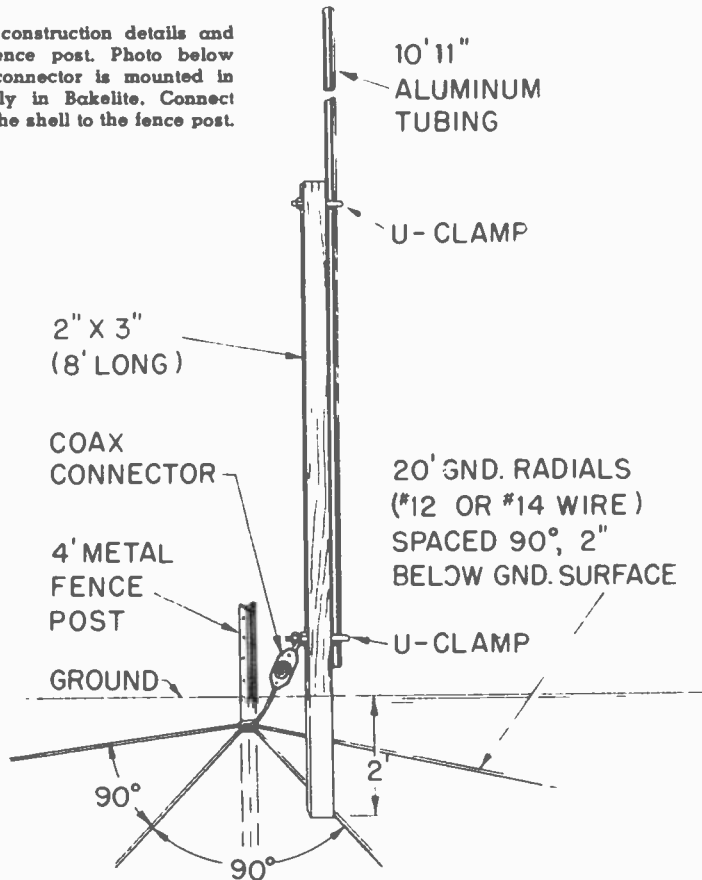


Fig. 2—Impedance of matching stub is maximum at antenna and zero at shorted end. At one point on stub, impedance matches that of the feed line.

for CB + 10 + 15 + 20

Fig. 1—Diagram at right shows construction details and dimensions. Solder radials to fence post. Photo below is of base of antenna. SO-239 connector is mounted in special holder. Mount it similarly in Bakelite. Connect inner lug to antenna and connect the shell to the fence post.



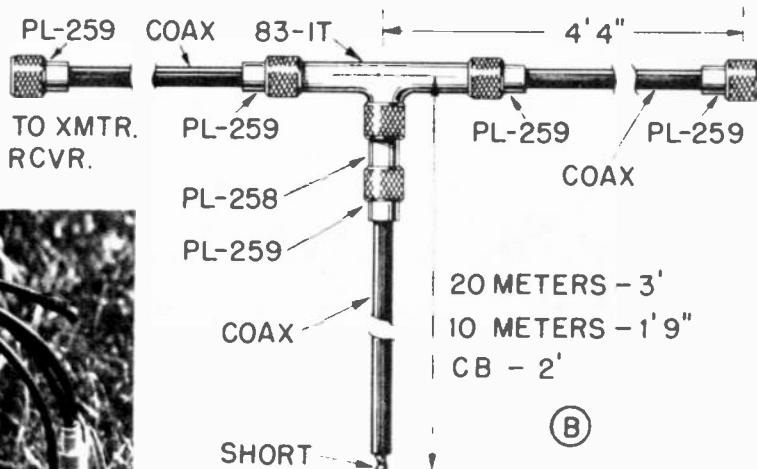
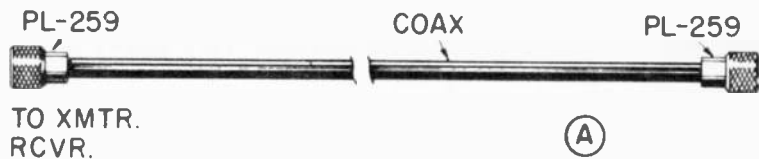


Fig. 3—When operating on 15 meters, connect transmission line (A) from transmitter/receiver directly to antenna. For operation on 10 and 20 meters and Citizens Band, use a 4-ft. 4-in. length of coax and three matching stubs, as in B. 83-1T tee connector is not drawn to scale.

as shown in Fig. 1. The post acts as a ground for the antenna system. The four 20-ft. radials should be soldered to the post (for a good electrical connection) and buried in the ground about 2-in. beneath the surface. They should radiate horizontally and be separated from each other by 90°.

For operation on 15 meters connect the transmission line from your transmitter (or receiver) to the connector at the base.

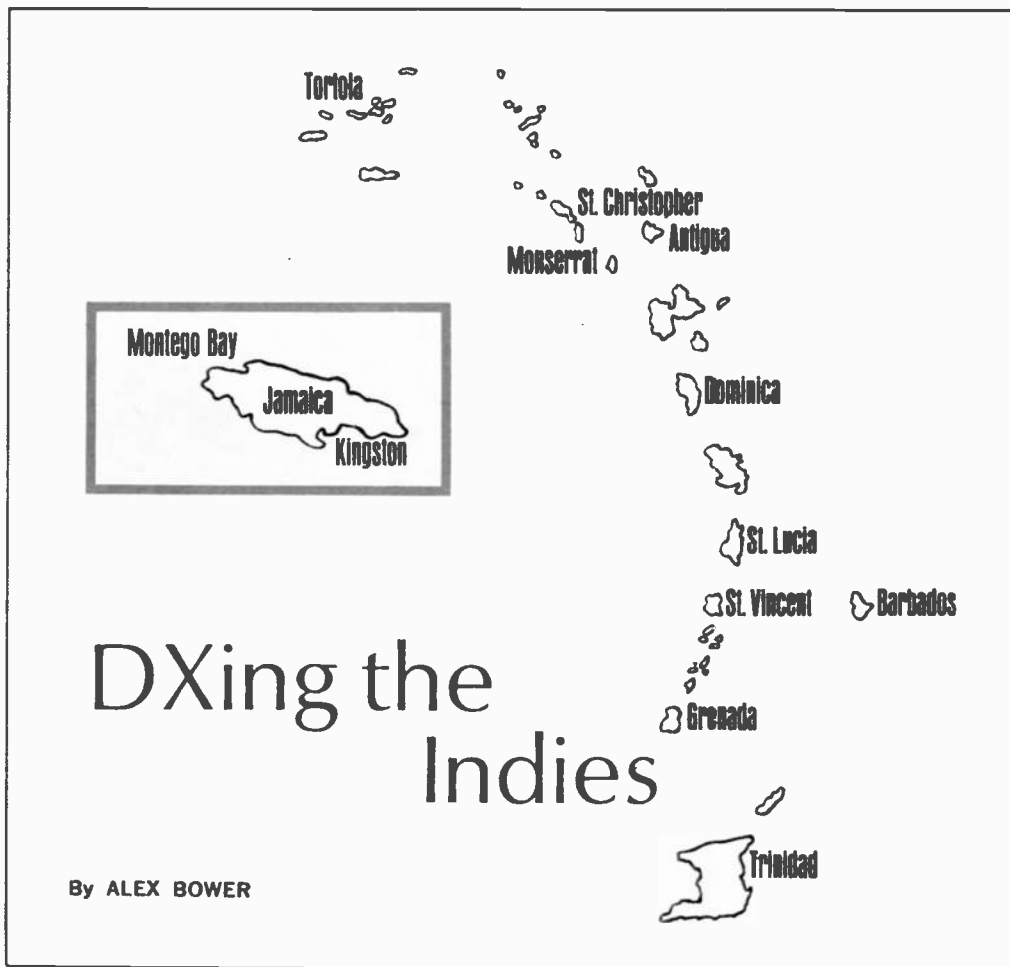
For operation on 10 and 20 meters, connect a 4-ft. 4-in. length of RG58/U coax between the base of the vertical and an 83-1T coax tee-adaptor as shown in Fig. 4(B). Connect the line from the transmitter to the opposite side of the tee adaptor. Connect the stub (a shorted length of coax) for 10- and 20-meter operation to the third terminal of the tee adaptor.

For operation on 10 meters, the stub must be 1 ft. 9 in. long. For operation on 20 meters, the stub must be 3 ft. long. For operation on the Citizens Band, the stub must be 2 ft. long. The short at the end of each stub is made by soldering the braid and inner con-

ductor together. Tape the connection.

If the antenna is constructed as shown, the stub lengths result in low standing-wave ratios on all bands. If you desire to try other combinations of antenna and stub lengths, it will be necessary to use an SWR meter and to experiment with other stub lengths and tap-on points. Connect the SWR meter between the tee adaptor and the transmission line. You'll then be able to observe the influence of stub adjustments as you attempt to obtain the lowest SWR. The length of the stub is from the base of the vertical to the short. ☐

MATERIALS			
Quan.	Description	Mfg. No.	Lafayette No.
1	PL-258 adaptor	83-1J	32 E 20027
5	PL-259 plug	83-1SP	32 E 20043
1	M-358 tee adaptor	83-1T	32 E 20068
1	SO-239 receptacle	83-1R	32 E 20035
1	8-ft. length 2 x 3		
1	11-ft. length 1½-in. o.d. aluminum tubing		
1	4-ft. metal fence post		
2	U clamps		
80 ft.	No. 12 or No. 14 wire		
—	RG58/U coaxial cable		



DXing the Indies

By ALEX BOWER

THE islands of the Caribbean are renowned as a cozy spot to spend a winter vacation. There is additional fun in the 13 countries that formerly comprised the British West Indies for they can prove to be a bonanza for medium-wave fans looking to improve their country scorecard.

All of the stations on these islands broadcast in English on MW with only one, Grenada, having a SWBC outlet. Because of the tropical location of the islands, all of these stations can be DXed in winter and summer but some of the locations are not the easiest to log, no matter what the time of year.

Grenada is the central broadcasting location for the Windward Islands Broadcasting Service, which continues to operate despite the fact that the Windwards no longer exist as a political entity and are now British protectorates.

W.I.B.S. operates low-power BCB relays in the mini-states of Dominica on 695 kc, St. Vincent on 705 kc and St. Lucia on 1575 kc. The main station for W.I.B.S. is widely heard at 3285 and 11970 kc on short wave and also has a 5-kw rig broadcasting at 535 kc, the acknowledged bottom edge of the BCB. During the winter months, W.I.B.S. transmits on 2420 kc as well.

W.I.B.S. issues a QSL card at their Grenada headquarters on St. George's; however, they are slow in responding to SW reports and even more erratic when it comes to verifying reports of BCB reception.

St. Lucia is an exception when it comes to reporting, as it has its own 10-kw station, R. Caribbean, in addition to the W.I.B.S. relay. This is a commercial operation and occasionally makes it into the U.S. when QRM from stations in Colombia and Kentucky is

at a reasonably low level.

Leeward Islands. Antigua's image as a quiet site for international relays was shattered recently by violent labor unrest. This country's station is still on the air, but remains one of the more difficult West Indies stations to log. The Antigua Broadcasting Service was last reported to be transmitting on 644 kc. The station is a slow verifier and to make it tougher it has a very early sign-off at 2000 hours EST.

Antigua's neighbor to the southwest, Monserrat, will make an easier target. R. Monserrat has only 250 watts but this is improved by broadcasting on the split frequency of 885 kc. The best time to receive this signal is around sunset, before interference from a more powerful station called R. Libertad (no relation to the clandestine outlet of the same name) gets on the air. Another station that operates from Monserrat is R. Antilles, a commercial operation on 930 kc.

The station on St. Christopher, sometimes known as St. Kitts, is the toughest of all the West Indies stations to log. The outlet ZIZ, operates with low power on the crowded FCC designated channel of 570 kc.

The island of Anguilla was administered by St. Kitts until 1968, at which time a declaration of independence was pronounced by the tiny island. The uprising was quashed by an invasion of the British Army but one of the byproducts of the revolt was R. Anguilla which has been reported by members of the National Radio Club on 1505 kc.

ZBVI at Roadtown on the British Virgin Island, Tortola, has a 10-kw transmitter on 780 kc. Unfortunately, R. Barbados at Blackrock near Bridgetown, the capital of Barbados, also broadcasts on 780 kc. When the interference from the United States is conquered, R. Barbados usually comes into your receiver on top. The best time to try for ZBVI is at their sign-on around 0500 EST. U.S. stations are usually silent Monday mornings at that hour.

Barbados differs from the island states of Leeward and Windward in that she is a completely independent nation, as are Jamaica and Trinidad

In these other sovereignties in the Caribbean, R. Jamaica and R. Trinidad once operated on SW but switched to all MW broadcasting for greater coverage

R. Trinidad is easiest to get on 730 kc at 0430 EST when the station signs on. They are quick in responding to reception reports.

Jamaica is the largest of the British West Indies islands and consequently has the largest number of BCB transmitters. The R. Jamaica outlets most often logged are on 720 kc which is located at Kingston and 770 kc at Mandeville. The Jamaican stations are good verifiers, except when they experience transmitter difficulties and are reluctant to verify reports of broadcasts at other than assigned frequencies

At the present time there are only two broadcast stations operating from the Bahamas, both located at its capital, Nassau. ZNZ is on the air 24 hours a day on 1540 kc and is often logged in the U.S. and Canada. ZNZ2, on 1240, is generally considered a graveyard channel and is seldom heard at a distance

If you can't afford to drop down and play in the sun, at least you can have the satisfaction of knowing that you have picked up one of the rare treats left for the DXpeditioner

WEST INDIES MEDIUM-WAVE BROADCASTS*			
Freq. (kc)	Station	Location	Notes
535	Windward Islands Broadcasting Service (W.I.B.S.)	St. George's, Grenada	
570	ZIZ	Basseterre, St. Christopher	
644	Antigua Broadcasting Service	St. John's, Antigua	
695	W.I.B.S.	Roseau, Dominica	Reports to St. George's, Grenada.
700	Jamaica Broadcasting Corp. (J.B.C.)	Montego Bay, Jamaica	Reports to Kingston.
705	W.I.B.S.	Kingstown, St. Vincent	Reports to St. George's.
720	R. Jamaica	Kingston, Jamaica	
730	R. Trinidad	Port of Spain, Trinidad	0430 (EST) sign-on
750	J.B.C.	Point Galina, Jamaica	Reports to Kingston.
770	R. Jamaica	Mandeville, Jamaica	Reports to Kingston.
780	R. Barbados	Black Rock, Barbados	
780	ZBVI	Roadtown, Tortola	0500 (EST) sign-on
840	R. Caribbean	Castries, St. Lucia	
885	R. Monserrat	Plymouth, Monserrat	
930	R. Antilles	Plymouth, Monserrat	
1540	ZNZ	Nassau, Bahamas	
1575	W.I.B.S.	Castries, St. Lucia	Reports to St. George's.
2420	W.I.B.S.	St. George's Grenada	

*Except where indicated otherwise, the best reception is in the early evening hours.

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An FCC License is a legal requirement if you want to become a Broadcast Engineer, or get into servicing any other kind of transmitting equipment—two-way mobile radios, microwave relay links, radar, etc. And even when it's not legally required, a license proves to the world that you understand the principles involved in *any* electronic device. Thus, an FCC "ticket" can open the doors to thousands of exciting, high-paying jobs in communications, radio and broadcasting, the aerospace program, industrial automation, and many other areas.

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Daniel J. Smithwick started his CIE training while in the service, and passed his 2nd Class exam soon after his discharge. Four months later, he reports, "I was promoted to manager of Bell Telephone at La Moure, N.D. This was a very fast promotion and a great deal of the credit goes to CIE."

Eugene Frost, Columbus, Ohio, was stuck in low-paying TV repair work before enrolling with CIE and earning his FCC License. Today, he's an inspector of major electronics systems for North American Aviation. "I'm working 8 hours a week less," says Mr. Frost, "and earning \$228 a month more."

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EI-92

Paint-Can Dummy Load for Hams

By R. GALGANO

AMONG the many accessories found around the ham shack, the dummy load is the one most often taken for granted. It's not unusual for amateurs to spend a great deal of money for a transmitter and then hang a light-bulb or a wirewound-resistor dummy load on the end of it.

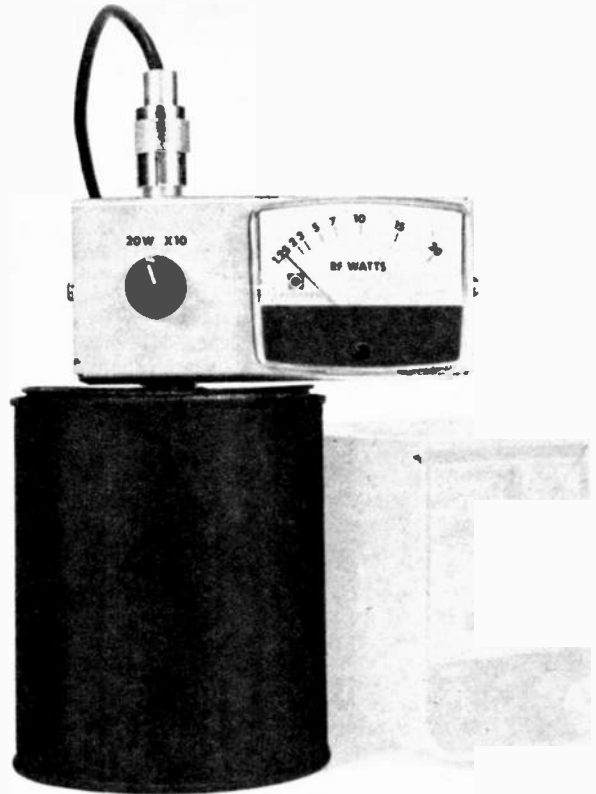
An inadequate dummy load can lead to serious mistuning of the transmitter which means only a fraction of the power will reach the antenna. And loss of output power is only an inconvenience compared to what may be happening to the transmitter.

If only a small part of the final's power is actually getting out, what happens to the power that isn't? It stays in the final where it is dissipated as heat that can cause serious damage or completely destroy the stage. Expensive RF power transistors in solid-state transmitters won't take this punishment very long. In addition to causing excessive power dissipation, an improper load may make the transmitter final unstable.

We have seen cases where a solid-state transmitter has become unstable and gone into oscillation. In a fraction of a second the predriver, driver and final transistors became inert chunks of silicon and the power supply was demolished.

To adjust the coupling system or check the power and efficiency of a transmitter correctly, a properly-designed dummy load must be used. The load must be a pure resistance and must match the output impedance of the transmitter. It should have absolutely no reactive component. Wirewound resistors are out because they are highly reactive at RF frequencies. Non-inductive power resistors are made but they're costly.

The old standby, a light bulb, is also out for VHF use. Poor enough at any frequency, the lamp load is hopeless at VHF frequencies.



Its impedance changes with temperature at any frequency, and at VHF frequencies the filament is likely to have resonances that make its brilliance unreliable as an indicator of output power. Particularly in the low-power range, lamps are extremely poor loads for VHF transmitter testing; and this includes the Citizens Band.

Our dummy load consists of a 50-ohm resistive load mounted in a quart paint can filled with oil. In addition it includes a wattmeter to tell you your transmitter's output power. The load is made up of ten 510-ohm 2-watt carbon resistors connected in parallel to provide a 51-ohm load. In free air, ten 2-watt resistors in parallel can safely dissipate 20 watts. Immersing the resistors in oil increases their dissipation to 200 watts.

