10 Really Basic Transistor Experiments

ELECTRONICS ILLUSTRATED

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MARCH 1968 • 50¢

Build This Bare-Essentials Ham Transmitter for Under $10!

Build a UniFET Preamp for CB

How to Log 25 Great Cities

The ABCs of Good Record Care

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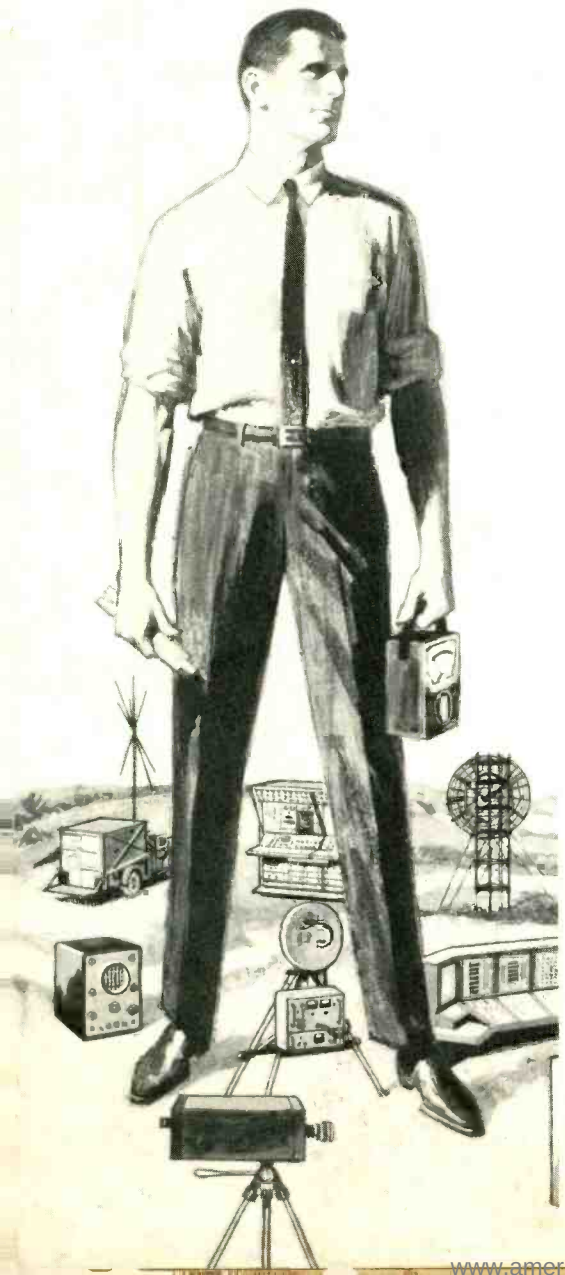

JUST THINK how much in demand you would be if you could prevent a TV station from going off the air by repairing a transmitter... keep a whole assembly line moving by fixing automated production controls... prevent a bank or airline from making serious mistakes by servicing a computer.

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

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

What You Need to Know

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

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SPECIFICATIONS

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Audio Power Output: 3.5 watts.

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Export: International Dept., Canada, Gould Sales Co.

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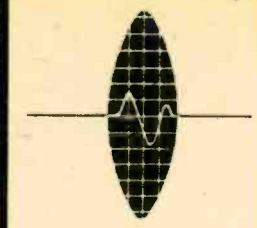

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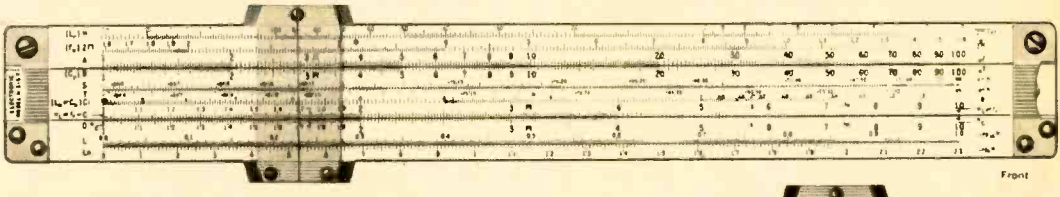

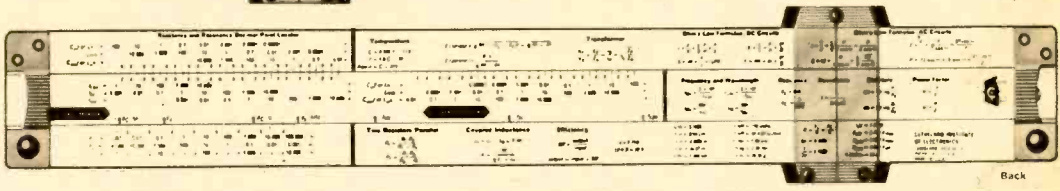

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● TROUBORU IN PALADISE

Learning a language from the short-wave courses [Jan. '68 EI] sounds great on paper but it doesn't work in practice since you can't ask questions or look things up in the textbook. I knew this Japanese girl out here and we were getting along fine on the Japanese I was learning from radio. But I missed some lessons and the next time I tried to talk to her I must have said something wrong, having forgotten what I knew. I don't know what it was but I'm glad she didn't have a samurai sword handy.

M. Sgt. J. G.
Honolulu, Hawaii

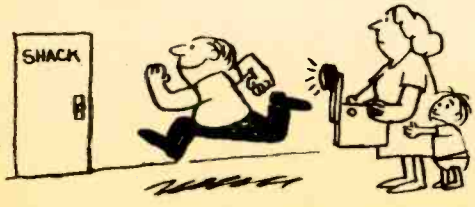
Maybe you just talk too much, Sarge.

● LIKE A FLASH

In the article on your strobe light [Jan. '68 EI] you say that it will stop the motion of objects that are going at up to 1,200 cycles per minute. Will it prevent my husband from rushing off to his ham shack immediately after dinner every night? I've simply got to find something that will stop him. I'd like our son to get to know his father.

Mrs. A.R.
Schnectady, N.Y.

Maybe your son should take up amateur radio.



● BIG SECRET

I see that the Civilian Personnel Office at Ft. Belvoir wants to hire people with background in optics, pulsed circuitry, photoemission, vacuum techniques, laser research, light-source research, transistorized electronics, automatic pattern recognition, visual perception, atmospheric optics, visionics, image intensification, far-infrared components, illumination systems and TV systems. What sort of a project would this be for?

Jason Frisch
Columbia, S.C.

Actually, their coffee-maker is on the blink.

● THANKS

I was quite impressed with the article on Master Control [Jan. '68 EI]. I doubt if anything will be done by the local FCC people but at least the operation has been exposed. Many thanks from all of us who have been the victims of Master Control's venom.

[name withheld]
Chicago, Ill.

● TOOT, MON!

I would be most appreciative if you would please tell me who makes a device for changing the sound of bagpipes similar to the ones for the saxophone you featured in your January issue. Also, is it available with battery power for marching bands? I do hope quantity discounts are available. There are 50 of us and it's sure to cost a pretty penny.

Angus Macleod
Antigonish, Nova Scotia

No one yet has fitted out the pipes for hard rock.

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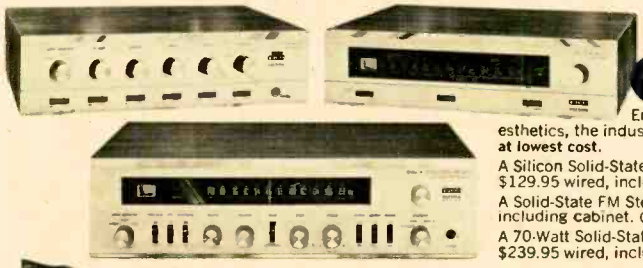

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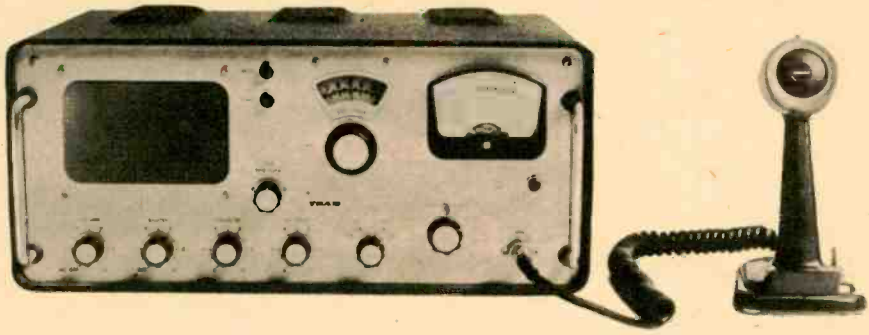
Electronic Marketplace



Citizens Base . . . The Titan II CB base station combines the functions of a standard AM transceiver with those of a SSB receiver and a DSB suppressed-carrier transmitter—making it compatible with any unit presently available, according to the manufacturer. Output is rated at 4 watts on DSB, 4.5 on AM. Comes with all 23 transmit crystals (receiver is continuously tunable across the band). $482. Tram Corp., Lower Bay Rd., Box 187, Winnisquam, N.H. 03289.

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Electronic Marketplace

Looking for Values . . . If you bother to add them up you'll find that there are a total of 684 possible settings built into the Model TE-219 resistor/capacitor substitution box—plus contacts for adding other values out of your spare-

parts bin. Built-in configurations include both straight resistor or capacitor and both together in either series or parallel hookup. Insulated test leads with clips are included. $14.98. Olson Electronics, Inc., 260 S. Forge St., Akron, Ohio 44308.

Compact . . . The LRC-60 is a recent entry to the current trend toward the compact—a hi-fi system that you can set on a table. This one combines a 60-watt AM/FM stereo receiver with a McDonald 500 record changer in its single cabinet. Only loudspeakers (8 or 16 ohms impedance) must be added to complete the sys-

tem. The 4-speed changer has pause and cueing controls and includes a Pickering V15/AC-3 stereo cartridge. The receiver (which fits in that small space thanks, in part, to the use of four ICs) has FETs in the tuner front-end and automatic stereo/mono switching. Connections for stereo headphone and tape recorder are provided on the front panel. $219.95. Lafayette Radio Electronics Corp., 111 Jericho Tpk., Syosset, N. Y. 11791.

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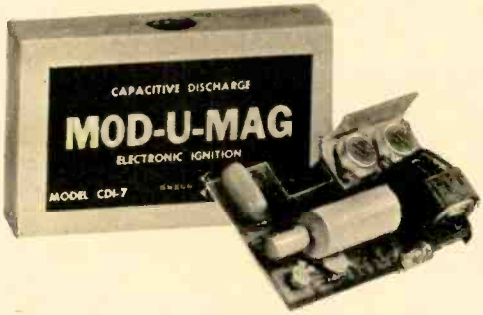
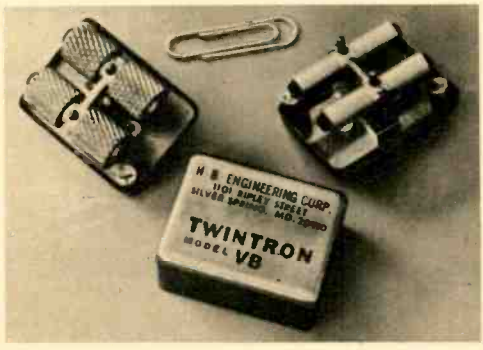
Go! . . . The Mod-U-Mag is a capacitative discharge electronic ignition system designed for use with any 6-, 12- or 24-V battery-distributor-coil engine, positive or negative ground. According to its manufacturer, the Mod-U-Mag can



increase engine speed to over 10,000 rpm and increase engine efficiency, too—by as much as 20 per cent. Current at the points is also reduced, controlling pitting, while a faster, hotter spark contributes to better sparkplug service than with conventional ignition. $49.95. A dual-coil model for twin-engine marine use sells for $64.95. Gregg Electronics, 3915 Dacoma, Houston, Texas 77018.

Selective . . . The Twintron, a tunable narrow band filter, will either reject or pass any frequency within its range. Three models are available with ranges of 100-700 cps, 300-3,000 cps and 700-8,000 cps. The Twintron is designed



so that the Q can be adjusted from a minimum of 50 to over 200. The units can be used in such projects as electronic-organ oscillator circuits, electronic piano tuners, FM discriminators and other devices with frequencies in the audio range. About $10. H. B. Engineering Corp., 1101 Ripley St., Silver Spring, Md. 20910.

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CIRCLE NUMBER 15 ON PAGE 11

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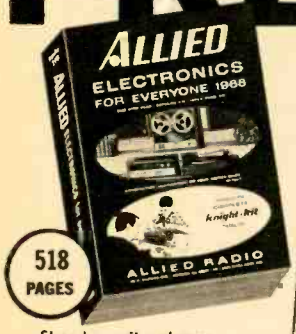

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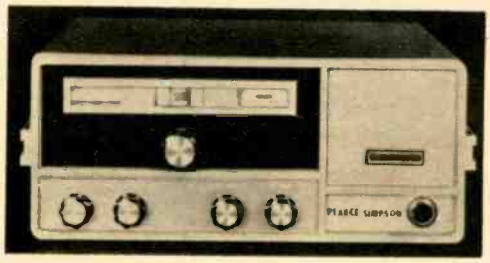
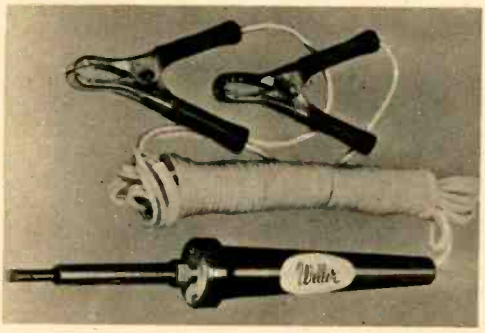
CIRCLE NUMBER 23 ON PAGE 11

Electronic Marketplace

CB Base. . . The Guardian 23B is a 23-channel Citizens Band base station that includes a built-in preamp for a high-impedance desk microphone, permitting hands-free operation and allowing the operator to move up to 1½ ft. from the mike and still retain 100 per cent modulation. Mounted on the front panel are controls for tone, squelch, RF gain and volume. (The similar Guardian 23 without the preamp is still available, as well.) The high-impedance mike is optional. $296.90. Pearce-Simpson, Inc., Box 800, Biscayne Annex, Miami, Fla. 33152.



Hot Rod. . . You say your mobile rig conked out when you were miles from anywhere and you would have given up your four-on-the-floor for five minutes with a soldering iron? Maybe, next time, you'll be better prepared. The TCP-12 is a 12-V (AC/DC) soldering iron with a 12-ft. power cord ending in battery clips. (A similar model, TCP-24, is for 24-V use.) Current drain is rated less than 3 A; with the standard tip, temperature is rated at 700°F. The iron will accept any tips in the manufacturer's PT series for TCP-1 soldering pencils. $10.95 (12-V or 24-V). Weller Electric Corp., 100 Wellco Rd., Easton, Pa. 18042.



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Broadsides

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

TAPE and phono accessories are described in Catalog 6706. Included are editing aids, telephone pickups, recording tape, bulk erasers, record-care items, measurement devices for stylus and turntable and accessories for VTRs. For a free copy write Consumer Products Div., Robins Industries Corp., 15-58 127th St., Flushing, N.Y. 11356.

A wide variety of special-purpose **instrumentation gear** is listed in a catalog that encompasses relays and stepping switches, timers and counters, gyros and transducers of various types, motors, power supplies and what have you. Write for Catalog 8-67A, free from American Relays, Electronics Div., 39 Lispenard St., New York, N.Y. 10013.

Stereo components, including a stereo FM receiver, speakers and speaker systems, crossover networks and bass energizer are described in brochure AL-1368. A copy is free from Altec Lansing Div., LTV Ling Altec, Inc., 1515 S. Manchester Ave., Anaheim, Calif. 92803.

Semiconductor **heat sinks and thermal devices** are described in Distributor Catalog 1967. Included are insulating wafers, mounting hardware and thermal-joint compounds. A free copy is available to consumers who write to Wakefield Engineering, Inc., Wakefield, Mass. 01880.

A catalog describing a variety of **design calculators** lists, among others, disc computers for solving RF-circuit problems, a manual containing hundreds of electronic formulas, a voltage-drop calculator, slide rules and metric conversion tables. For a free copy write to Tad Products Corp., Dept. 501, 639 Massachusetts Ave., Cambridge, Mass. 02139.

Electronic **wire and cable**—everything from hookup wire to 82-conductor TV camera coax—is listed and illustrated in Catalog 867. In addition you'll find AC extensions, home-appliance cords and accessories. A free copy is available by writing Belden Corp., Box 5070A, Chicago, Ill. 60680.

The Wireformer is a tool for shaping and cutting wire—coat hangers, 5/32" dia. cold-rolled rod, ⅛" piano type or spring steel—in **making racks and hangers** to be used in pegboard wall storage. It is illustrated in a new flyer, free from Vinkemulder Mfg. Co., 917 Princeton Blvd., Grand Rapids, Mich. 49506.

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CIRCLE NUMBER 4 ON PAGE 11

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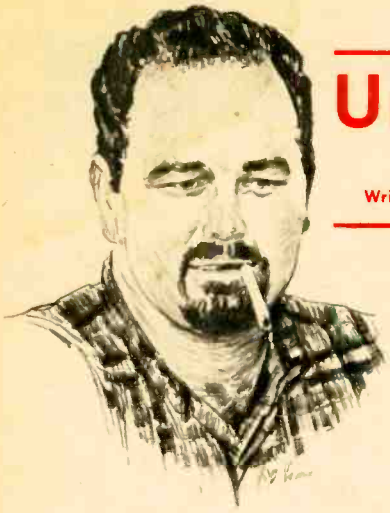

Uncle Tom's Corner

By Tom Kneitel, K2AES/KQD4552

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

★ *After working well for a while, my transistor radio suddenly began to squeal. If I tap the set the squeal sometimes stops. I bought another (different brand) but the same problem is starting. What gives?*

A3C Robert P. Mark
Kessler AFB, Miss.

Probably a solder connection is making intermittent contact or there's a crack in the circuit-board foil. Open the set and lightly tap and poke all of the connections on the board with the eraser end of a pencil (with the set turned on, of course). This should give you the trouble spot in quick order.

Fidelity Dept. It seems to me that our space-program folks might give a listen to some of the voice tapes from our astronauts. Shades of Rudy Vallee's megaphone! Are we sending up men or robots? Nobody expects Ol' Nipper to be sitting at Cape Kennedy listening for his master's voice but a better modulator might somehow be worked into interstellar transmitters.

★ *I've been making a survey, asking people if they believe in flying saucers and people on other planets. Among those asked were lawyers, policemen, school teachers, former NASA employees and scientists. Most believed in flying saucers and people on other planets. And most of those who believed had a high education! That proves you are pretty dumb. So how did you get to be a writer in a great magazine like EI?*

Dennis Runyans
Ashville, Ala.

The people at EI aren't so bright, either.

★ *I have a military-surplus BC-653A transmitter. If you are familiar with the set you know about its massive size. Well I dragged it down into my basement only to discover that the dynamotor was missing. With the dynamotor the set operates on 12 V. How can I get the set working without it?*

Dave Lawson, KOD6334
Searingtown, N.Y.

Putting out between 11 and 23 watts on voice on 2-4.5 mc, the BC-653A is 400 lbs. of nothing. Actually, it works pretty well but it takes the patience of Job to sort out the millions of tuning units. My suggestion is to eat some Wheaties, haul it back upstairs and peddle it to someone who needs a boat anchor. Besides, with a CB license what do you need a 2-mc rig for?

★ *I purchased a well-known CB rig recently and when I got it home I found that it didn't transmit. Taking it back to the dealer, I got a replacement rig that had a faulty relay. Returning that set directly to the manufacturer, they sent me a set that doesn't even light up. Things like this are the story of my life. What I can't understand is—why* me?

Phil Ottoman
Louisville, Ky.

Why *not* you?

★ *Okay, Mr. Genius-On-Undercover-Radio-Stations, let's see you come up with anything on a real mystery station that calls itself Seville Geenis on about 10800 kc. All efforts to pin this one down have proven fruitless. Many DXers report hearing it.*

Gerald Bender
Altoona, Pa.

Although your data on the station is sort of sketchy, I think you're hearing Civil Genius which operates on 10720 kc. This station is operated by the U.S. Army Strategic Communications Command (STRATCOM) and uses an AN/TSC-19 transmitter which can run 10 kw into rhombic antennas, although they also use a sloping-vee and a log-periodic type. Shake them

[*Continued on page 22*]

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Military specialties range from Helicopter Pilot to Microwave Radio Technician. There are over 300 courses of training you can choose from in the Army. And, if you qualify, your choice is guaranteed before you enlist.

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EJ 3-68

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CIRCLE NUMBER 11 ON PAGE 11

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CIRCLE NUMBER 17 ON PAGE 11

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It's the "MUST" screwdriver — the first tool you reach for when you're doing a job.
WedgeAction POWER grips the screw rigidly inside the screw slot. Lets you concentrate on starting and driving the screw without fumbling.
A precision hand tool of finest quality steel and plastic you'll be proud to own or give.

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The original "Wedge-Type" screwdriver

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CIRCLE NUMBER 5 ON PAGE 11

up by sending a reception report to 11th Signal Group (STRATCOM), Fort Huachuca, Ariz. 85613.

★ *After following your column lo these many years I now realize that you really have nothing much to say. The few causes you've pushed are ones you've led up blind alleys and clubbed to death. Who writes your comedy material?*

Rich Divitt
San Francisco, Calif.

You.

★ *Is it unlawful to buy and use extension telephone at home? I see that they are available from many sources. The ads claim you can "enjoy an extra phone without increasing your phone bill."*

Frank X. Brien
New York, N.Y.

The ads are truthful but they also should say that you can do this only until caught. In most states the phone companies will not only charge you for the extra phone but will bill you retroactively to the time they estimate the phone was added to their lines. Play it safe by disconnecting the bell inside the phone.

★ *I put a four-track stereo tape system in my 1955 Plymouth, adding the necessary adaptor to change the 6 V to 12 V. Trouble is that I now get a high-pitched whine from the speakers whenever the set is on, even with the volume control cut all of the way. I've tried shorting the ground wire but that didn't help.*

Dave McDonald
Inglewood, Calif.

It looks as though oscillations from the transistors in your power converter are leaking through. About the only thing you can do is ask the manufacturer of the power adaptor to suggest the proper filtering components for your particular model.

Riot Dept. Here's a little note to the FCC. It's about the riots that are becoming such a familiar aspect of our streets. Wonder if you know that many CBers in and near the areas of conflict report hearing a rather well-coordinated communications network operating on 27 mc, complete with dispatchers giving the rioters orders for "spontaneous" outbreaks? A few FCC mobile units equipped

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with direction-finding equipment and some brave engineers might work wonders if they could take time out from nailing dangerous CB hobbyists.

★ *Every night at around 5150 kc I pick up a woman on a tape saying, "This is the American Telephone and Telegraph Company," over and over again. What is this?*

David Kaye,
Jersey City, N.J.

Sounds like AT&T.

★ *I have a 1938-vintage National receiver that covers 14 to 640 kc in six bands. Can this long-wave receiver be converted for short-wave reception?*

W. N. Weaver
Charlotte, N.C.

By using it as variable IF in conjunction with a regular short-wave receiver you'll have a lash-up known to most hams as a Q-5er. It will give you excellent selectivity but poor image rejection above about 10 mc.

★ *I have just bought a Patrolman radio from Radio Shack and an AC converter for it. With the converter plugged in I can hear the time signal of WWV in four places on the regular broadcast band. What gives?*

Alan Traganza
Citrus Heights, Calif.

I just built a short-wave radio kit. It seems to work fine but can't hear WWV on it. Can you suggest how I might get this station?

Joe Stroud
Huntsville, Ala.

You want the time, Joe? Call Alan.

★ *We have a problem in our neighborhood. It concerns electrical interference. The scratchy-sounding interference covers all radio stations (from broadcast frequencies right through short-wave and CB channels) and causes snowy lines on the TV picture. Can you suggest how to end this?*

Al Lipinski,
Des Plaines, Ill.

Why not request your power company to send an investigator to check it out? It may be that one of their transformers is at fault. If that fails, contact the FCC office in Chicago and explain your problem. They probably will be able to track down the source of the noise and put an end to it.

[*Continued on page 27*]

Introducing the world's first 5-channel, solid state, Citizens Band Radio with a Class B push-pull audio amplifier, super-sensitive receiver, and full-powered transmitter, that comes with either palm microphone or telephone handset at no extra cost: The Sentry II, by Pearce-Simpson.
Total weight, 3 pounds. Total price, $99.90.

At $99.90 Pearce-Simpson introduces a remarkable new CB Radio.

How remarkable? This remarkable:

It features no close range blocking.

A greatly improved noise limiting circuit which virtually eliminates ignition and alternator noise.

Its specifications include 4-watt power output, 0.5 uv to open squelch, adjacent channel 50db down, cross modulation 80 db down and electronic switching.

And it carries a full one year warranty. Conclusion:

Nobody can make a better radio for $99.90. Not even Pearce-Simpson.

And at $139.90, Pearce-Simpson introduces the brand new Companion IV, featuring 10 channels solid state, plus P.A.

Plus: Both front and bottom speakers. An innovation which guarantees unobstructed, distortion-free sound no matter where the radio is mounted.

Touch-tap tuning. Which allows you to change channels just like that. No close range blocking.

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The Sentry II

At $139.90 you'd probably call The Sentry II a bargain. At $99.90 there's no question about it.

How can anyone put so much radio into so little space without cutting corners? Anyone can't. Pearce-Simpson can.

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City

State Zip

Overseas military personnel may write for special military price list.

CIRCLE NUMBER 18 ON PAGE 11

www.americanradiohistory.com

"I have not yet, indeed, thought of a remedy for luxury..." BENJAMIN FRANKLIN

Original wood engraving by Bernard Brussel-Smith

"I am not sure that in a great state it is *capable of a remedy;* nor that the evil is in itself always so great as it is represented.

"Suppose we include in the definition of luxury all *unnecessary expense,* and then let us consider whether laws to prevent such expense are possible to be executed in a great country, and whether, if they could be executed, our people generally would be happier, *or even richer.*

"Is not the hope of being one day able to purchase and enjoy luxuries, a great spur to labour and industry?

"May not luxury, therefore, produce more than it consumes, if, without such a spur, people would be, as they are naturally enough inclined to be, lazy and indolent? *To this purpose I remember a circumstance.*

> "The skipper of a shallop, employed between Cape May and Philadelphia, had done us some small service, for which he refused to be paid. My wife, understanding that he had a daughter, sent her a present of a new-fashioned cap.
>
> "*Three years after,* this skipper being at my house with an old farmer of Cape May, his passenger, he mentioned the cap, and how much his daughter had been pleased with it.
>
> " 'But' (said he) 'it proved a dear cap to our congregation.'
>
> "How so?"
>
> " 'When my daughter appeared with it at meeting, it was so much admired, that all the girls resolved to get such caps from Philadelphia, and my wife and I computed that the whole could not have cost *less than a hundred pounds.*'
>
> " 'True', (said the farmer) 'but you do not tell all the story. I think the cap was nevertheless an advantage to us; for it was the first thing that put our girls upon knitting worsted mittens for sale at Philadelphia, that they might have wherewithal to buy caps and ribbons there; *and you know that the industry has continued,* and is likely to continue and increase to a much greater value, and answer better purposes.'
>
> "Upon the whole, I was more reconciled to this little piece of luxury, since not only the girls were made happier by having fine caps, but the Philadelphians by the supply of warm mittens."

"Poor Richard" put his finger on this simple key to an expanding economy over 200 years ago. So, isn't it strange to find people—well-meaning people—in this country today who still frown on the luxuries most of us work to enjoy? They want the government to restrict the broad range of products and services in the marketplace. And to cut back on advertising because it makes people want things they don't need.

Don't need? Well, of course, no little girl *needs* a bow in her hair. Yet, Mary Murphy will forever top off the apple of her eye with a ribbon. And where would the ribbon factories be without her? And the ribbon clerks?

It is just this very human desire to add the little frills to our living that has created our jobs and our prosperity . . . the ribbon factories and automobile factories and television factories . . . and the most dynamic economy in man's history. Shouldn't we be careful about how we tinker with the forces that have created all this? Because the simple, troubling truth is, nobody knows for sure how far you can regulate our economy without damaging it.

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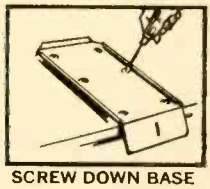
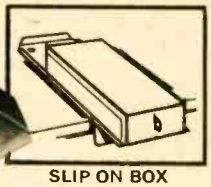


SCREW DOWN BASE



SLIP ON BOX

SWING UP BURGLAR-PROOF LATCH

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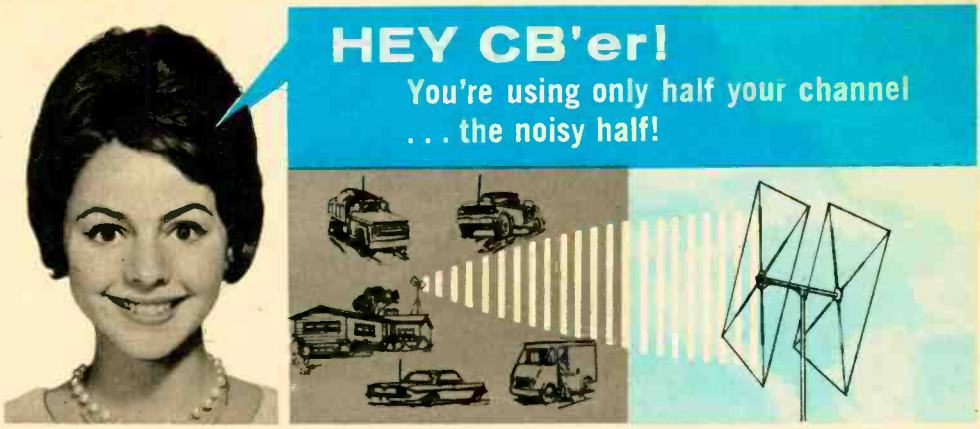

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CIRCLE NUMBER 19 ON PAGE 11

★ *You frequently go pretty far out on a limb talking about the CIA, spies, etc. I'm wondering if the CIA people are aware of your literary efforts and if they ever lean on you.*

Arthur Melon
Chicago, Ill.