The dimensions of the inner and outer tube that connect the load to connector SO2 are such that a 50-ohm impedance is maintained.

Construction

The resistors are mounted between two 2-in.-dia. copper discs spaced 13/16-in.

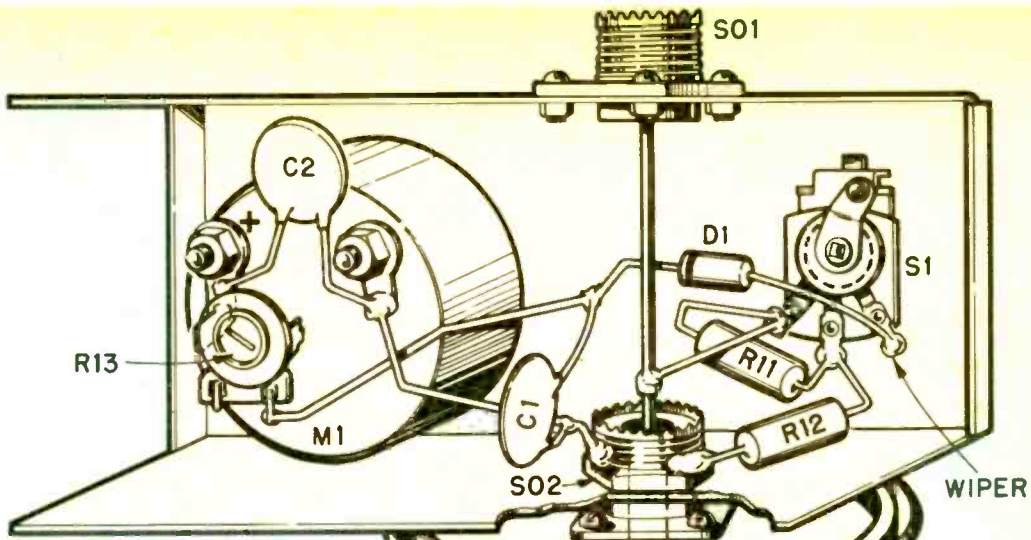
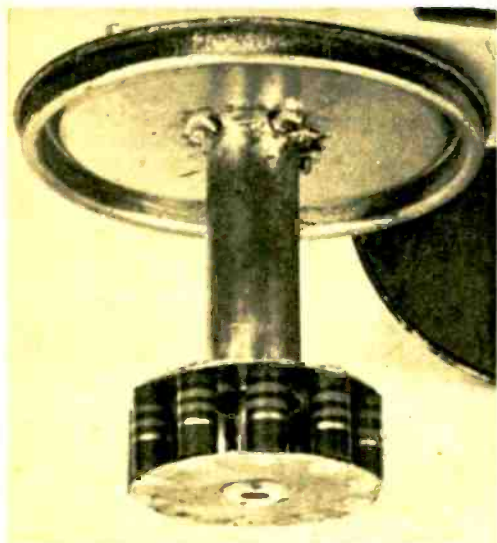


Fig. 1—Note in pictorial that SO2 is attached to top of paint can with machine screws. Fasten it to cabinet with two $\frac{3}{8}$ -24 hex nuts.



TOP OF
PAINT CAN

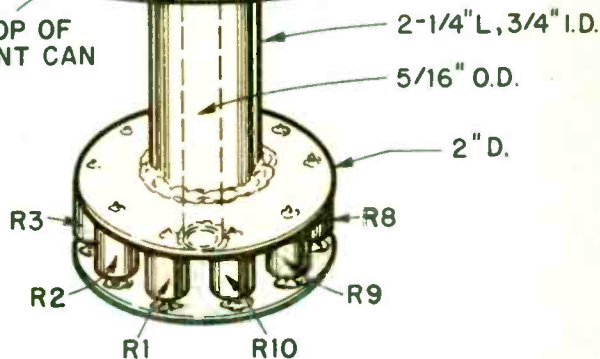
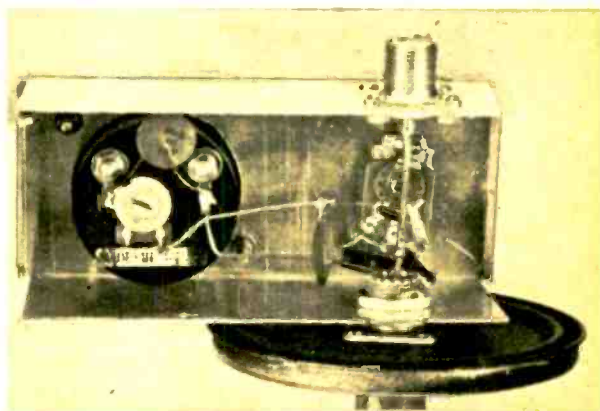


Fig. 2—Photo above shows construction of resistor load assembly. Note how outer copper tube is soldered to top of paint can. Small hole in top of tube allows oil to circulate. Photo at the right shows inside of the wattmeter.



apart as shown in Fig. 1. The leads of the resistors are soldered in 10 holes in each disc. The holes are spaced 36° and are drilled around the discs in a $1\frac{7}{8}$ -in.-dia. circle. These dimensions provide spacing to allow the cooling oil to circulate between the resistors. The paint can not only provides a

container for the oil, but is also an RF shield for the load.

The wattmeter is built in a $5 \times 2\frac{1}{4} \times 2\frac{1}{4}$ -in. aluminum chassis box that is mounted on the paint can's lid with connector SO2. The wattmeter is a two-range (20 and 200 watts) diode RF voltmeter whose scale is calibrated

in watts. (Paste the scale in Fig. 3 over the specified meter's scale.) The impedance of the wattmeter is high enough so that it doesn't affect the impedance of the load.

First thing to do is cut two 2-in. dia. discs out of 1/32-in. thick copper. In one disc (upper) drill a hole in the center large enough for a piece of 3/4-in. i.d. tubing (2 1/4-in. long) to fit in it snugly. In the other disc (lower) drill a 5/16-in. dia. hole in the center. Drill holes in the discs for the resistors' leads.

Solder the 5/16-in. o.d. inner tube to the center terminal of the connector (SO2) mounted on the can's lid. Solder the 3/4-in. i.d. outer tube to the lid making sure it is centered about the inner tube as shown in

Fig. 2. Drill a small hole in the large tube near the top to keep the oil from being forced out through connector SO2.

Paint-Can Dummy Load for Hams

Solder the 2-in. upper disc (with the large hole) to the bottom end of the 3/4-in. i.d. tube. Solder the resistors to the upper disc. Finally, slip the lower disc on the inner tube and insert the resistors' leads through the holes in the disc and solder them. Solder the inner tube to the lower disc and cut the tube flush with the disc.

Maintain 1/16-in. clearance between the resistors' bodies and the discs. This will minimize the mechanical strain on the resistors caused by heating and cooling. After completing the load, drill a small hole in the lid to provide venting.

Build the wattmeter in the main section of the chassis box as shown in Fig. 2. Be sure that C1, R12 and the lead from the negative side of M1 are soldered to ground at SO2.

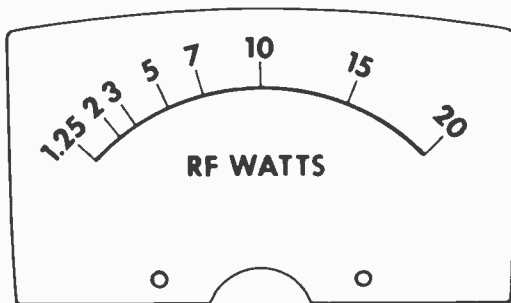


Fig. 3—Custom face for wattmeter. Cut this out and paste it over face of specified milliammeter.

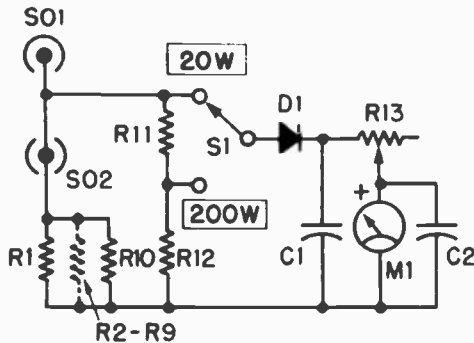


Fig. 4—Schematic. Resistors R1-R10 are load. R11 and R12 attenuate signal for 200-watt range. D1 is detector, C1, C2 bypass RF to ground.

Mount the wattmeter on the lid of the paint can with SO2 using two 5/8-24 hex nuts as shown in the pictorial in Fig. 1. Paint the can flat black and fill it to within 1 in. of the top with transformer oil. If you can't get transformer oil, mineral oil is almost as good. Do not use motor oil.

The VSWR of the load checked out as follows: 5 mc: 1.04:1; 30 mc: 1:05:1; 50 mc: 1.05:1. The load was tested with 50 watts of RF for 30 minutes. At the end of this time the can was not too warm to hold and the resistance of the load increased only 0.5 ohm. The power was then raised to 200 watts for five minutes. The can was still cool enough to hold and the load resistance increased only 1 ohm.


Operation

Adjust trimmer potentiometer R13 so the resistance between the wiper (which connects to the + side of M1) and the lug to which C1 and D1 connect is 7,500 ohms.

PARTS LIST

- C1, C2—.01 μ f, 500 V disc capacitor
- D1—1N34A diode or equiv.
- M1—0.1 ma DC milliammeter (Calectro D1-912)
- Resistors:
 - R1 through R10—510 ohms, 2 watts, 5%
 - R11—2,000 ohms, 2 watts, 5%
 - R12—1,000 ohms, 2 watts, 5%
 - R13—10,000-ohm, linear-taper trimmer potentiometer (IRC Type R103B)
- S1—1-pole, 2-position rotary switch (Calectro E2-159 or equiv.)
- SO1, SO2—SO-239 coax connector
- Misc.—5 x 2 1/4 x 2 1/4-in. chassis box (Calectro J4-740 or equiv.), 5/8-24 hex nuts (2 reqd.), one-quart paint can, 1/4-in. and 3/4-in. copper tubing

The Long Nights of Uncle Tom



TOM KNEITEL, or Uncle Tom as he is known to readers of his column in EI and the audience of S9, the CB magazine he edits, has this thing about investigating. He wants to know what and why and how. One of his interests is in communications, of course. Trouble was, he said, he'd already run through telegraphy, telephony, radio light waves and smoke signals. What could be next? The current mass interest in the occult gave him a fast answer: a Ouija board. Tom scoffed a bit at the idea, being a Doubting Tom if ever

The Long Nights of Uncle Tom

there was one, but he bought a board, anyway. A Ouija (weegee) board is a device produced by Parker Bros., the games people, and it is supposed to put you in touch with the world beyond . . . with spirits. The board is printed with the alphabet, numbers, yes, no and good bye. A little table about as big as your palm stands on three legs and has a lens in its top. Two people sit facing each other from either end of the board, their fingers resting lightly on the table. They ask questions. The table moves and the letters that show through the lens spell out messages. Spirits are supposed to be moving the table. Scoffers like Uncle Tom would say the people were pushing the table around. And they'd laugh. Except Uncle Tom does not laugh quite so readily any more. His Ouija board started making a bit too much sense, at least at times. Ouija sessions ran far into the night. Uncle Tom took on a tired, gaunt look. He appeared worried. Talking to spirits, if that's what it was, turned out to be anything but fun and satisfying.

Talking boards were quite a rage in the 1920s but had been around a long time even then. The French Army won the Crimean War, it was said, by taking advice from the long-dead Napoleon via skyphone (Uncle Tom's name for it). In libraries you can find the books of Patience Worth, whose writings supposedly appeared via Ouija to Mrs. Pearl Curran back in the 'Teens. Patience Worth, it seems, lived in Massachusetts in the 1600s and was killed by Indians.

Uncle Tom's wizardry on the skyphone started inauspiciously enough.

"I didn't know what to expect," he says. "A message from Judge Crater? Could I find out where Greta Garbo was or whether I'd get back the \$10 I lent my roommate in college?"

A few days later he wasn't poking so much fun. "It was like ham radio without a license . . . or a radio," he was saying. "I can't explain it."

What follows are excerpts from transcripts of sessions lasting several hours over two days. Those present included Uncle Tom, his wife Judy and a friend, Loretta. Ouija boards have no punctuation so we've left the messages as reported in the transcript. One pseudonym (Helen) is used to denote a real person who was critically ill at the time. As

a rule, Tom asked questions and Judy and Loretta worked the board.

Tuesday, first session.

Who are you?

BETH

Do you have a message for Loretta?

PIEWD

Do you have a message?

**PEM A HOME TO LEWEH AT C I AM MAT
MOVE TO HARD**

Is it hard to move the words?

HARD TO GET ASCROS

Did you give us an answer?

**HIM HERD ME ONCE BEFORE LAMP IS ON
GET A RCJARP ON GO GET BILL AS P FIND
HART**

Will you get Bill?

HIM CAN GET ACROSS YOU WANT

Uncle Tom and his cohorts are now in contact with Bill Wheton who is mentioned in Beth's last remarks. Bill is destined to become a major participant in these proceedings.

Is there reincarnation?

BELIEVE IF YOU NEED TO

Was Loretta reincarnated?

AGAIN AND AGAIN

Who was Loretta before?

BETTY REMASOT

Where did I live?

EURIP

When did I die?

16692

How?

**CHILD HURT I GET YOU ARE WORRIED
ABOUT DEATH**

Is there anything to fear?

**SOME FIND IT HARD OTHERS FIND IT
BEAUTIFUL TO BE FREE AT LAST**

Will Helen find freedom?

**IF COMING IS NOT TO HARD SHE IS
NEEDED VERY MUCH**

Who needs her?

FATHER

Why does he need her?

**ALOWN TO LONG MOTHER GOWN HACK
Did she come here?**

SEE SHE BELONGS AGNF

Did people ever come here to earth from elsewhere?

ALL ARE FROM GOD

We meant another planet.

NEVER

Is there life on other planets?

**FIND OUT SOON AS WE SEND A FLIER
THERE**

Where?

SOME ON MARS MORE ON VENUS

Where else?

TO COLD

Do the inhabitants look like us?

NO PEOPLE YOU SAID LIFE

Will man land on Mars?

YES NOT TO FAR IN FUTURE

Will we find life similar to earth?

ALL LIFE SAME

Will there be species like on earth?

NOT LARGE

Are these found on Mars?

VERY SMALL

What would these forms be known as on earth?

WHAT YOU WOULD CALL BUGS

What about God?

HE IS WHAT MAKES ALL A SPARK

Is God unhappy with us?

WE ARE ALL GOD IN THE END

Are we part of God?

Uncle Tom and his wife rest fingers on table of Ouija board. When contact is made with someone, the table will begin to move and letters will appear in lens of table. Besides the alphabet and numbers from one to zero, it says yes and no and signs off with a good bye.



WITHOUT THE ANIMAL WE CANNOT GO ON

What can't we do without the animal?
LIVE

Are we then spirits?

YES WE LIVE AS LONG AS MAN LIVES

Bill delves into politics.

Will Ted Kennedy be President?

NEVER TO MUCH TROUBEL

Did he cause that girl's death?

DID NOT MEAN TO

Where was he taking her?

FIGHT WITH OTHERS AT PARTY SHE

WENT WITH HIM FOR RIDE TO COOL OFF

What was the fight about?

HE DID NOT WANT TO TALK BROTHER

A new theory on the Kennedy assassination.

Who killed Jack Kennedy?

MORE ENVOLMED OSWALD WAS ONHLY ONE CAUGHT

Names of others?

TWO ARE DEAD ONE IS STILL ALIVE HIS FRONT IS EFFONAW

What front?

HE KNEW HIS DAYS WERE OVER IN UNIONS HE WAS A RED EVERYONE KNEW WAS ABOUT TO CAUSE A LOT OF PAIN FIND FOR A BANK BE TO DID GET BURFIWNEAD NO PROOF

Who are the two dead people with him in the killing?

CARL HAVER ED BROCK GET WHAT THEY DESERVED

Who killed them?

ONE CAR OTHER HEART

What about Jack Ruby?

ONLY IN AS FAR AS SURFASE HE NEVER KNEW WHY SEOD

Why have there been so many lies and cover-ups?

NO PROFF IT WAS NEVER AS TOLD

Should I tell this to the FBI or CIA?

IT WOULD NOT HELP TO MANY CRAZE IDEARS ALREADY JHONSON WANTED TO BE TOP MAN STOPPED STORIES

What about CIA or FBI?

HOOVER FIGHTING HIS OWN NECK

Wouldn't Nixon care?

ALL OVER EVEN WIFE WANTS TO LET HIM REMAIN HERO TO COMUNTRY

Were foreign governments involved?

JUST UNIONS

Why?

MONEY GETING OUT OF COUNTRY

Do you mean that Kennedy was after unions sneaking money out of the country?

YES

The matter is closed now?

UNIONS HAVE GOOD THING DONT ROCK BOAT

Was I right about Radio Americas?

EVERY GETS MIXED UP ONE DOES NOT WHAT THE OTHER IS DOING

(Uncle Tom once visited Radio Americas on Swan Island and was convinced it was a CIA propaganda station.)

Is the CIA mixed up?

YES

Where was Radio Libertad?

BOAT

A clandestine radio station is rumored to be a-building on Little Corn Island.

Are there any broadcasters on the Corn Islands?

RADIO AND WEATHER WASTCH A

I mean actual broadcasts.

FROM TIME NOT STEADY

What was the name of the broadcaster?

HE BE MAYDAY

A Mayday message from Corn Island?

HIT

Someone was hit?

SENT MAYDAY

(The tale takes a new twist. Later Bill talks more about a "Mayday to the people.")

Who?

CIA TO PEOPLE

You don't make sense.

PEOPLE NEED HELP

Is there a story here?

HOUNDRUS IS GOOD STORY CUBA IS OLD

Some personal items about Bill.

Can I get to you another time?

MAYBE I LIKE RADIO

Were you a ham?

PLAYED AROUND WITH YEARS AGO

CODE IS EASIER THEN THIS

What was your last name?

9WAEHOM

Repeat.

WHEUNOM

What country?

HERE

What city?

FRISCO

When did you die?

WAR 2

Repeat: your last name. It didn't make sense.

WHETON OM YOU SHOULD UNDERSTAND

ME

Do you call me OM, like in ham-radio slang?

The Long Nights of Uncle Tom

YES
How old were you when you died?
35
Do you still have any family here?
NO
Will you talk to me again?
CALL ME ON 6 FUNNY
I guess that there is no TVI where you are.
I BET YOU ARE WRONG QRS 4
Can you QSL with me?
I WILL TRY TO GET THROUGH WITH
CODE

Do you enjoy talking to us?
I AM SURPRISED YOU CAN HEAR ME
Is this your first contact like this?
YES
Have you ever tried to contact anyone?
NO
Will you come back to earth in another body?
NOT IF I CAN HELP IT
How are things there?
WHAT DO YOU EXPECT THEM TO BE LIKE
YOU ARE BETTER THEN ARE
Explain.

YOU ARE FUNNY IT IS GOOD WHY DO
YOU THINK I DONT WANT TO TRY AGAIN
Is it good for every one there?
IF YOU TAKE IT SUCH
Tell my father we think of him.
10 4 WA

Do you mean Ten-Four, like in radio talk?
10 4 QUT
QUT? If that's radio talk I don't know it by heart.
MINE TRYING TO SHOW OFF
What outfit were you with in the war?
148 RAIN

Is that the Rainbow Division?
YES
Do you have advice or a message for Tommy?
HOW ABOUT PUTTING MY NAME ON
SOMETHING YOU WRITE

OK, do I have the spelling right?
WHATON WILLIAM
Do you have a callsign?
WOULD LIKE ONE
Do you prefer any one in particular?
TRY GETTING A NUMBER FOR HERE
(Apparently a joke—a ham call for the
world beyond.)

Will you know if I put your name on an article?
YES
Do you have a final message?
BONZI
Goodbye, I hope people will believe us
EVERYONE HERE WONT BELIEVE
Do you see us?
NO

Can you do anything that we can see to give us
a sign you are here?
I NEVER TRIED
Can you move this piece of paper?
I CANT SEE
You can't see the piece of paper?
YES
You can't see the piece of paper?
CAN YOU DO ANYTHING HERE
Are you a spirit?
I GUESS SO
Do you have a body?
I AM NOT THE WAY I WAS BEFORE

Bill seemingly always must finish one subject before switching to another, as in the following when he keeps talking about himself.

Tell us about the war in Vietnam.
I AM TALL DAR AND HANDSOE
Were you before?
ALWAYS
What about the war?
I HAD ENOUGH WITH MINE
Will it ever end?
SO WHAT IF IT DOES ANOTHER WILL
TAKE ITS PLACE
Goodbye
GERONIMO
Tuesday, second session.

Can we speak to Bill?
ME BILL
Does the boat named Daydream mean anything to you?
IT IS RAIDO

(Daydream is a boat that supplies Swan Island, where R. Americas was located.)

Can you tell us what it was or is?
PIGS BAYS
Have you knowledge of Corn Island?
NO WEAETHER WATCH ONLY SOME TIME
USED FOR GOVERNMENT
Any leads for a story on Corn Island?
LET ME TRY TO GET STORY NI ME ILAND
TROUBLE CASTRO WANTS CANAL

Bill recalls his past.
You said you were in the army. What rank?
NOMCOM
Where were you wounded?
FRANCE GOT HIT BY TRUCK
What date?

1943 VERY BAD NO PURPLE HEART
(The date seems strange. . .)
How were you there before the invasion in 1944?
WE WERE KICKED BY GERY
What was your specific outfit in the Rainbow
Division?

BROWN HEN
Was that airborne or infantry?
DOPLMAT
You were with the brass?
YED I DID DRIVE
What was your serial number?
NEVER FORGID DID LEARN IT
You don't know your serial number?
NO

If I get a story here there will be some money involved. You have a share. Do you have anything you would like me to do with your share?
TALL DARK AND HANDSOM IS WAITING
Tell me your favorite drink and I will have one in your honor.
BUT

But what?
I MIS BUT

Tuesday, third session. Tom and Loretta working the board.

Are you still with us?
BJMSKRMH
Bill, Loretta and I are talking to you.
YES MIMSMFMH
Who is this? Tell us your name.
[No reply.]
We want to speak to Bill Wheton of the Rainbow
Division.

[No reply.]
Is it possible for Tom to come here?
Z ME LIZ LK

Judy and Loretta take over the board.

Can you hear us?
I CAN TALK NOW
Why wouldn't you talk to Tommy?
NO ENANGY
Why didn't the energy get through?
TOM

[Continued on page 96]

CB Corner

By Len Buckwalter, KQA5012

15 Legal Watts

THE document is hidden behind the locked door of a safe in Laconia, N.H., not far from the shores of Lake Winnepesaukee. With this precious piece of paper, Browning Labs claims to have the highest transmitter power in the CB industry in its new single-sideband rig, the Model SSB-15. The surprise is that earlier sideband circuits boasted power ratings of 10 watts peak envelope power (PEP) as the legal FCC limit, but Browning is raising it to 15. The higher rating is derived from a special two-tone method for sizing up sideband signals. It has also elevated an eyebrow or two among the competition.

Challengers to Browning's formidable 15-watts are now warned. If anyone doubts the claim, the company will swing open the safe, withdraw that precious document and shove it under his nose. It's a letter from Washington, D.C. that's signed and sealed by an FCC chief engineer. By conforming to the two-tone test procedure, Browning received the official nod for, as the company says, "ultimate legal power."

There's another surprise on the new sideband rig—it has a VFO (variable frequency oscillator) to shift the transmitter frequency. VFO operation, of course, is forbidden in CB because transmitters must be tightly controlled by crystals. I challenged a Browning spokesman on the point and he flicked away the objection. It seems that the new SSB-15 is in fact controlled by crystals, but the VFO can shift each channel's frequency by plus or minus 700 cps. Since the frequency still remains within the lawful tolerance, the VFO is an acceptable trimmer.

Browning says the VFO is there for a good reason. In sideband, a shift of as little as 50 cps can cause the voice to sound like Donald Duck or worse. The VFO enables all units to zero onto the precise frequency, a process called netting, to avoid a lot of receiver re-tuning. As sideband stations create no carriers, several units can talk at once without the usual ear-splitting squeals.

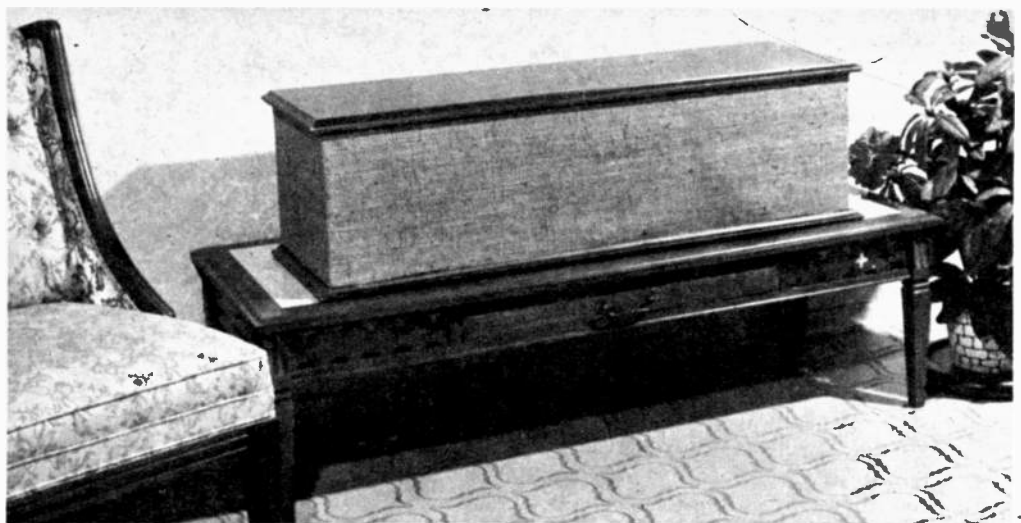
Blasting Burglars. "They steal anything that's not nailed down," complained one CB dealer about shoplifting in his store. Rigs are getting so small that heisting one gets easier all the time. So store managers resort to locked cabinets, wired alarms, mirrors and closed-circuit TV to foil the light-fingered. Maybe they're overlooking one of CB's hidden benefits: a set can sound its own alarm.

The idea was shown technically feasible several years ago at the United Nations in New York. Special receivers to interpret proceedings into four languages were handed to guests attending U.N. sessions. The trouble was that some receivers were mistakenly carried off the premises. So technicians devised an electronic reminder. They fitted each receiver with a low-power oscillator in the CB band and circled the exit door with a coil of wire. If the bearer of a hidden receiver walked through the door, the signal entered the coil and sounded the alarm.

The idea was a failure, but for diplomatic, not technical reasons. If this concept of crimestopping were applied to shoplifting, it would hardly demand any sort of protocol. During a CB theft, the oscillator of one channel could start emitting SOS—warning the manager to *Save Outgoing Set!*

Browning Labs' new SSB-15 SSB-CB transmitter with companion receiver. The SSB-15 boasts 15 watts of PEP power and a VFO that eliminates Donald Duck voices. Use of upper and lower sideband gives the transmitter 46-channel coverage.





Unitized Stereo Speaker System

By HARRY KOLBE **ALTHOUGH** stereo has been with us quite a while now, only a few single-cabinet stereo speaker systems have ever been marketed. And most of these systems failed to interest the audiophile and quickly disappeared from the scene. The one or two single-cabinet stereo speaker systems that have survived are very large—at least five or six ft. wide. Until now the consumer with limited space and/or a limited budget has been out of luck.

Small single-cabinet systems of the past have been unacceptable because the separation of the speakers has been relatively small. As a result, the auditory perspective of the reproduced sound is very narrow. Stereo separation is difficult to achieve because the distance of the listener from the speakers must be reduced to correspond to the short distance between the speakers. Such confined listening is not satisfactory. The object is to make a system with small physical separation between the speakers that will produce apparent sound sources with greater separation.

The Design

An early approach to a unitized stereo speaker system is shown in the top sketch in Fig. 1. The effective separation between the apparent sound sources of the speakers was inadequate.

Another approach was to mount the two speakers in the ends of the cabinet as shown in the middle sketch in Fig. 1. A consider-

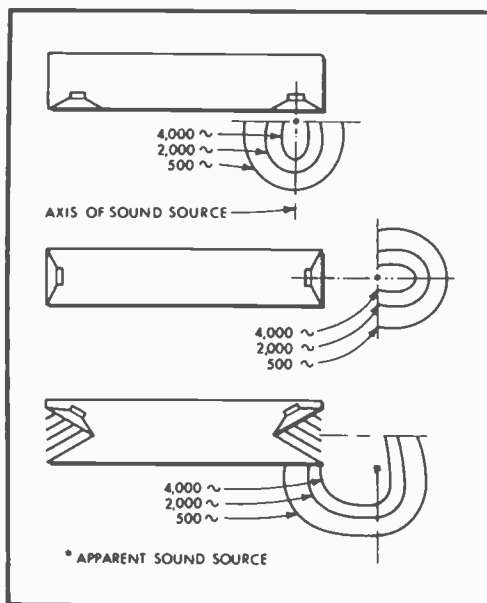


Fig. 1—Unitized speaker system at top is not satisfactory because the apparent sound sources are too close. In center, sound sources are spread out, but high-frequency response at front is poor. In our design at bottom, there's good spread and much less high-frequency attenuation.

able increase in the spread of the sound sources are projected to points beyond the speakers. The separation here is somewhat greater. Unfortunately, this approach has a serious drawback. The middle sketch shows that because of directional characteristics there will be considerable loss of high-frequency response and resultant frequency discrimination at the customary listening location in front of the system.

Thus, one system produced very limited stereo separation while the other produced good separation but at the expense of forward high-frequency response.

Our approach allows you to have your cake and eat it, too. The approach is shown in the bottom sketch in Fig. 1. This system is able to maintain as much spread as the apparent sound sources of the system shown directly above but restores the high-frequency response in the forward direction.

To accomplish this, we mounted the speakers at an angle and put an acoustic waveguide in front of each. The high-frequency sound which is emitted by the speakers is aimed in a forward direction by the waveguides. The results are excellent. Although the enclosure is only about 40-in. wide, the apparent separation is as good as two separate speaker systems five or more ft. apart.

The acoustic waveguides, which are very simple to make, are 1/16 in. thick aluminum vanes. The dimensions and spacing of the vanes shown in Figs. 5 and 6 are critical.

The enclosure is a tunneled-port bass-reflex design which has been carefully matched to the resonant frequency and compliance of Olson S-786 (\$13.98) speakers. The resultant bass and mid-range response is very respectable. The system works best mounted on a wall at ear level but will still give outstanding performance away from a wall.

Construction

The tunnel port is a 4 in. long piece of 3 $\frac{3}{8}$ -in. o.d. cardboard mailing tube mounted flush with the front of the enclosure. The aluminum vanes of the acoustic waveguide are held in place with silicone rubber adhesive and glue.

A 1 in. wide piece of weather stripping with adhesive backing should be cemented to the rear cleats to which the back panel is attached because the enclosure must be airtight—except for the port.

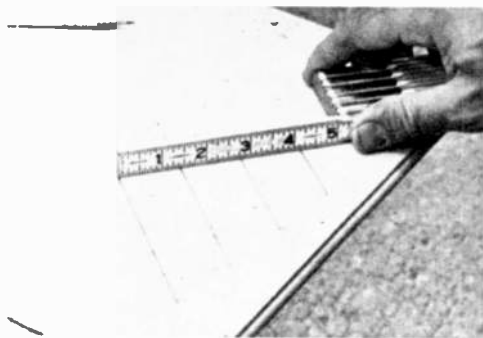


Fig. 2—Using the construction details in Figs. 5 and 6, locate accurately lines for vanes. The four vanes on each side must be spaced equally.



Fig. 3—View of partially assembled cabinet. Diameter of hole in speaker mounting board is 6 $\frac{1}{4}$ in. Attach panels with wood screws and white glue.

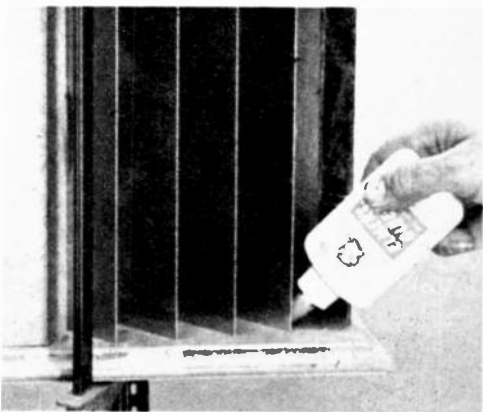


Fig. 4—Aluminum vanes are set in grooves cut in top and bottom. To be sure there are no rattles, secure with glue and silicone rubber adhesive.

Unitized Stereo Speaker System

The cabinet is made of $\frac{3}{4}$ in. thick plywood or particle board. If a router or shaper is available the top and bottom edges may be decoratively shaped, otherwise they may be left square. As an alternate you may wish to use decorative molding such as nose and cove. This will simplify construction and

it is an excellent way to conceal the raw edges of the plywood. If you prefer a square-edge appearance, simply put matching wood tape on the edges with contact cement.

After the sections are cut out, carefully locate and lay out the lines for the aluminum vanes, as well as the speaker boards. Best way to cut the grooves is with a router fitted with a $\frac{1}{16}$ -in. bit. Set it to project $\frac{1}{16}$

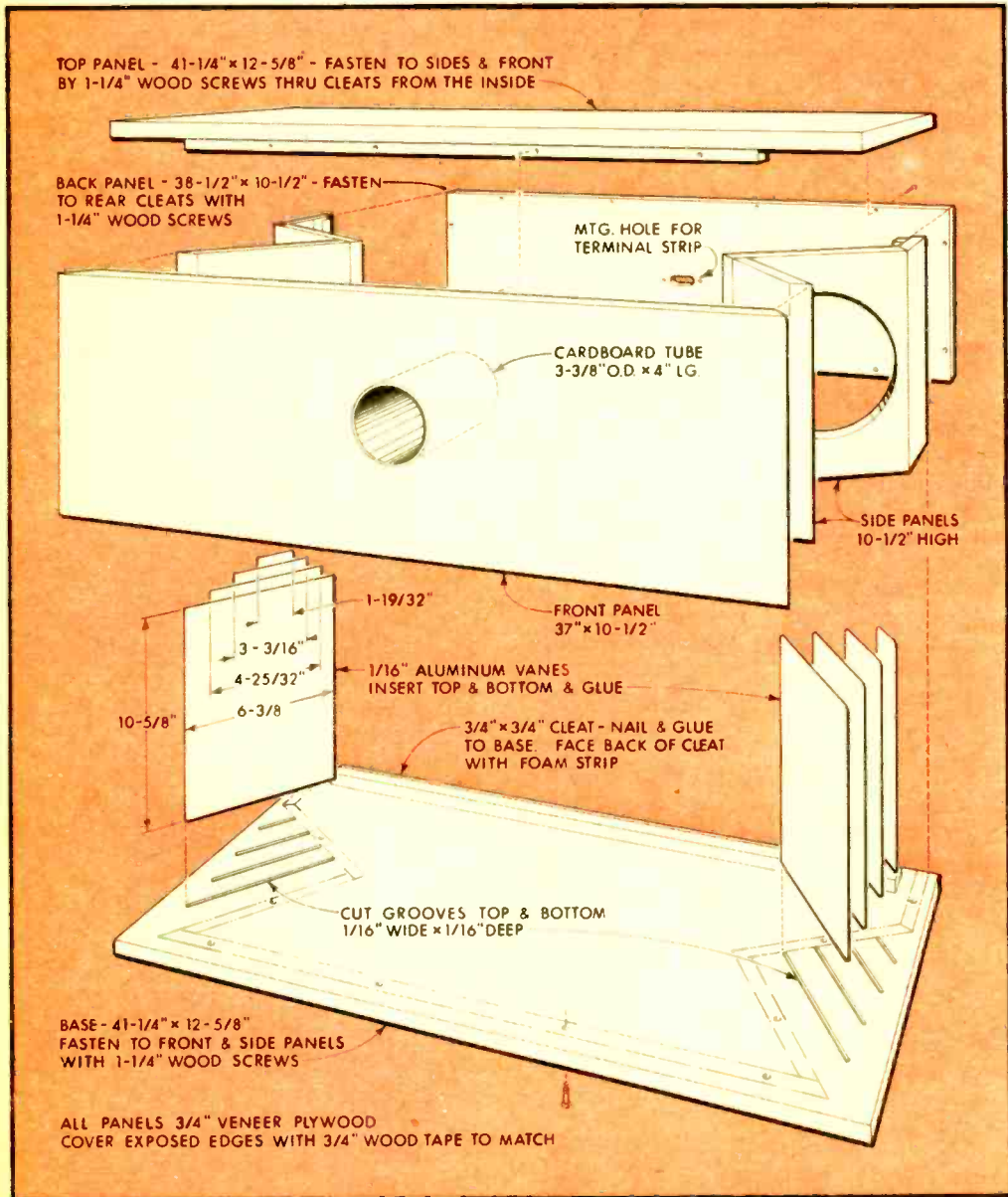


Fig. 5—Cleats are used on top panel so screws won't show in top. Cleats are not necessary on bottom panel (except at the back) because the screws through the bottom panel won't be visible.

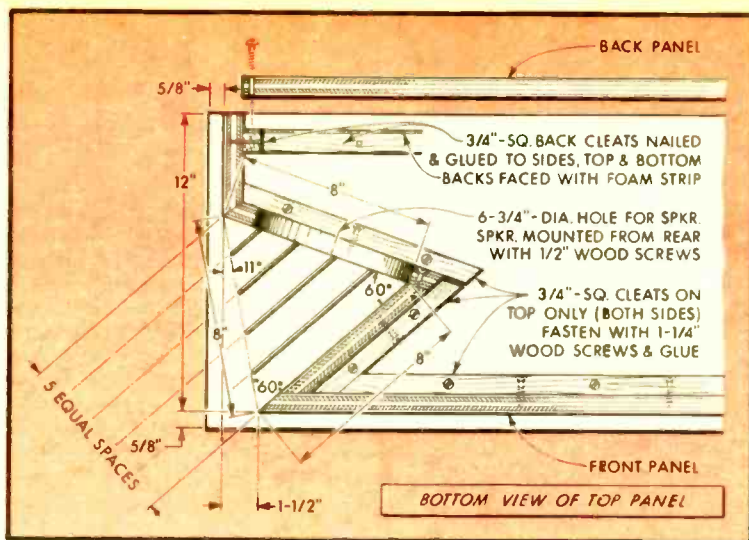


Fig. 6—Diagram of one corner shows construction details for positioning vanes and speaker mounting board. Spacing between vanes is about 1½ in. It may vary slightly, depending on construction, but should be same between vanes.