The CIA is of the stiff-upper-lip school. They never confirm or deny anything. But they read and catalog every word written about the Company (as the CIA is called by its agents). I hear my stories on the CIA's Radio Americas are great favorites.

Laser Dept. Keeping up with the highly touted laser is almost impossible but here is some of the latest: Scientists have finally succeeded in sending voice modulation and photographs over laser beams. . . Medical people are alarmed that miracle-cure claims for cancer by laser may have been premature. Information now coming through indicates that in many instances the laser cure is not only temporary but even causes the cancer to spread. . . Experiments in tattoo removal by laser have been encouraging. . . Lastly, the mighty laser may have met its match in the new anti-laser shield that has been developed by Bausch & Lomb. It reflects 90 per cent of the beam, harmlessly absorbs some of the remainder. Several models are available for different wavelengths. The military will probably want to check into this device.

★ *Other than the laser (which everybody knows about) is there really any such thing as a death ray?*

B. L. Winniger
Laredo, Tex.

A while back the U.S. government was turning monkey brains into scrambled eggs by giving them a whiff of RF at 388 mc. The latest experiments in locked laboratories of the French Government are in the new field of Infrasound, sub-audio oscillations (below 10 cps). The technique can turn a man into a veritable crepe suzette at a distance of five miles. The most potent frequency seems to be around 7 cps. It causes buildings to crumble into dust and human organs to stop functioning. At low power outputs all it produces in humans is insanity. Present problem is producing a unit that will generate 10 kilowatts with a beam narrow enough that it won't sizzle the operator's brains.

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Bare-Essentials Transmitter

By JIM WHITE, W5LET

EVERYBODY talks about inflation these days. According to the experts, we're spending too much and driving the price of everything sky high. Washington now threatens us with higher taxes to stop our spree.

But for hams on a budget there's a way to have your cake and fight inflation, too. You do spend a little of the green stuff but it won't make much of a dent in your wallet or the national economy. The way out: our Bare-Essentials Transmitter. This little 40- and 80-meter rig takes the prize as *the* anti-inflationary CW transmitter of the year. You spend only $7 to get it on the air.

There's no chassis. The rig is built on a piece of wood—any kind, like the end of an orange crate, will do. And for tie points you use finishing nails. The 50C5 (or a 50L6) tube can be salvaged from an old AC/DC radio. You'll have to spend 11¢ for a tube socket but you won't have to buy a socket for the crystal. It's not fancy but it packs a wallop for its price.

Used with a mediocre antenna, it has worked stations all over the U.S. When conditions are right and with a good antenna there is no reason why it can't work some real DX.

The Circuit. The transmitter consist of a 50C5 crystal oscillator, which operates on either 40 or 80 meters. Since the 50C5 has a 50-V filament it uses a 400-ohm 20-watt dropping resistor instead of a filament transformer.

The power supply for the plate and screen voltages is a doubler which provides about 350 VDC. Two capacitors, two silicon rectifiers and a 1-watt resistor complete the power supply.

Building The Transmitter. First thing is the chassis, which is simply a 10 x 6 x ¾-in.-thick piece of wood. Take a close look at the pictorial

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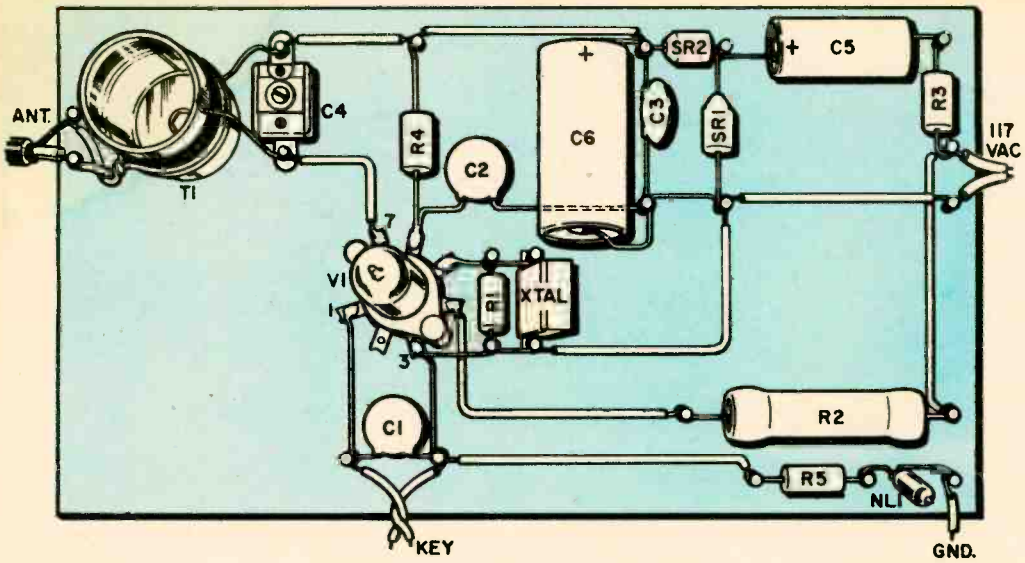


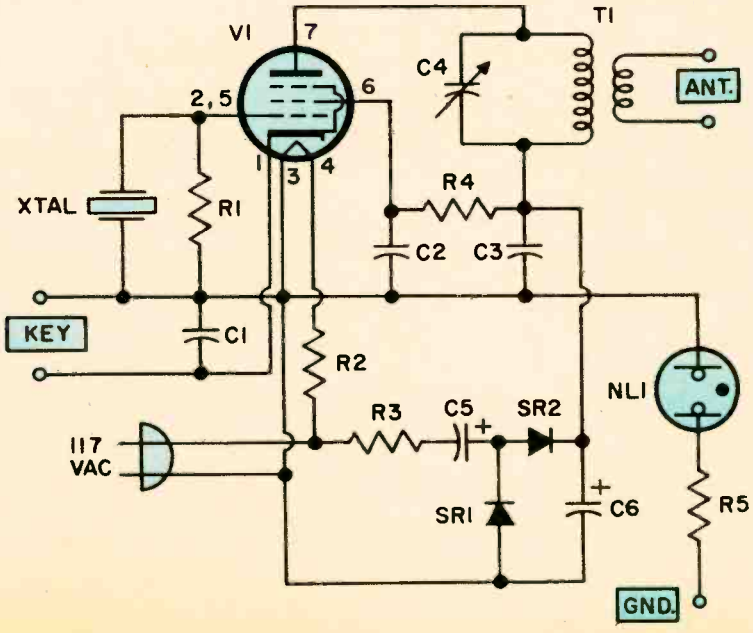
Our model, built on 6 x 10 x ¾-in.-thick piece of pine, has 23 finishing-nail tie points. V1's socket sits on ⅜-in. spacers; carpet tacks hold it in place. Contacts from discarded tube socket hold crystal.

Bare-Essentials Transmitter

to see where each part goes. The tube socket is mounted on short spacers so that its lugs clear the wood.

The rest of the parts are soldered to finishing nails in the board. The power-supply components are located in the upper right corner of the board. There is no power switch so the AC leads go directly to the nails.

Nails again are used for connecting points for the antenna and for the key. Another nail, located at the lower right of the board is for a ground connection for neon lamp NL1. If the AC plug is in the wrong way, the hot side of the line will be connected to the key. This will mean that 117 V exists from the key to ground, enough to cause a severe shock. However, if the plug is reversed, the ground side of the AC line will be connected to the key circuit and a shock hazard will not exist.



Transmitter schematic. Power supply is a voltage doubler whose output is about 350 V. Output circuit is inductive-link type. Purpose of NL1 is to warn you if AC plug is inserted incorrectly. Be sure to connect R5 to water-pipe ground. If NL1 lights, reverse the plug.

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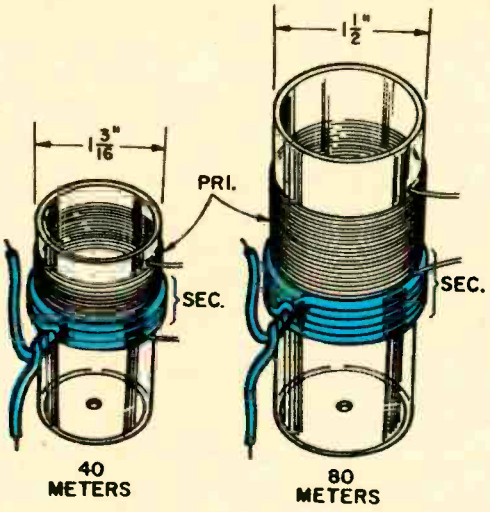


Coils. Our 40-meter coil was wound on 1 3/16-in.-dia. plastic pill bottle; however, 1¼ in. would do. Primary is ½-in. wide; 80-meter primary is 1⅛ in.

PARTS LIST

C1,C3—.005 μf, 1,000 V ceramic disc capacitor
C2—.01 μf, 1,000 V ceramic disc capacitor
C4—2-30 μμf trimmer capacitor
C5—40 μf, 150 V electrolytic capacitor
C6—40 μf, 450 V electrolytic capacitor
NL1—NE-2 neon lamp
R1,R5—100,000 ohm, ½ watt, 10% resistor
R2—400 ohm, 20 watt wirewound resistor
R3—10 ohm, 1 watt, 10% resistor
R4—10,000 ohm, 1 watt, 10% resistor
SR1,SR2—Silicon rectifier, 400 PIV, 750 ma
T1—Transformer; 40- and 80-meter primaries wound of No. 24 enameled wire; secondaries wound of No. 20 solid hookup wire (see text)
V1—50C5 tube
Xtal.—40- or 80-meter crystal
Misc.—plastic pill bottles (see text), 10 x 6 x ¾-in.-thick piece of wood, finishing nails, 7-pin tube socket, AC cord

By connecting a water-pipe ground to the nail, the neon lamp will light if the AC plug is in the wrong way. Observe carefully the polarity of the silicon rectifiers and the electrolytics.

The coils are wound on plastic pill bottles. The 80-meter coil is wound on a 1½-in.-dia. x 3½-in.-long bottle. The 40-meter coil is wound on a 1 3/16- or 1¼-in.-dia. x 2-in.-long bottle. First drill a small hole in the bottom of each of the bottles for the mounting screw.

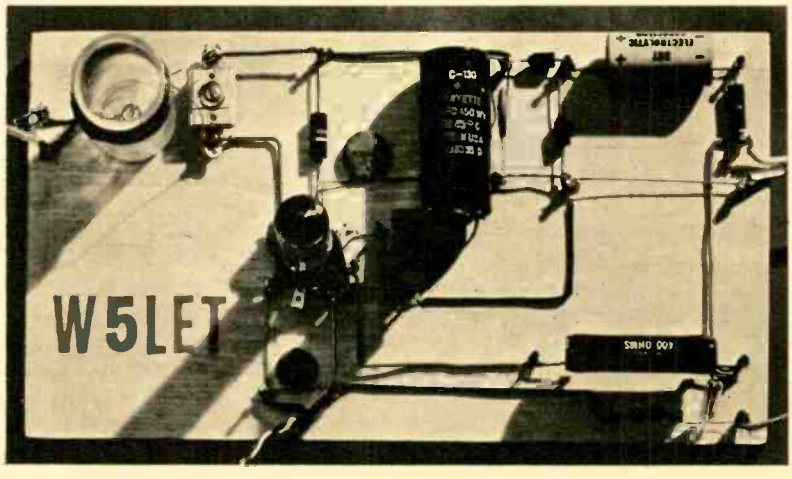
The plate winding (primary) for the 80-meter coil is 45 turns of No. 24 enameled wire, closewound. The 40-meter primary is 23 turns of No. 24 enameled wire also closewound. Both secondaries are No. 20 solid hookup wire: the 80 meter is four turns, the 40 meter three turns.

Before winding the primaries drill four small holes (two at the top and two at the bottom of the primary winding) in each form. Then thread the ends of the primary wire through these holes.

The secondaries are wound over the primary coils and are held in place by twisting the ends together as shown in the coil pictorial.

On The Air: After mounting a coil mount

[*Continued on page* 109]



Ready to go on the air. Layout is wide open; there should be no construction problems. Power supply is in upper right corner, neon lamp and current-limiting resistor R5 are in lower-right corner. Lugs of trimmer capacitor C4 are soldered to heads of finishing nails. T1 (upper left) is screwed to board.

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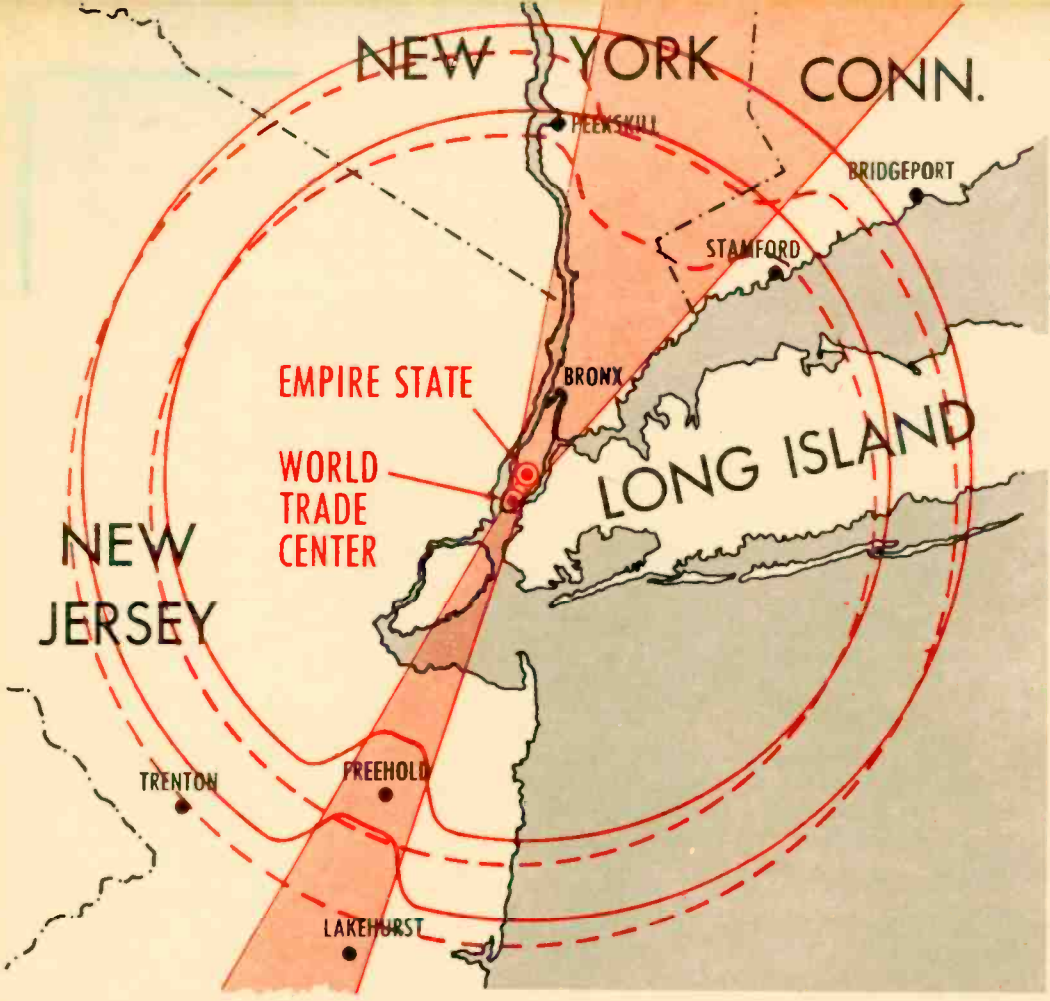

NEW YORK's TV-TOWER CRISIS

AT first it was only a murmur, lost in the din. A few brief references in the trade press pointed out that if New York's World Trade Center, a pair of towers proposed by the Port of New York Authority to outdo the Empire State Building as the world's tallest, was to be built as planned it was sure to alter the area's TV and FM reception. But nobody seemed to be listening.

The Port Authority was in trouble with its project in all quarters. Merchants whose shops faced condemnation were up in arms. The city wanted colossal fiscal concessions. A powerful real estate group claimed unfair competition from the non-profit Port Authority. Critics of architecture complained that the monstrous design would deface the city. And rival authorities jealously accused the Port Authority of exceeding its lega limitations. Perhaps the WTC might never b built.

One by one the obstacles were overcome, however. And suddenly, last spring, the murmur became a roar. Proclaiming the Right to Watch, a group of 24 congressmen from both parties and three states, backed by two FCC commissioners, began delving into problems from ghosting to signal loss that might be expected once the 1,350-ft. monster reaches above the Empire State's antenna farm (see No Room at the Top, July '67 EI).

TV reception in New York is tricky, anyway. Tall buildings absorb or reflect signals, causing dead spots or ghosts or both and making picture quality in some areas within a few miles of the transmitters less satis-

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factory than that in most suburbs.

Our map shows the changes that are expected when the WTC is built. The solid circles represent signal-strength contours for signals originating at the Empire State—the outer circle for Grade A signals, the inner one for City Grade. The dashed circles represent signals from the WTC.

From the Empire State Building, the WTC would cast a propagation shadow extending down through Freehold and Lakehurst in southern New Jersey. From the WTC, the whole midtown Manhattan skyline would cast a much wider shadow up over the populous areas of upper Manhattan, the Bronx, Westchester County and beyond. These same areas (represented by the color shading) could also be expected to suffer from multipath distortion—ghosts in TV. Multipath, while less predictable than loss of signal strength, could be expected to cover even larger areas.

The most severe multipath problem is expected where signals originating at the Empire State Building bounce off the WTC, whose height and surface area would feed strong reflections into receiving antennas along with the original signal. Relocating the transmitters atop the WTC would solve this problem but aggravate the shadow problem and create snow on a great many more TV screens.

Engineers began investigating a number of possible solutions. Coating the WTC towers with signal-absorptive materials was rejected as experimental and too expensive. The towers could not be turned on their site to minimize multipath because of the subway tracks beneath. Also considered impractical was a plan to slope the upper floors at an angle of 6° to deflect their spurious signals upward.

Broadcast engineer Frank G. Kear suggested that the WTC towers be limited to 900 ft. The Port Authority countered with the suggestion that the stations now transmitting from the Empire State take a trip downtown as soon as the WTC was completed. It would provide its modern facilities free until the stations' leases ran out at the Empire State. And transmitters could be located closer to the antennas in new, air-conditioned quarters.

To the broadcasters, it sounded like paradise. But not to Congressman James H. Scheuer of the Bronx nor to engineer Kear.

[*Continued on page* 108]

Anticipated multipath caused by WTC reflection of signals from Empire State Building may alter ideal picture quality (top) this much in most-affected areas—a wedge extending up Park Avenue, through the Bronx and out past suburbs like White Plains. Ghosting would be less extreme elsewhere.

Placed within a propagation shadow, areas now getting good reception (immediately below) could expect only fair reception; fair reception would become poor (bottom). Pictures demonstrate the type of distortion caused by loss of signal strength. Actual drop in quality will not be this extreme.

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CIRCLE NUMBER 3 ON PAGE 11

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Kit TO-68, 80 lbs. . . . $35 dn., $30 mo. **$349.95**

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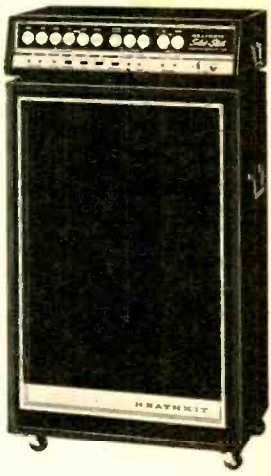
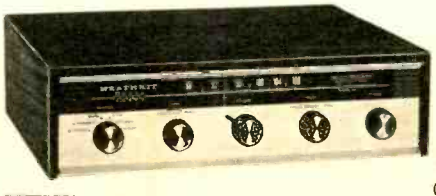


All the "big sound" features every combo wants . . . tremolo, built-in "fuzz", brightness, reverb, separate bass and treble boost and more. Delivers a shattering 120 watts EIA music power (240 watts peak power) through two TA-17-1 speakers . . . or 90 watts through one TA-17-1 speaker. Features 3 independent input channels, each with two inputs. Handles lead or bass guitars, combo organ, accordion, singer's mike, or even a record changer. All front panel controls keep you in full command of all the action.

Speaker system features two 12" woofers, special horn driver and matching black vinyl-covered wood cabinet with casters & handles for easy mobility.



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The Glidophone, a Really Out-of-Sight EMI

By FRED B. MAYNARD

THE balmy beaches of Hawaii and the soft sound of guitar music. What better dreams could one have on cold winter nights. Now there's something very different about the sound of that Hawaiian guitar. Have you ever noticed it? It's a gliding or slurring sound produced in going from one note to another. The player plucks the string with the slider bar at a position a little higher or lower than the note he wants. He then slides or glides into the correct note.

Thanks to electronics, it isn't necessary to even have a guitar to produce this sound. The Glidophone will do it. This EMI (electronic musical instrument) will make people sit up and take notice of you.

Although the circuit is a fairly simple four-transistor configuration, it produces some sophisticated musical effects such as vibrato, sustain and controlled gliding.

How it Works. Transistors Q1 and Q2 form a tone oscillator which is resistance tuned, has about a two-octave range and can be easily frequency modulated (vibrato). The modulating signal is generated by a second R-C oscillator, Q3. This oscillator produces a 6-cps sine-wave signal. This signal, fed to the base of transistor Q2, causes the oscillator (Q1, Q2) frequency to vary at the rate of 6 cps. This imparts musical liveness to the otherwise dead, dull sound of the tone oscillator.

The signal from the tone oscillator (Q1, Q2) is fed to sustain gate Q4 through R11; the output is taken from Q4's collector. Con-

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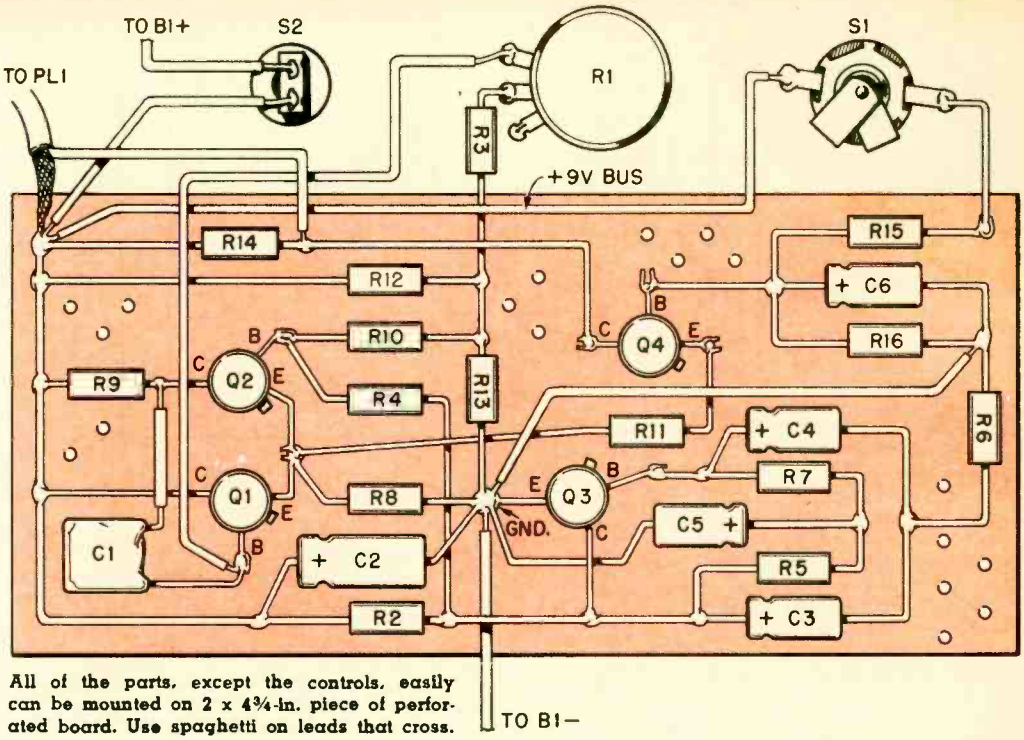


All of the parts, except the controls, easily can be mounted on 2 x 4¾-in. piece of perforated board. Use spaghetti on leads that cross.

nected to the base of Q4 is a charge-storage capacitor (C6) and discharge resistor R16.

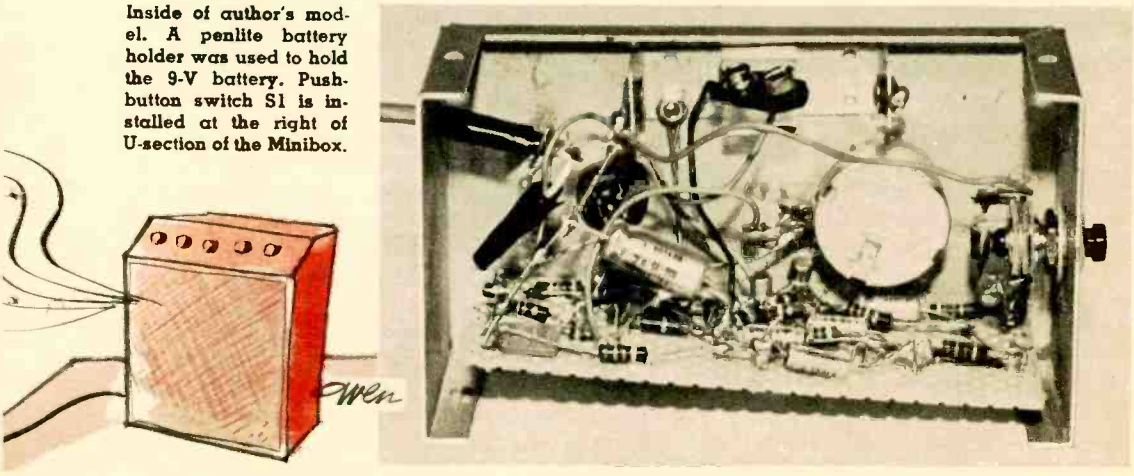
Q4 is normally cut off and does not allow a signal to get from its emitter to collector. When S1 is closed, C6 rapidly charges, opens the gate and lets the signal through. When S1 is opened the charge tends to hold the gate open, but the charge leaks off to ground through R16. The gate gradually closes and the tone decreases in intensity.

You play the Glidophone with S1 and R1. Potentiometer R1 tunes the tone oscillator over a range of about two octaves. There are, of course, precise settings of R1 which correspond to specific musical notes in this range. These positions can be marked on a dial under R1's knob.

The Glidophone has its own 9-V battery and has a cable for patching into a PA amplifier or musical-instrument amplifier.

Construction. The circuitry, exclusive of R1, S1 and S2 was built on a 2 x 4¾-in. piece of perforated circuit board. It can only be this small, however, if you use miniature electrolytic capacitors, such as Sprague Type TE *Littl-Lytic*, for C2 through C6. A 5¼ x

Inside of author's model. A penlite battery holder was used to hold the 9-V battery. Push-button switch S1 is installed at the right of U-section of the Minibox.



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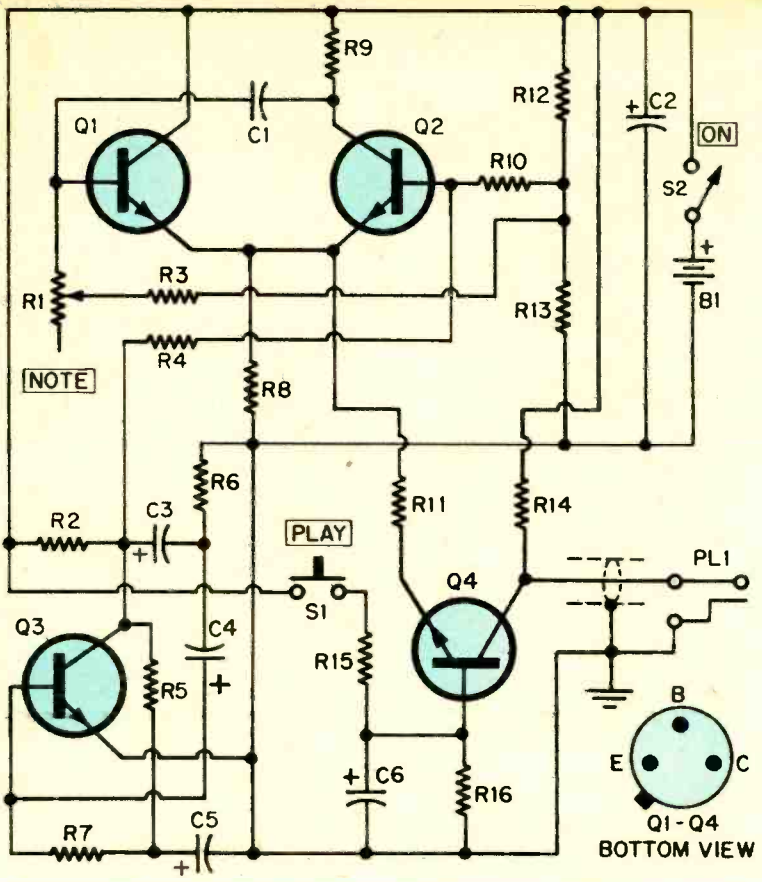
The Glidophone



Glidophone schematic. Transistors Q1 and Q2 comprise tone oscillator. Q3 is vibrato oscillator; its output is fed to base of Q2 where it frequency-modulates tone. Signal is then fed via R11 to emitter of sustain gate Q4. When S1 is pressed, voltage applied to Q4's base opens gate and permits signal to pass to output plug PL1. When S1 is released, charge on C6 keeps gate open. Output dies away slowly as charge on capacitor C6 is dissipated through R16.