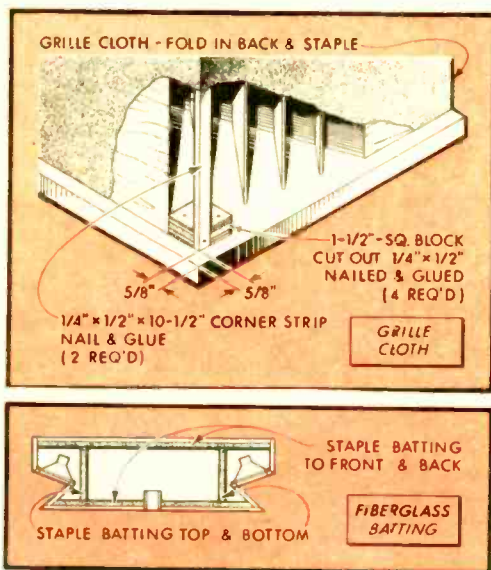


Fig. 7—Top sketch shows construction of corner supports around which grille cloth is wrapped. Sketch below shows location of fiberglass batting.

in. and proceed to cut free-hand or with the aid of a guide strip nailed on the work. Repeat this for each slot. If a router is not available, use a sharp knife cutting two parallel lines 1/16 in. apart then clean out the area between with a small chisel or a knife.

Fasten the cleats to the underside of the top panel then mount the front and diagonal speaker boards using white glue and screws. Cleats are *not* used on the bottom panel. Instead, you can use screws through the bottom because they won't show.

Install the cleats for the rear panel then mount the speakers. Staple fiberglass batting where indicated and apply the weather stripping to the face of the rear cleats. Install the rear panel with round-head screws.

The type of grille cloth you use is optional. However, we recommend an open-weave material, such as burlap, to prevent high-frequency attenuation. We used a piece of tan burlap. The price is reasonable and more important it is available in 54 in. widths and any length.

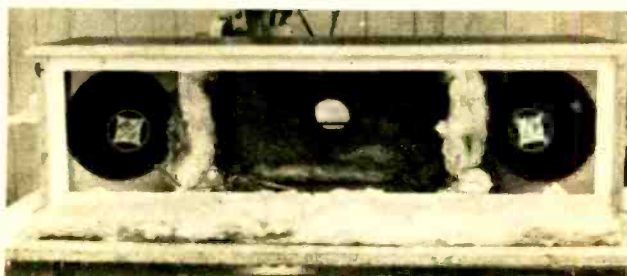
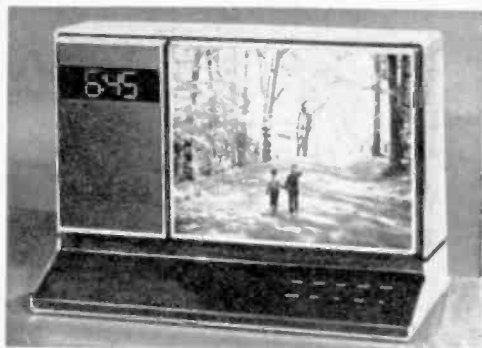


Fig. 8—Inside view from rear. Note fiberglass batting on front panel and installed vertically at side of each speaker. It is also on rear panel. Use staple gun to hold batting in place.

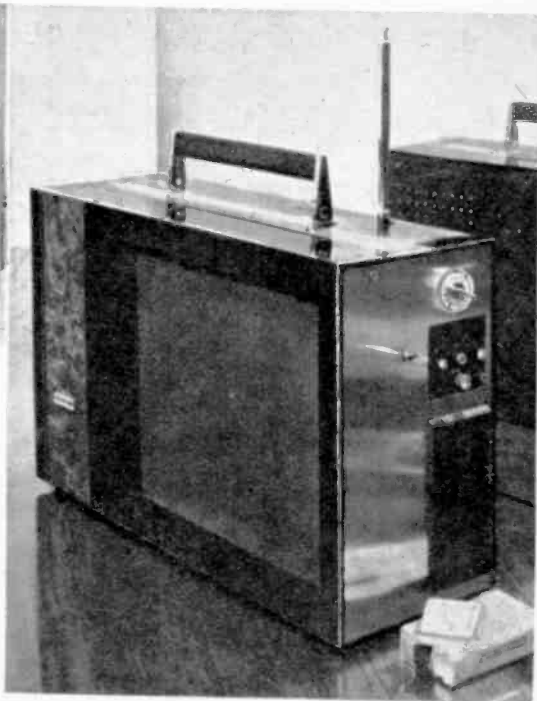


A WATCH WITHOUT HANDS The Hamilton Pulsar wristwatch computer offers accurate time with a digital face and push-button time keeping. The time keeper of the watch is a quartz crystal which vibrates at 32,768 cps. The vibrations are reduced to one pulse per second by a multi-stage IC binary counter. The watch is equipped with a demand button which conserves power. When the button is pushed, an array of dots displays the time in hours and minutes. If the button is continuously held down, the hours disappear and the seconds will begin to tick off. The matrix is located behind a TV-like filter screen. The complex device senses light conditions and varies the amount of light in the matrix with surrounding light conditions. The watch will sell for \$1,500.

Electronics in the News

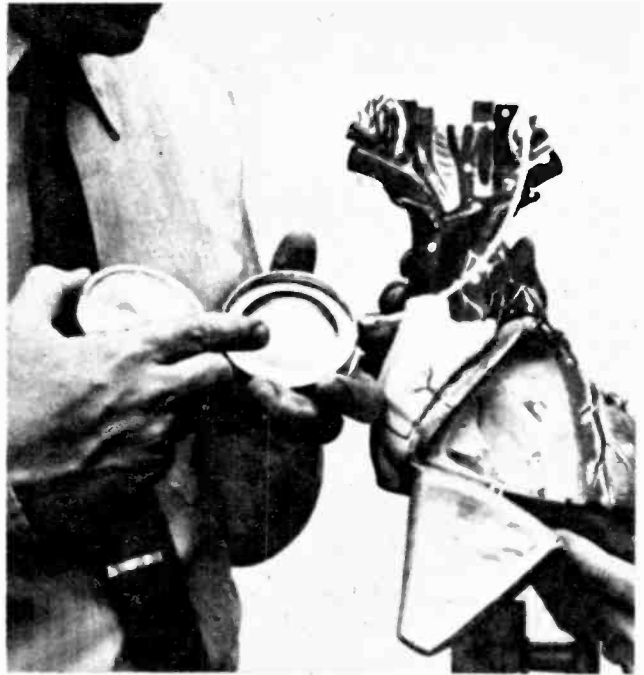


Pressed Duck . . . Television screens are getting larger as the depth of the set decreases. One reason why maybe the b&w Mallard line from Philco shown in the photo at right. The set uses a unique CRT that measures 5½ in. from front to rear. The CRT incorporates magnetic deflection so that the electron beam travels to the screen in an oblique pyramid rather than the symmetrical pyramid of standard tubes. This system of deflection allows the gun to be placed on the side of the screen, (rather than behind it) at a right angle. The photo above is of a prototype of Philco's color Mallard.



Keeping Pace With the Heart . . .

A pacemaker is a device similar to an electronic clock, producing 70 pulses of current a minute. The impulses stimulate a weak heart to beat. In conventional pacemakers batteries are employed to power the pacemaker and provide the power for the pulses. These batteries have to be replaced annually. Bell Labs has developed a pacemaker that employs piezoelectric discs to convert variations in blood pressure into electricity. The benefit is that once installed, the device will never have to be removed.



Under Cover Radio . . . The trend in crime prevention nowadays is toward better communication. Until a few years ago this meant sending out squads in radio cars. This was found to be cumbersome in addition to taking the neighborhood cop off his beat. Hallicrafters has developed a line of personal two-way FM communications equipment that is much smaller and more compact than personal radio equipment employed today. The concept is of a multi-component system that straps on the upper portion of a policeman's body like a shoulder holster or bandolier. The system consists of a transceiver, a battery compartment, combination speaker-microphone, flat press-to-talk switch and 3 to 4 in. antenna. Weight is less than 24 oz. ●

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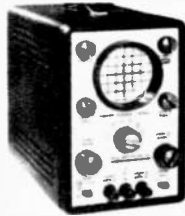
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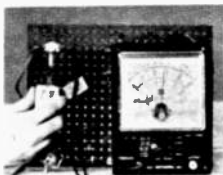
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Buyer's Guide to Cassette Accessories

By ROBERT ANGUS

"THE HUMAN MIND can conceive of nothing," Ben Franklin once wrote, "but that another mind can improve upon." The inventors of the cassette recorder can say amen to that, for their brainchild has spawned products that are designed to improve on the original.

The deluge of equipment can be divided into two practical groups. There are those accessories that add to the versatility of a machine and those that are helpful when it comes to keeping it in tip-top shape.

If you've got a portable cassette recorder and would like to have a portable radio in addition, there are plug-in tuners available that are built in the standard cassette package (see Fig. 1). You can buy just AM (about \$10), AM-FM (\$20) or wait until the AM/stereo-FM tuners are introduced. If you're an old salt, Panasonic now has a marine-band tuner for cassette recorders. A word of advice in this department—be sure to try the tuner in your recorder before purchase for some manufacturers design these devices for their own brands and all are not compatible with other makes.

There is a family of accessories available to convert your cassette portable into a dictating machine. Produced primarily by such recorder manufacturers as Norelco, Sony and Craig, the group includes stenographic headsets and a foot pedal to start and stop the machine while keeping your hands free for typing.

Battery power is not always the most convenient and there is a host of supplies to bridge the gap (Fig. 2). There are nickel-

cadmium powerpacks such as Craig's model 9205 (\$17) and Norelco's BP2204 (\$25). Both of these are designed for their own Carry-Corder models but can be used with some other makes of equipment. Panasonic manufactures an AC adaptor which can supply four different DC voltages. Again, before purchasing a power supply make sure it will operate with your particular recorder.

There are specialized recording devices like lapel microphones, parabolic reflectors, telephone pickup coils and microphones with a switch to turn the recorder on and off. These vary in price and quality, depending on the degree of fidelity you need and the quality of your recorder. Some telephone coils produce a hum which all but obliterates the conversation they're supposed to pick up. Among those which don't are Norelco's TP 86 for \$7.65 and Craig's Model 9501 for \$3.49. There are less-expensive models, too, but be on the lookout for junk.

As soon as you amass a library of any size you'll be needing a carrying case to help you tote your cassettes. There are a number of sizes, styles and types of construction. They range in price from \$2.98 to \$20 or more and to the untutored eye all look much alike (except for capacity, which tends to increase with the price).

Wood is more durable than cardboard or plastic alone and makes for solid construction. By the same token, heat-sealed plastic bonds better than mere glueing. The combination of heat sealing and stitching makes not only for durability but for good looks as well. There are also alligator leatherette



Fig. 1—AM plug-in tuner. Putting recorder in play mode moves head into tuner and turns on power. Output is coupled inductively to head.

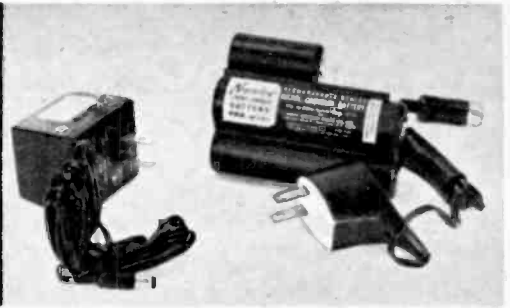


Fig. 2—Alternate ways of powering a recorder. Panasonic converter (left) supplies four DC voltages. Norelco Battery Pak is rechargeable.

attache cases of cardboard or wood holding 30 cassettes. The Le-Bo Products wood cassette model sells for \$11.95. A cardboard version might retail for about \$2 less.

Cassette heads, like the heads on reel recorders, collect oxide. A large enough deposit will interfere with the performance of the machine. Because cassette heads are difficult to get at, accessory manufacturers have come up with an odd assortment of gadgets to do the job. The one which looks easiest to use and is most common is the head-cleaning tape cassette. Inside a standard cassette is a length of abrasive tape. You simply play the cassette as you would ordinarily and the abrasive coating removes the oxide from the heads. They'll do the job all right, but they'll also wear down your heads—cutting their life expectancy by as much as 25 per cent. A better job is done with the cleaners which contain a length of cotton tape.

Before playing the tape, you soak it in a cleaning solution (in Le-Bo's version, the cleaning fluid is squeezed onto the tape during playing from a plastic reservoir inside the cassette). The cotton applies a solvent which loosens the oxide, then wipes both off as it continues to travel past the heads. Of course, a cassette player can be cleaned in the same way and with the same tools as a reel recorder—a cotton-tipped swab and a cleaning solution like denatured alcohol. There are several good commercial cleaners available from Robins, Recoton, Le-Bo, Audiotex and others. If drugstore Q-tips aren't long enough to reach into the heads on your machine, Robins has a set which includes the long-handled variety with a bottle each of head cleaner and tape lubricant. It's priced at \$2.25.

Some manufacturers have combined abrasive head-cleaning tapes with test tapes to

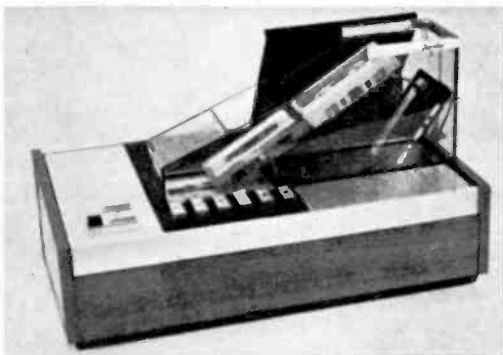


Fig. 3—For eight hours of continuous music, Norelco produced this circulator which flips cassette after play and inserts new cassette.



Fig. 4—Maintenance cassettes. Robins (left) demagnetizes heads. Center rig checks speed. Combo tests balance. Fourth cleans heads.

Buyer's Guide to Cassette Accessories

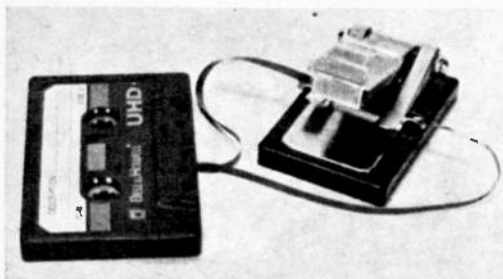


Fig. 5—Robins Gibson Girl cassette tape splicer. Tape winders are available to pinpoint exact spot where splice should be made.

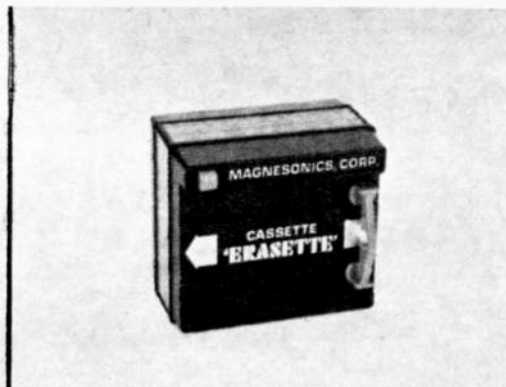


Fig. 6—Cassette bulk eraser from Magnesonics. Plastic holder at right is fitted in cassette's hubs then cassette is moved over face of unit.

form three-in-one cassettes (see Fig. 4). Besides cleaning, these tapes enable you to check balance between stereo channels and alignment of the record/play head. If you want test tapes, they're available separately. However, it may not do you much good to know that your head is out of alignment if you don't have the tools or the skill to align it. (See **TAKING CARE OF A CASSETTE RECORDER**, Sept. 70 EI.) Good test cassettes are available from Channel Marketing. They contain a frequency-response test, a test to determine tracking, a program and individual track volume balance check, speaker and program identification and an automatic switching test. To find out if your player is running at the proper speed, there are Robins strobe units for \$6.15.

Sooner or later, your unit's heads will become magnetized, requiring the use of a demagnetizer to reduce noise and restore high-frequency response. There are probes similar to those designed for reel recorders and the easy-to-use cassette types. Le-Bo and CM have DC models which plug into a car's cigarette lighter for \$8.95; or an AC type for \$6.95. Both utilize two pole pieces which press against the head and remove residual magnetization. Because it's so difficult to see what you're doing, we found the shell types—pole pieces mounted in a cassette—much easier to use. You simply insert the cassette and plug in the AC cord hanging out the bottom and then remove the cassette after a minute or two.

Before we leave the housekeeping area, there's the matter of keeping your tapes

properly labelled and indexed. Robins is one of the first manufacturers to offer replacement labels for cassettes and an intelligent indexing system. If you elect to re-use a cassette, until now you've had to scratch out the original label information and try to find room to write in what you've just recorded. The Robins labels, at 5¢ each in packages of 20, come in five colors to permit color coding of recorded material. They're pressure-sensitive and can be pressed into place.

Robins currently offers the only tape splicers for cassettes (Fig. 5) and TS 115 Gibson Girl automatic for \$5 and the TS 215 pocket-sized splicing block with 25 pre-cut base, splicing patches and a burnishing roller.

To facilitate splicing and editing, Robins offers a pair of tape winders—tiny reel locks tooled to fit the cassette hubs—which sell for \$1.50. They permit rocking the tape back and forth past the heads on certain recorders to find the right spot to edit.

The bulk eraser is as useful to the cassette recordist as it is to his reel recording cousin. It rapidly and thoroughly erases everything on the cassette. Robins has a cassette model, TMC 1, at \$20 which seems to work well. Almost as fast, and substantially less expensive (\$1.98) is Channel Marketing's SED Speed Erase, a ferrite bar that fits over the open end of a cassette. Magnesonics has a model which erases the entire cassette without the use of a recorder (see Fig. 6).

You may not need all of these cassette accessories, but the longer you own your recorder or player, the handier you're likely to find some of them. ●

Good Reading

By Tim Cartwright

ABC'S OF THERMISTORS. By Rufus P. Turner. Howard W. Sams & Co., Inc., Indianapolis, Ind. 96 pages. \$2.95

Does *thermistor* bring to mind a solid-state device for measuring temperature? That definition short-changes this versatile semiconductor, according to Rufus Turner, and he gives a convincing argument. After explaining the principles of electronic thermometers he describes the applications thermistors have in some unusual instruments, such as the one illustrated below. This is a circuit for a windspeed indicator having no moving parts. Using two thermistors, the blowing wind cools an exposed thermistor. Its resistance, compared to the sheltered thermistor, changes and unbalances a bridge circuit.

Dr. Turner depicts about four dozen different circuits that reveal how thermistors can compress an audio signal, act as a voltage regulator or introduce time delay. This is no cook book of construction projects but the chapter on thermistor fundamentals should furnish the experimenter with enough background to attempt simple projects. The book is the first simple, one-source publication we've seen on these useful devices.

SMALL APPLIANCE REPAIR GUIDE. By Wayne Lemons & Glen Montgomery. Tab Books, Blue Ridge Summit, Pa. 95 cents (paperbound)

"You should be reluctant to clean the inside of any percolator brought in for repair . . ." warns this practical guide. This advice is typical of the down-to-earth information which fills this volume. The

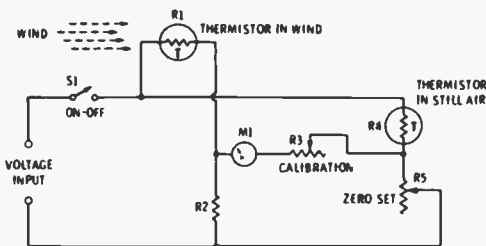


Fig. 2-5. Anemometer.

authors seemingly speak from atop a mountain of broken appliances and have written a fine guide for the self-servicer or beginner interested in a field that's desperately in need of technicians. Everything in the field is described—from why toast won't pop up to steam irons that won't whew and such other 20th Century artifacts as electric blankets, mixers, knives, shavers, deep fryers and hair dryers. There are good tips on the appliance fixer's recurring nightmare—how does this thing come apart?—and a chapter on making a portable tester that should help diagnose the ills of almost any small appliance. Oh, yes—why shouldn't you clean the inside of a percolator? It changes the taste of the coffee.

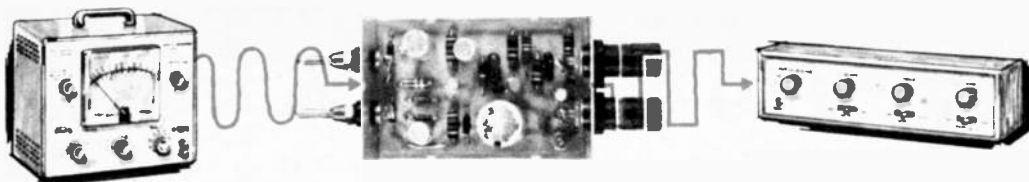
OFFICIAL HANDBOOK OF METAL DETECTORS. By Dr. Arnold Kor-tejarvi. *Recreonic Publication, Inc.*, St. Petersburg Beach, Fla. 165 pages. \$3.25

Spanish gold discovered along the Florida coast! Coins worth \$2,000 found in two weeks! Frantic search for King David's missing treasure! Amid such breathless reports it's no wonder that an *official* handbook of metal detectors has reached print. Dr. Kor-tejarvi, though, is no doctor of English as he surgically slices the language and sounds like he's writing from Frankenstein's castle in Transylvania. An example: "I choose the best way to classify the general designs of metal detectors by the Laws of Physics and the Laws of Electronics." After the doctor buries his monsters, the book becomes a reasonable primer on metal detectors. With admirable restraint (there are no get-rich-quick promises), he details the limitations of each piece of equipment and relates some practical techniques of small-time treasure hunting such as coin shooting or prospecting for nuggets. Although much of the book consists of instructions provided by various manufacturers, it still might be a worthwhile investment before you spend your money on a metal-locating instrument.

ELECTRIC MOTORS AND THEIR APPLICATIONS. By Tom C. Lloyd. John A. Wiley & Sons, Inc., New York, N.Y. 332 pages. \$10.50

If you have 20 electric motors in your home operating on six different principles, you had better buy this book because these machines are shaping our destiny. The author has produced a clearly written, up-to-date text on the essentials of electric motors and

[Continued on page 103]



Free-Power Square-Wave Generator for Audio Testing

By HARRY KOLBE THE MOST basic test instruments for audio servicing are an oscilloscope and a signal generator. Making sine-wave tests with them can reveal much about the performance of an amplifier. However, characteristics such as frequency response, phase shift and ringing (oscillation) can't be determined by sine-wave tests. They require a square-wave test signal.

Unfortunately there are audio generators that don't have a square-wave output. And some that do put out a less-than-ideal square wave that will result in incorrect evaluation of an amplifier's performance.

Our Free-Power Square-Wave Generator (a converter, basically) is a simple and inexpensive way to put square waves on your service bench. It can be plugged into the output of any audio sine-wave generator (Fig. 1) whereupon it will convert the sine-wave output into square waves. No modifications need be made to the sine-wave generator.

Unlike many other square-wave converters ours is most unusual in that it doesn't require batteries or a power supply. *It gets its power from the sine-wave input signal itself.* Part of the input signal is rectified and doubled to power the three-transistor squaring circuitry. (Fig. 2.)

Ideally, the sine-wave generator should

have a 1,000-ohm (or lower) output impedance and be able to deliver a 2-V signal under load. But there are exceptions. For example, we used our converter with a sine-wave generator whose output impedance is 1 megohm and whose maximum unloaded output voltage is 7.6 V. When we plugged in the converter, the generator's output voltage dropped to 2.4 V. However, this was sufficient voltage to operate the converter satisfactorily.

The frequency of the square waves will be the same as the frequency of the input sine wave. If the sine-wave input signal contains distortion, this will not appear in the square-wave signal. The converter has a rise time of about 30 nanoseconds. It generates excellent square waves from 10 cps to 500 kc. The photo of the scope trace in Fig. 3 is of a 1-kc square wave.

Construction

The converter can be built on a 3 x 1 7/8-in. piece of perforated board. The pictorial in Fig. 4 shows the location of all parts. Flea clips or brass eyelets are ideal for tie points. The photo below the pictorial shows the construction used by the author. He chose to make a printed-circuit board, which doesn't simplify matters that much because there are so few parts in the project.



Fig. 1—Generator is built in a 3 1/4 x 2 1/4 x 1 1/8-in. Minibox. On back are chassis-mount banana plugs which fit in jacks on sine-wave generator. Square-wave output at front is available at dual five-way binding posts. Unit is powered by input sine-wave.

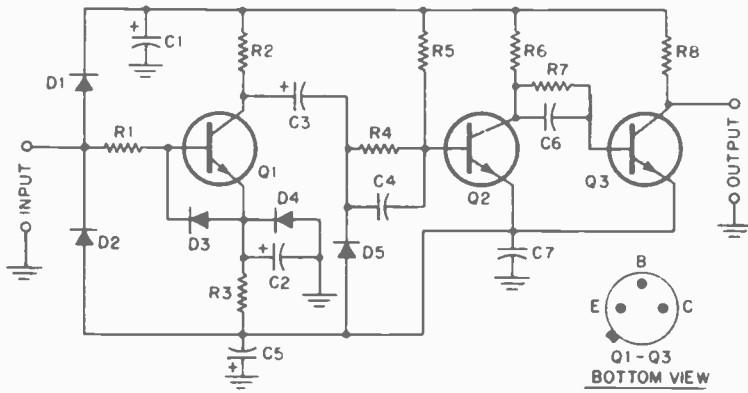


Fig. 2—Part of sine-wave input signal is rectified by D1, D2 and filtered by C1, C5 to provide operating voltage for circuit. Transistors Q1, Q2 convert sine-wave input to square wave of same frequency. Transistor Q3 isolates circuit from output, provides gain.

PARTS LIST

- C1—100 μ f, 15-V electrolytic capacitor
 C2—30 μ f, 12-V electrolytic capacitor
 C3—50 μ f, 12-V electrolytic capacitor
 C4—1,000 μ f, 500-V silvered-mica capacitor
 C5—500 μ f, 15-V electrolytic capacitor
 C6—100 μ f, 500-V silvered-mica capacitor
 C7—.01 μ f, 50-V disc capacitor
 D1-D5—1N914 diode
 Q1-Q3—2N5179 (RCA) or HEP 56 (Motorola) transistor
 Resistors: $\frac{1}{2}$ watt, 10%
 R1, R5, R6, R7—10,000 ohms
 R2, R3—4,700 ohms
 R4—1,000 ohms
 R8—3,300 ohms
 Misc.—Dual five-way binding posts (H.H. Smith 224 BB, Allied 47 A 1328), $\frac{3}{4}$ x $2\frac{1}{8}$ x $1\frac{1}{8}$ -in. Minibox, perforated board

At the left side of the U-section of the Minibox install two chassis-mount banana plugs using shoulder washers to insulate them from the box. Mount them on $\frac{3}{4}$ -in. centers to match the output jacks of most audio generators. At the other side of the box, mount two insulated five-way binding posts

on $\frac{3}{4}$ -in. centers or install the dual five-way binding post specified in the Parts List.

Mount the board in the cabinet using $\frac{1}{4}$ -in. spacers to keep the board away from the cabinet. Then make connections from the board to the input and output connectors.

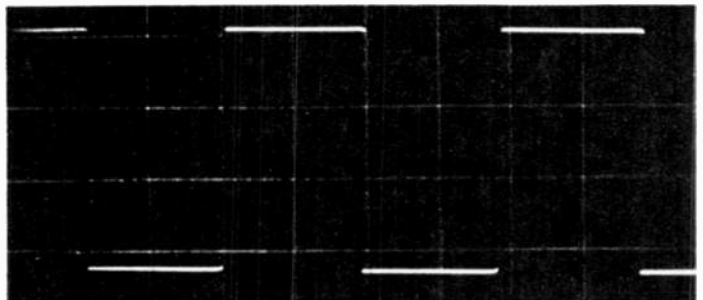
Square-Wave Testing

Square-wave testing makes it possible to check at the same time the phase, distortion, stability and frequency response characteristics of an audio amplifier. Here are the reasons why.

A square wave consists of a fundamental-frequency sine wave and all of its odd harmonics which are in definite phase and amplitude relation to each other. The square wave is the algebraic sum of the fundamental frequency and an infinite number of its odd harmonics, all sinusoidal in shape and having a common time of origin.

In practice, however, the 30th harmonic is the highest order of sufficient amplitude to be of importance. An amplifier that changes the phase relation or the amplitude of any of the components of a square wave will distort the square wave. Only when the amplifier passes all the frequencies of the square wave without attenuation or phase shift will the

Fig. 3—Scope photo of 1-kc square-wave output of converter. At 500 kc, there's only a very slight rounding of upper and lower right corners of square wave. The 10-kc pattern is about the same as 1 kc.



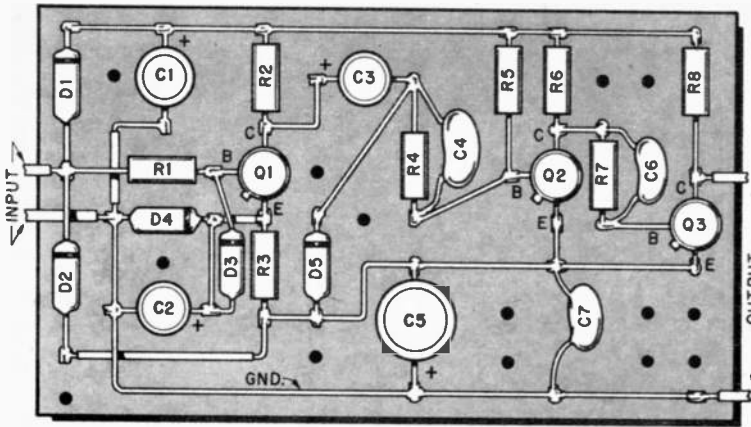
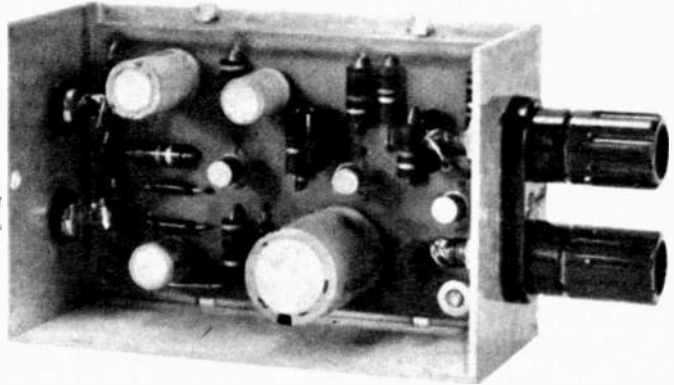


Fig. 4—Pictorial at left shows location of parts on 3 x 1 1/2-in. perforated board. Push-in terminals or brass eyelets are ideal for the points. Note in author's model below that shoulder washers are used on chassis-mount banana plugs at left. Dual five-way binding posts are for output connections.

Free-Power Square-Wave Generator



output be undistorted.

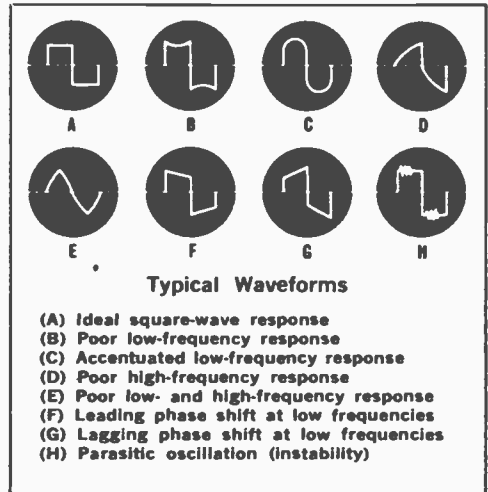
What you do is feed the square wave into an amplifier, then observe it at the amplifier's output on a wide-band scope. The display will reveal the amplifier's shortcoming as shown in the typical patterns at the right. Note how frequency response, phase shift, instability and distortion show up.

Don't expect to see waveforms that look exactly like these. The patterns shown here are theoretically ideal and will differ from those you'll observe because of the response of the scope itself and because of the settings of the scope's controls.

The frequency response limits of an amplifier can be approximated by multiplying and dividing by 30 the fundamental square-wave frequency that is perfectly reproduced. For example, assume a 1,000 cps square wave is perfectly reproduced. This means that the amplifier is capable of flat reproduction of frequencies from about 30 to 30,000 cps.

Here's another thing you can do with square waves. Assume you want to determine the exact flat position of an amplifier's tone controls. Feed a 1,000-cps square wave in the

amplifier and simply adjust the controls for best square-wave response. When you move the controls from the flat position, you'll see the square wave's shape change reflecting high- and low-frequency boost and attenuation.



The Ham Shack

By Wayne Green
W2NSD/1



AS I closed the last Ham Shack, I was preparing to leave on a trip to Jordan. I am pleased to report that the journey was such a success that I accomplished far more than I thought possible.

King Hussein was waiting for the plane at Amman's airport with a royal entourage and ceremonial red carpet. This welcome might have gone to my head had I not learned that the King's sister was a fellow passenger on the plane, a more likely recipient of the cheers of the crowds.

My spirit buoyed immediately as I was given a special palace escort through customs and immigration and whisked to the Jordan Intercontinental Hotel by limousine to stay as the guest of His Majesty.

The day after I arrived I was picked up by His Majesty's private secretary, Patricia Salti, and driven to the palace a few miles outside of town where the King and his family live. This is also where he has established his ham station. The King was waiting for me in front of the palace and welcomed me warmly. We talked for a while about amateur radio and then I got busy operating his station while he observed.

The primary purpose of my trip to Jordan was to help the King handle the hundreds of hams who were trying to make contact with the royal station, JY1. After this initial onslaught the King could operate the station in a more leisurely atmosphere so that the joys of hamming would not be lost to him.

During the two weeks that I was there, I operated the station every day for about five or six hours, working just about every amateur in the world that was seriously trying to get through to JY1. It had been many years since any station had been active from Jordan, so business was brisk. By the end of my stay I was able to call CQ quite a few times before getting a contact, so I suspect that the main reason for my trip was accomplished.

Perhaps the most important benefit of my

trip to Jordan was an unexpected and lasting one. His Majesty asked me to prepare a set of amateur radio regulations for Jordan so that ham radio could be established in his country on an organized basis. I prepared these and helped to establish the Royal Jordanian Amateur Radio Society for the administration of licenses. I am still working on a set of exams to be used as qualification for the two grades of license that are available.

His Majesty asked me to arrange for seven complete amateur radio stations to be sent to Jordan. These will be set up in schools, orphanages and remote military bases for the first Jordanians to become licensed amateurs. The King believes that amateur radio is one of the most valuable tools in interesting teenagers in technical careers. At present virtually all teenagers in Jordan aim at being doctors, lawyers or civil servants.

There is no possible way for any country to grow without communications and electronics and it all begins with amateur radio.

New Amateur License Proposed. The 800,000 or so hobbyists now using the 23 CB channels are certainly enough proof that there is a real need for some sort of hobby band. The legitimate users of CB have long been pushed off the band by the multitudes flocking to the 23-channel nightmare.

If we need a hobby band, why not have one? For all the mighty groans about a shortage of frequencies, there are dozens of unoccupied TV channels and a wide assortment of other vacancies here and there throughout the VHF band. One of the most vacant of all, sad to say, is the amateur 220- to 225-mc band.

In giving the matter a lot of thought I considered the problems faced by the FCC in administration of the present CB band, the need for activity on 220, the need for development of inexpensive VHF equipment and the need for more radio amateurs. With these in mind I sat down and worked out a plan which would seem to solve all of the problems.

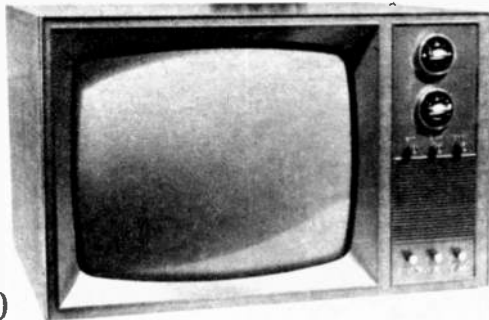
I have petitioned the FCC to establish a new hobby class of amateur radio license. The examination would require no code and no theory, only a knowledge of the rules and regulations. The license would permit operation with a 100-watt power limit in the 220.5- to 224.5-mc band using narrow-band FM.

[Continued on page 101]

El Kit Report

A New Name in Color TV Kits

Conar Custom 600



ONE of the important events of the Soaring Sixties was the rapid growth of color TV. Dormant until that fabulous decade began, sales of color TV receivers blossomed at an extraordinary clip. In 1963 the first color TV kit appeared on the market. It was a Heathkit and remained unchallenged (except for new models) until 1969.

Then the Conar Instruments Division of the National Radio Institute (3939 Wisconsin Ave., N.W., Wash., D.C. 20016) announced a color TV kit. The kit, which sells for \$366, was originally designed as a training project to be used with NRI's home-study course in color TV servicing. Subsequently a new construction manual was prepared and the set was added to Conar's line of kits.

Its basic design makes it a close kin of those early b&w receivers that had a full set of electronic picture-adjustment controls. That is, there are no preset or locked circuits that require a component change to center the picture or alter its width. All the controls such as vertical and horizontal centering, height, linearity and high voltage are accessible for convenient adjustment. Most are shaft-type controls; the few that need rare or occasional adjustment are screwdriver-adjust controls. To facilitate convergence adjust-

ments color-coded gun-killer switches are provided on the rear chassis apron to eliminate the need to pierce the CRT's leads.

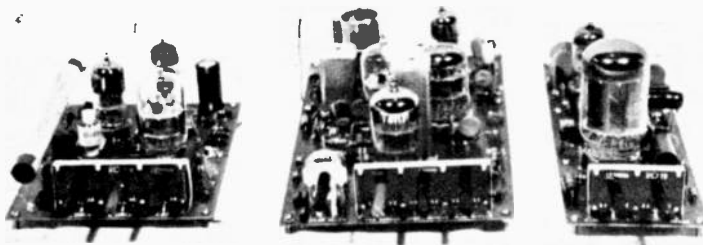
The static and dynamic convergence adjustments are standard: permanent magnets around the neck of the CRT for static adjustments and a movable dynamic-convergence board which is normally mounted inside the cabinet. For convergence the dynamic-convergence board can be attached to the back of the cabinet facing forward so you can observe the effect of adjustments.