PARTS LIST

B1—9 V battery
C1—.05 μf, 75 V or higher ceramic disc capacitor
C2—100 μf, 15 V electrolytic capacitor
C3,C4—1 μf, 50 V electrolytic capacitor
C5—2 μf, 25 V electrolytic capacitor
C6—5 μf, 25 V electrolytic capacitor
PL1—Phono plug
Q1-Q4—HEP-50 transistor (Motorola)
Resistors: ½ watt, 10% unless otherwise indicated
R1—20,000 ohm, linear-taper potentiometer
R2—6,800 ohms
R3—1,500 ohms
R4,R16—220,000 ohms
R5,R7—47,000 ohms
R6—1,800 ohms
R8—1,200 ohms
R9,R10—2,200 ohms
R11—100,000 ohms
R12,R13—3,300 ohms
R14—10,000 ohms
R15—4,700 ohms
S1—Normally-open push-button switch
S2—SPST toggle or slide switch
Misc.—5¼ x 3 x 2⅛-in. Minibox, shielded cable, perforated board, flea clips, battery holder

3 x 2⅛-in. Minibox was used to house the Glidophone. Everything is mounted in the main section of the box.

Modifications. The sustain time depends on the resistance of R16; with the value shown the time should be about 1½ to 2 seconds. A 500,000-ohm pot could be substituted for R16 to permit changes.

Resistor R4 controls the vibrato depth. A 500,000-ohm pot at this point would make the depth variable. Resistor R6 controls the vibrato speed which is now about 6 cps. A 2,500-ohm pot would allow adjustment.

Playing The Glidophone. The lowest note on our model is F below Middle C. The pot's dial can be calibrated in the corresponding notes, C, D, E, etc., by tuning up with a piano or other instrument.

The Glidophone should be played by grasping the box from the back with your left-hand thumb and last three fingers. Curl your index finger up over the top to push S1. In this way you can turn the pot to any position easily. You will have to depend on your ear, like a singer or whistler does, to play exactly in tune.

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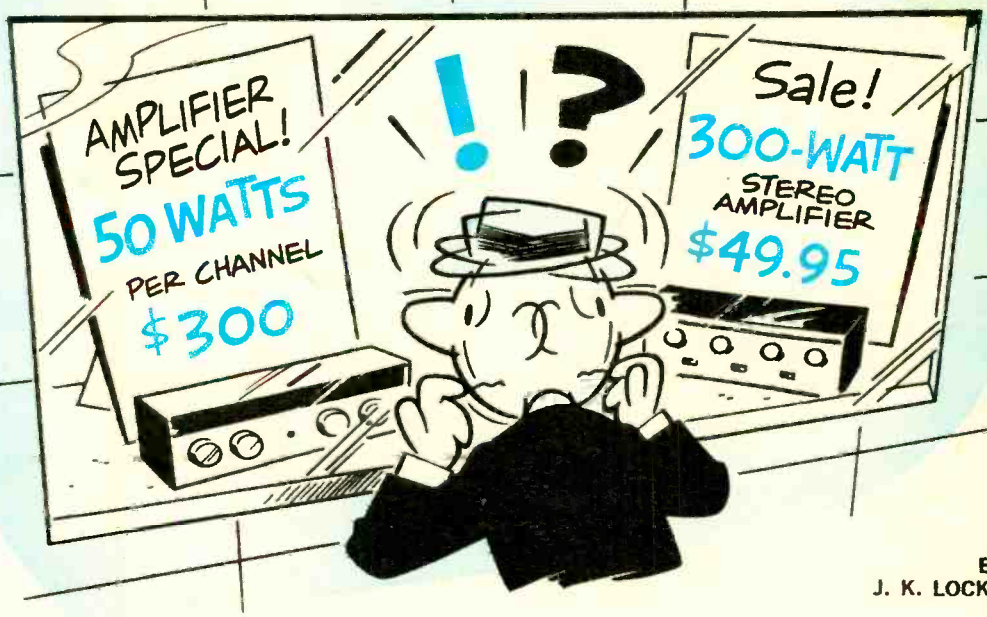
HOW TO COPE WITH THE POWER HOAX



By
J. K. LOCKE

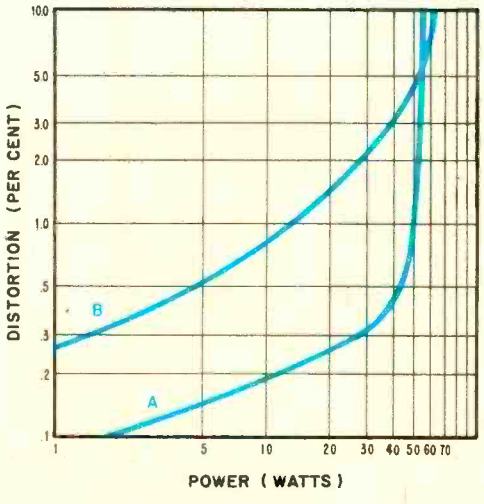


Fig. 1—Two amplifiers with different power curves can carry identical ratings. Curve A would represent a 50-watt amplifier measured at 1% THD under the IHF standard. Curve B might be typical of an amplifier rated at 50 watts by EIA standards (at 5% THD). Amplifier A is designed to keep distortion low all the way up to rated output while B sacrifices quality for volume. Rated under the IHF standard at 1% THD, it would be a 13-watt rig.

TIME was, when somebody said a watt he meant a watt—a 746th of a horsepower, 1 joule per second; 6,280,000,000,000,000,000 electrons being hustled along by 1 volt, 44.23 ft.-lbs. of work, 1 A of current flowing through 1 ohm of resistance.

But no more. Today a watt means a—well, it means almost anything you want it to mean. For instance . . .

A few days ago I was stopped by a sign propped atop a coffin-size mahogany box in a store window. From the knobs and the grill cloth I gathered that it was what they unblushingly call a stereo.

MAGNIFICENT SOUND!

shrieked the sign in second-coming letters.

BREATHTAKING 360 WATTS OF STEREO REALISM!

Wow! I thought. That ought to be enough to loosen Aunt Maude's girdle. I went inside and glanced at the instruction book. "EIA power, 180 watts," it said on the last page in a size of type usually reserved for the exclusions in an insurance policy.

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HOW TO COPE WITH THE POWER HOAX

Since 180 is half of 360 the figure on the sign obviously referred to *peak* power. Any audio amplifier cranks out AC. And when an electrical engineer talks about AC power he is talking of *effective* power—the *average* power developed as the AC swings from positive to negative and back. Peak power simply refers to the power figured on the instantaneous peaks in that AC—and has nothing to do with *peak-handling* or *music* power.

Peak power, as it works out, is exactly twice as high as effective power. But it doesn't mean anything. A 50-watt signal, for example, by definition has 100-watt peaks. But to call it 100 watts or imply that the amplifier, because it hits 100-watt peaks, is a 100-watt amplifier is a deliberate attempt to make the customer think he's getting something he's not.

Okay. What we *really* have is a 180-watt amplifier, right?

Wrong. Mumbling that little incantation about EIA (Electronic Industries Association) covers a bundle of tricks.

Now we're talking about music power. This is where the amplifier's ability to handle short bursts of power comes in. When an amplifier suddenly is driven hard its power supply flags after a half-second or so. You could get a higher reading if you could make power measurements before it has had a chance to drop to a steady level. Since

JUST WHAT IS A HI-FI WATT?

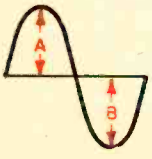
The wattage rating of an amplifier can be cited in many ways: steady-state (or sine-wave) power, peak sine-wave, average music (or program) power and peak music power. And music power ratings can be measured under either the IHF or the EIA systems, giving quite different results. One amplifier, in other words, can carry at least six different ratings, depending on how you define your terms.

There is only one way to measure DC power. But AC is trickier. If you're quick enough theoretically you could measure voltage and current at any given instant and multiply them to get the instantaneous power. Or if you know the value of the impedance across which the power is being developed simply measure either voltage or current and apply one of the formulas:

$$P = \frac{E^2}{Z} \text{ or } P = I^2Z.$$

(For this discussion, incidentally, assume that voltage and current are in phase.) But such a figure tells little about the total amount of work being done, which is what power ratings are all about.

If you measure current or voltage as they swing through maximum values at A or B you can calculate peak power. But that doesn't square with a power measurement taken



in a DC circuit. Say you have a 5-ohm resistor with 10 VDC across it. Power dissipated in the circuit is $10^2 \div 5$ or 20 watts. But if you measured the temperature of the resistor (one way to check power being dissipated) you'd find the one in the DC circuit much hotter than the other.

One way to estimate total power consumption in the AC circuit would be to measure voltage at every instant during the cycle, add all the readings and divide by the number of measurements to get an average voltage. Then calculate power. The value arrived at by this system will work out to exactly 0.636 times peak power. But with average AC volts adjusted to the same value as a DC circuit those resistors still won't be the same temperature.

The reason can be found in those two power formulas. They show that with constant resistance, power increases in proportion to the square of the voltage or current. To find what AC voltage equals a DC voltage in terms of work done, mathematicians have devised the so-called root-mean-square (rms) method. Take voltage readings at every point across the sine-wave cycle. But instead of simply averaging them, square each reading, add these squares, average them and take the square root of the result. (Take the *root* of the *mean* of the *squares.)* This rms voltage works out to 0.707 times peak voltage (or peak voltage equals 1.414 times rms voltage). Since rms voltage or current can be used to calculate effective power (which would heat our resistor just as much as the same values in a DC circuit) standard AC voltmeters and ammeters are designed to read rms values.

Let's say we want to measure the output of the 16-ohm tap on a particular amplifier at 1 per cent distortion (THD). We feed in a 1,000-cycle tone and crank up the gain until a distortion meter across the output measures 1 per cent. Say we find the output voltage at this point to be 28.3 V (rms). The sine-wave or continuous-power output of the amplifier would then be:

$$\frac{(28.3)^2}{16} = 50 \text{ watts.}$$

Peak voltage in this case would be:

$$28.3 \times 1.414 = 40 \text{ volts}$$

and peak power:

$$\frac{(40)^2}{16} = 100 \text{ watts.}$$

If you refer again to our basic formulas you will see that power is proportionate to the square of the voltage. If you work this out for any value you will always find that peak power is just twice the effective power. So a 50-watt signal, by definition, contains 100-watt peaks.

What we've been talking about so far is steady-state

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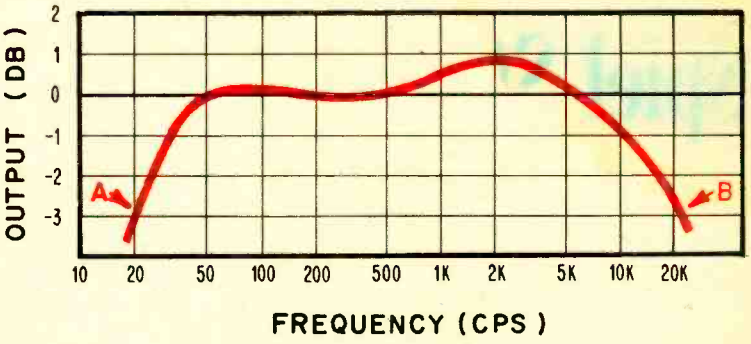


Fig. 2—Power bandwidth curve like this would result if VU meter (here reading 0 for 50 watts) measures output at constant distortion (here 1% THD) across frequency spectrum. The resulting rating would be specified as a power bandwidth of 20 to 20,000 cps (A and B, 3db down from 50 watts) at 1% THD.

meters don't respond that fast (and neither do people) another method generally is used.

The manufacturer first measures power-supply voltages with the amplifier idling. Before applying a signal he substitutes a larger power supply (delivering correct voltages with virtually unlimited current) for the one in the amplifier. Then he can drive the amplifier to maximum output. And that maximum output may be 20 per cent or more above steady-state readings. So what we're talking about in our test case is an amplifier that can crank out 180 watts by straining mightily for a fraction of a second. Its ability to produce *sustained* power typically might be found to be in the vicinity of 140 watts.

There have been lots of argument over music power. Proponents say its gives a better measure of the amplifier's ability to play music—which usually comes in spurts—than does a steady-state rating. There is some merit in this argument. In fact, the best way to tell the story about an amplifier is to give *both* music power and steady-state ratings.

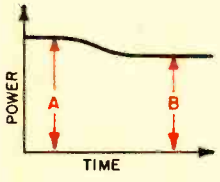
The 140-watt figure refers, of course, to both channels. Each channel alone is rated at 70 watts—still a pretty hefty amplifier. But that's not the whole story. That EIA measurement has another catch in it: power output is measured at 5 per cent distortion. Now that's enough to make music sound like a bucket of nails caught in a cement mixer. Crank the gain of that amplifier back until you're getting less than 1 per cent distortion (which many experts still would consider too high for honest high fidelity) and you'll be lucky to get 50 watts.

And manufacturers can use the 5 per cent figure to inflate their ratings in still another way. In Fig. 1 the curve marked A shows the output of an amplifier that uses lots of negative feedback so the distortion stays low all the way up to rated power. It delivers 45 watts at about 0.5 per cent distortion, 50 watts at 1 per cent. From that point on, distortion rises rapidly. It would do the manufacturer of this amplifier little good to rate the unit at 2 per cent or even 5 per cent since

[*Continued on page* 110]

power—the ability of an amplifier to produce a continuous tone at a particular level. Music power, on the other hand, has to do with its ability to handle, on a momentary basis, peaks that run higher. There's a limit to what the power supply can deliver to the rest of the circuit. As the amplifier begins to draw current, the supply voltage drops. And the more it drops the less power the amplifier can turn out.

If a high-level signal suddenly hits the amplifier, the power supply capacitors can keep the voltage up for, perhaps, something like a half-second (level A in the graph). If the signal continues beyond that the voltage begins to drop and the amplifier falls to its steady-state level (B). In the case of that hypothetical 50-watt amplifier, the



initial level may be as high as 60 watts. The amplifier, in other words, is capable of handling peaks (loud cymbal crashes, for example) requiring up to 60 watts without distorting.

But music power is measured in two ways, one specified by the Institute of High Fidelity (IHF), and other by the Electronic Industries Association (EIA). These rating systems are discussed in detail in the accompanying article. The result of their differences is that our amplifier might rate 60 watts under the IHF standard—measured at 1 per cent THD (total harmonic distortion)—and 70 watts under the EIA's—at 5 per cent THD.

So our hypothetical amplifier might carry six different ratings: 50 watts sine-wave; 60 watts IHF music power; 70 watts EIA music; 100 watts sine-wave peak power; 120 watts IHF peak music power; and 140 watts EIA peak music power. But the music, for all that, wouldn't be any louder.

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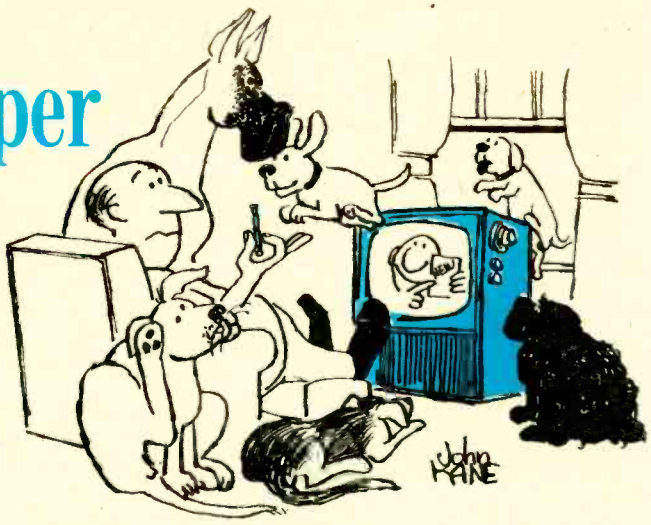
Spiel Stopper

By VICTOR KELL



Blow the whistle on TV commercials and you'll begin to enjoy the programs.

EARS still aching from that last bellowing commercial for deodorant? We're not surprised. Commercials are getting louder and louder and louder.

No need to wallow in a sea of tripe, though. Our Spiel Stopper can slap down a commercial's sound level below that of the program—you can even kill the sound entirely. Best of all, you control the sound level without leaving your seat. You just blow in an almost soundless whistle (one you use to call a dog) to change the sound level.

The Spiel Stopper contains a tuned AF amplifier which controls a stepping relay. The stepping relay determines the amount of resistance connected between the TV receiver's output transformer and the speaker. In our design, the stepping relay provides full volume, two 6db (about) steps of reduced volume, and full off. Each time you blow the dog whistle the stepping relay advances one position. If the relay was at full volume, one tweet lowers the volume slightly while three tweets shut off the sound. A fourth tweet starts the cycle over, returning the sound to the normal level. And the Spiel Stopper can be used to change the sound level of the program itself.

The design of the relay amplifier is such that under normal conditions neither persons speaking in the room nor the sound from the TV's speaker will trip the device. The amplifier is tuned to the dog-whistle's frequency, which is approximately 6 kc or higher.

Construction. Our model is built on the main section of a 5 x 7 x 3-in. Minibox. The amplifier is wired as a sub-assembly on a 4½ x 2¼ in. piece of perforated board; flea clips are used as tie points as all the components must be rigidly mounted; a loose component will cause the device to trip of its own accord. Note in Fig. 4 that Q1 through Q4 are mounted upside down so their leads hold them against the board.

With the exception of capacitors C1, C2, C9 and RY1 all components go on the underside of the board. To avoid having the underside components short to the cabinet, use only miniature components; 1/10 or ¼-watt resistors and 30 or 75-V capacitors.

Rectifier SR1 is an encapsulated four-diode full-wave bridge rectifier. The Motorola type HEP-175 will fit the spacing of the holes in the board. You may use individual diodes connected as shown within the dotted lines around SR1. Diodes should be rated at 15 PIV or higher and the current rating should be 100 ma or higher. When using the

Fig. 1—Whistle is picked up by mike under TV.

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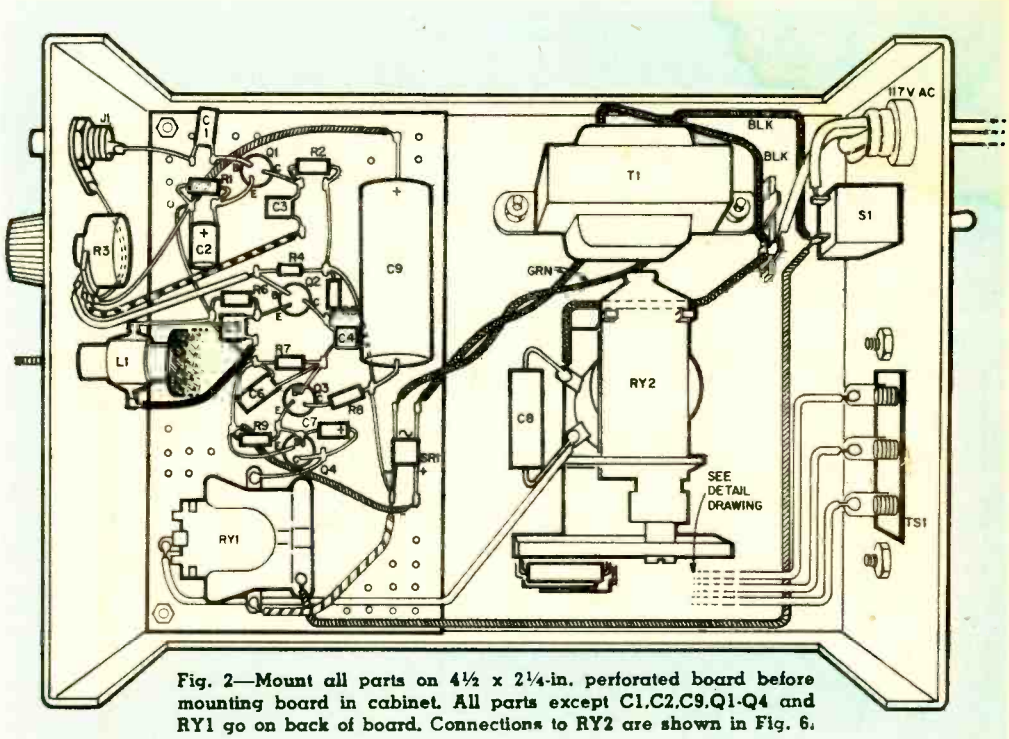

Fig. 2—Mount all parts on 4½ x 2¼-in. perforated board before mounting board in cabinet. All parts except C1,C2,C9,Q1-Q4 and RY1 go on back of board. Connections to RY2 are shown in Fig. 6.

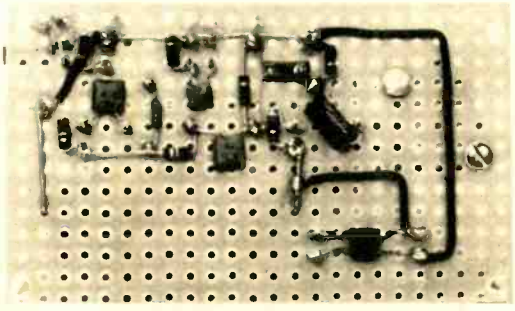

Fig. 3—Bottom of circuit board. Square component at lower right is full-wave bridge rectifier. If it's easier, mount some more parts on top side.

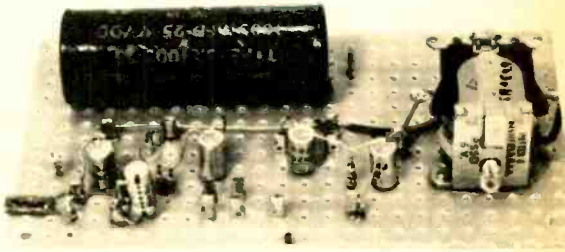

Fig. 4—Top of board. Note how transistors are mounted upside down. Only other parts on this side of our board are C1,C2,C9 and relay RY1.

bridge, the 6.3-V leads from T1 connect to the two terminals marked with a ~ symbol. The + and − terminals are so marked.

After the amplifier is completed, temporarily mount it in the bottom of the cabinet using ¼ in., or longer, spacers between the board and the cabinet at each mounting screw. Next, mark the position for input jack J1, gain control R3 and coil L1. Make certain C9 does not touch L1. Finally, mark the mounting holes for T1, stepping relay RY2, terminal strip TS1, power switch S1 and the rubber grommeted hole for the AC cord. Remove the amplifier, mount the cabinet components and then re-install the amplifier and complete the wiring except for resistors R10, R11 and R12.

Resistors R10, R11, and R12 form an attenuator pad for the TV's speaker. An exact-matching L-pad is not used as the resistors required aren't standard and are difficult to obtain. The resistors are rated at 1 watt and ½ watt and starting values are 2.7 ohms for R10, 2.2 ohms for R11, and 1.8 ohms for

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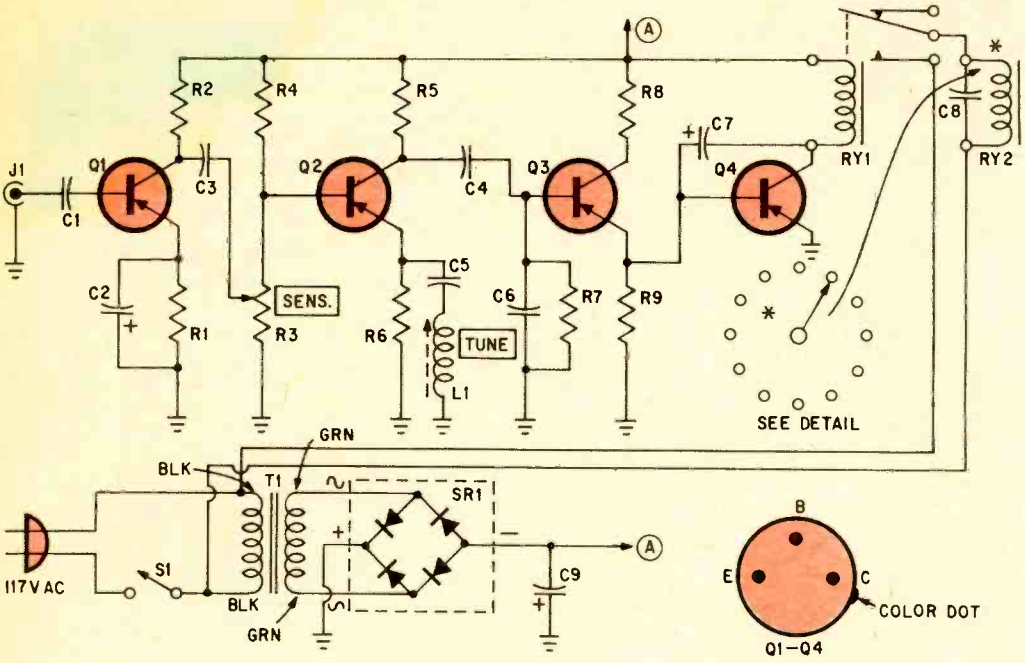

Spiel Stopper

Fig. 5—Capacitors C3,C4 attenuate frequencies below 5 kc. L1/C5 series-resonant circuit increases stage gain up to 20db. 6-kc signal from whistle is greatly amplified and actuates relays RY1,RY2.

R12. If the variation in sound level between full volume and the first lower position is too great, change R10 to 2.2 ohms. If the difference between the first and second-lower volume level is too great, change R12 to 2.2 ohms.

To avoid eight do-nothing positions on RY2 which must be switched-through, install jumpers across RY2's contacts as shown to provide two more duplicate terminal arrangements to allow continuous cycling.

The microphone must be capable of response to at least 6,000 cps. We suggest you use the unit specified in the Parts List as we are certain it will work to 6,000 cps and it is small.

Checkout and Tune-Up. The dog whistle must be tuned to the amplifier. The correct setting for the whistle we used (a Silent-Master Sonic Wave type 501, available at J. J. Newberry Stores) will generate a 6,000 cps signal with the rod approximately ¼-in. in. Releasing the collar at the base of the whistle allows the tuning rod to be screwed in and out. With the rod full out, the whistle's frequency is about 6,000 cps. With the rod full in the frequency is between 10 and 15 kc.

PARTS LIST

Capacitors: miniature disc, 30 V or higher unless otherwise indicated
C1,C5—.005 μf
C2—1 μf, 6 V electrolytic
C3,C4—.001 μf C6—.001 μf
C7—10 μf, 12 V electrolytic
C8—.05 μf, 200 V
C9—1,000 μf, 15 V electrolytic
J1—Phono jack
L1—TV width coil, 42-215 mh (J. W. Miller 6330, Lafayette 34 H 8649)
Q1,Q2,Q3,Q4—2N2613 transistor (RCA)
Resistors: 1/10 or ¼ watt unless otherwise indicated
R1,R6,R9—1,000 ohms
R2,R5—10,000 ohms
R3—5,000 ohm, miniature audio-taper potentiometer (Lafayette 32 H 7355 or equiv.)
R4—62,000 ohms
R7—6.800 ohms
R8—47 ohms
R10—2.7 ohms, 1 watt
R11—2.2 ohms R12—1.8 ohms
RY1—SPDT relay, 6 VDC, 335-ohm coil (Potter & Brumfield RS5D, Allied 41 B 5896)
RY2—12-position stepping relay (Potter & Brumfield SA-1N-12A, Lafayette 30 H 8697)
S1—SPST switch
SR1—Silicon bridge rectifier, 1 A, 50 PIV (Motorola HEP-175, Lafayette 19 H 5408)
T1—Filament transformer: 6.3 V @ 1 A
TS1—Three-screw terminal strip
Misc.—Miniature crystal microphone (Lafayette 99 H 4518), 7 x 5 x 3-in. Minibox, dog whistle (see text), perforated board, flea clips, ¼-in. spacers

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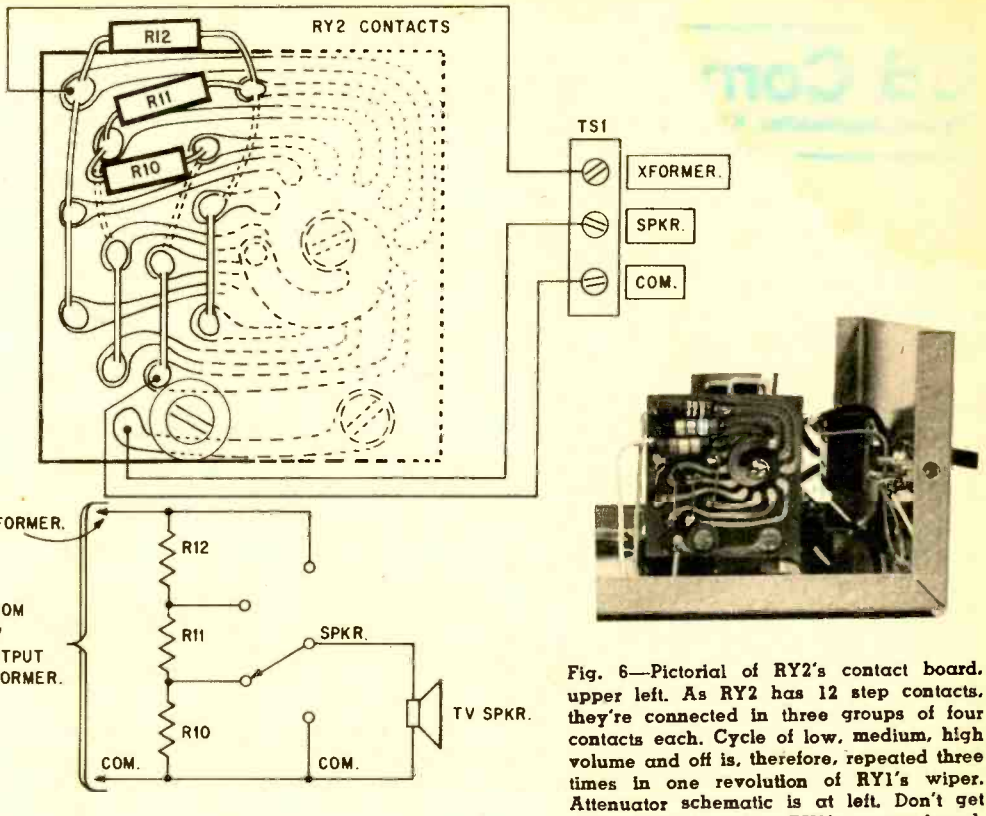

Fig. 6—Pictorial of RY2's contact board, upper left. As RY2 has 12 step contacts, they're connected in three groups of four contacts each. Cycle of low, medium, high volume and off is, therefore, repeated three times in one revolution of RY1's wiper. Attenuator schematic is at left. Don't get solder between foil on RY2's contact board.