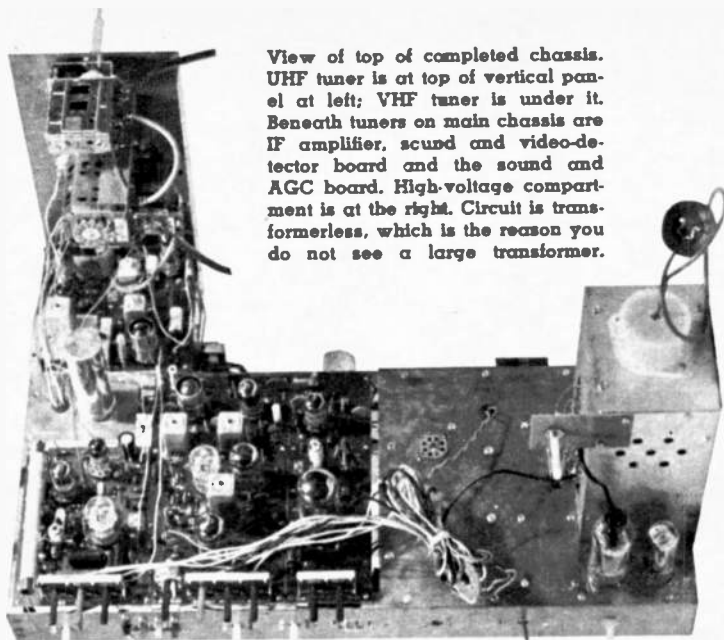
A built-in crosshatch/dot-pattern generator precludes the need for an external generator. When the dot-selector switch is flipped, the screen is filled with dots or lines for static and dynamic convergence. The power supply is a transformerless voltage doubler. Tube heaters are connected in series but there is a filament transformer for the CRT. There is no built-in degaussing coil. The cabinet is vinyl-clad steel.

The set has a rectangular tube that provides a viewing area of 180 sq. in. There are 21 tubes, 20 diodes and three transistors. Both front-ends are assembled and pre-aligned: the VHF has two tubes and the UHF is solid state.

The kit is supplied with a 106-pg. con-

Three of the set's six printed-circuit boards. At left is video amplifier. In center is the color-circuit board. At right is the horizontal oscillator, vertical oscillator and the high-voltage-regulator board.





View of top of completed chassis. UHF tuner is at top of vertical panel at left; VHF tuner is under it. Beneath tuners on main chassis are IF amplifier, sound and video-detector board and the sound and AGC board. High-voltage compartment is at the right. Circuit is transformerless, which is the reason you do not see a large transformer.

What happened after the power switch was replaced and power was turned on? No viewable picture. It took some troubleshooting to locate a defective capacitor that caused the focus potentiometer to burn out. After replacing these parts—lo and behold, living color!

But our builder was still unable to sit back and enjoy the fruits of some 53 hours of construction time. Next came the Maintenance, Alignment and Troubleshooting Manual. This book covered initial set up, sound alignment, purity adjustments, static and dynamic convergence. Then the builder adjusts the color-oscillator transformer, reactance coil and burst transformer. Finally there were the

adjustments to the sound-rejection circuits and color killer. At last, the back went on the cabinet to wrap it all up. It sounds like a lot of work but it took only about three hours. Subsequent convergences after the parts age should take a lot less time.

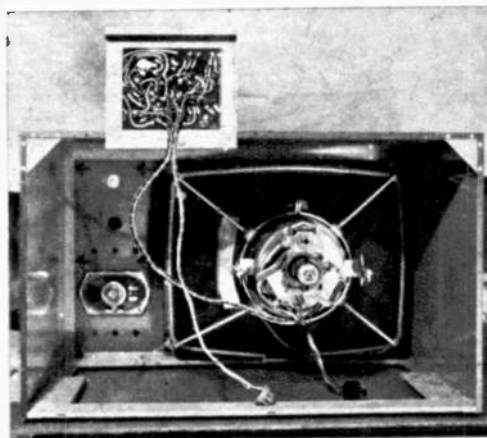
What's the picture like? Not bad. Our builder found the color to be generally good. However, Conar supplied him with a larger coupling capacitor to be installed in the video amplifier that corrected a problem of color bleeding. Convergence and purity are satisfied.

Included with the construction manual are large pictorial diagrams which you pin up over your work area. Construction starts off with the assembly of six printed-circuit boards. These are identified as IF amplifier (the transformers are pre-aligned) and video detector; sound and AGC; video amplifier, color circuits; horizontal oscillator, vertical oscillator and high-voltage regulator; and convergence.

Following board construction you assemble the main chassis, the high-voltage shield can, then wire the main chassis which includes connections between boards and chassis-mounted components.

Putting it Together. Unfortunately our builder had problems with the construction manual. Time was wasted by having to resolve some ambiguities between the step-by-step instructions and the pictorial diagrams. A call to Conar got him a set of addenda sheets to update the manual (an early one). A single wiring error, however, put a short across the switch and welded the contacts.

Looking into the cabinet prior to installation of main chassis. The dynamic-convergence board is shown in position used for making adjustments.



Looking into the cabinet prior to installation of main chassis. The dynamic-convergence board is shown in position used for making adjustments.

How to Control Your Recorder and Record from Afar Wirelessly and Learn to Love Buggers



By **JOSEPH RITCHIE** FASTEST way to get fed up with making live recordings is to entangle yourself in wires and become distracted by operating the machine's controls. It happens almost every time you use a recorder to tape a home-movie sound track or to bug a room. If you've made such recordings, you know it's always a nuisance to control a recorder located a distance away.

However, using an FM wireless mike, a portable FM radio and our Controller, you'll have a wireless tape-recording system that will make those oddball recording jobs easier done than said.

How it Works

The FM wireless mike is a miniature FM broadcast station that transmits up to 200 ft. Tune it in on an FM radio and you get audio at the radio's earphone jack. The audio is fed via a patch cord to the recorder's input jack.

But how is the recorder started and stopped? The Controller does that. It receives another signal from the radio, when

you turn on the mike, that starts the recorder. When the mike is turned off its carrier disappears and the Controller stops. Thus, you don't waste tape when there's nothing to record.

For best results the FM radio should have AFC (automatic frequency control) to prevent drift. AFC will also help correct for the frequency drift of the wireless mike.

Figure 4 shows the typical detector circuit of many transistor FM radios. When a signal is not received there is no voltage across capacitor Cx. When a signal from the mike is received, a DC voltage appears across Cx. It is from 0.2 to 3 VDC or more depending on the radio and the signal strength. The DC voltage goes to the Controller via isolation resistors Rx, Ry and jack J2.

Note that the radio's audio signal is taken from a tap on the detector-transformer's secondary. But in some multi-band FM radios the audio signal is taken from a resistor divider network across Cx. In such radios install only Rx, eliminate Ry and connect J2's frame to the radio's ground

Fig. 1—Complete wireless tape-recording system consists of an FM radio, an FM wireless mike, a reel or cassette recorder and our control box at the right.



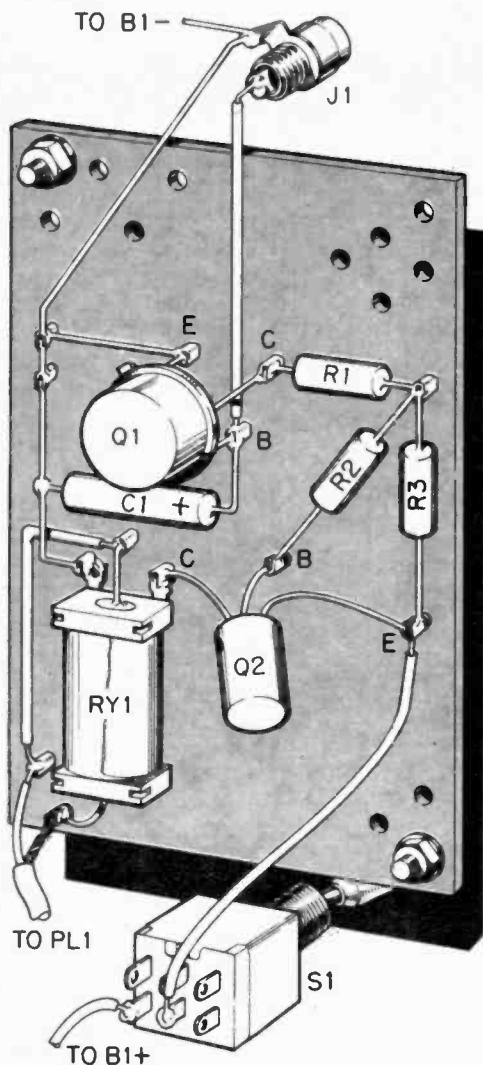
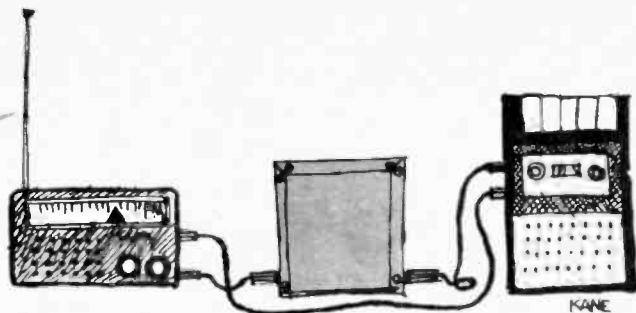


Fig. 2—Perforated board is $2\frac{1}{4} \times 3\frac{1}{4}$ in. RY1's coil lugs are at top. Its switch contacts are leads coming from the center of top and bottom.

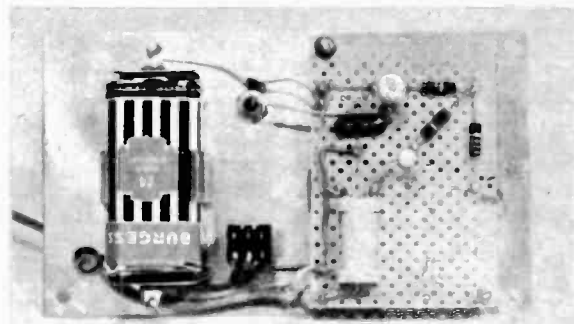


Fig. 3—Battery holder, switch S1, input jack J1 and board are mounted on back of box's metal cover. Relay is held to board by its solder lugs.

rather than to the negative end of Cx. In either case make certain Rx connects to the positive end of Cx—the end that faces the diode's (D1) cathode.

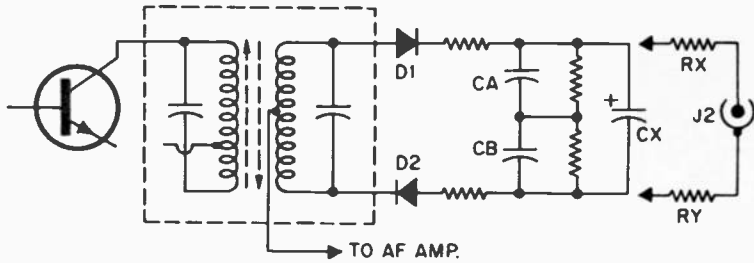
Resistors Rx and Ry must be 27,000 ohms. Less resistance will seriously affect the FM detector. A higher resistance will not provide sufficient signal to operate the Controller.

Take a look at the Controller's schematic in Fig. 5. The circuit is a sensitive high-gain DC amplifier with a reed relay (RY1) in the output transistor's (Q2) collector circuit. The DC voltage from the radio at J1 causes RY1 to close. The contacts of RY1 are connected via PL1 to the recorder's remote-control (start/stop) jack. With the recorder's controls preset to the record mode, the recorder will start when RY1's contacts close and will stop when the contacts open.

Construction

The Controller can be built in just about any metal or plastic cabinet. The parts can be mounted on a small piece of perforated board using push-in terminals for tie joints. Layout is not critical. Substitution should

Fig. 4—Connection to a typical FM radio. In some multi-band radios, the AF signal is taken from a resistor divider connected across Cx. In such a radio, connect Rx, eliminate Ry and connect J2's frame to ground point on board.



Control Your Recorder

not be made for Q1 because the specified transistor has a very high gain. Using a silicon transistor for Q1 will probably make the unit inoperative. Transistor Q2 can be any high-gain type. Any small relay with a 20-ma coil (300 ohms at 6 VDC) can be used, though the reed relay specified will work even when battery B1 is exhausted to half its normal voltage.

In most transistor FM radios you'll find it's often difficult to connect across Cx unless the radio's circuit board is removed and connection is made to the circuit-board foil. However, if the radio's parts are end-mounted (as is frequently the case) the resistor between the detector and Cx often has one accessible lead sticking above the board. Resistor Rx or Ry can be soldered to this lead and it won't matter whether the connection is made to the diode (D1) or Cx side of the resistor as long as the lead from Rx and Ry to the connection is no longer than 1/4-in. Install jack J2 at some convenient place

in the side of the radio. If there is no space for J2 and the radio has a jack for an external power supply, remove the connections to the jack and use it for J2.

Checkout

Prepare a short length of shielded cable to connect the radio's DC-control-voltage jack (J2) to J1. Connect an ohmmeter to PL1. Apply power to the Controller by setting S1 to *on* and then tune in an FM station. When a station is tuned in, RY1's contacts should close and the ohmmeter should indicate zero ohms. If RY1 fails to close, make the following check: Temporarily connect a 1.5-V battery to J1 (negative to J1's frame). If RY1 fails to close, the trouble is in the Controller. If RY1 closes, Rx and/or Ry is improperly installed.

Operation

If the controller checks out, turn on the FM mike and tune in its carrier on the radio.
[Continued on page 101]

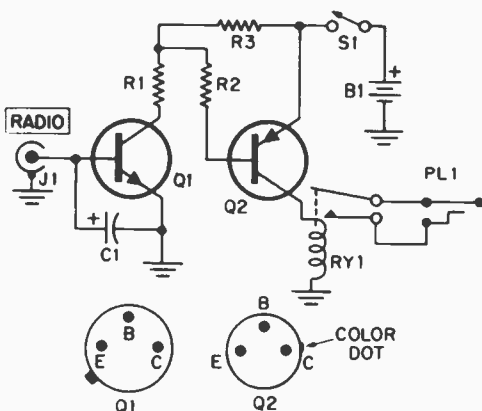


Fig. 5—DC signal from FM radio (when wireless mike is turned on) is fed to J1 and amplified by Q1, Q2. Q2 closes RY1 which starts recorder.

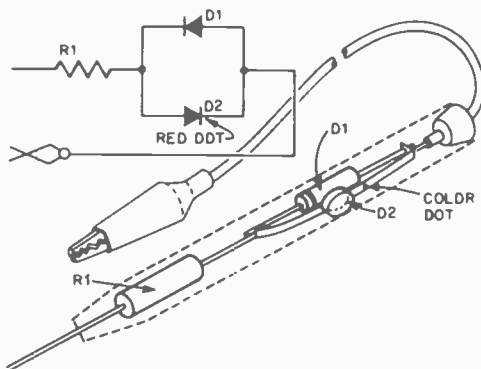
PARTS LIST

- B1—6 V battery (Burgess Z4 or equiv.)
- C1—2 μ f. 6-V electrolytic capacitor
- J1, J2—Phono jack
- PL1—Tape recorder remote-control connector (Radio Shack 274-1551)
- Q1—2N1306 transistor (RCA)
- Q2—2N2613 transistor (RCA)
- R1—12,000 ohm, 1/2 or 1/4 watt, 10% resistor
- R2—1,000 ohm, 1/2 or 1/4 watt, 10% resistor
- R3—2,200 ohm, 1/2 or 1/4 watt, 10% resistor
- RxRy—27,000 ohms (see text)
- RY1—Reed relay; SPST contacts, 12 VDC, 250-ohm coil (Magnacraft W101MX-2, Allied 41 A 4441)
- S1—SPST switch
- Misc.—Battery holder, 3 3/4 x 6 1/4 x 2-in. utility case (Radio Shack 270-627), perforated board, FM radio, FM wireless microphone (Piezo WX-127 or equiv.) Note: The Piezo FM wireless microphone is available for \$18.50 prepaid from Custom Components Inc., Box 153, Malverne, N.Y. 11565. Canadian orders add \$1. N.Y. State residents add sales tax. No foreign orders



Holder for tester (above) should be clear plastic so you can see glow of gallium-arsenide diode. Note in right photo size of diodes compared to 1/2-watt resistor. Diode D2 is above D1.

Glowworm Voltage Tester



THE days of the old neon-lamp voltage tester are numbered. It was great for indicating the presence of 90 to 600 V. But in the world of low-voltage solid-state equipment, it doesn't do much for you.

Using one of the newest solid-state devices, a gallium-arsenide light-emitting diode (Monsanto MV50), you can build a voltage tester that glows red when connected to 5 to 400 V, either AC or DC. This makes it versatile enough to be used with both, say, transistor radios and household appliances.

It also indicates the polarity of a DC voltage. When the probe (R1) is positive with respect to the ground clip, diode D2 glows. The brilliance depends on the voltage. If the polarity of the voltage is reversed, D2 doesn't glow.

Take a look at the schematic above. When D2 is forward biased (R1 positive with respect to clip), it glows red. Resistor R1 (10,000 ohms, 1/2 watt) limits D2's current to 40 ma at 400 V. Diode D1 (1N4001) pre-

vents D2 from being destroyed by a reverse-polarity connection in a circuit (R1 negative, clip positive). The maximum reverse voltage of D2 is 3V).

The tester shown in the lead photo above can be built in the clear plastic body of a discarded ball-point pen. Diode D2 is very delicate. We recommend that you bend its leads very carefully and use a low-wattage iron when soldering. It might be helpful to tin D2's leads before soldering to them.

The tester can fulfill most all the functions of the old neon continuity tester. It is especially useful in solid-state projects in which voltages are low. You can use it to check batteries, power supplies, multivibrators, oscillators, SCR and IC circuits.

The MV50 can be purchased from electronic parts distributors that handle Monsanto semiconductors. It is also available for \$4.50 (postpaid) from Custom Components, Inc., Box 153, Malverne, N.Y. 11565.

—Charles L. Andrew

“He’s a good worker.
I’d promote him
right now if he had
more education
in electronics.”



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You'll miss a lot of opportunities if you try to get along in the electronics industry without an advanced education. Many doors will be closed to you, and no amount of hard work will open them.

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Going back to school isn't easy for a man with a

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The Listener

By C. M. Stanbury II

Jamming the U.S.

In a surprise move, the Canadian Minister of Resources has said that Ottawa may begin to jam broadcasts from the United States in an attempt to foster Canadian nationalism.

The Minister, J. J. Greene, declared in a published statement, "We have not gone to the extent of jamming the airwaves along the border but—who knows?—even this may come."

Until recently this statement would have been dismissed as flag waving on the part of the Minister, but an incident in England has caused experienced observers of the radio scene to have second thoughts.

Radio Northsea International is a rock-music pirate station operating in the R. Caroline tradition off the coast of England. Last winter, the station was heard widely in the U.S. on 6210 kc. After interfering with British ship-to-shore transmissions on 1610 kc, the station switched its frequency to 1578.

Following this switch to a new frequency the British Ministry of Posts and Communications began to jam the transmissions.

Other than a few instances under martial law in emergencies, this is the first time that jamming has been used by a non-totalitarian country.

Despite a lack of experience in this phase of broadcasting, the British were remarkably well prepared. Every key BBC medium-wave station now is assigned a portable jamming unit in the form of a truck with a telescoping antenna with powers ranging from 1 to 10 kw.

When the Ministry decided to jam RNI, it borrowed one or more of these units from the highly respected BBC. With the BBC's entry into a field generally reserved for countries like the U.S.S.R. it is easily possible that other countries might follow suit, including Canada.

If Mr. Green's comments were intended as a joke, his humor was ill timed for it is clear that a serious threat to listening freedom is developing on an international scale. In response to this threat, the World DX Club has begun a new anti-jamming campaign. The British based club is one of a few with a truly international outlook and has active representatives in many countries, including a

spokesman in the United States.

While WDXC's approach to the situation still is undefined, it probably will assume an exploration-and-exposure method. If you are interested in these developments it would be advisable to join WDXC and receive their colorful bulletin, Contact. Another step in the right direction is letting your views be heard. You might contact the North American representative of the club, William Matthews, at Box 15306, Columbus, Ohio 43215.

Canadian DX. Now that U.S. ship-to-shore traffic is switching from medium wave to VHF, DXers should have less interference to contend with in attempting to log some of the more remote Canadian stations. These would include VCK, VCN and VOJH, especially on the key channel of 2182 kc, the distress frequency.

VOJH is at Cornerbrook, Newfoundland, on the Gulf of St. Lawrence's rugged eastern shore, while VCK is on the Gulf's bleak northern coast at Seven Islands, Que. VCN is Grindstone Radio, operating from the even more remote Magdalen Islands.

The Magdalens are not considered a separate country. However, they present a rarer DX prize than many islands accorded country status. Although VCK and VCN are located in Quebec, most transmissions are made in English rather than French.

On the BCB, a new 50-kw station has come on the air on 540 kc. It is CBEF located at Windsor, Ont., and is the first clear-channel station east of the Mississippi in several years. For listeners in the Mid-West interested in programs in French, this station will be a good bet.

Propagation Forecast. Sunspot activity is still relatively high and, as a result, daytime DX in the 15-, 17- and 21-mc bands will be good to excellent.

At night, conditions are expected to be about the same as they were last year at this time, with the 6- and 9-mc bands generally best for DX over all-dark paths.

Noise levels due to thunderstorm activity are at a minimum in the winter months and broadcast-band DX should improve compared to the last few months. ☐

El Kit Report

Blister-Pack Tube Tester

Mercury 990



WHEN a TV set starts acting up, the best plan of attack is to first check the tubes. But it's a waste of time to pull tubes, put them in a bag and head for the super-market or drugstore tube tester. The efficient approach is to have handy your own tube tester—like the Mercury Model 990. The kit sells for \$21.95 (\$34.95 assembled) and you can put it together in five hours.

An unusual thing about the 990 is the way it's packaged. As is common in elec-

tronic-parts retailing nowadays, the 990 is displayed in a blister package as shown above. Notice that it comes with the tube sockets and slide switches already mounted.

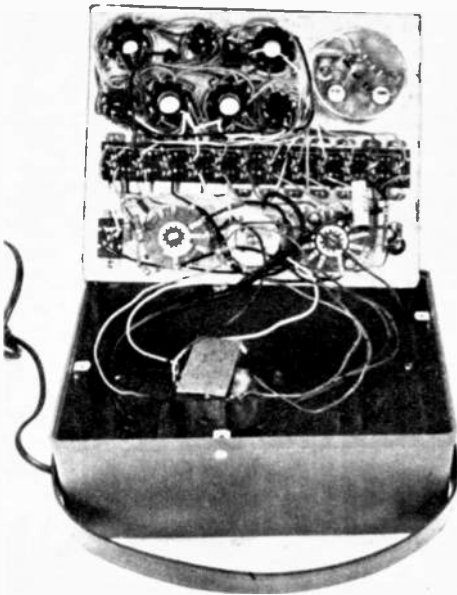
The 990 is equipped with eight sockets for the following tubes: Compactron, Nuvistor, seven pin, octal, 9-10 pin, magnoval, novar and decal. These will cover every tube you'll encounter in modern TV sets.

By means of 12 SPDT (center position open) slide switches, the grids and plate of a tube are connected together for a standard cathode-emission test. The open-circuit position of each switch disconnects any tube element. The meter is in a half-bridge rectifier circuit.

There are three rotary switches. One applies the following filament voltages to the tube: 1.4, 2.5, 5.0, 6.3, 12.6, 25, 50 and 117 V. The second switch connects the filament return pin on the tube. The third selects one of four fixed-resistance loads and one of two test voltages. Unlike some other emission testers that are calibrated with a tube known to be good, the 990 is ready for service after you complete the check-out tests.

Construction was no problem. Wiring is tight between the sockets because of the 990's 6½ x 7½ x 3½ in. size. As for performance, it's easy to operate and accurately disclosed good and bad tubes in our junk box. We fault the kit for only one minor omission. The grid/plate clip was missing.

The 990 is a valuable addition to any test bench. It has a tough plastic case that will withstand a lot of knocking around. And by mailing the registration card back to Mercury, you will periodically receive test settings for new tubes. ●



View of inside. The filament transformer is supplied mounted in the high-impact plastic case.

Swap Shop

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

SHORT-WAVE LISTENING

HALLICRAFTERS S-22R receiver. Will swap for a quality tube tester. David Ferrant, 22 Bass Ave., Gloucester, Mass. 01930.

KNIGHT Star Roamer and Scanner control box. Will trade for Knight KG-221 Hi-Band Monitor. Ken Torrence, 65 Monroe Pl., Sharon, Pa. 16146.

HALLICRAFTERS S-38B receiver. Will trade for ham or CB transceiver. Terry Bigler, 71835 Siesta, 29 Palms, Calif. 97277.

LAFAYETTE 271 L three-band receiver. Will swap for best offer. George Lammers, P.O. Box 321, Livingston, Ala. 35470.

ROSS receiver covering AM-FM-SW. Would like a trade for an electric guitar or VOM. Leonard Deiterman, Ward, S.D. 57074.

HALLICRAFTERS L-39 receiver. Will swap for best offer. Frederick Bachand, RD-2, Johnsonville, N.Y. 12094.

HEATHKIT GR-64 short-wave receiver. Will trade for CB equipment. Tom Harris, 13039 Helen St., Southgate, Mich.

HALLICRAFTERS SX-24 receiver. Will swap for Don Britton construction plans and courses. Joe Wegner, P.O. Box 262, Glendale, Calif. 91209.

KNIGHT Star Roamer and homemade antenna tuner. Will swap for best offer. Brian Reynard, 1609 Tropical Dr., Lake Worth, Fla. 33460.

SILVERTONE 4586 floor radio with BCB and 1.8-5.5 and 6-17 mc. Will trade for best offer. Eddie Geiger, 4425 Landon Dr., Knoxville, Tenn. 37921.

HALLICRAFTERS S-38D general-coverage receiver. Will swap for Heathkit HW-16 or best offer. Joseph Morrissey, 42 Acres Ave., West Yarmouth, Mass. 02673.

ONE-TUBE short-wave receiver. Swap for 100-mw CB base station. M. Dillon, 243 Eureka St., Petrolia, Ontario, Canada.

KNIGHT Star Roamer receiver in good condition. Want nam accessories. Rich Leitermann, 1847 Ludington Ave., Wauwatosa, Wisc. 53226.

HALLICRAFTERS S-120 short-wave receiver. Will swap for Heathkit HR-10B ham receiver. Tim Dietz, 764 Ludlow St., Lawrenceburg, Ind. 47025.

ANTIQUÉ ELECTRONICS

PHILCO 1933 table radio and Zenith 1936 radio. Will swap for a pre-1948 TV. Lonny Simonian, 6222 East Townsend, Fresno, Calif. 93727.

RADIOLA III, 1924, in working condition. Will swap for battery-operated antique radio. John Wolkonowicz, 11 Hartford Rd., Worcester, Mass. 01606.

WESTERN ELECTRIC 10A BCB radio circa 1930 with spare tubes. Want a cylinder phonograph and records. John Schretzmayer, 140 Southern Blvd., East Patchogue, N.Y. 11772.

ATWATER KENT Model 55 with cabinet. Will trade for best offer. Joe Wong, 618 19th Ave., San Francisco, Calif. 94121.

PHILCO 1920 radio. Want complete ham set in working order. Jim Sullivan, RD 1, Alvord, Iowa 51230.

PACKARD car radio in working condition. Circa 1935. Want Hallicrafters S-40B receiver. Ron Layton, RD 2, Box 14, Connellsville, Pa. 15425.

ATWATER KENT model 55 Radio in perfect condition. Will trade for a four-track tape recorder. Ronald Halhcock, 2707 Garden View Dr., Jefferson City, Mo. 65101.

RCA Model R52 console receiver in good condition. Will trade for CB rig or test equipment. Clarence Gauthier, 86 Charlton St., Oxford, Mass. 01540.

GREBE CR-3 with wood variometers. Will swap for best offer. J. Worcester, RD 1, Frankfort, N.Y. 13340.

CITIZENS BAND

LAFAYETTE HA-300 2-watt, 2-channel, walkie-talkie with AC adaptor and channel 11 crystal. Will swap

for a general-coverage receiver. Maynard Smith, 650 Bryant St., East Meadow, N.Y. 11554.

KNIGHT 220A VHF receiver for the 154-175-mc band. Will trade for a new Eico 379 audio generator. Joseph Rotello, 1341 S. Edlin Ave., Tucson, Ariz. 85711.

MIDLAND 13-724 2-watt, 3-channel walkie-talkie. Will make a deal for antenna rotator or SWR meter. Pete Wilhelm, 1904 South Robert St., West St. Paul, Minn. 55118.

CB OUTFIT complete with base and mobile stations. Will swap for stereo cassette recorder. W. B. Gibson, Box 284, Fairborn, Ohio 45324.

AMPHENOL 675 transceiver with power supply for base station use. Will trade for an oscilloscope or best offer. Bob Perdue, 778 Newport, Detroit, Mich. 48215.

LAFAYETTE HB-111 CB rig with transmit crystals for channels 9 and 13. Desire in return a small transistorized CB mobile set. Kerry Greenwald, 77 Beverly Pl., Levittown, N.Y. 11756.

LAFAYETTE HE-20C CB rig with astroplane antenna. Will swap for amateur equipment or best offer. Gregory Gogates, 326 Conklingtown Rd., Wanaque, N.J. 07465.

LAFAYETTE HB-266 CB transceiver mike. Will swap for Eico base-station mike. Richard Noble, 512 New Market Ave., South Plainfield, N.J. 07080.

SONAR FS-23 covering 23 channels. Operates as base or mobile. Will swap for an AM power modulator. Ronald H. Bounds, RD 1, Box 183, Snow Hill, Md. 21833.

AIR MASTER walkie-talkie by Lafayette. With AC adaptor. Want CB transceiver in good condition. Evan Luck, 21805 Pleasant Grove Rd., Marengo, Ill. 60152.

AUDIO AND HI-FI

REK-O-KUT turntable, SW receiver, and CB rig. Will trade for TV camera or test equipment. Jack Rosenbach, 1001 West 79th Pl., Denver, Colo. 80221.

HEATH AC-11 multiplex adaptor for FM receiver. Will swap for best offer. Todd Folger, RD 3, Box 189, Westfield, Pa. 16950.

MUNTZ stereo amplifier with AM tuner. Will trade for a Lafayette HE-20T 23-channel CB transceiver with crystals for channels 9, 10, 11 and 14. G. Bryson, 8762 Hosmer St., Detroit, Mich. 48214.

SCOTT LT-10 FM tuner and Wollensak twin-lens reflex camera. Would like in return a four-track stereo tape deck or complete recorder. Harvey Brody, 2409 Deerfield Rd., Far Rockaway, N.Y. 11691.

STEREO amp and pre-amp in immaculate condition. Rated at 30 watts. Will trade for oscilloscope or signal generator. John Mitchell, 2 Milford House Rd., Milford, N.H. 03055.

PENTRON Stereo-Magic recorder, two or four track. Will swap for Touch-Tone telephone equipment. Richard M. Jacobs, 4941 Tracy, Kansas City, Mo. 64110.

CORONADO AM-FM radio, Heath VF-1 and electronics publications. Will trade for Heath DX-20 and Eico 722 or equivalent. Eugene Hult, 241 Montana St., Centerville, S.D. 57014.

VOICE OF MUSIC model 722 four-track stereo tape recorder. Want in trade a DX-60B and HR-10B or best Xmtr. Rcvr. combo. Thomas Ziko, 350 Rear Preble St., South Portland, Me. 04106.

OTHER EQUIPMENT

BLACK LIGHT. Will swap for test equipment or best offer. Bob Rogers, 7701 5th Ave. So., Birmingham, Ala. 35206.

HEWLETT-PACKARD 200CD wide-range oscillator. Will swap for Heath 10-14 oscilloscope. Tom Jackson, 15813 Andover Dr., Dearborn, Mich. 48120.

TRIPLETT model 2413 tube tester. Will trade for antique radios or radio magazines dating before 1950. Alan Douglas, Box 225, Pocasset, Mass. 02559.

PORTABLE and table-model AM radios. Will swap for VTVM or VOM. Bruce Friedman, 21 Stuyvesant Oval, N.Y., N.Y. 10009.

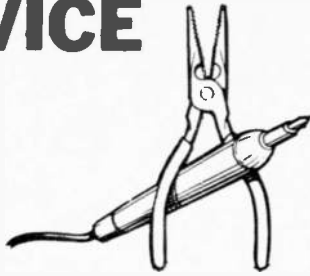
EICO 400 oscilloscope and Eico 324 RF signal generator. Will swap for best offer. Alan Mark, P.O. Box 372, Pembroke, Mass. 02359.

NATIONAL RADIO Institute TRF signal tracer and RCA Dynamic Transistor Demonstrator. Will trade for TV or auto electronics equipment. Frank Hareford, 1416 21 St. N.W., Washington, D.C. 20036.

[Continued on page 103]

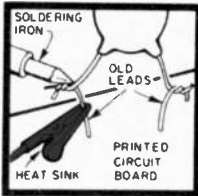
SERVICE TIPS

By
ART MARGOLIS



WHEN testing tubes, be sure to look for more than one listing in the tester manual. For instance twin triodes will have two separate listings. A four-section tube might have four separate listings. If any one of the sections should be bad, the tube must be discarded.

When replacing a bad component on a printed-circuit board (sketch at left), you have to cut the leads on the old part and solder the new component to the old leads. Use a heat sink between the board and the soldering point so that the excess heat is drained away. This prevents the free lead soldered to the board from coming loose.



Arriving home from vacation and about to watch a color TV that hasn't been turned on for a few

weeks? You had better dry out any moisture that might have accumulated during its inactivity. This is easily accomplished by placing a 60-watt bulb inside the set and leaving the light on for a few hours. Then it's safe to turn the set on.

If you begin losing high-frequency response on your tape machine, it's usually because the tape is not snug up against the head. It might appear snug but some of the tape's oxide coating has formed a layer on the head over a period of time. The cure is easy, if you swab down the head with a cotton ball moistened with head cleaner.

Lots of electric appliances have leather-covered cabinets. These covers can get annoying creases when something heavy is left on top or against them for a while. To get rid of these creases, either iron the cover with a steam iron or put a damp cloth over the crease and rub with a hot soldering iron. Be careful with plastic covers.

The new instant-on type tube TV's have been found to have a new variation on an old trouble. The symptom, you can't turn the TV off except by pulling the plug out of the wall. Your first reaction might be to think your set has a shorted on-off switch. Wrong again, Watson. The diode across the on-off switch that permits heater operation while keeping the B+ off has shorted. Since it's across the on-off switch, the TV stays on. You can remove the diode which will restore the on-off switch but removes the instant-on feature or you can replace the diode which will restore the set to the correct working condition.

SEE SOMETHING YOU WANT
ESPECIALLY MORE INFORMATION

A large, bold, black number '2' is centered within a black oval shape. The oval is tilted slightly upwards to the right. The number '2' is white and has a thick, rounded font style.

Many products advertised in this issue offer you further information direct from the manufacturer. At the bottom of many ads will be a "Circle No." line. This means that the advertiser offers you further product information, free, right to your mailbox. Look through the advertising, and

turn to page 11. Circle the advertisers' number, complete the coupon, and we will take care of the rest.

**ELECTRONICS
ILLUSTRATED**

The Long Nights of Uncle Tom

Continued from page 62

Is it because he's tired?

HE IS NERVERS

Can Tommy talk to you later?

DONT KNOW

Tom returns.

Bill, I'm back and relaxed. Can we talk now?

BELIEVE

Please explain reincarnation.

[No reply.]

Judy and Loretta take over the board.

Bill, are you still there?

HE DOES NOT HAVE IT

What?

WHAT IT TEAKS HI BEAUTIFUL

Why can't you talk to Tommy now?

I DONT KNOW CHICKS ARE GOOD I HAVE-
NET HAD SO MUCH FUN IN A LONG TIME

By what method do you receive or hear us?

I DONT KNOW I THINK HERE YOUR
THOUGHTS BEHFORE ME HOW

We can't make that out

HOW DID YOU GET THROUGH

How do you know when we want you?

DO YOU KNOW ME

Explain because we still don't understand.

I DONT EATHER

Do you know how we are communicating with
you?

I FEEL YOUR THOUGHTS

Back to the spy business.

Is the CIA setting up a station on Corn Island?

BUYING ANTENA IN CHICGO

What will the call sign or identification be?

NONE WILL THINK IT IS ON BOAT

The story takes form.

Will it be a CIA station?

CIA WILL USE IT TIMES BRIZALONS

What is the motivation of the station?

MAYDAY TO PEOPLE

Are they going to warn the people?

YES AND KEEP CANAL IF THEY CAN

Will Castro try to get canal by an invasion?

GET PEOPLE WORKED UP

Why does he want the canal?

STOP AMERICAN SHIPPING TO EAST
FROM EAST

Why is Brazil so interested in the canal?

COFFIE WE BUY HER GOODS AND SUGER

Why on Corn Island?

IT IS OWNED BY HONNDRUS WE HAVE
LETET BARIZAL RENT FROM US

NOBODY KNOWS IT USA

(Bill seemingly confuses Honduras and
Nicaragua, which owns the Corn Islands.)

If I can get this story in print will I have a scoop?

YOU WILL GET A VISIT

The FBI will visit me?

MORE THEM

Who else will visit me?

CIA

What will they do?

FRIEND IN CIA WILL CALL LAUGH

You mean the CIA will deny the story?

YES

Are there other existence planes higher or lower
than where you are?

JETS AND PROPS

(When there are two meanings to a word

Bill often assumes the wrong one.)

No, I mean spiritual planes. From where you are
now, do you move on further?

I CANT SEE THE REASON FOR GOING
ANYPLACE

Do you understand reincarnation?

I DONT UNDERSTAND ME

Can you tell us anything?

SPARK IS LIFE IT DOES NOT DIE

The spark of life cannot die, right?

ME

That's what you are—the spark of life?

I THINK SO WHAT I AM YOU WANT TO
KNOW I AM ME THE I CRY I LAUGH

You have the same emotions now that you al-
ways had?

SAME ANIMAL GONE

If you're good on earth or bad does it make any
difference afterwards?

GOOD YOU CAN LIVE WITH YOURSELF

Suppose you are evil?

YOU CANNOT LIVE WITH SELF

Do you ever rest?

NONE ED ANIMAL GONE

What happens to the spark in a pet when it dies?

NEVER THOUGHT ABOUT IT WILL HAVE
ASK

We will say goodbye for now, Bill.

CQ 10-2

Wednesday, first session. Enter a lady poet
with a sense of humor.

Bill, are you there?

ME GOT SE YOUR

Who is this?