There are two ways to tune the amplifier, the first, using an AF signal generator, is the best. Temporarily open the power supply's negative lead going from SR1 to R8 and RY1. Install a DC milliammeter capable of indicating at least 50 ma, between the negative lead and RY1 and R8. Connect the generator, set at 6,000 cps to J1, and adjust its output level to approximately 0.003 V. Then adjust L1's slug for maximum meter indication. If the meter fails to indicate an increase in current as L1 is adjusted, increase the generator's output to 0.01 V. After L1 is adjusted disconnect the generator, plug in the microphone and adjust the whistle for maximum meter indication. When tuning is completed, remove the meter.

The second tuning method requires you to adjust the whistle to what sounds like 6,000 cps (tuning rod about ¼ in. in) and then adjust L1 for maximum meter indication as you blow the whistle.

Installing the Spiel Stopper. Cement a small L-bracket to the back of the mike. Do not use solder as the heat from the iron might destroy the mike. Attach the mike to the bottom or side of the TV receiver far from the speaker. The mike should face the usual viewing area in the room.

Mount the Spiel Stopper on the back of the TV set. Connect a wire to one voice-coil lug on the speaker and connect the other end of the lead to the *com.* screw on TS1.

Unsolder the other lead to the speaker—

[*Continued on page* 109]

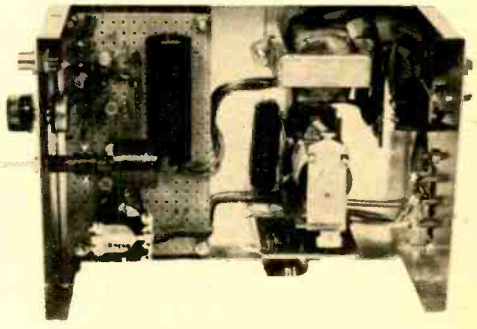

Fig. 7—Completed project. Don't try to build it in a smaller cabinet as the transformer (upper right) may end up being too close to circuit board.

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CB Corner
By Len Buckwalter, KQA5012

CB: Colossal Baby

THE U.S.A. is the world's biggest user of radio, boasts a recent government report. It points proudly to the proof: some 5 million transmitters are licensed for U.S. operation. But inside that statistic lies another superlative. By far the biggest single chunk of the 5 million is operated on the Citizens Band. About half the nations radio transmitters go to CBers.

CB's approximately 2½ million rigs dwarf the country's police radios (a piddling 220,000) and make aviation (170,000) sound like it never got off the ground. Hams fight their air battles with a quaint quarter-million sets.

The Big Two . . . With more than 90 million cars registered (as of 1966), it was only a matter of time before local automobile dealers would offer CB as an optional accessory. Ford has been doing just that since 1960. It now features several Raytheon CB models.

Raytheon is tight-lipped about how well the transceiver has moved in dealer showrooms. But since no other auto maker followed suit for a half-dozen years one could assume that sales have not been spectacular. Nevertheless, there are signs that CB is ready for a second assault on the optional auto accessory market.

First symptom is a recent statement by Raytheon. During the first three months of 1967 Raytheon sold more CB sets through Ford dealers than in any other similar period since 1960. One Raytheon official sees it as a coming boom. "We're past the point of inevitability in cars," he said. "Now it's just a matter of time."

Some weight is given to that remark by another new development. General Motors has announced that CB radio is now offered through its GMC Coach and Truck Division as an optional accessory. One rig will be a six-channel set of standard design, exclusively supplied to GM—not by its Delco division but by Lafayette Radio Electronics Corp.

What Price Power? . . . A gadget that promises to "boost the power of any transceiver" caught our eye recently. Just plug it into the wall, then plug your transceiver into the device's outlet. Touted result: an increase in power up to 25 per cent.

Our guess about the accessory was that it's nothing more than a step-up transformer that raises line voltage. So we rigged a simple experiment to satisfy our curiosity about what it might do. The setup, a tube CB rig and a Variac (for adjusting line voltage), appears in the photo.

First the line voltage was adjusted on the low side. With 110 V powering the rig, output was a feeble 3.2 watts. But at a more-normal 115 V, the transmitter reacted with a respectable 3.7 watts output. Pushing on to 120 V, the set put out a walloping 4.4 watts. True to the claim, here was nearly 25 per cent more output power. Just a few more line volts and . . .

. . . You'll be in the market for a new transceiver. Robert Tomer, an authority on the matter, says this in his book, Getting the Most Out of Vacuum Tubes: "Equipments operated at 10 per cent over the rated line voltage have been shown to experience more than 100 per cent increase in breakdowns over a given period of time." He goes on: "Tubes, when operated at 10 per cent above their rated heater voltage, will suffer up to a 50 per cent decrease in heater life."

More power to you?

Variac (right) controls voltage of incoming house current in test of effect on RF output power of CB rig (What Price Power?, opposite column).

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How to Install a Tape Player in Your Car

Tape is in with the mods since good AM music went out with the rumble seat.

By JOHN CAPOTOSTO

ONE for the road can be tragic, but eight for the road means smooth entertainment. The eight we mean is an eight-track stereo tape player in your car. Music you like when you want it. No blabbering commercials about bad breath, backache or bow legs. Install a tape player in your car and you get up to 1 hour and 20 minutes of stereo music, or 2 hours and 40 minutes of mono music.

All this comes from the latest rage—the fully automatic solid-state tape player. You select the program on the tape by merely pressing a button.

The unit we installed is a Lear-Jet Stereo-8 player whose output is 4 (rms) watts per channel. Balance, tone, volume and track-selector controls are conveniently located at front of the unit.

The $135.50 player is supplied with a mounting bracket and installation instructions. Connection cables, speaker grilles and four speakers are included. The player is also available with FM radio for $199.95. You'll see this and several other tape players listed on page 41 of Lafayette's 1968 catalog.

In four-door cars you mount a speaker in each door. In two-door cars two speakers are placed as far apart as possible in each door.

Before you start installation, look at a service manual for your car to determine the best location in the doors for the speakers. Although the speakers are quite shallow, they could interfere with the door-locking or the window mechanism. Most manuals show exploded views of the doors which clearly indicate what's behind the panel.

Installation of our system was simple and straightforward. The only time we departed from instructions was when we cut the speaker holes in the door panels. The instruction told us to use a hole saw, but we didn't own one that could make a 4½-in. dia. hole. Conventional saws will handle sizes up to 2¼ in. We used a saber saw fitted with a metal cutting blade.

First step is to locate where you want to mount the speakers in each door after check-

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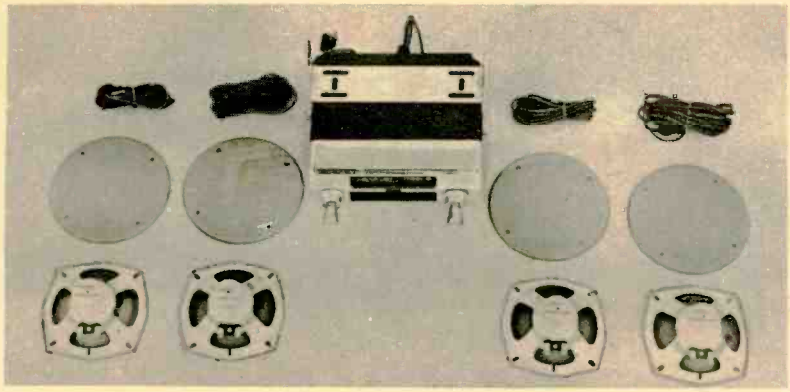

Fig. 1—A tape system in your car will consist of player (center), four speakers, grilles and connecting cables. Lear-Jet Stereo 8 shown costs $135.50. The player is also available with an FM radio costing $199.50.

How to Install a Tape Player in Your Car

ing the manual. Locate the front speakers as far forward as possible and the back as far to the rear as possible. Use a divider to scribe a circle in the door panel the same size as the speaker diameter. The material used in door panels will vary, but generally it consists of a fiber board covered with upholstery material. Use a razor blade to cut through the top layer of material then carefully peel off the material to expose the metal. If you use a saber saw to cut the hole, first make a blade-entry hole with a drill.

Locate the speaker mounting holes in the door panel by placing one of the speakers against the hole as shown in Fig. 4. Drill a ⅛-in. hole at each corner to accommodate the tinnerman nuts, then slip the nuts into place. To prevent chafing of the insulation on the speaker cables (which could ground them) use a rasp to remove burrs. Check the fit of each speaker and grille on the door. Both should go on easily and fit perfectly flat on the door.

Speaker cables must be routed from each door to the area under the dash where the player will be mounted. Some cars have holes in the door edges and frame which make it a simple matter of routing wires. In other cars the holes must be drilled.

Again, choose an area which will not interfere with any of the mechanism inside. Stay away from the hinge areas because they are usually reinforced and you will have quite a bit of metal to go through. When you have

Fig. 2—After locating speakers on doors, draw a 4¼-in. dia. hole with compass. Then use razor and saber saw (metal-cutting blade) to make cutout.

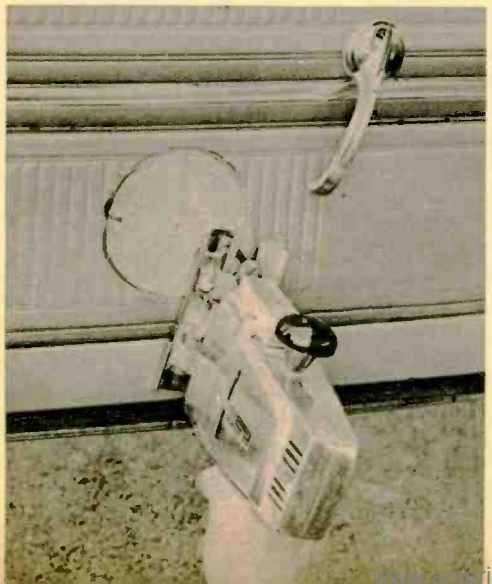

Fig. 3—Insert speaker into cutout to locate mounting holes. Drill screw clearance holes then insert tinnerman nuts. Wires get connected next.

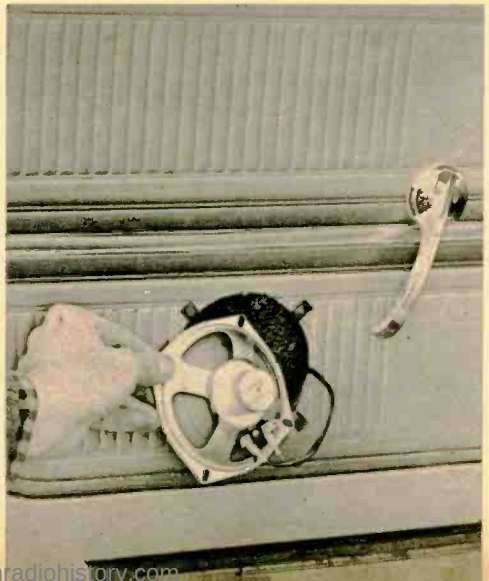

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Fig. 4—After you have connected the wires to the speaker, place the grille over the speaker and mount the assembly in door with supplied screws.

Fig. 5—If holes are not available at door edge and frame, drill a ⅜-in. dia. hole in each for wire passage. Leave play in wire with door open.

located the position for the hole proceed to drill with a ⅜-in. bit. The holes in the door edge and frame must be aligned to prevent undue strain on the wire when doors are opened and closed. The instructions do not mention using a rubber grommet in these holes, but we strongly recommend them.

When all the necessary holes are drilled, fish the cables through and out to the speaker openings. Attach the wire leads to the appropriate speaker terminals following the color code shown in the instructions. Then route the wires via the carpet and the kick panels to the front of the car.

Next, the player bracket gets mounted at a convenient location under the dash. If space permits, the ideal spot is under the radio, otherwise mount it under the glove compartment. But be sure that there's room for a passenger's knees. Mount the bracket with the sheet metal screws provided. When the bracket is in place, check the fit of the player, then make the necessary electrical connections. The fused black wire lead gets connected to the accessory terminal or the ignition switch. The remaining wires from the speakers get plugged into the polarized receptacles to assure proper phasing.

Installation time was about three hours and was well worth the effort. The fidelity is absolutely great. We haven't enjoyed listening to music on the road as much in a long time. And we've turned the glove compartment into a tape library

Fig. 6—Install the player mounting bracket, in which slotted holes permit lateral adjustment, under the dash with supplied sheet metal screws.

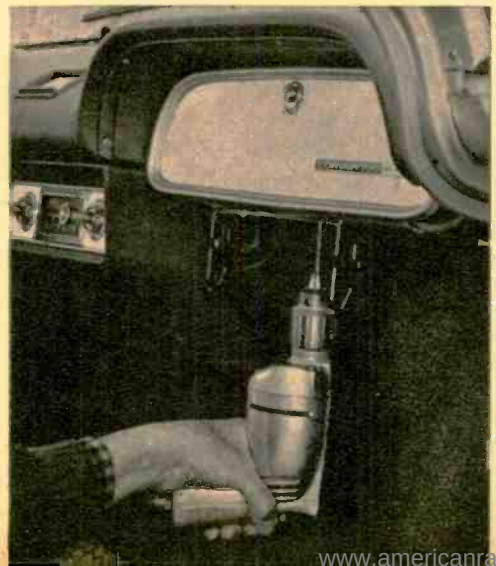

Fig. 7—Polarized connectors assure the correct speaker hookup; fused black wire goes to the ignition switch. Player is installed in mounting bracket.

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The Listener

By C. M. Stanbury II

In Search of Libertad

ALTHOUGH R. Libertad has been with us since October 1961, its location and modus operandi have remained a mystery. During the past nine months a series of rapid-fire events has shed some light on the situation—making it, at the same time, even more intriguing.

First, in the spring of 1967, EI received a report that seemed to indicate RL had been heard on the former R. Americas frequency of 6000 kc. The suggestion that RL was using RA's former transmitter and that this was the reason for the sudden departure of RA from short wave was lapped up by the Establishment. It turned out, however, that R. Libertad had *not* been heard on 6000 kc (although some guys are still trying to log it there).

On Saturday, July 29, a severe earthquake shook the area around Caracas, Venezuela, and RL was off the air that evening. It was back on Monday, July 31 (the station is normally silent on Sundays). DXers have believed for some time that RL's studios are in Caracas and from the sound of its SW modulation it seems likely that programs are relayed to the transmitter site by a slightly stretched VHF link. The earthquake tends to substantiate this, putting RL within 100 mi. of Caracas.

But let's go back a little. Beginning in December 1962 and continuing off and on for the next couple years, RL used a 60-meter outlet whose frequency varied most of the time between 5065 and 5068 kc. If in YV land, this would have been for Venezuelan coverage. The behavior of its signals on my antennas in no way resembled that of other 60-meter Venezuelan stations, though.

During this period a government telephone station operated at Caracas on 5072.5 kc. The two stations often were only 5 kc apart (meaning sidebands would overlap). Such a condition would have caused some QRM to the telephone service even with top-flight communications receivers. And for the average listener in central Venezuela, using a simple receiver, the interference would have been ruinous. So I conclude that RL's 60-meter operation was not at that time within 100 mi. of Caracas.

There seem to be only two likely explanations for this behavior. Either RL's transmitters are aboard ship (permitting gradual movement that would not be detected by DXers) or the 60-meter outlet was an airborne relay. An airborne station could be up to 200 mi. from Caracas and still be

[*Continued on page* 117]

Map illustrates possible uses of VHF link for R. Libertad relay from Caracas. Islands between Netherlands Antilles and former British West Indies (Trinidad, Tobago, Grenada) belong to Venezuela.

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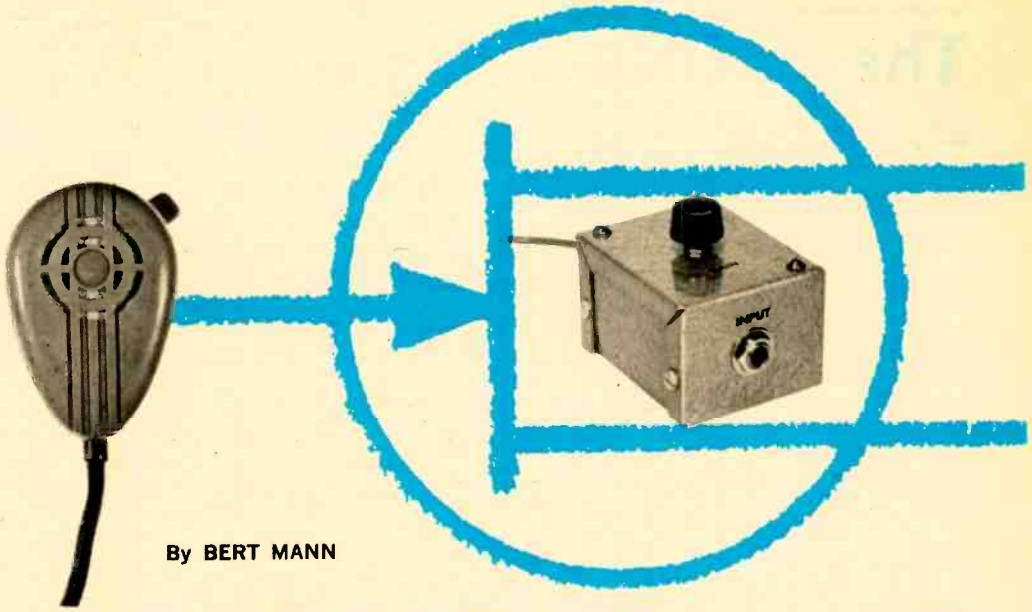


By BERT MANN

A UniFET Mike Preamp?

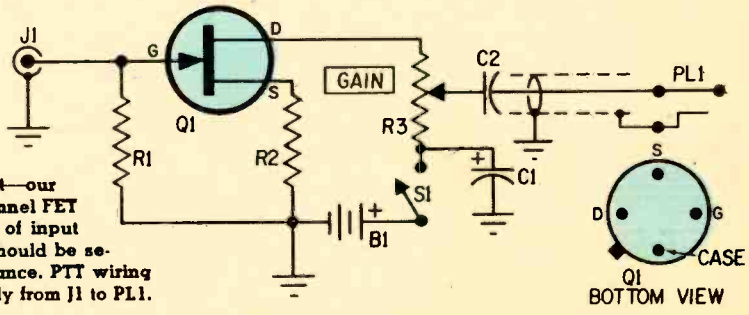
WERE Sir Walter Scott an active CBer he just might paraphrase one of his verses thusly: "Breathes there the man with soul so dead, who never to himself hath said, I need more *talk power!*"

When it comes to modulating a CB transmitter, there are times when a little extra output from your mike can mean the difference between a muddy and an intelligible signal.

Unfortunately, most solid-state mike preamps must apologize for some performance deficiency. Either the input impedance is low (which will cause a loss of lows), the noise level is high or the frequency response is too limited.

Move up to the latest in solid state—the FET (field-effect transistor)—and you come up with an almost universal preamp requiring no apologies since it does nothing to the signal except amplify it. Our preamp uses a single FET, hence the word UniFET in our title.

Frequency response? Ruler-flat from 10 cps to 20 kc (2db down at 40 kc). Distortion? Less than 0.4 per cent at maximum gain. Input impedance? Up to 22 megohms. Noise level? Better than 70db down. Oh, we forgot, the gain is 15 to 20db depending on the particular FET. Best of all it's cheap (less than $10)



Talk about a simple circuit—our preamp uses a single N-channel FET and five other parts. Value of input resistor R1 (see Parts List) should be selected to match mike impedance. PTT wiring (not shown here) goes directly from J1 to PL1.

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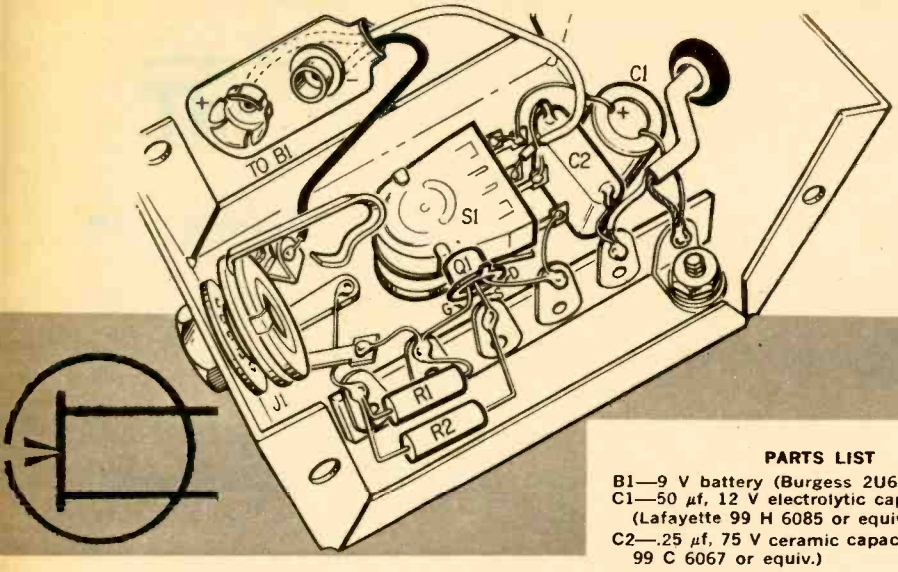
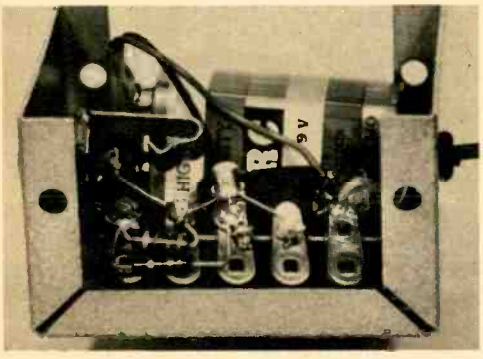


PARTS LIST

B1—9 V battery (Burgess 2U6 or equiv.)
C1—50 μf, 12 V electrolytic capacitor (Lafayette 99 H 6085 or equiv.)
C2—.25 μf, 75 V ceramic capacitor (Lafayette 99 C 6067 or equiv.)
J1—Jack (see text)
PL1—Plug to match mike jack on existing equipment (see text)
Q1—HEP-801 field-effect transistor (Motorola, Allied HEP-801. $1.59 plus postage)
R1—2.2 megohm, ½ watt, 10% resistor
R2—270 ohm, ½ watt, 10% resistor
R3—5,000 ohm miniature potentiometer with SPST switch (Lafayette 32 H 7363, or equiv.)
S1—SPST switch on R3
Misc.—2¾ x 2⅛ x 1⅝-In. Minibox



Input jack J1 should match plug on your mike. Instead of using single-conductor shielded wire for output cable, use shielded cable with extra leads for PTT switching. Note in photo at left that if R3 is mounted dead center, there will be just enough room for the battery and the terminal strip.

and easy to build since there are only six components.

Construction. The model shown was designed to be mounted on a transceiver (or tucked into a recorder) therefore, it's small.

Under no circumstances change any parts values. We already have designed in tolerances to handle variations in the specified FET's characteristics and output impedances (anything from 25,000 ohms up).

As shown in the photograph, the preamp is assembled on a single terminal strip. Note that the strip mounts only at one end. An extra-long strip with the unused mounting terminal was cut down to size. Note that the FET has four leads; the one designated *case* is cut short and not used.

Checkout. Connect a 0-10-ma meter in series with a battery lead and turn on power switch S1. Normal operating current is 1 to 1.5 ma. Allowing for FET variations, up to 2 ma is all right. If the current exceeds 2 ma or is less than 1 ma, check for a wiring error.

Using the Preamp. The preamp has a high-impedance input—the value being determined by R1, which is 2.2 megohms. This value is suitable for practically all experimenter applications—everything from a 50,000-ohm high-impedance dynamic mike to a ceramic or crystal mike. If you require an even higher impedance, substitute a higher-value resistor for R1.

Adjusting *gain* control R3 will cause a scraping noise, so be certain to set R3 to the proper point at the beginning of use. Do not adjust R3 during transmission or recording. The equipment's own gain control should be used for volume-level adjustments.

Remember that the preamp is intended only for microphone applications. Input voltage in excess of 0.1 V (such as from a tuner or recorder) will cause higher distortion—up to 3 per cent with 1-V input signal.

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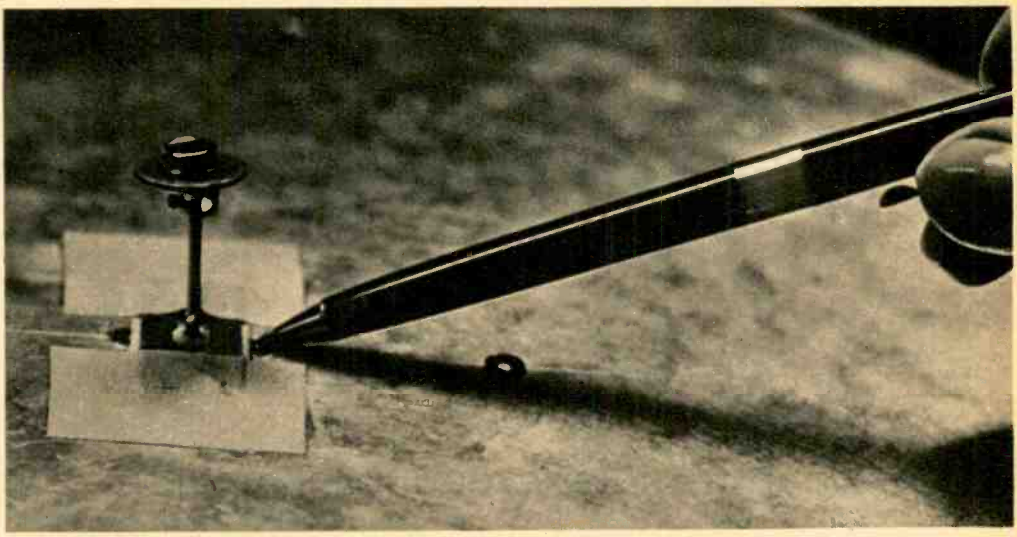

SIA-TINIEST ANTENNA OR BIGGEST BUST?

By DAVID WALKER

ANTENNA installers were ready to plunge off the nearest tower. Antenna manufacturers began to wonder about retirement in Florida. TV viewers gloated over the prospect of junking roof-top antennas.

That might describe reaction to the sensational announcement some weeks ago that true miniaturization had finally come to the input end of receivers with a device called the SIA (for Subminiature Integrated Antenna). The specifications read like the stuff of electronic dreams. Size, about 3 in.; weight, about 3 oz. Developers of the SIA stated it would eliminate all but one per cent of outdoor antennas. It would produce sharper television pictures with fewer shadows and less snow. Cost—a mere two or three dollars.

The SIA springs from no less a source than the Avionics Lab at Wright-Patterson Air Force Base. And to gift-wrap the package, it looked as though it would be offered at no patent royalty to all manufacturers.

But while Air Force scientists spoke of revolutionary developments, civilian engineers were unsheathing slide rules and parrying with their oldest axiom: If you want more signal, stick up more metal.

Edwin M. Turner, a scientist at Wright-Patterson AFB in Ohio, was the father of the SIA. Its mother was necessity. Regular antennas aboard aircraft and space vehicles steal useful payload, cause much aerodynamic drag. And long whips may reveal the position of a battlefield radio operator. So Turner got the idea of shrinking the antenna to minisize by introducing a transistor to compensate for the missing metal.

It's easy enough to boost antenna gain by adding a transistorized RF amplifier but Turner's version is novel. It has enormous bandwidth; that is, it accepts a wide range of frequencies with about equal efficiency. This might make a single SIA suitable for the entire VHF and UHF TV bands. Unlike earlier amplified antennas, this one places the transistor at the top, not bottom.

Many antenna engineers thought Turner's concept impractical as recently as three years ago. But during a trip to Germany in 1963, Turner revealed it to Dr. Hans Meinke, a research physicist working for the U.S. Air Force. Meinke built SIA prototypes and reported that his early models actually ex-

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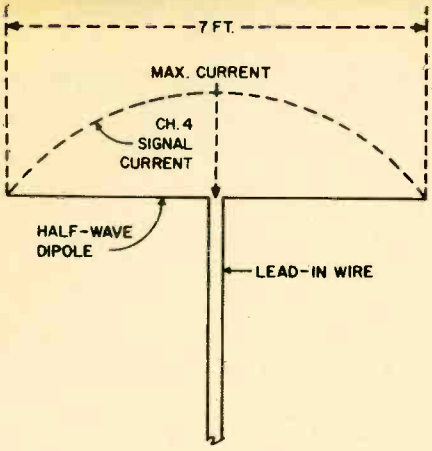

FIG. 1 – HALF-WAVE DIPOLE

Dipole is tuned to a particular frequency (here TV channel 4). Element is tapped at center where current induced by received signal is at a maximum.