JANE

Do you have a message for us?

SWACET

Rephrase, please.

NIBFE ? MUST POET COME T

Are you a poet?

NICE TRY BU RIGHT

When did you write poetry?

1748

Is that when you lived?

DIE

Were any poems published?

JUST TNMEHIPEUT

Any short poems you can tell us?

MAID FROM ULSTER

Were you from Ulster, England?

YES

What was your last name?

HARDIMS

Hardims?

HARDY

Hardy?

YES

What year were you born?

1726 MERGRATE

Margate?

YES

Were you married?

NO

How did you die?

PLAGE

Died of the plague? Did many die with you?

SOME

Have you ever contacted anyone else?

YES

Many times?

SOME

Do you know Ross?

TOSS ROSS

Ross.

CROSS

Not Cross, Ross.

TOSS

Are you having fun with me by making rhymes?

YES

You aren't going to give me any information,
are you?

[Continued on page 98]

NOW! THIS \$99⁹⁵ COMPLETE 8-TRACK STEREO TAPE CARTRIDGE SYSTEM



\$29⁹⁵
for only **plus mailing and handling**

when you join the Columbia Stereo Tape Cartridge Service by buying three cartridges now, and agreeing to buy only twelve additional cartridges during the coming two years, from the more than 1,000 to be offered

The richness of full stereo sound with the convenience of 8-track cartridges! Here's everything you need to enjoy the new world of 8-track cartridges! Precision-engineered to high Columbia standards, the System with its solid state design and rich walnut-vinyl finish — includes a Player with Program Indicator to control 4 stereo channels (8 tracks) of music that play automatically or can be switched from channel to channel with the touch of a finger (Cartridge), never need rewinding or threading. The Amplifier has right and left speaker Volume Controls, plus Tone Control to adjust bass and treble balance. The Twin Speaker Enclosures have sensitive yet heavy-duty speakers for maximum stereo fidelity. From Japan. Player is 8 3/4" W x 4 1/2" H x 10 3/4" D. Amplifier is 6 3/4" W x 3 1/4" H x 8 5/4" D. Speakers are 7 1/4" W x 9 1/2" H x 4 1/4" D

Beautiful, compact matched component system!

Here's the most advanced, most convenient, most trouble-free way for you and your family to enjoy stereo music in your home! It's the famous, 4-piece component COLUMBIA 8-TRACK TAPE CARTRIDGE SYSTEM... now yours at a truly fabulous bargain price!

With the Columbia 8-Track Cartridge System, you'll have everything you need to enjoy the full stereo fidelity, plus the effortless convenience of 8-track cartridges in your home! Convenience tapes "pop in" at the touch of your finger, play immediately and continuously—switch automatically from track to track... and the System, with its two beautiful, matched speaker cabinets, provides superb stereophonic sound!

Our regularly offered price for this System is \$99.95—yet now you may take the System for only \$29.95 when you join the Columbia Stereo Tape Cartridge Service and buy three cartridges of your choice at the regular Service price of \$6.98 each.

Your only obligation as a member is to purchase twelve additional cartridges during the next two years... music you'd probably buy anyway! As a member you will receive, every four weeks, a copy of the Service's buying guide. Each issue contains scores of different cartridges to choose from—the best-sellers from over 50 different labels!

If you want only the regular selection of your main musical interest, you need do nothing—it will be shipped to you automatically. Or you may order any of the other cartridges offered from any field of music... or take no cartridge at all... just by returning the convenient selection card by the date specified. What's more, from time to time the Service will offer some

special cartridges which you may reject by returning the special dated form provided... or accept by doing nothing.

Your Own Charge Account! Upon enrollment we will open a charge account in your name. You pay for your cartridges only after you've received them. They will be mailed and billed to you at the regular Service price of \$6.98 (some special cartridges somewhat higher, plus a mailing and handling charge. Free Cartridges! You'll get an additional cartridge of your choice FREE for every two cartridges you buy, once you've completed your enrollment agreement. That's like getting a 33 1/3% discount on all the 8-track cartridges you want, for as long as you want!

COLUMBIA Stereo Tape CARTRIDGE SERVICE

Terre Haute, Indiana 47808

MAIL COUPON TODAY

COLUMBIA STEREO TAPE CARTRIDGE SERVICE

Terre Haute, Indiana 47808

Please accept me as a member, and send me the Columbia 8-Track Cartridge System described here. I am enclosing my check or money order for \$29.95. (Complete satisfaction is guaranteed or my money will be refunded in full.) Also send me these three cartridges, billing me \$6.98 each, plus mailing and handling for the System and cartridges. Fill in numbers:

--	--	--

My main musical interest is (check one box only):

- Easy Listening Young Sounds Country

As a member of the Service, my only obligation is to purchase as few as twelve additional cartridges during the coming two years. I may choose selections from all fields of music at the regular Service price under the terms outlined in this advertisement... and I may cancel my membership at any time thereafter. If I continue, I am to receive an 8-track cartridge of my choice FREE for every two additional selections I purchase.

Mr. Mrs. Miss (Please Print) First Name Initial Last Name

Address.....

City..... State..... Zip.....

If you wish to charge the cost of the System and your first three cartridges, plus mailing and handling, to your credit card, check one and fill in your account number below.

- Uni-Card American Express Master Charge
 Diners Club BankAmericard Midwest Bank Card

Account Number..... Expiration Date.....

Signature..... A41-5/55
A41-6/65

CHOOSE YOUR FIRST 3 CARTRIDGES!

Herb Alpert & The Tijuana Brass
GREATEST HITS
A Taste of Heavy... 11 MORE

185843

TOM JONES
TOM
Without Love There Is Nothing... Love... More

191734

ANDY WILLIAMS
GREATEST HITS
Moon River
Happy Feet
Born Free
Dear Heart
More

187666

CROSBY, STILLS
NASH & YOUNG
DALLAS TAYLOR & GREG REEVES
Deja Vu

188060

HELLO, I'M JOHNNY CASH

186270

SIMON & GARFUNKEL
Bridges Over Troubled Water

186809

THREE DOG NIGHT
It Ain't An Easy

188656

THE 5th DIMENSION
PORTRAIT
Puppet Man & More

191205

... And Still More Selections To Choose From!

- 187088 Barbra Streisand's Greatest Hits
- 189639 Frank Sinatra—Watertown
- 191270 Tammy Wynette—Tammy's Touch
- 186114 Butch Cassidy and the Sundance Kid
- TWIN-PACKS—Twice the music, yet each one counts as only one selection
- 171520 Super Rock (30 of Today's Biggest Hits)
- 187286 Chicago (23 in all)
- 189977 Best of '70—Terry Baxter and His Orchestra

The Long Nights of Uncle Tom

Continued from page 96

EACH PERSON MUST

Do you have any messages?

BILL RISTHIRWIAN DEED GIVE TO ME

Repeat that please

ME HE CE BE SE WE PE UE WE TE GE KE

Are you joking with rhymes again?

YES

Have you been told that you have a good sense of humor?

HIBOTUPUT SHE KING ED

Who was the King of England when you were there?

FRENCH

You were French? I thought you were English.

QUEEN

Jane rewrites history.

Who was the Queen?

S ANNE

Wasn't King George on the throne in those years?

GEORGE SON ARE FRENCH

When you were in England did you ever see royalty?

A CARRIAGE DROVE BY

Must have been exciting

BEST

How old were you?

CHILD

How did you know we were here? We called Bill.

BILL SAID TO WAIT

Do you know my father?

BET HIM YOU WOULD TALK

About him?

BILL SAID ONLY HIM

You bet Bill that I would talk to you? He said I wouldn't?

YES

Can I call you if Bill isn't around?

C I AN RYTHME

I wrote some poetry once.

TIME DIME FINE WINE

Is pine OK? Does it fit there?

KIND

You like to make rhymes?

I CAN POET

Cheerio, hope we contact you again soon

GOD BLESS

Wednesday, second session.

Bill, are you there?

I AM HERE I WAS TRYING TO FIND ABOUT ANIMALS THE SPARK FROM THE DOG

Any luck?

HIDE ICNZEB WE NOT FIND TODAY DEAP MCIDEHCKAHSRAF

Are you going to keep trying?

YES GIVE ME TIME

Bill's explanation.

Corn Island doesn't belong to Honduras. It is Nicaragua.

I KNOW IT AS HOUNDRES

The flying-saucer mystery is solved at last.

What about flying saucers?

FUNNY

They are a joke?

YES

What are people seeing and photographing?

WHAT THEY MAY WANT TO

They aren't anything at all?

IF THEY ANYTHING IT FROM HERE

You mean God sent them?

NO

They are from earth?

EARTH

Bill once asked Uncle Tom to publish a story with his by-line. So . . .

THE CORN ISLAND AFFAIR

By William Wheton

A new radio station will be set up late this year on Little Corn Island in the Caribbean. It will be owned and staffed by Brazilians. The Corn Islands, presently under lease by the U.S. from Honduras (sometimes known as Nicaragua), have been rented quietly to Brazil for the purpose.

The station will be commercial in nature (a soft-drink company is buying time through an office in Buenos Aires), though CIA agents will work there and CIA programs will be fitted into the programming.

The station is being established to send out what might be considered Mayday calls to the people of Central America because Cuba's Fidel Castro will move at the beginning of 1971 to create disturbances in Panama. This will be done to rid the Panama Canal of American control so Cuba can control it. The idea was presented to Castro by China, a nation which has offered Castro food aid in exchange for cooperation.

The plan, if successful, would jam American shipping from both coasts and nearly destroy Brazil's coffee exports to the Pacific.

A large number of engineers is involved in the radio project. The 100,000-watt transmitter is being built in Maryland. A high-gain antenna is coming from Chicago.

Color TV Kit

Continued from page 83

factory as evidenced by the absence of color tint in a b&w picture.

Although the set does not have AFT (automatic fine tuning) there is no difficulty in tuning a picture. Compared to other nearby color sets with comparable antennas, the Connar produces a picture free of snow and noise.



"And this is the memory unit."

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Actually Start Your Own Part-time Business

Many customers have actually started their own business with this hardware store-at-home catalog. Its 188 pages are so crammed with fully-illustrated merchandise that any friend, neighbor or relative who sees it is bound to want something from it. And as only the retail prices are listed, the confidential low costs, which are con-



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- Lancaster Chain Saws
- Portable Power Saws
- Crill Presses
- Belt-Disc Sander
- Westinghouse Power Motors
- Vises with Steel Screws and Guides
- Hopsy Split Image Transit
- Jet Fuel Igniters
- Prism Binoculars and Telescopes
- Champion Spark Plugs
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- Bernz-O-Matic Torches
- Paint Sprayers
- Smith-Corona Typewriters and Adding Machines
- Tractors—Sprinkler Heads—Lawn Mowers
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- Waltham Watches
- Motorola and Webcor Tape Recorders & Stereos

cealed in a code known only to you, offer you an opportunity to actually earn money. Once you start, you'll be amazed how easy it is to sell, because these amazing values actually sell themselves. And, because U.S. General Supply keeps all the merchandise on hand in their huge warehouse, most orders are shipped out the day they're received.

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Bugging the Fuzz

Continued from page 46

ceivers. If you want to try some DX from the next town the antenna will probably need improvement. Manufacturers of ham, CB and other two way antennas offer a line of monitor models. They are well suited for outdoor mounting, high and in the clear, to intercept stronger signals from distant stations. An example is the GP-1 ground plane by Newtronics that covers 25-50 mc at a price of \$11.95. A special feature of this and other monitor antennas is a cutting chart which enables you to adjust elements to an exact resonant frequency. Or, you can simply cut the antenna to the middle of the band.

Now that you have all the equipment, you might be somewhat dismayed at what you hear. Policemen don't have very much time to gab, so each department employs a system of codes similar to those in the chart.

In the secrecy department there are a couple of other matters. It is against the law to repeat what you hear in these transmissions, or to use them for purposes of profit. There are many states that have laws prohibiting the mobile use of police receivers. Check with your city or town police before mounting your equipment under the dashboard.—*Len Buckwalter, Tom Kneitel.*

A Letter From Georgetown

Continued from page 22

unmercifully—by Frank Koulstone, among others. Often the 007 chaps would arrive in heavy trench coats and then keep them on even in the stifling heat of Georgetown's afternoons.

"Going south?" Frank used to ask them

"Yep."

"To Nicaragua?"

"Nope."

"Oh? To Swan, maybe?"

"Yep."

It all seemed to be part of a strange code by which CIA agents, like George Washington or Boy Scouts, do not tell lies, but they aren't given to volunteering the truth, either. You might check us out on this theory if you've a mind to. Like the next time you run into a CIA operative just ask him straight out: "Hey, how's it going with that new station of yours on Little Corn Island?"

—*Bob Beason*

How To Control Your Recorder

Continued from page 86

Then connect a patch cord between the radio's earphone jack and the recorder's mike jack. Talk into the mike and adjust the recorder's gain control for proper level.

If the radio is equipped with AFC, set the AFC switch to *on*. Then plug PL1 in the recorder's remote-control jack. For proper operation it is very important that the mike's output frequency be set to an absolutely dead spot on the dial—generally around 88 mc. If there's even the slightest trace of a station in the background, the Controller will not stop the recorder when the mike is turned off. ●

The Ham Shack

Continued from page 81

The use of FM would help free us from the terrible mess that is made by all those AM carriers on 27 mc and would greatly reduce interference problems. While the 200-mc band does not provide the skip conditions experienced on 27 mc, the 100-watt power limit will permit ground-wave coverage far above that experienced on 27 mc. More important will be the use of repeaters, the development that has had such a tremendous impact on two-meter communications.

The opening of a hobby-class band would quickly encourage manufacturers to produce reasonably priced equipment for the development of this band—equipment which would also benefit those higher-class licensed amateurs interested in using the two 500-kc segments of the band on each end of the hobby band.

Television interference should be at a minimum with these allocations because they are above TV Channel 13.

Special call letters have been requested for this new license, starting with NA1AAA, a series which would mathematically permit the licensing of over 4,500,000 operators. This would allow the holder to keep his suffix letters when the class is raised, turning a NC2BDF into a WB2BDF, for example.

The initial response to the proposal, except from the ARRL, has been quite enthusiastic. It would seem to answer an awful lot of problems and cause a minimum of difficulties. How does it strike you? ●

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CIRCLE NUMBER 13 ON PAGE 11

Over and Out

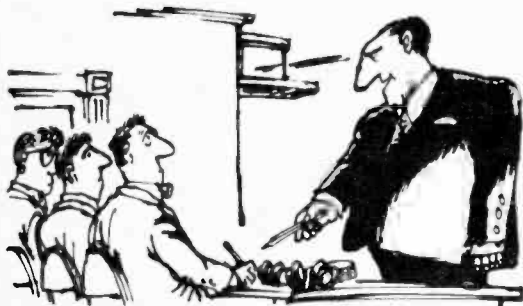
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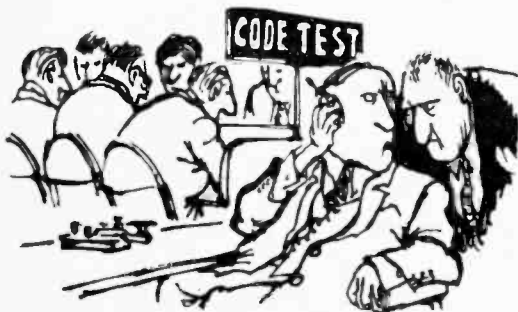
"... Look, Marconi, I don't care about any test you're going to take. Just knock it off!"



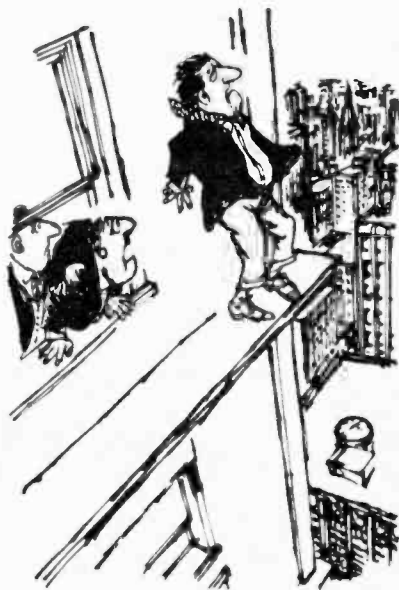
"Honey, it's me. Listen, look in my code test book and see if 'P' is di-dah-dah-dit or dah-di-dah-dah..."



"Our code oscillator is out of order so I'm going to tap out your code test on the table with my pencil..."



"I just got a bribe offer at 3 wpm."



"... Mr. Harris, you shouldn't take it like this. A little more code practice and I'm sure you'll pass the test..."

Good Reading

Continued from page 77

bolsters the book with many practical considerations in their design and application. Mr. Lloyd, incidentally, punctuates his otherwise sober work with some outrageously funny asides. Best example: In 1889 a controversy raged over whether to produce AC or DC electrical power. The group against AC called alternating current deadly and a newspaper illustration of the day showed a man sitting in an electric chair, the sheriff about to throw the switch. The article explained that hanging by rope was sickening, inhumane and uncertain. But the man in the picture needn't fear any bungling because he will be executed by Westinghouse alternating current.

Mr. Lloyd's comments: "There is no evidence that the well-known slogan, 'You can be sure if it's Westinghouse,' originated at this time."

Swap Shop

Continued from page 94

FLOURESCENT X-ray negative illuminator and two 16-mm sound movie projectors. Want 8-mm movie equipment in trade. Jeff Goodman, 23 Pioneer Blvd., Huntington Sta., N.Y. 11746.

GIBSON reverb-echo unit in mint condition. Will swap for best offer. David E. Drake, RFD 5, Box 277A, Traverse City, Mich. 49684.

HEATHKIT oscilloscope, Model O-12 with 5-in. CRT. Will swap for a Hallicrafters communications receiver. Robert Roy, 151 Ray St., Manchester, N.H. 03104.

POLAROID Land camera with leather carrying case. Will swap for two Heathkit AS-13 speakers or equivalent. Steve Lympny, 9 Buena Vista Dr., Delmont, Pa. 15626.

TRANSIENT DETECTOR, Model 2601A manufactured by Huggins Labs. Will trade for best offer. Dan Williams, 4614 Broadmeadow Ct., Huntsville, Ala. 35810.

LIONEL 027 gauge model trains. Make swap offer for hi-fi equipment. Ralph Archer, 1620 Pilgrim Ave., Bronx, N.Y.

DEVRY Technical Institute "Electronics Instrumentation and Control" course. All lessons available. Will trade for shot-wave receiver. James Payette, Box 741, Sault Ste. Marie, Ontario, Canada.

ELECTRONICS books and information. Want in return CB mobile antenna or ham receiver. Gary Castellini, 3567 Lincoln Ave., Wineland, N.J. 08630.

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ASSORTED TUBES (oldies like 39/44's and others). Trade for BC-454 or BC-455 surplus receiver, with or without power supply. Larry Gravett, 434 Ednor Rd., Silver Springs, Md. 20900.

RF PLASMA TORCH with power supply. Want sniperscope or snooperscope, or what have you. Edward Miller, Jr., 12010 Telegraph, S. Rockwood, Mich. 48179.

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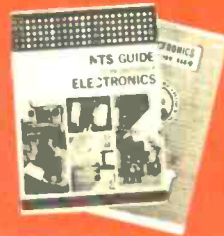
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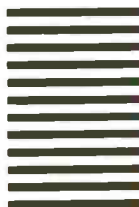
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