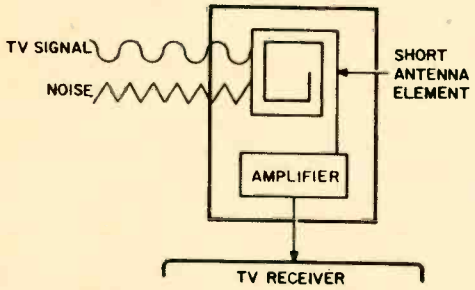

FIG. 2 – ELECTRONIC ANTENNA

So-called electronic antenna tries to compensate for short element with RF amplifier. amplifies noise and interference as well as useful signal.

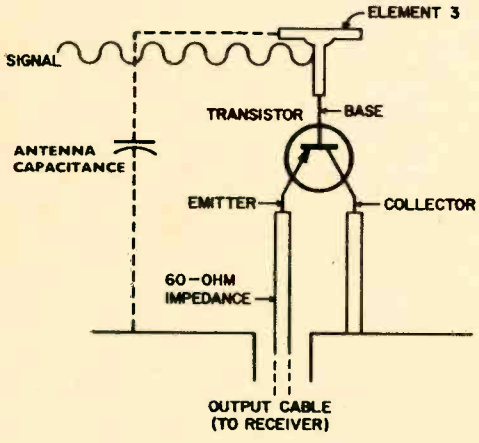

FIG. 3 – SIA ANTENNA

SIA presents same impedance to antenna leads over wide frequency spectrum. lowers resonant frequency by raising effective antenna capacitance.

SIA-TINIEST ANTENNA OR BIGGEST BUST?

ceeded original specifications. Meinke's explanation of how SIA works is hidden under a web of complex formulas but certain major points emerge.

A conventional, full-length antenna must be a specific size to resonate, or tune, the incoming signal. For TV channel 4, for example, most signal is received in a rod about 7-ft. long. This is a standard half-wave dipole (Fig. 1). Its length must be changed for ideal match to the frequencies of other channels. This explains why a TV antenna is often a collection of varying-size elements that add up to a tuning compromise over the band.

It's possible to shrink half-wave elements by adding loading coils. Although coils keep the elements electrically tuned to the signal the arrangement is far less efficient—mostly because reduced element size (or aperture) intercepts less of the signal. And the coils eat up part of the signal through wire losses.

Earlier attempts to miniaturize the TV antenna through the use of transistors have been unsuccessful. The so-called electronic antenna (Fig. 2) is simply a small antenna coupled to an RF amplifier. Amplification applies to both the TV signal and the noise picked up by the antenna, however, resulting in poor picture quality even though input at the receiver may be strong.

The SIA (Fig. 3) uses the transistor (or several transistors) in an attempt to solve these problems. A number of configurations are possible. Although Meinke's description of their operation is obscure, the effect may be thought of as amplifying the meager amount of capacitance or inductance that exists in the antenna's vastly shortened elements (rather than the current, as in the electronic antenna designs).

In Fig. 3, the two elements at the bottom are connected to the output cable—the emitter element to the hot lead and the collector element to the ground lead. The capacitance between element 3 and the antenna's ground is indicated by the dotted line. As the transistor base is driven by signal currents the transistor amplifies the current flowing from collector to emitter. But the result is a multiplication of the effective antenna capacitance, reducing resonant fre-

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THESE ARE THE DRAWINGS THAT STARTED THE SIA CONTROVERSY

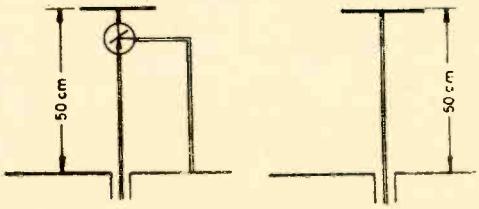

Fig. 4—Original report presented these diagrams in comparing SIA's basic design (left) with simple stub antenna of the same length. Some SIA configurations shown in the report were more complex than one shown here and use several transistors.

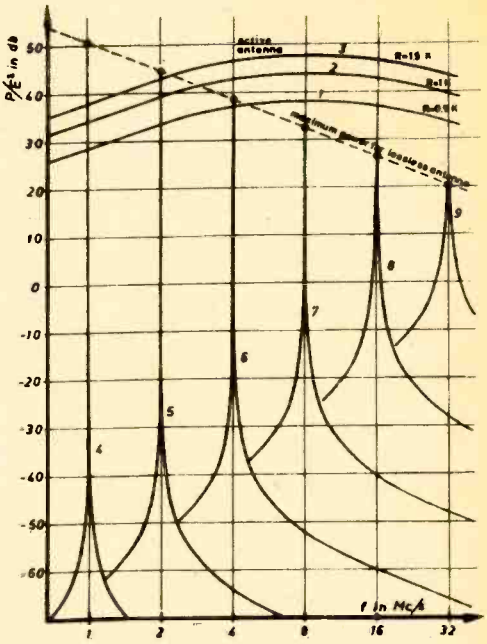

Fig. 5—Diagram at right illustrates the broadband characteristics of SIA designs (curves at top) in comparison to coil-loaded antennas tuned for various frequencies (peaking curves at bottom). (TV channel 4 is above 71 mc, off chart to the right.)

quency and simulating a much longer antenna element. (The necessary biasing components have been omitted from the diagram.)

This reduction in resonant frequency, says Meinke, is the important property of the design because it invests the SIA with extremely wide tuning range, or bandwidth (Fig. 5). Another major claim is impedance matching. In a conventional TV antenna, it's not economically practical to resonate perfectly to every channel. The result is some mismatching—and loss of signal—between the antenna and the lead-in wire. The transistor in the SIA, on the other hand, is said to provide a consistently good match (whose impedance may be varied by design) and efficient signal transfer throughout its tuning range. Result of the marriage between antenna and transistor amplifier is said to allow 50 to 100 times more signal current to flow in the antenna.

When news of the SIA broke, electronic trade papers drummed out doom for the rooftop TV antenna. Industry reaction skittered between hysteria and blinking confusion. But as the shock wore off there came a devastating appraisal by sober minds. The most potent spokesman against SIA is Lewis H. Finneburgh, Jr., President of the Finney Co., a leading TV antenna manufacturer.

In studying the SIA technical report Finneburgh made a remarkable discovery. He found that performance was being compared to an antenna of the *same height* as the SIA (a half-wave dipole is the usual basis of comparison for TV antennas).

Take a 3¼-in. antenna (simply a rod) and use a coil to resonate it to about 71 mc (TV channel 4). The 3¼-in. SIA is said to produce signals that are equal to or slightly better than the 3¼-in. rod-and-coil combination. If an SIA is barely better than a stubby tuned rod, Finneburgh asks, does it have any reason to exist in the first place?

Probably so—and the reason is bandwidth. The simple rod-and-coil will tune to 71 mc but signals quickly deteriorate on either side of that frequency. The SIA, however, continues to tune over a large frequency span.

Nevertheless, Finneburgh's rebuttal of SIA claims is concerned primarily with the amount of signal an SIA picks up when compared with a half-wave dipole. It takes little engineering expertise to figure out that a 3¼-in. rod will make a poor showing against TV elements many times their size. And building the SIA *into* the TV set would aggravate the signal-pickup problem many times over. Finneburgh estimates that even the twinlead running from the TV tuner to the back panel may capture more signal than an SIA mounted on top of the set!

Second focus of the rebuttal centers on ghosts, a problem almost as aggravating as

[*Continued on page* 115]

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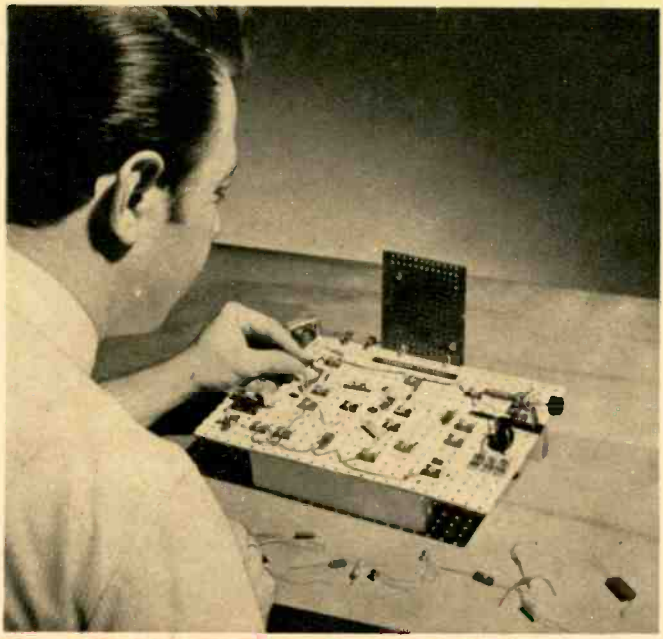
10 REALLY BASIC TRANSISTOR EXPERIMENTS



Clip these experimental circuits together and they'll come alive in seconds.

By LEN BUCKWALTER, K1ODH

IT'S one thing to study about how a transistor circuit works. But to get a feeling for what's really going on you must build, troubleshoot and experiment with a circuit. Big bugaboo about this approach is that it takes so much time to get things working. And then when you move on to another experiment, you must rip apart the preceding setup in the process of which component leads get chewed up and shortened.

But with a breadboard all of this annoyance of soldering, unsoldering and clipping can be forgotten. Clips hold everything in place. We will show how to set up ten basic transistor circuits on our board and explain how each works.

The board is a living schematic because its layout is similar to that of a circuit's schematic. This makes it easy to convert diagrams into working devices. The board has permanently attached to it components found in many transistor circuits—battery, potentiometer, output transformer, speaker. You won't have to go searching for a chassis for each project.

Points lie bare on a breadboard, making them accessible. Touch meter probes to different points, increase the negative voltage on the base of a PNP transistor, for example, and you can see the collector current rise.

If circuit design is your dish of tea, the board can be as important a tool as a soldering iron (which you don't need). But a breadboard has limits. You may not get good results using it for high-frequency circuits where connections must be short or stages shielded from each other. If you build a receiver for 30 mc, for example, you might assemble the critical RF stage separately on a small piece of plastic, then assemble everything else according to the system to be described. And long leads might result in some hum pickup. When pushing a transistor near its power limits, the board won't work as a heat sink for cooling.

Our experimental circuits include RF and audio oscillators, a radio transmitter and alarm devices.

Building a Schematic

The board in Fig. 1 has a schematic-like quality. Negative and positive buses from the

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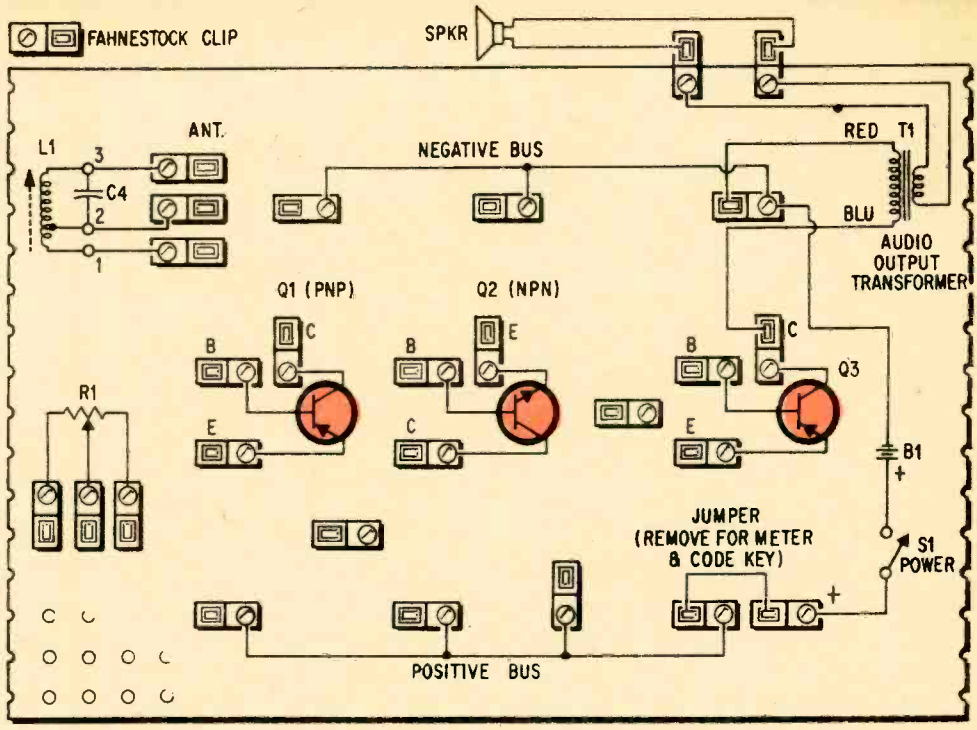

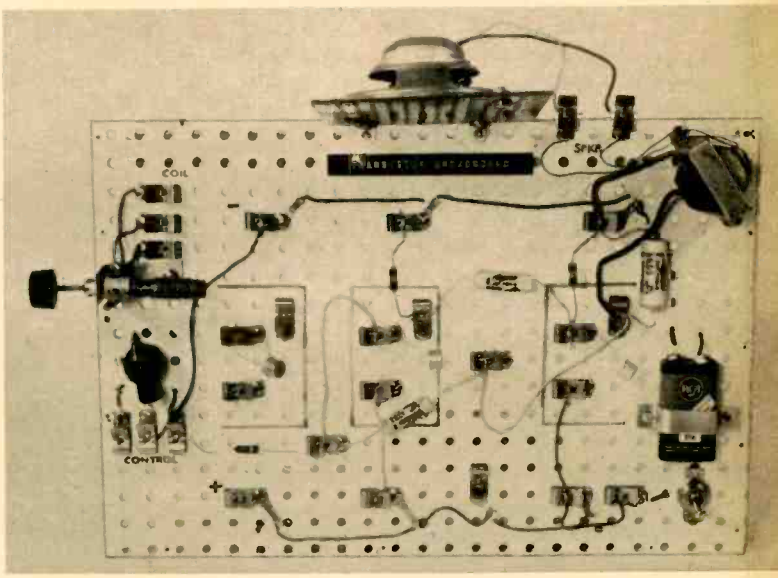

Fig. 1—Top view of the board (right) shows the mounting position of all parts. Board specified in Parts List is 12 x 8 in. Attach 1¾ and 2¾-in. pieces of wood under front and back edges, respectively, to raise and tilt work surface. In pictorial/schematic above, attach fahnestock clips approximately where shown. Transistors and several other parts are shown schematically. Attach speaker to small piece of perforated board and mount it with small angle bracket at top of board as shown at right. If you experiment with a circuit using an NPN transistor, connect it as transistor Q2 is hooked up on board.

battery run along top and bottom to provide ready tie points. Three transistor mounting areas are positioned so parts fall into the best places for connecting them to power or to other stages. If you're in the midst of circuit assembly and have no mounting points for a component, just add clips.

One precaution, though, so you won't burn up transistors: watch out when connecting them. A PNP (Q1) is mounted as shown in Fig. 1. This places a PNP transistor in the correct position: collector is near the negative bus and emitter close to the positive bus. This would be reversed for NPN transistors, as illustrated by Q2. In all projects we'll build, the transistors are PNPs. Specific transistors are mentioned in the Parts List but you can use inexpensive general-purpose

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transistors now widely available. Let's set up the first circuit and check its operation.

1) Audio Oscillator. As you can see in Fig. 3 it's just a short step from the basic board set up to the first operating circuit. If you're using new resistors and capacitors, don't cut the leads. Just bend the last ¼-in. of wire so it slips into the clip. Wherever you have to make a connection (say, between a transistor's emitter lead and the positive bus) use short lengths of hookup wire.

When the audio oscillator is completed, flip the power switch on. You should hear tone from the speaker which can be varied from about 100 to several thousand cps, depending on the setting of potentiometer R1.

Since the two transistors are connected as an electronic switch, each one alternately turns the other on and off. Part of Q3's current is fed to the speaker, where it produces a steady tone.

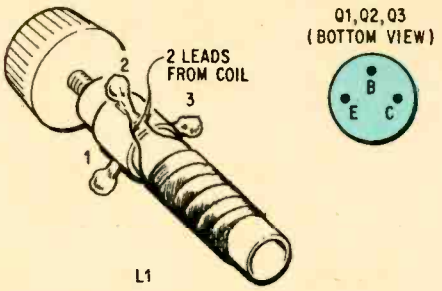
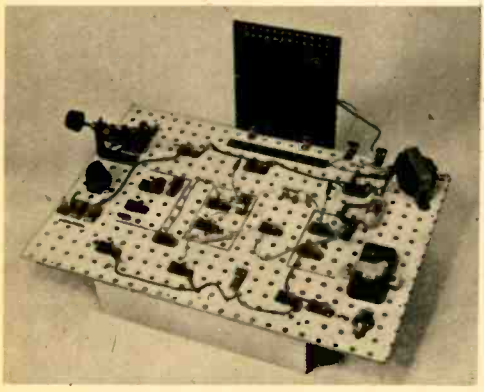


Fig. 2—Pictorial shows numbers we have assigned to the lugs on loopstick antenna coil L1. Sketch at the right identifies the leads of the transistors.

2) Code-Practice Oscillator. If you want to use the circuit for code practice, remove the jumper wire and connect a key in its place. A variation is to use the circuit in a simple two-way telegraph system. Wire a second key across the first and put it in another room. Add a second speaker in parallel with the first.

To understand how the oscillator operates, recall basic transistor theory. When transis-



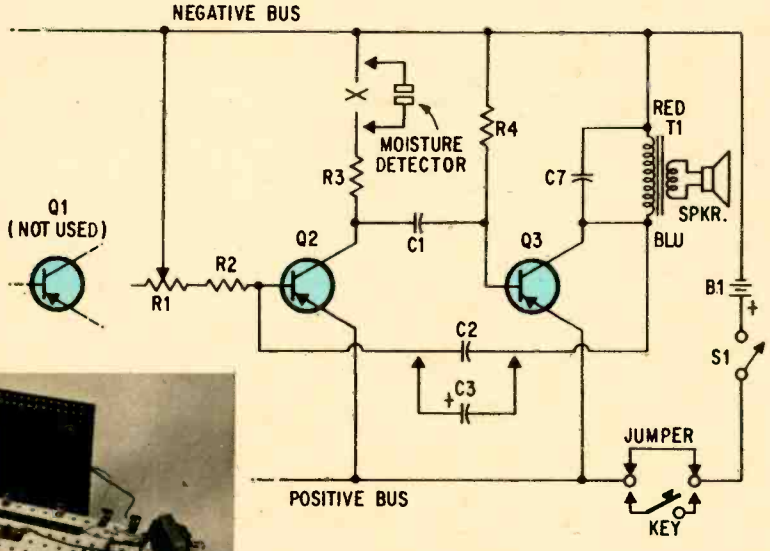


Fig. 3—Schematic above is of basic audio-oscillator circuit. Connect C3 in parallel with C2 and you have a metronome. Connect key instead of jumper for a code-practice oscillator. Two pieces of metal mounted on plastic board and connected between negative bus and Q2's collector give you a moisture detector. Photo at the left shows how the speaker is mounted at the rear edge of board.

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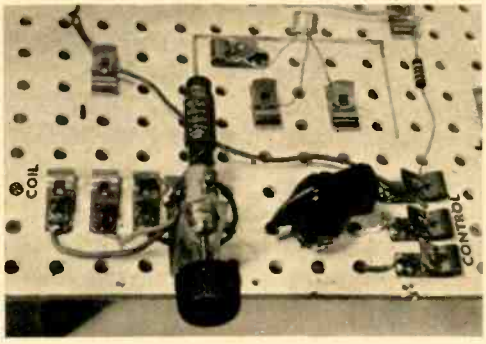


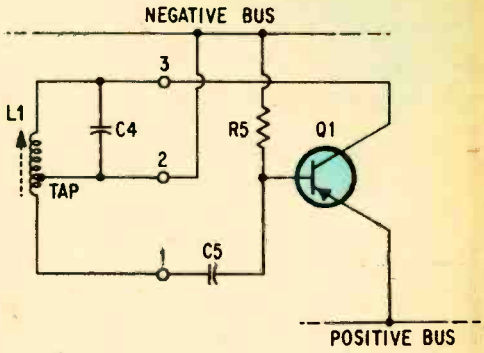


Fig. 4—Photo (left) shows how L1 is mounted and connected to clips. RF oscillator schematic is at right.

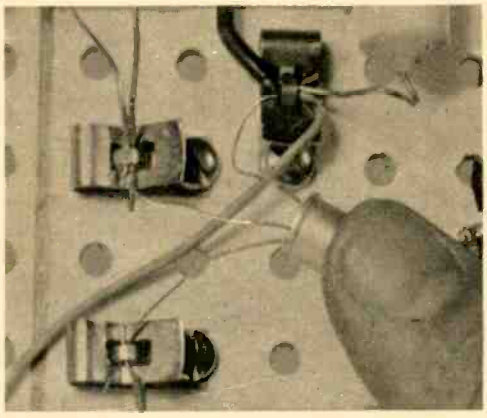
tors are connected as they are in this circuit —a common-emitter connection—a signal applied to the base emerges in amplified form at the collector. However, its polarity is reversed. That is, a negative-going signal on the base produces a positive-going signal at the collector.

Let's say the circuit is turned on and a random pulse of current drives Q2's base negative. This turns on Q2, which sends a positive signal to the base of Q3. The pulse turns Q3 off and a negative signal appears at its collector. Further, that negative signal is fed back to Q2 via capacitor C2. Transistor Q2 is now forced to conduct even more. In fact it is driven so hard it conducts current right up to its limit and becomes saturated. Yet the circuit doesn't remain locked in this state.

A switchover now starts as no further signal can ride through coupling capacitor C1. Capacitor C1 now discharges electrons to Q3's base. As Q3 comes back on, the whole process is repeated. The back-and-forth oscillation produces the tone in the speaker.

3) Metronome. You can slow the action so the circuit becomes an electronic metronome. Simply install C3, a 15 μf capacitor, across C2. Capacitor C3 is so large that electrons going from Q3 to Q2 take more time to charge C3. Switching action is considerably delayed. The speaker produces a series of clicks whose speed can be changed by R1. Potentiometer R1 changes circuit-operating speed by introducing resistance in the discharge path of the C3. When resistance is great, electrons leak more slowly from C3.

4) A Burglar Alarm. You can build one quickly by setting up the first audio oscillator circuit again. Remove the jumper and run a pair of wires from these clips to a switch on a window you wish to protect. This switch should be a type that is normally open. When an intruder opens the window the switch



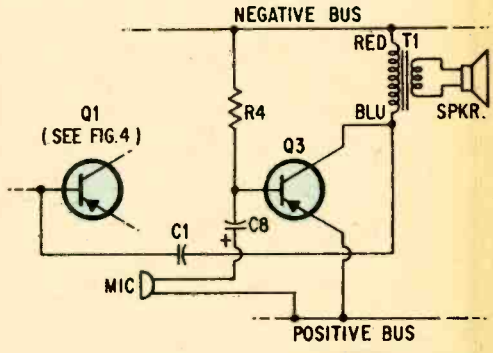


Fig. 5—Photo (left) shows how clips hold leads. Schematic at right is part of circuit of wireless mike.

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will close and start the oscillator.

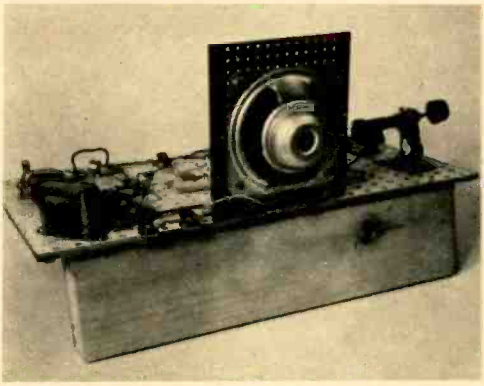
5) Moisture Detector. If you set up the board as a regular audio oscillator (Fig. 3) you can make a simple change that enables the circuit to function as a moisture detector. The presence of water causes the oscillator to start and produce a tone. Begin by unclipping R3 from the negative bus. This stops the circuit from oscillating since you've opened Q2's collector circuit. But if you wet two fingers and connect them in place of R3 the tone will start.

Moisture provides enough of a conducting path to complete the collector circuit. What's novel is that so little current (on the order of microamperes) is needed by Q2 to control switching action that starts current flowing in the speaker circuit. If you want to make a more practical project, make a moisture detector by mounting two wires or metal plates close together on a piece of plastic. When water falls on them the tone will start.

6) RF Oscillator. The next circuit to explore is an RF oscillator. As shown in Fig. 4, it is little more than a transistor and a broadcast-band antenna coil. Operation, however, is different from that of the audio oscillator. The RF oscillator relies on circulating current going back and forth in its tuned circuit. Since this implies that the

PARTS LIST

B1—9 V battery
C1,C2—.01 μf, 600 V tubular capacitor
C3—15 μf,, 15 V electrolytic capacitor
C4—330 μμf, 500 V ceramic disc capacitor
C5—.02 μf, 600 V tubular capacitor
C6—.001 μf, 600 V tubular capacitor
C7—.05 μf, 600 V tubular capacitor
C8—30 μf, 15 V electrolytic capacitor
L1—Loopstick antenna (Superex VLT-240, Allied 11 B 1286)
MIC.—Dynamic microphone (see text)
Q1,Q2,Q3—2N1303 transistor
Resistors: ½ watt, 10% unless otherwise indicated
R1—1 megohm, linear-taper potentiometer
R2—3,300 ohms
R3—10,000 ohms
R4—150,000 ohms
R5—2,200 ohms
R6—100,000 ohms
S1—SPST switch
SPKR.—Speaker, 3-in., 3.2 ohms
T1—Output transformer; primary: 2,000 ohms, secondary: 3.2 ohms (Allied 54 B 1401 or equiv.)
Misc.—Fahnestock clips ¾-in. long, 25 or more); Masonite breadboard, 12 x 8 in. (Lafayette 19 H 1701 or equiv.)



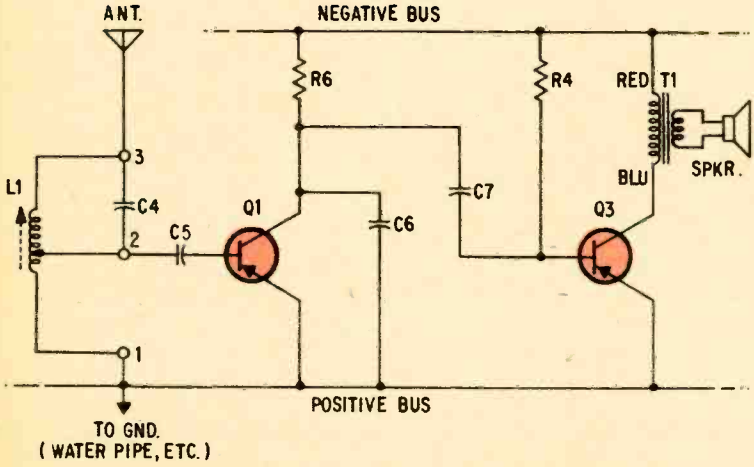


Fig. 6—Photo above of rear of breadboard shows how speaker is mounted and 2¾-in. piece of wood is used to raise board. Schematic at left is of simple radio. Q1 functions as detector and Q3 is audio amplifier. Use a long antenna, good ground and headphones and you'll pick up quite a few stations.

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polarity of the current changes, the tuned circuit can control the transistor's base circuit.

We've selected a Hartley oscillator for this one. When a random surge of current enters the tuned circuit—coil L1 and capacitor C4—it circulates between them. (The frequency depends on the value of inductance and capacitance.) But unless there's some reinforcement of the current, it quickly dies out because of resistance in the wires and other circuit losses. The transistor replenishes these losses so oscillation continues. It starts in the lower part of L1—the section of the winding below the tap. Circulating current in the main part of L1 is inductively fed back to the lower winding. Since this energy is returned to Q1's base, Q1 will amplify it whenever polarity is negative. This causes a large collector current to flow and this flow is returned to the main winding of L1. There it restores circuit losses. Thus, the oscillator continues to produce an RF signal so long as power is supplied.

You can assemble the circuit by following the layout of the board in Fig. 1 and the schematic in Fig. 4. Note that L1 must be connected correctly and C4 is permanently soldered across L1 terminals 2 and 3.

Check the completed circuit by turning on power and holding an AM radio within 1 or 2 ft. of L1. Turn L1's knob until you hear a whistle or loud hiss from the radio. Since the signal may appear at several points on the dial, move the radio away from the board slowly and retune the radio and/or L1 until just one signal is heard. You may not be able to cover the complete broadcast band, especially the lower end. If you want to get a signal at this part of the dial, install more capacitance in parallel with C4 (about 30 to 100 $\mu\mu$f more). Here are some applications for the RF oscillator:

7) Signal Generator. It can supply a strong signal to a radio to aid in troubleshooting.

8) CW Transmitter. Insert a key in place of the jumper wire and you can interrupt the signal. Tune a weak AM signal on a radio. This signal will act like that from a BFO in a communications receiver and make the signal from the transmitter audible as a tone. To increase the range of the transmitter, add a length of hookup wire to lug 3 on L1 and connect a wire from the positive bus to ground (water pipe, etc.).

9) Wireless Mike. The RF oscillator in Fig. 4 is converted easily into a broadcast-band transmitter by adding the stage shown in Fig. 5. Transistor Q3, operating as an audio amplifier, varies base voltage of oscillator Q1 in step with your voice. (An audio signal is taken from Q3's collector and fed by capacitor C1 to Q1's base.) The microphone may be a dynamic type of a few thousand ohms impedance or magnetic earphone.

10) Radio Receiver. The board setup in Fig. 6 is a radio receiver which will pick up local broadcast stations. Radio signals are intercepted by the antenna and fed to the L1/C4 tuned circuit (the same one used in the RF oscillator). Only voltages at the desired frequency build up in the circuit, which is tuned by L1. The signal then is coupled by C5 to the base of Q1. The tap-off point is near the lower end of L1. Reason for this is that the tuned circuit develops highest voltages at the top of the coil but impedance at this point is high. The transistor's low input impedance would load or short these voltages if connected at the top end. The tap point near L1's ground end is a point of low impedance and matches Q1's base impedance.

Next important step—detection—is taken care of by omitting Q1's base bias resistor, R5. The process of detection converts the RF signal to an audio signal by clipping off its positive or negative half. This is necessary so the two halves will not cancel each other out. Since the transistor does not have base-bias resistor, the base is controlled only by the RF signal. When the negative half of the signal reaches the base, current flows in the transistor's collector circuit. When the signal goes positive, the transistor is cut off. This amounts to rectification—another way of saying the signal has been detected. One refinement is the addition of capacitor C6 at Q1's collector. This is a filter which helps remove any remaining RF signal. Transistor Q3 operates as a standard audio amplifier.

Good reception with this receiver requires at least a 30-ft. antenna. And a good ground connection similarly improves performance. Station tuning is done with L1.

• **On Your Own.** These projects are just the beginning. Once you get the knack of using the board, you'll be able to strap together circuits quickly. If you want to try your hand at design, consider these points:

[*Continued on page* 115]

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How To Log 25 Great Cities

LAST issue, EI's DX Club added a new award to its arsenal. This one is for QSLs from any 25 of the world's 50 largest cities. At first glance this seems like a pretty rough assignment but with the aid of the guide in this article all of the great cities on our map are well within reach of any DXer, no matter how simple his receiver. All that's really needed is a little effort and, depending upon the quality of your receiver, patience.

To forestall chaos, the award counts studio rather than transmitter location. For instance, if you have a QSL from WNYW, R. New York Worldwide, it counts as New York even though WNYW's transmitters are in Scituate, Mass. (This rule has been followed by most BCB DXers for many years.)

The rule does not apply, however, when studio and transmitter locations are in different DX countries. For example, if you log a BBC transmitter in England (Skelton, Crowborough, etc.) it counts as London. But the BBC relay at Tabrau, Malaysia (BBC Far East Station) would not.

Figuring things this way still leaves one problem. Moscow is notoriously coy about identifying its transmitter locations which may be as far away as Siberia or even may be in an East European satellite. (In the past R. Moscow has almost certainly used at least one transmitter belonging to R. Sofia in Bulgaria.) So to avoid the impasse, all international transmissions from R. Moscow will count (as Moscow) for the award, even if transmitter location can't be established.

All the cities mentioned so far—London, Moscow and New York—are in the cinch category. Let's switch to those on the list that will give SWLs the most trouble. At first glance this would seem to be Chicago, Detroit, Los Angeles and Philadelphia which can be heard only on the broadcast band. But the stations listed operate all night. And after midnight (sometimes even before) they often

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By ALEX BOWER

are heard in every part of the continent even on the most unDXworthy receivers. In fact, while we list a short-wave station for New York, the BCB station listed will be received just as easily in many areas.

Probably the most difficult on our list are All India Radio's station at Delhi and R. Pakistan at Karachi. Neither have transmissions beamed our way. Further, for reception in North America their signals must pass over or close to the Pole, increasing absorption and making ionospheric reflection erratic. Nevertheless, both often are reported by North American DXers and, though sometimes slow, both apparently verify all correct reports.

Cities that have programs beamed our way but still may provide a few headaches are Djakarta (R. Republik Indonesia) and Vienna (Austrian Radio). For some reason neither seem to have the power to beat the QRM consistently but any DXer will be able to log them with a little persistence. Austrian R. is a good verifier; R.R.I. tends to be unpredictable.

The overseas service of R. Australia makes Melbourne a cinch. Australia's other major city, Sydney, has a regional SW outlet often heard in North America, especially as spring approaches. Other cities whose signals will improve as we come nearer the equinox are Buenos Aires (Argentina) and Santiago (Chile).

Eight of the earth's major cities are located in Red China (including Manchuria) but so far as we know the only Communist Chinese station that will QSL is the international service of R. Peking. This one answers all reports with somewhat vague verification messages accompanied by some of the wildest propaganda ever distributed to DXers. The studio rule is important here because R. Peking's transmitters could be anywhere in China's 3.7 million sq. mi.

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How To Log 25 Great Cities

Two 60-meter stations have been listed: R. Sutatenza (actually transmitting just above the band) at Bogota (Colombia) and R. Rumbos at Caracas (Venezuela). Both are consistently heard in North America and, while broadcasting entirely in Spanish, have ID announcements that can be picked out readily. Be sure the R. Rumbos station you log is on 4970 kc. R. Barquisimeto (YVMQ) on 4990 also carries many Cadena Rumbos programs but its studios are not in Caracas. R. Sutatenza and R. Rumbos rate as excellent verifiers, as do all the Latin Americans we have picked for the guide.

There are, of course, a number of other cities included in our guide. If you live on the West Coast you may want to go after Seoul and Tokyo; if you live in the East you may go for Madrid and Budapest. You'll also find Bangkok, East Berlin, Lima, Mexico, Paris, Rio de Janeiro, Rome, Sao Paulo and Tehran in our guide.

Whatever 25 you log remember that, in sending reports to any of the stations listed except the four Communist entries, return postage should be enclosed either in the form of International Reply Coupons or uncancelled stamps from the appropriate country.

EI'S GUIDE TO LOGGING 25 GREAT CITIES

City, Country	Station	Frequency (kc)	Time (EST)
Bangkok, Thailand	R. Thailand	11910	Mornings
E. Berlin, Germany	R. Berlin International	9730, 11890	Early evening
Bogota, Colombia	R. Sutatenza	5075, 5095	Early evening
Budapest, Hungary	R. Budapest	9833	Evenings
Buenos Aires, Argentina	R.A.E.	9690	Weekday evenings
Caracas, Venezuela	R. Rumbos	4970	Evenings
Chicago, U.S.A.	WGN	720	Nights
	WLS	890	Nights
Delhi, India	All India Radio	11810, 15175	0830
Detroit, U.S.A.	WJR	760	Nights
Djakarta, Indonesia	R. Republik Indonesia	9865	Before 1030
Karachi, Pakistan	R. Pakistan	11672, 17815	0830
Lima, Peru	R. Nacional del Peru	9562	Late afternoon & evenings
London, England	B.B.C.	(many)	(many)
Los Angeles, U.S.A.	KFI	640	Nights
Madrid, Spain	R.N.E.	9360	Evenings
Melbourne, Australia	R. Australia	15240, 17840	2000-2200
Mexico City, Mexico	XEWW	9515	Almost any time
Moscow, U.S.S.R.	R. Moscow	(41 & 31 meters)	Evenings
New York, U.S.A.	WNBC	660	Nights
	WNYW	15440	Daytime
Paris, France	O.R.T.F.	15200, 17850	1400
Peking, China	R. Peking	17790, 17860	From 2000
Philadelphia, U.S.A.	WCAU	1210	Nights
Rio de Janeiro, Brazil	R. Globo	11805	Evenings
Rome, Italy	R.A.I.	11865, 15310	Early evening
Santiago, Chile	R. Corporacion	9498	Evenings
	La Voz de Chile	9700	2200
Sao Paulo, Brazil	R. Bandeirantes	11925	Evenings
Seoul, S. Korea	V. of Free Korea	15425	2200
Sydney, Australia	A.B.C.	6090	0500
Tehran, Iran	R. Iran	11730, 15135*	Afternoons
Tokyo, Japan	R. Japan	15135, 17825	Evenings
Vienna, Austria	Austrian Radio	9770	Early evening

*Frequencies vary

The remainder of the world's 50 greatest cities are more difficult or downright impossible to log. They are: Barcelona, Spain; Bombay, India; Cairo, U.A.R.; Calcutta, India; Canton, China; Chungking, China; Hamburg, Germany; Harbin, Manchuria; Leningrad, U.S.S.R.; Lu-ta, China; Madras, India; Milan, Italy; Mukden, Manchuria; Nagoya, Japan; Osaka, Japan; Shanghai, China; Tientsin, China; Wuhan, China; Yokohama, Japan.

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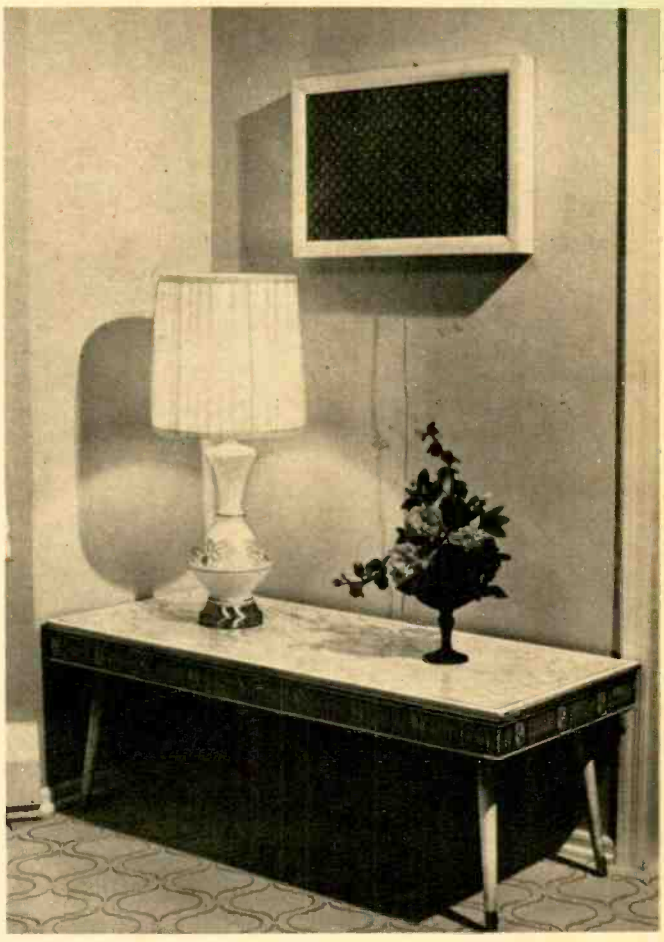
Super Super Thin Speaker

How Does 1½ In. Strike You?

By JOHN CAPOTOSTO



A DECADE ago it was the bookshelf speaker that made the scene. But the first designs could be squeezed only on encyclopedia shelves. However, they've gotten smaller and now will fit on paperback shelves. Next came the so-called ultra-thin speakers which were about 6-in. thick.

Latest show-stopper is a speaker (made by ERA Acoustics Corp., 311 E. Park St., Moonachie, N.J. 07074) which is only 1½-in. thick. Yes, that's two of them in a frame hanging on a wall in the photo above. It's not a trick set up in which part of the speakers are in the wall. That's that whole ball of wax.

Heart of the system is this new speaker which resembles an oversize waffle. Instead of a conventional heavy metal frame, magnet and paper cone, the speaker consists of two pieces of polystyrene plastic. One piece (the front) is a radiating panel. The other, the rear panel, is simply the supporting frame in which the magnet is installed.

Figure 3 shows the two speakers in our frame. The front of the left speaker is facing you. The speaker at the right is turned around. Here you can see the plastic supporting frame, the magnet and the connecting lugs.

The size of a single P-20 speaker is 11¾ x 14 11/16 x 1½-in. thick.

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Super Super Thin Speaker

According to ERA the magnet weighs 4.8 oz. and the total weight is 19 oz. It can handle up to 20 watts (peak) and has an 8-ohm impedance.

Some of the unusual features of the Poly-Planar, as ERA calls it, are that is is completely waterproof and may be operated underwater. Back on land, it can be played unbaffled to radiate in two directions. Because it's so slim, you can easily install it in a ceiling or a wall.

Take five P-20s, stack them up on their long dimensions, frame and grille-cloth them and you have a room divider. Matter of fact the applications for the P-20 are tremendous when you think about it.

How does the picture-frame system sound? Not at all bad when you realize that it costs only about $25. With some bass and treble boost on our amplifier it didn't sound half bad. Not quite up to our large three-way bass-reflex system but respectable, nevertheless. The response curve in Fig. 1 is supplied by the manufacturer. Note that the low end drops off around 100 cps.

Because we wanted an ultra-thin system we decided on the picture-frame design, which amounts to an unbaffled enclosure. For best performance such an enclosure requires two speakers and facing in opposite directions as shown in Fig. 3. However, when you wire the speakers (they can be wired in series for a system impedance of 16 ohms or in parallel for an impedance of 4 ohms) be sure that they are in phase. For example, if you are connecting them in parallel, the leads to the second speaker would be reversed.

ERA supplies with each speaker plans for a bookshelf and a bass-reflex enclosure. We did not try a speaker in either of these enclosures; therefore, we cannot comment on their performance.

The construction of a frame for two speakers is quite simple. If you have a bench saw or router, you can cut the main frame supports from a ¾ x2-in. furring strip. Otherwise you can use the alternate construction shown in Fig. 4. Miter all corners for a professional-looking job.

Assemble the bottom and side of the frame then install the speakers with faces reversed as shown. The lip on the speakers will fit into the recess of the frame and they will hold

Frequency Response
Unbaffled Model P-20

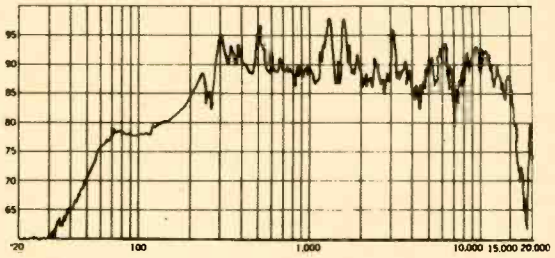

Fig. 1—Response curve of Model P-20 supplied by manufacturer. Scale at the left is relative response in db. Note low-end drop-off at about 100 cps.

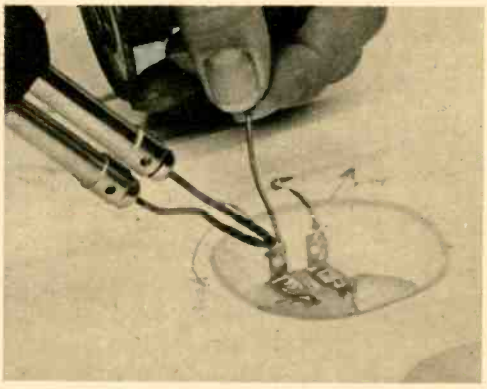

Fig. 2—Get connections right—it won't be easy to change them after grille cloth is on. Cut a groove in plastic for lead to other speaker.

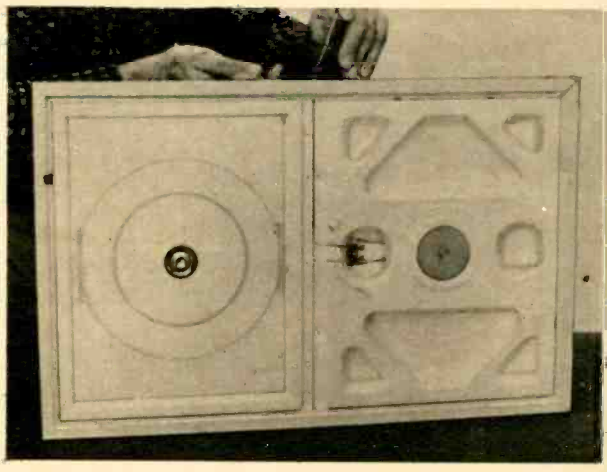

Fig. 3—Install the speakers in frame so they face in opposite directions. Pass thin wire through small hole drilled in the bottom of the frame.

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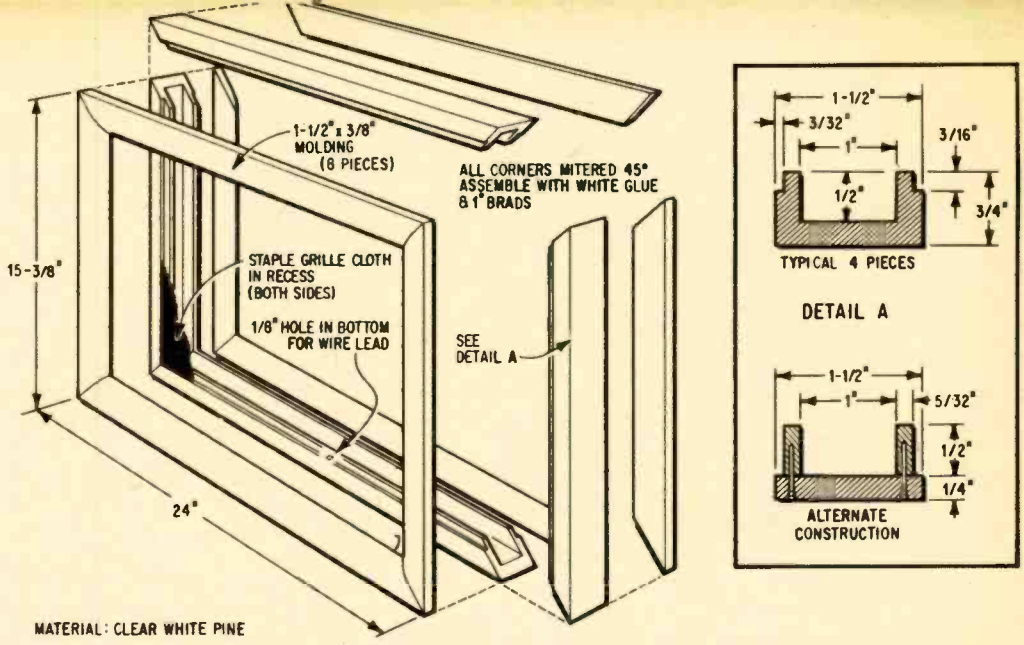

Fig. 4—Complete frame details. If you have a bench saw, use ¾ x 2-in. furring strips for top, bottom and sides and use dimensions at top in detail A at right. Otherwise, use alternate construction shown.

firmly without gluing. Add the top piece using white glue and brads for assembly.

Wire the speakers as described and solder all joints cleanly. Check the wiring carefully as once the speakers are enclosed, you won't be able to get at them again. Cut small grooves where necessary to keep the lead wires below the surface. Fasten a grille cloth with staples as shown. The slight recess in the main frame keeps the staples from interfering with the outer frame. With grille cloth in place, cut the clam-shell molding to size and apply over the main frame using brads and white glue. A coat of paint or stain will finish things off and make the speaker suitable for any decor.

Price of the P-20 is $10.95 plus 50¢ for postage. You can order them from Tridac Electronics Corp., Box 313, Aldon Manor Br., Elmont, N.Y. 11003. Or write to ERA for the name and address of a dealer in your area.

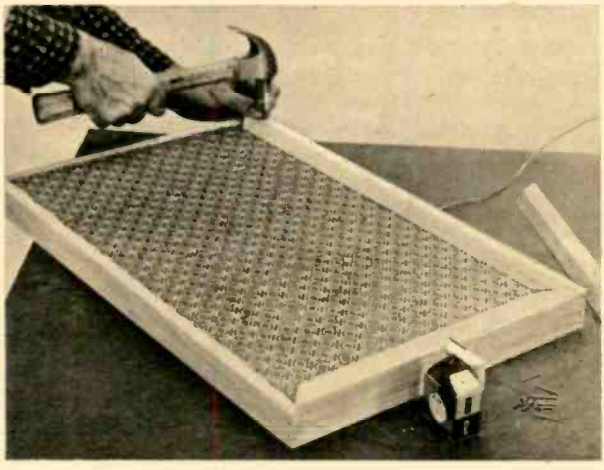

Fig. 5—Attach grille cloth with staple gun. After cloth is installed, complete the frame by adding clam-shell molding on front for wall installation.

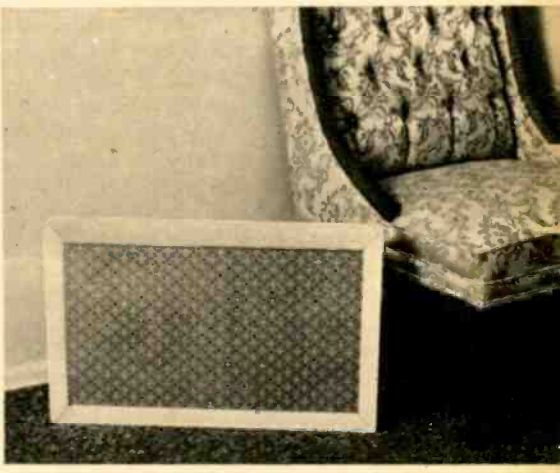

Fig. 6—Framed speaker is at home just about anywhere. Ordinarily it won't fall over, but if it is unsteady, put feet at the rear for added support.

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The Ham Shack

By Wayne Green
W2NSD/1

INCENTIVE LICENSING is, to amateurs, a combination of religion and politics and has been discussed with all the open-mindedness you would find at a W.C.T.U. prayer meeting on Skid Row. During the conception and gestation periods I was not considered to be one of its staunch supporters. Now that the child is born it is obvious the parents were only passing friends.

The great bulk of active amateurs probably will find that the changes in the bands will have little to do with them. The fellow who spends his time in the traffic nets certainly will not notice much. The VHF operator may be a little disgruntled at having the low end of the 6-meter phone band moved up to 50.25 mc but most of this area now is being used by only a handful of sidebanders, anyway. Rag chewers generally stay off the busier sections of the bands so they will lose little.

About the only group to feel the change are the DXers. When the new frequency allocations go into effect it will be absolutely necessary to have an Extra Class license if you are going to chase CW DX. Even phone DXers will have a hard time of it without an Extra license unless they specialize in 20- or 40-meter phone exclusively. Once you get on the DXCC Honor Roll it behooves you to work every new country that comes on the air without fail—and now and then one of them is going to be up on 15 meters where you would miss it.

This, I think, is good. Working DX is fun and I am all for it. But the Honor Roll has done more to ruin amateur radio than any other program of the ARRL. What kind of people-to-people communications can we have when dozens of fellows are breaking in all through a contact because, as they say, they *need* the new country? This hello-goodbye stuff is a pox on our hobby and its main cause is that Honor Roll.

There are so many things to talk about with DX amateurs that it is a crime to limit ourselves to a signal report and a recitation of equipment. I am one of the blabbermouths who grab onto rare DX and then talk at length. I have been rewarded just about every time in several ways. There is the enjoyment of actually communicating with someone who is in an unusual spot and finding out what it is like there. And then, when he's ready to sign off, he usually tells me that this was an interesting contact and that it has made amateur radio more fun for him.

The new allocations won't interfere with my having interesting chats with people in unusual places, thank heavens. I suspect that the main result will be a lot less interference from the handful of rabid new-country chasers.

The greatest pity about the new regulations is not the changes they make but those they leave unmade. The drop in interest in CW has left big areas of our bands open for exploitation by commercial interests that couldn't care less about legal allocations. The segment between 14150 and 14200 kc should have been opened to U.S. phone several years ago. There are similar segments on other bands.

A recent poll showed that about 30 per cent of active stations at any one time are using CW. Yet on 20 meters we have 200 kc allocated for CW and only 150 kc for phone. And you can put several CW stations in the bandwidth of one phone station. We still are prisoners of bands set up when 90 per cent of the activity was on CW and protected by the staunchly CW-oriented ARRL HQ group.

I wish our regulations could recognize the technical strides that have been made in recent years and start removing AM signals from our lower bands, just as spark and then unstable signals were legislated against in years gone by. Today only the lazy or the ornery are using AM in the 20-meter band. With brand-new sideband transceivers tagged at only $120, cost no longer is a real hangup.

Getting back to DX, the Stanford Research organization has shown that one ham station in a foreign country often can get more of an audience that one of those million-dollar short-wave broadcast stations. Perhaps if amateur radio stations were permitted to engage more in communications and less in the pointless swapping of signal reports, we would find foreign governments more enthusiastic about supporting amateur operation in their countries.

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You can't operate on the Citizens Band without a license. In fact, the law requires it to be displayed prominently at the transmitting site. The only test required is in filling out the license application but even that is flunked by some 3,000 would-be CBers each year.

How To Get A CB License —the first time!

By LEN BUCKWALTER, KQA5012

GETTING a CB license used to be trickier than passing a rubber check. Nearly half of all applications were bounced by the FCC because of infamous Item 9 which challenged you to explain why you needed CB. But a welcome change in the rules eliminated that essay contest and made filing almost a breeze.

Almost—the FCC still finds it necessary to return some 300 applications each month. The bad news arrives with Form 550, an official notice that, translated, says, "Sorry you fumbled your form. Return to Go."

In most cases this means only that you will have to make corrections on the form. But it's easy to avoid pitfalls in CB paperwork—even on the first try. Almost any United States citizen 18 years of age is eligible. (Don't apply if you're a 10-year-old alien with a prison record who wants CB as a hobby.) If you're under 18, you still can operate a CB rig. The equipment, however, must be licensed by a person over 18 who assumes responsibility. Reason is that it's the equipment—not the operator—that gets the license. All members of one family may operate several rigs licensed under a single application form. This also applies to business and government organizations which also are eligible for CB.

The $8 license fee is only part of the tab. You also must certify that you have a copy of the CB rules which cost $1.25. So the first step toward a CB license is twofold. Start by obtaining FCC Form 505 (the application itself). Local radio distributors may have them on hand and some CB manufacturers pack it with new equipment. Otherwise, mail a request to the nearest FCC office (see our table of locations). Address it to Engineer in Charge, Federal Communications Commission. If you're close by, a phone call usually does the trick.

While you're waiting for the application you should send for the rule-

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How To Get A CB License —the first time!

book. It's available *only* from the publisher: Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Request Volume VI, Federal Communications Commission Rules and Regulations and enclose a check or money order for $1.25 payable to Superintendent of Documents. You should receive the rules in about two weeks.

When you receive the application form you'll find that there are two identical copies except that one is marked Work Sheet in large red letters. This is the one you begin with and it will be the copy you retain. Remember as you fill it out that the FCC's biggest reason for bouncing applications is would-be CBers who simply don't take the time to read the questions carefully. (We'll go over the form in detail in a moment.) Once you're *sure* the Work Sheet is right carefully transfer your answers to the other copy, using inked block letters or typewriter.

Double-check the copy. Then make out a check or money order (cash is not acceptable) for $8, payable to Federal Communications Commission. Mail the application and the $8 to Federal Communications Commission, Gettysburg, Pa. 17325 and file away the Work Sheet for future reference. If the application has no defects your license should arrive in about four to six weeks.

If the application is rejected it is returned in about two weeks with a notice singling out the errors. You may make corrections directly on the original form, sign and resubmit it. An FCC stamp proves you've already paid the fee.

A CB license is good for five years. But don't get caught when renewal time rolls around. It's not FCC practice at present to notify you when the license is about to expire. It is your responsibility to file a renewal (on the same Form 505) at least 60 days before expiration date. If you file only a week or two in advance your new license might arrive *after* the expiration date, leaving you legally CB-less in between.

WHERE TO GET CB-LICENSE APPLICATION FORMS

FCC Field Engineering Offices can be found under the United States Government listings in the telephone directories of the following cities:

Alabama: MOBILE
Alaska: ANCHORAGE
California:
LOS ANGELES
SAN DIEGO
SAN FRANCISCO
Colorado: DENVER
Dist. of Col.:
WASHINGTON
Florida: MIAMI
TAMPA
Georgia: ATLANTA
SAVANNAH
Hawaii: HONOLULU
Illinois: CHICAGO
Louisiana:
NEW ORLEANS
Maryland:
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BOSTON
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BUFFALO
NEW YORK
Oregon: PORTLAND
Pennsylvania:
PHILADELPHIA
Puerto Rico:
SAN JUAN
Texas: BEAUMONT
DALLAS
HOUSTON
Virginia: NORFOLK
Washington: SEATTLE

Now let's go over the form question-by-question to see where problems arise and what to do about them. We'll assume you're an individual filing for Class D (mainstay of today's CB).

1. NAME OF APPLICANT

Enter last name, first name and middle initial in the space provided. A married woman should use her given name (e.g. Doe, Mary S.—*not* Doe, Mrs. John).

2. IF AN INDIVIDUAL OPERATING UNDER A TRADE NAME, GIVE INDIVIDUAL NAME, OR IF PARTNERSHIP, LIST NAMES OF PARTNERS (DO NOT REPEAT ANY NAME USED IN ITEM #1)

Leave these spaces blank. They're for businesses or organizations.

3. PERMANENT MAILING ADDRESS

Only your permanent address may be entered. You may not show an APO, Navy number or overseas address. It's possible, though, to have the license mailed to such an address if you request it in the remarks section on the reverse side of the application.

4. CLASSIFICATION OF APPLICANT

Check only one box: *Individual*, unless the license is for an organization or business.

5. CLASS OF STATION

Virtually all CB is under Class D so mark that box. Class C is for model radio control and Class B is a little-used VHF band that requires costly equipment.

6. IS THIS APPLICATION TO MODIFY OR RENEW AN EXISTING STATION LICENSE?

If this is your first application, check *No*. A *Yes* answer applies only if you already

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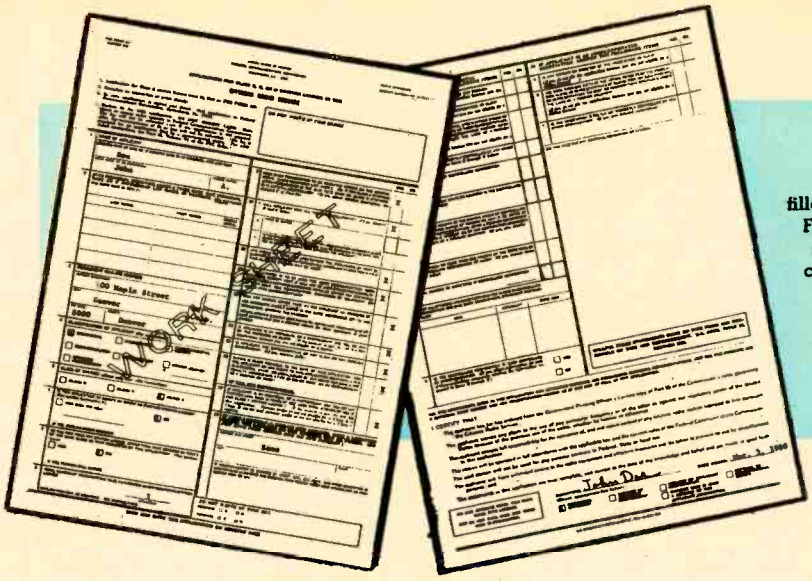

Application form is filled out in two copies. Front of form (far left) shown in Work Sheet copy that is retained by applicant; other side is final copy to be sent to FCC with $8 license fee.

have a call-sign and are renewing or modifying an existing license.

7. DO YOU NOW HOLD ANY STATION LICENSE, OTHER THAN THAT COVERED BY ITEM 6, OF THE SAME CLASS AS THAT REQUESTED BY THIS APPLICATION?

Check *No* on this one, since no person may hold more than one license in any class.

8. TOTAL NUMBER OF TRANSMITTERS TO BE AUTHORIZED UNDER REQUESTED STATIONS LICENSE?

Enter the number you expect to operate at any one time during the next five years. Individuals are entitled to use up to six units (business, 12). But if you say you will use only *one* you had better put a darn good reason in the remarks section of the form or it will be assumed you have hobby use in mind.

9. DOES EACH TRANSMITTER TO BE OPERATED APPEAR ON THE COMMISSION'S RADIO EQUIPMENT LIST PART C, OR, IF FOR CLASS C STATIONS USING FREQUENCIES IN THE 26-67 MC/S BAND OR CLASS D STATIONS, IS IT CRYSTAL-CONTROLLED?

This requires a *Yes* answer to meet technical regulations.

10. A. WILL APPLICANT OWN ALL THE RADIO EQUIPMENT?
B. NAME OF OWNER
C. IS THE APPLICANT A PARTY TO A WRITTEN LEASE OR OTHER AGREEMENT UNDER WHICH THE OWNERSHIP OR CONTROL WILL BE EXERCISED IN THE SAME MANNER AS IF THE EQUIPMENT WERE OWNED BY THE APPLICANT?

This requires a *Yes* answer under A to signify your ownership and control of the equipment. If you will not own it you'll have to indicate in B and C that you have a written or other agreement under which you have complete control.

11. HAS THE APPLICANT READ AND UNDERSTOOD THE PROVISIONS OF PART 95, SUBPART D, DEALING WITH PERMISSIBLE COMMUNICATIONS FOR WHICH THIS CLASS OF STATION MAY BE USED?

You must answer *Yes* here, saying you understand the rules. Otherwise, the application will not be accepted.

12. IF THE STATION IS TO BE USED FOR VOICE COMMUNICATION, DOES APPLICANT CERTIFY THAT IT WILL NOT BE USED EITHER FOR COMMUNICATION OVER A DISTANCE EXCEEDING 150 MILES OR FOR THE EXCHANGE OF CHIT-CHAT, IDLE CONVERSATION, DISCUSSION OF EQUIPMENT OR HOBBY-TYPE COMMUNICATIONS?

Again a *Yes* answer is mandatory for the application to be acceptable. This is your certification that you'll operate according to the rules.

13. WILL ANY PERSON, OTHER THAN (1) THE APPLICANT, (2) MEMBERS OF HIS IMMEDIATE FAMILY LIVING IN THE SAME HOUSEHOLD, OR (3) HIS EMPLOYEES, OPERATE THE STATION?

If only your immediate family or organization will operate the equipment answer *No*. If there's some reason for a *Yes* you must explain it on a separate sheet of paper. Remember, hobby use is illegal.

14. IF APPLICANT IS AN INDIVIDUAL OR A PARTNERSHIP, ARE YOU OR ANY OF THE PARTNERS AN ALIEN?

This is answered *No*. Aliens are not eligible for a CB license.

15. IS APPLICANT THE REPRESENTATIVE OF ANY ALIEN OR ANY FOREIGN GOVERNMENT?

This one's normally answered *No*. If you represent a foreign government explain fully on a separate sheet of paper.

16. WITHIN 10 YEARS PREVIOUS TO THE DATE OF THIS APPLICATION, HAS THE APPLICANT OR ANY PARTY TO THIS APPLICATION BEEN CONVICTED IN A FEDERAL, STATE OR LOCAL COURT

[*Continued on page* 115]

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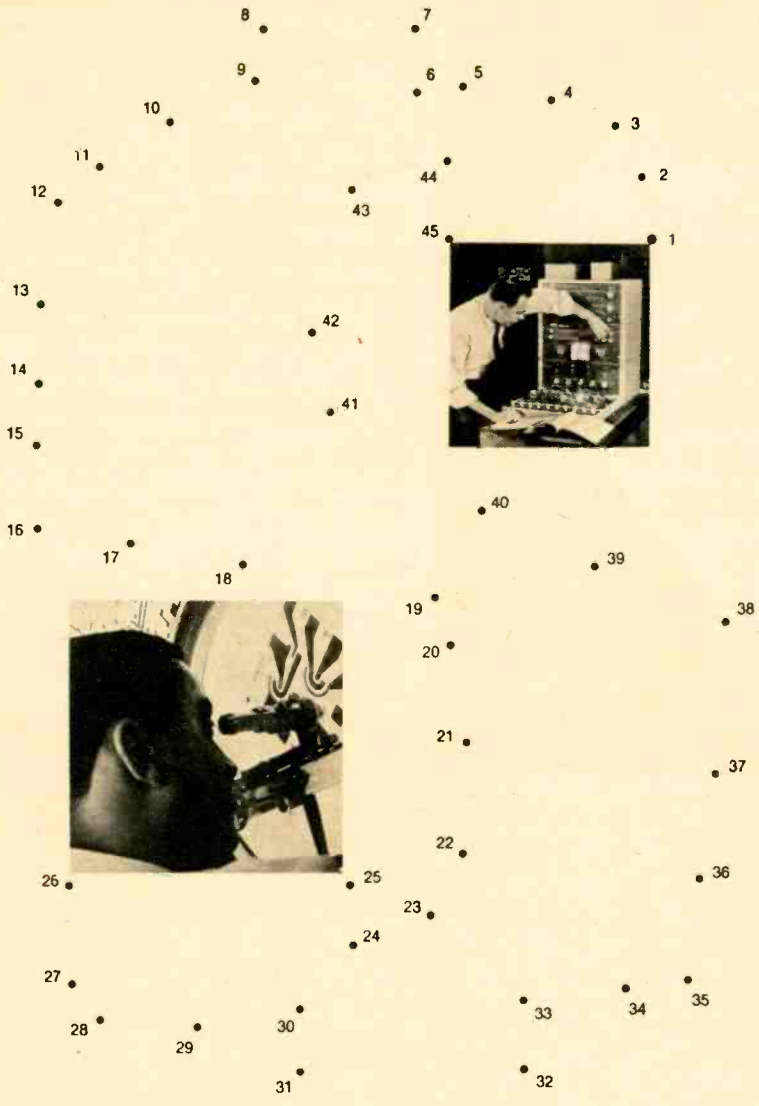

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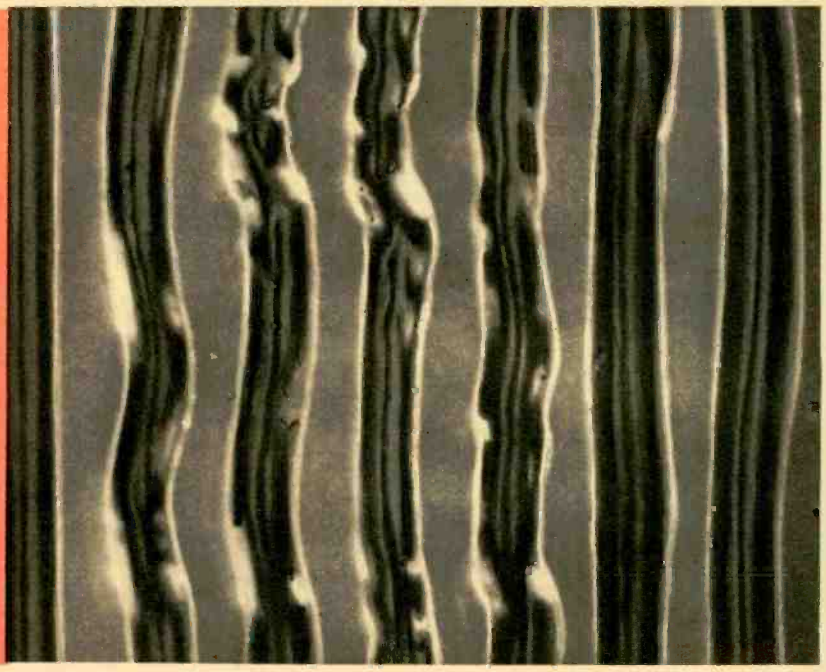
THE ABCs OF RECORD CARE

By ROBERT ANGUS



NO matter how elaborate or expensive your high-fidelity installation, chances are that you have shelled out far more for records than you have for equipment. And when you have that kind of an investment it pays to protect it. There are around 1,100 separate products on the market to help you protect your records but, as we'll see, record care primarily is a question of housekeeping.

Just how long can you expect an LP to last—even with proper care? A weekly newsmagazine recently infuriated record-makers by asserting that records will last for 500 playings. The industry, in righteous indignation, retorted that it's impossible to set such a limit because wear depends on how the owner stores his records, how often he plays them, what he plays them on, even what materials they're made of—and (not least important) how he defines wear. The audio purist may claim that the high frequencies have been wiped from a record on its first playing; a teen-ager may continue to rock to the Beatles when all but the beat has been lost in the noise.

You have virtually no control over record material, of course. Polystyrene tends to wear faster than vinyl. But what are you going to do about it if the recording you want happens to be pressed in polystyrene? This inexpensive material is used almost exclusively for 45s and low-cost (99-cent) LPs.

To understand the problem of record care, it's necessary to begin with a groove's-eye view of the playback process. Imagine a freshly plowed furrow in a field—one that isn't quite straight but has abrupt, minute bends and curves in it. This furrow isn't uniformly wide or deep, either. It bobs up and down, widens and pinches together as it might after a light plow in springy soil. A part of our field might, in fact, resemble the photomicrograph above.

Now imagine an object designed to fit into the furrow to translate its twists and turns into electrical energy. We don't want it to be heavy enough or sharp enough to move the earth and reshape the furrow. It should float along, faithfully rocking from side to side as the furrow bends, riding up over rocks and roots, descending as the furrow deepens. Every once in a while, however, a rock

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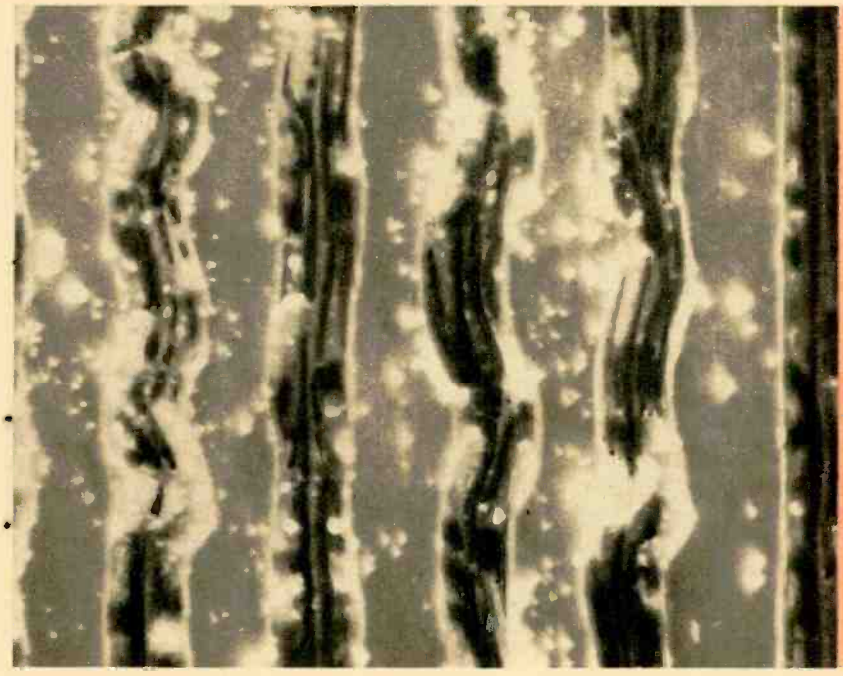

Photomicrographs show the difference between new record (opposite page) and one that has not been cared for. Part of the debris in the picture on this page is dust picked up by static charge generated in playing the record or removing it from its jacket. Other specks are chips of vinyl torn loose by worn or overweight stylus. Once the surface of the vinyl has been penetrated the rate at which it breaks down gets faster. Smallest variations in groove wall, representing high frequencies, go first; ragged edges of worn spots introduce noise. Dirt and oil also fill in bulges in groove wall, preventing stylus from tracking. Both photos were retouched lightly for clarity.

may become trapped in front of our stylus. As it pursues its path along the furrow it pushes the rock ahead of it.The rock gouges the sides of the furrow and smooths out curves. That's exactly what happens when dirt gets into your record grooves.

Keep an eye out for furrow-spoilers. The first thing to check is the condition of your stylus—at regular intervals. If you're one of the few still using a metal stylus, the fact that you've read this far proves you care enough about your records to throw it out and buy a diamond one. A new diamond can be had for less than $10—frequently with a quality stereo cartridge attached. Diamond styli were once called permanent but they actually have a life expectancy of about 12 months under normal home conditions.

A diamond can be damaged in two ways—by shattering (due to impact, for instance when it is allowed to bounce onto a moving turntable) and by wear as it plows through mile after mile of record grooves. If yours is a conical stylus (most are) its tip should be almost spherical. After months of use, however, the edges become worn so that the tip is more chisel-shaped than round. The chisel then cuts or stretches the vinyl as it passes. This alters the sound you get out of the groove, attacking first the high frequencies, then the overall sound.

The elliptical stylus is designed to fit the stereo groove even more snugly than the conventional cone. But it, too, tends to be ground down by wear. Whatever the contour of the stylus, it goes without saying that one that is well-made treats records more gently than one made in a hurry. And care in manufacture usually is reflected in stylus price.

The next factor to consider is tracking force—that is, the weight the stylus exerts on the record surface. Tracking force is adjustable on modern high-quality record-playing equipment and the recommendations of the manufacturers of both the cartridge and the tone arm or record changer should be taken seriously. For top-quality equipment, they generally call for 1-2 grams of tracking force. As you reduce tracking force from, say, 10 grams, record

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wear can be expected to be reduced as well. But when the pressure of the stylus in the groove gets too low the stylus will begin to skid and chatter, eventually hopping out of the groove altogether. Obviously, both distortion and record wear will increase rapidly as this begins to happen.

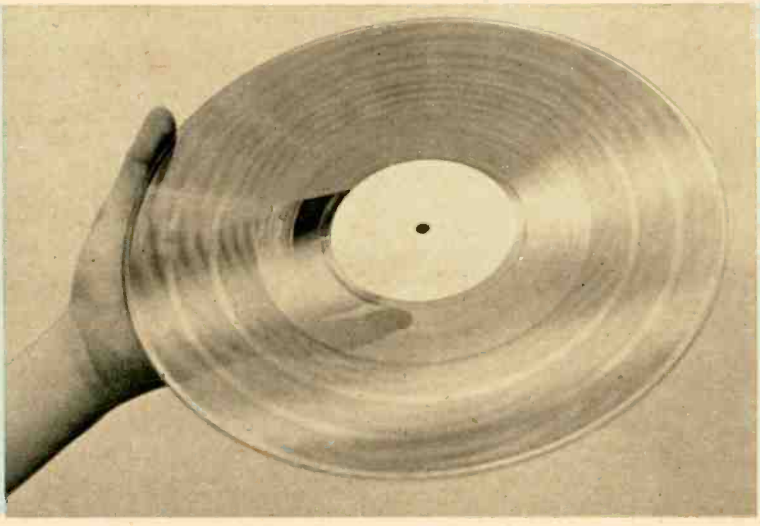
A tracking force of 1.5 grams may seem infinitesimal. But pressures on the groove wall work out to more than 3 tons per sq. in., so small is the contact area. At 3 grams you increase this pressure to more than 7 tons per sq. in.—and cut years from record life.

So much for the way your stylus treats your records. How should *you* treat them? There are two schools of thought on this subject. One believes that where there's a problem, there's a gadget you can buy to solve it. The other holds that as long as records stay in their jackets, they can't come to any harm. It may be hard to believe but there are some record collectors who still have mint (unplayed) copies of 78 rpm discs by Caruso and Farrar or LPs by Toscanini or Stan Kenton. You can compromise by playing the record once, simultaneously copying it on tape and listening only to the tape from then on. If you tape each record as it arrives, you catch it in the bloom of youth—no ticks, pops or scratches (assuming a good pressing) and no erasure of high frequencies. After your interest in the tape has waned you can erase and reuse it, resorting to the disc on the relatively few occasions when you still want to hear it.

If you prefer to rely on the gadget approach you'll find devices ranging from stylus microscopes and brushes down to almost useless items like radium anti-static bugs and downright harmful preparations such as one anti-static aerosol spray that actually attacks record surfaces.

Plastic records are prone to develop static electric charges. The static attracts all sorts of dust and grime and holds it on the record surface. Thus many record cleaners have operated on the premise that if you can get rid of the static charge, it's a simple matter to remove the dust. Some of these products did more harm than good and few are still on the market.

Anti-static sprays were among the first products to attempt the job. Then came the detergents—in sprays, plastic bottles, roll-on applicators, and a variety of other forms. The Library of Congress in its 1959 report on record care and



To keep skin oils, which attract dust, out of record grooves always hold record so you touch only the edges or the label. Best way is to put middle finger at center hole, balance edge on thumb and heel of your hand as shown in photograph.

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storage recommended a solution of ethylene glycol, lightly applied. This is the heart of the Elpa Dust Bug or detergents such as that marketed by the Dexter Chemical Corp.

Many record collectors, however, prefer to launder their records regularly in a sinkful of warm (not hot) water with a capful or two of a very mild kitchen detergent such as Lux. Each record is washed carefully with the hands, rinsed under warm running water and stacked vertically in a rubber dish rack to dry. The water removes the static charge, the detergent the dirt.

Once they're clean, you'll want to return your records to their jackets. You can buy polyethylene bags or envelopes made of paper or glassine in which to insert your records to protect them from the inside of the jacket. The poly-bags are particularly good because they collect dirt from the record itself, they can be folded over to provide a good dust-tight seal and are more yielding than paper. A close second are the polyethylene-lined paper envelopes like those supplied with Angel, RCA Victor and London records (among others). Paper envelopes certainly are better than nothing; glassine, on the other hand, becomes brittle with age, forming sharp edges that can scratch record surfaces.

For the fastidious, there are a host of gadgets to handle records without letting your fingers touch them (rubber-coated grippers and disposable paper mittens are two of the most exotic). But a little practice and reasonable care should enable you to get your records from jacket to turntable and back without leaving fingerprints (which attract dust) on the playing surface. If you're right-handed, take the record jacket in your left hand. Bow it between your hand and your body, reaching inside with your right hand. The thumb should rest along the record edge while your middle finger locates the center hole. Having found it, simply lift the record out. To place it on the turntable, grasp the record between both hands, touching only its edge.

There are a host of brushes to pick up dust before the stylus does. When you go brush shopping, look for one whose bristles are firmly fastened and flexible enough to yield rather than grind dirt into the groove. Many professionals use no brushes at all, with the exception of a hand-held camel's hair brush to dust the stylus assembly from time to time. Some use the swivel type which covers the entire record in one revolution (practical only on manual turn-tables). Outrigger brushes that clip on the tone arm are generally frowned upon.

And last, but not least, there's the plastic turntable [*Continued on page* 115]

Use a mild soap and warm water to wash records, rinsing them thoroughly and allowing them to drain until dry. Polyethylene-lined paper envelopes (in background) may be bought in some record stores to protect discs inside original jackets.

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Notes from El's DX Club

ISRAEL reportedly has assigned three new ham prefixes. 4X6 is former Egyptian territory, 4X7 former Syrian and 4X8 former Jordanian territory. Just how these areas will count as DX countries is anyone's guess at the moment.

The Maldive Islands Broadcasting System (note correct ID), according to a letter they wrote H.L. Chadbourne, apparently in planning a power boost. They currently operate on 3329 kc from 0730 PST sign-on.

A new frequency for R. Nacional Espana's Canary Islands relay is 15365 kc. Bob LaRose (New York) tells us they are there as well as on 11800 kc from 1500 to 2300 EST.

Did you know that the Red Chinese telephone station at Shanghai sometimes uses an English language test tape? Bill Sparks reports reception at 2140 PST on approximately 18590 kc.

R. Damascus (Syria) has turned up on a new frequency: 11915 kc at 1500 EST, in Arabic. Previously this channel had been held down by R. Cairo.

A new off-band frequency for R. Pyongyang (North Korea) is 16295 kc, which they use around 1915 EST for Spanish to Latin America.

The Far East Broadcasting Co. has just obtained three transmitters (one 50-kw and two 30-kwers) that formerly were used by Press Wireless, Inc. They were shipped to the Philippines.

The first reliable report in a couple years on R. Mogadishu (Somali Republic) is turned in by California's William Sparks. He heard it on approximately 6097 kc at 2235 EST (1935 PST).

Capt. Ronald N. Orr, writing from Thailand, tells us that the VOA's 760-kc station is now heard regularly in Southeast Asia. West Coast BCB DXers might have a chance to log this one.

Mark Connelly (Mass.) reminds that if any European BCB station can be heard in North America this season it probably will be the O.R.T.F. transmitter at Nice, France, on 1554 kc. The station operates all night, which means it could show up any time during our evening hours.

Correction to the November *Notes:* ZBTAR should read ZB2AR.

An interesting fluke is reported by Bob LaRose. Moscow has been heard with two different Russian language transmissions simultaneously on 15460 kc at 2000 EST. Probably one transmitter is in Asia and the other in Europe.

If you have yet to log the Republic of Panama, watch for test tapes from the Tropical Radio Telegraph Co. late afternoons and early evenings on 9132.5 kc. Call letters on this frequency are HPI, as reported by Bob Conder (North Carolina).

Believe it or not, there is another RA on 6000 kc (remember the deleted R. Americas SW service?). The new entry has nothing to do with the CIA. It is R. Afghanistan, scheduled at 2030-2230 and 0230-0330 EST.

Propagation: During daylight hours, DX openings on transatlantic circuits will be possible from 15 to 26 mc. The 10-meter amateur band will be open to Europe during the late morning hours (local time) about half the days of the period. The 10-meter band will also open regularly between the U.S. and Africa, as well as into Latin America, during daylight. Openings in this band will also occur into Australasia during the late afternoon and evening hours, local time.

At night, European and African openings are expected regularly in the bands from 6 to 15 mc. Conditions from Latin America should continue good to excellent with DX in the 15-mc band until after midnight, local time.

Because of higher noise levels in the spring, BCB DX is expected to taper off somewhat.

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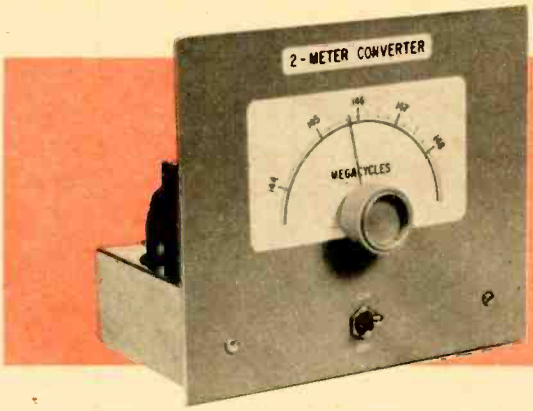

2 Tubes for 2 Meters

By CHARLES GREEN, W6FFQ

MANY'S the time, we'll bet, when you were locked in a traffic jam you looked up at a plane and dreamed of cruising along at 30,000 ft. Things are free and clear up there.

And so it is with hams. Operating in the down-in-the-basement 80-, 40- and 20-meter bands, they often feel as though they're on a bumper-to-bumper expressway. So how do they get to 30,000 ft.—frequency wise? By switching to the wide-open spaces of 2 meters (144 to 148 mc).

The 4-mc spread is just beginning to fill up with local rag chews, nets and experimental transmissions from new rigs. It's still clear air. Two meters is the only band in which Novices can operate phone (145-147 mc) and Technicians have all amateur privileges. MARS and CAP nets are active on the top and bottom ends of the band, handling messages and general traffic.

Using our converter, you can listen to the band on any broadcast receiver. Just connect it to the receiver and tune on the converter. The converter uses a Nuvistor grounded-grid tuned-RF stage which feeds a dual-triode mixer-oscillator stage. This stage converts the 2-meter signals to a broadcast-band frequency.

Construction. Our converter is built on a 5 x 7 x 2-in. aluminum chassis. The front panel is a 7 x 8-in. piece of aluminum. Start off by laying out the component positions on the top of the chassis, as shown in Fig. 1. Easy way to do this, is to tape paper on the top of the chassis, scale the measurements from the pictorial and photo then transfer them to the paper.

Center the tuning capacitor's (C2A,B,C) mounting template (supplied with the capacitor) on the chassis and mark the mounting holes. Because of the converter's operating frequency, parts placement is extremely critical.

The terminal strip for R5-C16A,B is mounted under one of C2's mounting screws. Install ground lugs on the other two mounting screws. Before installing C2, carefully remove one *rotor* blade from each section. Cut ⅜-in. holes in the chassis directly below each of C2's terminal lugs.

Before installing L1, solder a length of No. 22 hookup wire to the lower lug and wind two turns around the coil as shown in Fig. 4. Install a ground lug under the base of the coil and bend the lug about ¼ in. away from the chassis. Solder a short wire from the ground lug to the coil's lug as shown in Fig. 3. Position L1 as shown in Fig. 4 and mount it on the chassis. Install coil L2 and L4 under the chassis where shown in Fig. 1.

Wind 12 turns of No. 22 hookup wire around L3 and twist the ends together for about 1½ in. Cut off the remainder of the wire. After mounting L3, solder the wire ends to J2.

Keep the wiring around V1 and V2 as tight and direct as possible. Cut capacitor and resistor leads just long enough to allow tight point-to-point wiring. Don't push components against the chassis. Use the two ground lugs mounted under C2's mounting screws to hold the coax from J1 to L1 in place.

To make a dial pointer, we bent and shaped a piece of tin around the flat portion of C2's outer concentric shaft. We soldered a piece of wire to the tin band. The front panel on our model was mounted to the chassis with two sheet-metal screws.

Alignment & Calibration. Plug in V1 and V2 and turn on power switch S1. Plug in the

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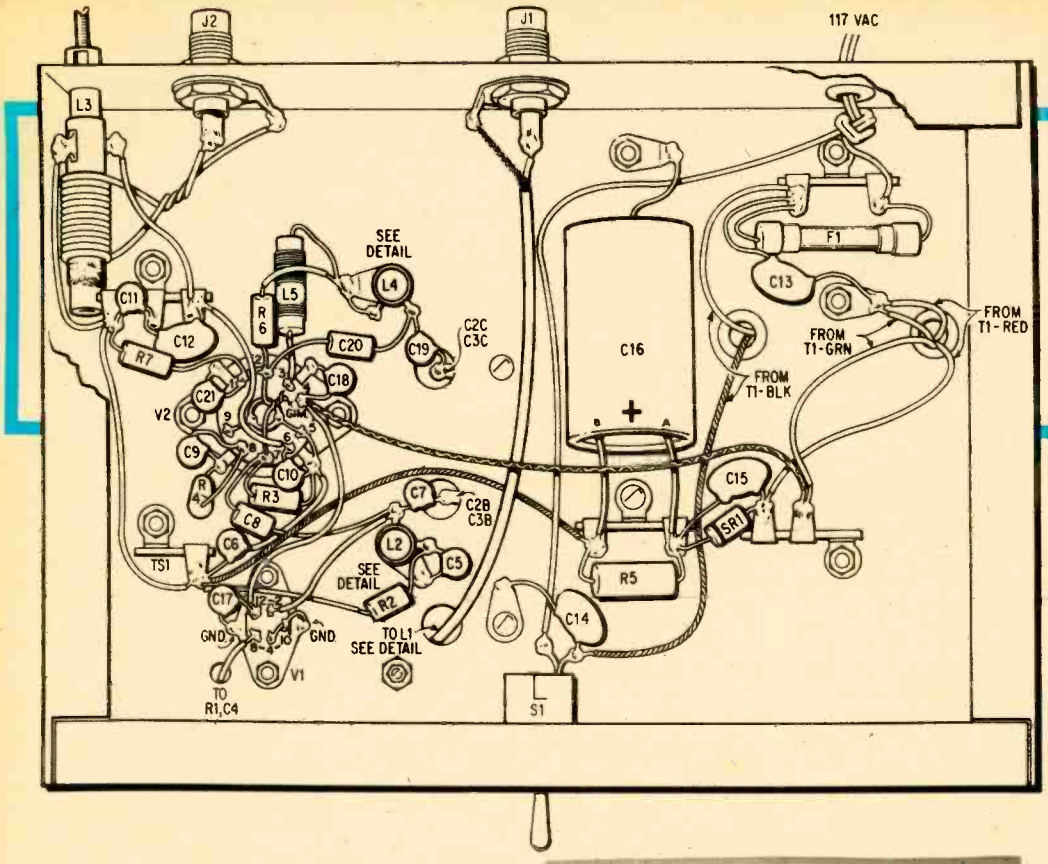

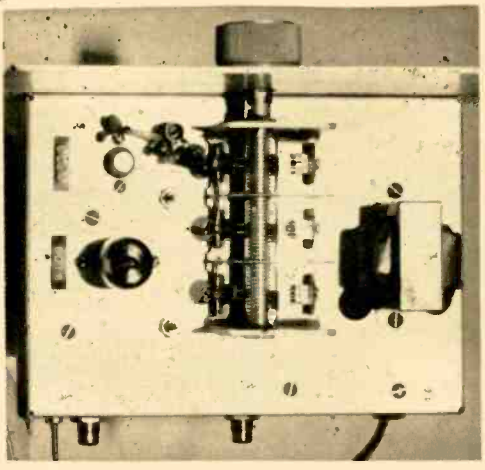

2 Tubes for 2 Meters

Fig. 1—Note in pictorial of underside of chassis (above) the exact location of parts around V1 and V2. To lay out your chassis, take dimensions from pictorial and multiply them by 1.35 for 5 x 7-in. chassis. Holes through which leads from C19, C7 and lead from J1 pass are ⅜-in. dia. Gimmick capacitor between pins 2 and 7 of V2 is two twists of No. 20 solid hookup wire. See Fig. 3 for details on coils L1,L2 and L4.

converter and allow it to warm up for at least 10 minutes. This time is required to allow the oscillator to stabilize and stop drifting. While things are warming up, check for any signs of trouble, such as component overheating.

Connect the converter output (J2) to a broadcast or communications receiver's antenna and ground terminals, using either coax or twisted wires. If the receiver does not have antenna and ground terminals, wind four turns of hookup wire around its loop antenna and plug the wire in J2. If the receiver is an AC/DC type, do not connect the converter to the receiver's chassis. To be safe, connect isolating capacitors of approximately .001 μf in series with each lead from the converter's output, or link-couple to the antenna coil of the receiver.

Tune the receiver to a quiet spot on the

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high end of the dial (ours was set to 1650 kc). Turn each coil's slug-adjustment screw so the ends are the following distances from the chassis: L1—½-in., L2—¾-in., L3—½-in. and L4—¾-in. If you have a signal generator that covers 144 to 148 mc, connect it to J1 and set the output for a modulated 144-mc signal.

Set C2 so that the plates are not quite fully meshed and adjust L4 until you hear the signal in the receiver. The signal generator output voltage may have to be set very high in order for you to hear the signal at this point. As you adjust L4, the signal will be heard at two positions of L4's tuning screw. Set the screw so it is highest from the chassis. This will cause the oscillator to operate at a frequency higher than that of the incoming signal.

Adjust L1 and L2 for maximum output

PARTS LIST

Capacitors: 1,000 V ceramic disc unless otherwise indicated
C1,C7,C10,C19—10 μμf (zero temperature coefficient, NPO. Sprague Series 10TCC. Allied 43 B 9961)
C2A,B,C—Three-gang variable capacitor; 7.0-17.7 μμf per section. (J. W. Miller 777-VC, Allied 54-0009. $4.65 plus postage; not listed in catalog. Remove one rotor blade from each section; see text.)
C3A,B,C—2-15 μμf trimmer capacitor on V2A,B,C.
C4,C9—470 μμf
C5,C6,C11,C17,C18,C21—.001 μf
C8,C20—27 μμf
C12—47 μμf (NPO, see C1)
C16A,B—20/20 μf, 150-V electrolytic
C13,C14,C15—.01 μf
F1—½ A pigtail fuse
J1,J2—Phono jack
L1,L2,L4—0.088-.120 μh RF coil. (J. W. Miller 20A 107RB1, Lafayette 34 H 8944). L1 is modified: See text.
L3—Subminiature antenna coil (J. W. Miller 2002, Lafayette 34 H 8749)
L5—1.72 μh RF choke (J. W. Miller RFC-144, Lafayette 34 H 8973)
Resistors: ½ watt, 10% unless otherwise indicated
R1—240 ohms
R2,R7—1,000 ohms
R3—1.2 megohms
R4—10,000 ohms
R5—2,200 ohms, 2 watts
R6—22,000 ohms
S1—SPST toggle or slide switch
SR1—Silicon rectifier; minimum ratings: 500 ma, 400 PIV
T1—Power transformer; secondaries: 125 V @ 15 ma, 6.3 V @ 0.6 A (Allied 54 B 1410 or equiv.)
V1—6CW4 Nuvistor tube V2—6DT8 tube
Misc.—Nuvistor and 9-pin tube sockets, 2 x 7 x 5-in. aluminum chassis, aluminum front panel, RG58/U coax, terminal strips

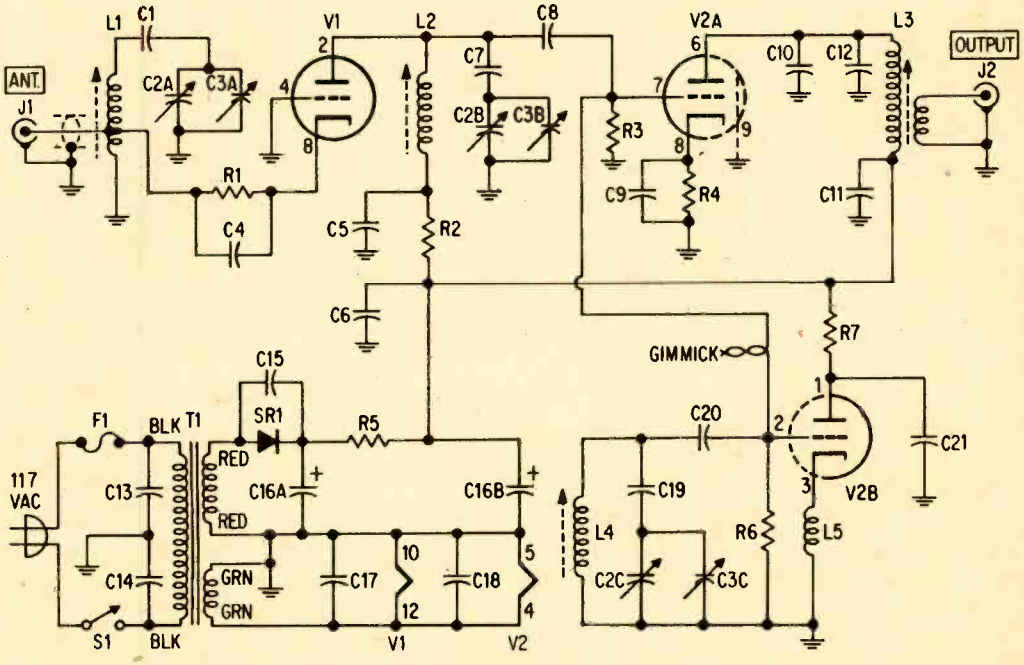

Fig. 2—Signals from antenna are tuned by C2A, amplified by grounded-grid RF amplifier V1 and coupled to mixer (V2A) grid via C8. Oscillator V2B is coupled to mixer grid with gimmick capacitor and tuned by C2C above frequency of incoming signal. Difference frequency is coupled by L3 to output (J2).

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2 Tubes for 2 Meters

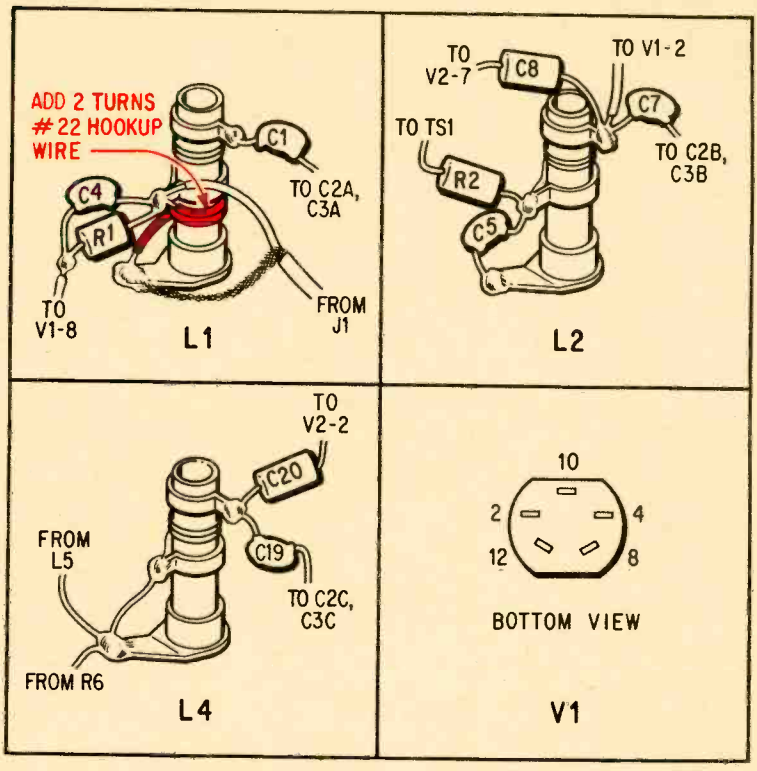

Fig. 3—Detailed diagrams of coils and Nuvistor socket. Note on L1 that you have to add two turns of No. 22 hookup wire. One end goes to the bottom lug on the coil; the other goes to ground lug between coil form and chassis. You must install the ground lugs between coils and chassis as they are not supplied with the coils.

from the receiver, reducing the signal generator's output voltage, as necessary, to prevent receiver and converter overload. Adjust L3 to peak up the signal to the receiver.

Set the signal generator to 148 mc and adjust C2 until you hear the signal. Adjust C3A and C3B for maximum output from the receiver. You may have to adjust C3C to hear the signal at the dial's high end.

Repeat the adjustments at the 144-mc and 148-mc dial points while rocking the tuning capacitor as you adjust for maximum signal. Now calibrate the remainder of the dial with the signal generator. We calibrated our dial at 0.25-mc points. If you don't have a signal generator, connect an antenna to J1 and peak up the converter with an on-the-air signal.

Operation. Always allow a 10-minute warmup period to stabilize the oscillator before using the converter. An outside antenna is required for most signals; for strong signals a whip about 18-in. long will do. Connect it to the converter with RG59/U coax. For weaker signals a beam (for horizontally-polarized signals) or a ground plane (for vertically-polarized signals will be necessary). A TV antenna will also work for horizontally-polarized signals.

Fig. 4—Closeup of coil L1 (arrow) shows how it's mounted near front section of tuning capacitor. Note coax from J1 coming up through chassis.

Images of strong signals on the low end of the band may be received approximately 3 mc away on the high end of the converter dial. The sensitivity of the converter-receiver combination depends primarily on the receiver that you're using. If desired, the converter can be aligned for a different output frequency other than the broadcast band. If you have a communications receiver, the converter can even be aligned for an output in the 80-meter ham band.

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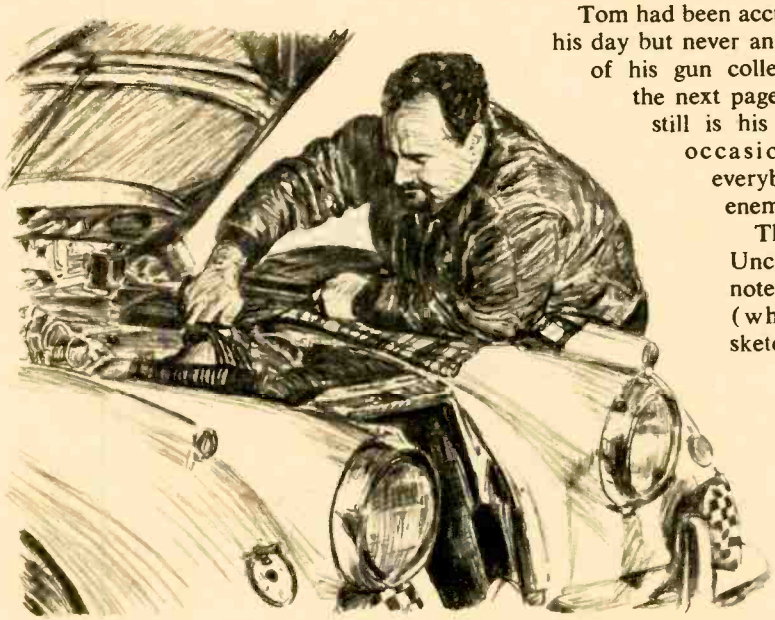
A PEEK IN UNCLE TOM'S CABIN

Drawings by
J. GEORGE JANES

NOT long ago two FBI agents showed up at the office of Tom Kneitel, proprietor of Uncle Tom's Corner in EI. After questioning him they revealed that a reader in Texas had torn a drawing of Tom from the head of the column and sent it in with the comment that it looked mighty like a picture in the post office—a mug shot of one of the country's ten most-wanted men, a chap who was presumed to have murdered his wife and child, then burned the house to cover his tracks and skipped town.

Tom had been accused of a lot of things in his day but never anything like this. In spite of his gun collection (see drawing on the next page), his deadliest weapon still is his typewriter. And if he occasionally slings ink—well, everybody's got to have a *few* enemies.

These new drawings of Uncle Tom were done by noted artist J. George Janes (who also executed the sketch that caused the furor)



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A PEEK IN UNCLE TOM'S CABIN

and are presented for the further enlightenment and entertainment of all FBI agents everywhere. They show Tom at his home in Commack, N.Y. (which he has not burned down even once). He lives there with his second wife and three children. Other occupants of the Kneitel household have included assorted dogs and Jaguars (the automotive kind; see tinkering Tom at the bottom of the previous page).

Although he has settled down (if that's the correct phrase) to a career as a writer and editor, Tom also has been a disc jockey in Coral Gables, Fla.—until the station went broke. He has peddled movies (we didn't dare ask what kind), even worked for a detective agency. That lasted two weeks.

Now he edits a CB magazine, S9, is a ham licensee, fools around with short-wave listening (top drawings), collects coins and eats one meal a day—from 2 to 10 p.m., or so he claims.

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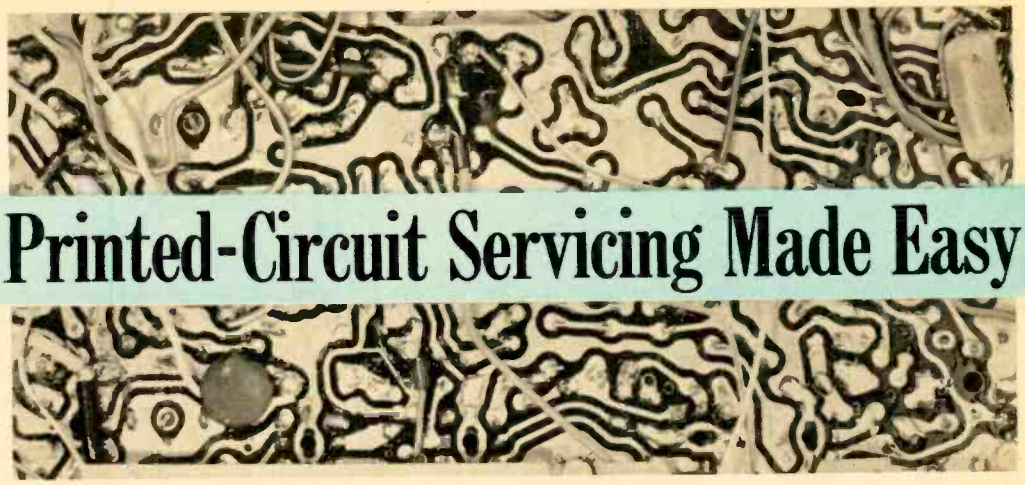

Printed-Circuit Servicing Made Easy

By JOSEPH RITCHIE

BACK in the days when the tube was king, servicing was a snap. To change a component you charged in with a 150-watt soldering iron, grabbed some No. 20 wire with a hefty pair of long-nose pliers and pulled till the connection broke free.

But printed circuits have foil thinner than a human hair (and twice as delicate) and components jammed so close you can't see light between them. The servicing techniques you used with tubes will turn a miniature radio into a box of spare parts faster than you can pull your thumb off a hot soldering iron.

Printed-circuit servicing requires new techniques and, above all, new tools. That old pair of 6-in. dykes that slipped between the pins of a tube socket can debilitate a handful of parts *and* the PC board itself with just one squeeze.

The Outer Shell

Before we can tackle a printed circuit we've got to eliminate the manufacturer's Berlin Wall. Most modern printed circuits carry a protective coating intended to prevent oxidation of the copper foil and connections. If the servicing will require soldering or desoldering on the foil the protective coating must be removed first. Trying to push the soldering iron through the coating is a sure way of opening the circuit by digging insulating canals in the foil.

The protective coating is removed easily with General Cement's Print-Kote Solvent (Fig. 3). After repairs are made the exposed foil can be recoated with Print-Kote Silicon Resin. Similar resins and their solvents are available from other sources.

When Foil is the Villain

Your repair may require work on the copper foil itself. The most common problem is *open foil* which can be a hairline break caused by bending of the circuit board or a large break caused by excess soldering heat that has broken the bond between foil and board, lifting the foil. The simplest and best repair is a jumper wire soldered across the gap (Fig. 6). Just lay the wire on the foil and solder. Don't start drilling holes in the board to wrap the jumper around the board. That's not necessary.

When you must repair a large gap in a wide foil section (such as is used to carry filament current) either use several wire jumpers in parallel or paint on a new foil section with Print-Kote Copper Print (Fig. 4). If the foil was silvered (for instance, in high-frequency tuners) Silver Print should be used.

The Right Touch

Since excess soldering heat can ruin the foil, use a low-temperature solder when possible. If you don't feel like splurging on special solder any standard *thin* solder (1/16 in. or thinner) should be used. The larger stuff is so thick that by the time the iron melts the solder the foil has long since given up the ghost.

A defective component is simpler to track down than a hairline break in the foil but it can't be repaired so easily. Replacing com-

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Printed-Circuit Servicing Made Easy

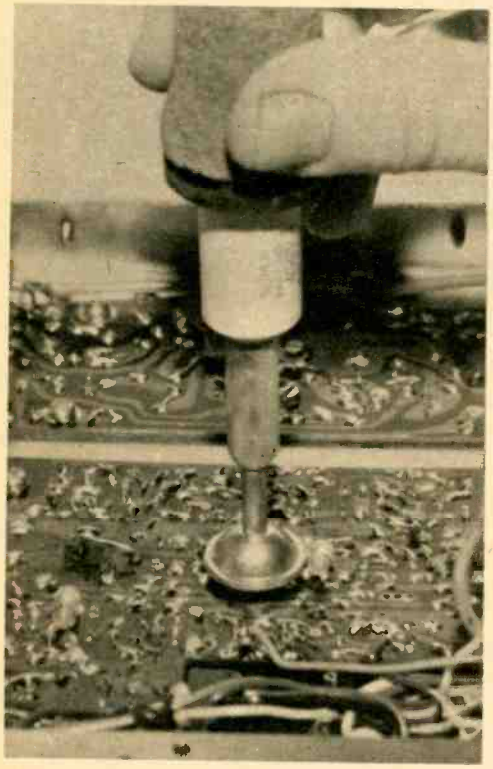

Fig. 1—Desoldering accessories (tiplets) come in various shapes, heat several connections at once.

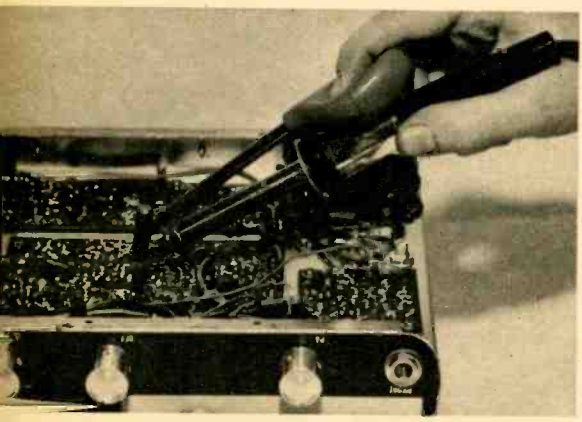

Fig. 2—Endeco Model 300-K desoldering kit uses suction to remove solder melted by attached iron.

ponents requires extreme care, special tools and, above all, the correct technique. A slight tug on a resistor, which would do no more than splash some solder from a hand-wired chassis, can strip the foil from the board. So, whatever you do, do it gently.

The Right Tools

Special tools and techniques go hand in hand so we'll discuss them together. First, you are going to need a new soldering iron. That 150-watt bull will ruin more than it will fix. Choose one rated at 25 to 50 watts.

One of the best bets is the Ungar 4045 because it takes interchangeable tips. For general use a fine pencil tip can be screwed in; special desoldering tiplets (Fig. 1) are used when you have to remove a major component. An IF transformer, for example, has 5, 6 or 7 leads sticking through the board. If you try to remove it with a standard tip one will cool before you get the next one hot. But a desoldering tiplet can be a large cup, bar or triangle that heats all the pins at once. There's even a slotted tip that allows you to dig under a bent wire so it can be straightened for removal.

Another handy device is the Endeco No. 300 pencil (Fig. 2). This is a soldering iron with a hollow tip and a suction bulb. You press the bulb, put the tip over the connection, release the bulb, and practically every drop of solder is slurped off the connection. A similar device is the Ungar 7805 Solder-Off TFE Desoldering Bulb. It is just the bulb without an attached iron and therefore requires an extra hand to slurp with while you warm the connection. This should pose no particular problem, however.

If the component isn't jammed too tight against the board you'll often be able to make repairs simply by cutting out the defective component and using the original leads for tie points. The tool for the job is Krauter's Radio and Ignition-Nose Cutting Pliers. They're extra-thin long-nose pliers with the cutter located about ¼ in. back from the tip. Being thin, they can be snaked through a jumble of components and positioned for the cut. Then a quick press removes only the component you want.

Replacing Parts

Be certain when you cut components that you leave the longest possible leads. A good repair can be made by looping the ends of

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the cut leads, snagging the new component in the loops and then soldering.

If there's no room to swing a soldering iron or if the lead is so short you can't form a loop (a common problem) there's a cute gadget that will get you off the hook. The little helper is Sprague's Quig (Fig. 5), a small coil of wire coated with resin and a low-melting-point solder. You slip the Quig over the cut lead, slip the lead of the new component into the top of the Quig and when you touch it with an iron the solder flows and makes the connection. If you can't get the iron on the Quig you can heat the lead and it will melt the solder on the Quig.

Tracking Trouble

What we've said so far assumes that you already have located the source of trouble. Sometimes that's not so easy if you're flipping the board back and forth to trace, simultaneously, the convolutions of the printed side and the welter of components on the reverse. But there's a simple solution.

First, grind or file your test-probe leads to a fine point. (If they look like lethal weapons you've got them right.) Next, flip over that fluorescent desk lamp and place the printed circuit directly on the lighted tube. All the foil wiring will show right through the board and you can use those test-lead darts to pierce the protective coating. Of course, it may be difficult to place a printed-circuit TV chassis on a desk lamp but you can substitute a 60-watt bulb. Just hold it behind the chassis. And in case you want extra brilliance try a No. 1 photoflood lamp.

Critical Dimensions

When servicing PC boards it's important to keep in mind that PC wiring serves two purposes. First, it insures that component placement will be exact from unit to unit. This is a particular advantage in maintaining critical RF-circuit dimensions. So, when you're working on an RF board always install the replacement part in the exact location and position of the part you removed.

The second advantage of PC boards is, obviously, cost. And low-cost boards are also fragile boards. Don't forget that when you come to remount them. Tighten mounting screws a little at a time in rotation to equalize stresses on the board. If you tighten one screw all the way before tightening others, you'll bend the board and break the foil.

Fig. 3—Protective coating must be removed from PC board with solvent, replaced following repair.

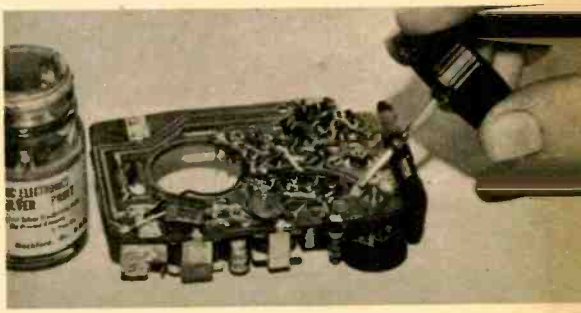


Fig. 4—Large foil areas can be repaired with conductive paints formulated for that purpose.

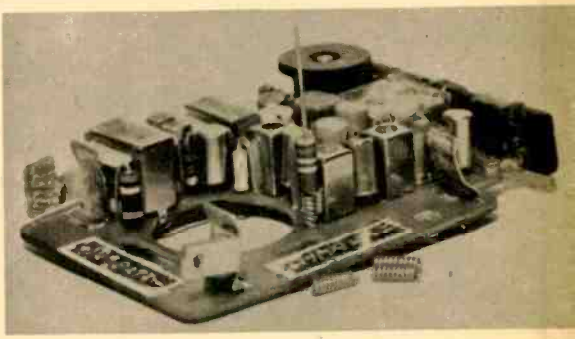
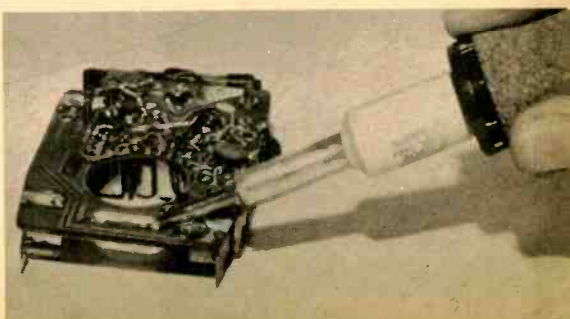


Fig. 5—Quigs (in foreground) are self-soldering splices for short leads even in tightest spaces.

Fig. 6—Damaged foil is joined and reinforced with wire jumper, shown being soldered to PC board.



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SEEING RED . . . The mysterious box in the foreground is called a Sunvistor. And, so far, the company that is importing from Japan to this country (Sharp Electronics Corp., Carlstadt, N.J.) is giving out little more information about it. It is said to stimulate color sensations in the color-blind by feeding current to the subject through the headset. Twenty minutes a day of properly controlled training with the device, says Professor Koichi Honkawa, its inventor, can eventually lead to corrected color vision.

Electronics in the News

Tap-a-Tune . . . The keyboard of this pocket-size electronic organ has no moving keys. Object was not to simplify construction (although the entire keyboard can be etched from a single copperclad panel) but to simplify playing. The instrument is made in England by Moviecol Enterprises Ltd. for use by the physically handicapped. Instead of depressing a key the player touches it with a stylus, completing the oscillator circuit and playing the note. Arpeggios require no fancy fingerwork—only the sliding of the stylus over the keys. The organ has a vibrato switch and can be tuned to match the pitch of other instruments in a combo. It is powered by a 9-V battery. Next, perhaps, we'll have a larger model for more fleet-fingered players wearing electrified gloves?

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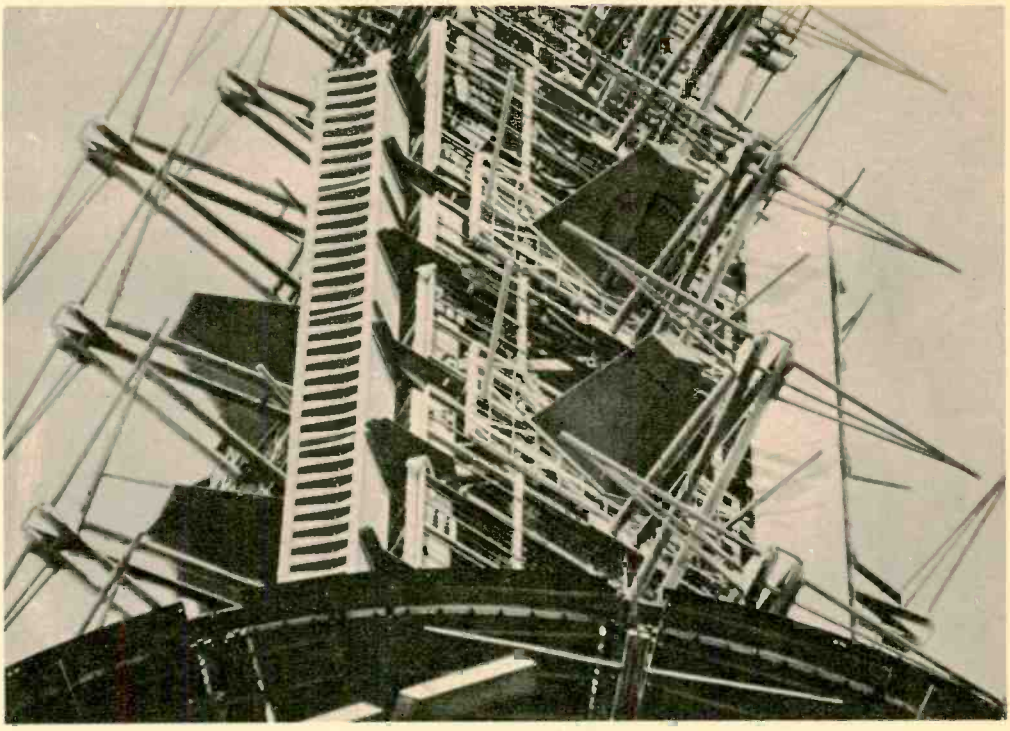

Topper . . . Since we ran our story on the antenna farm atop New York's Empire State Building (No Room at the Top, July, '67 EI) something new has been added—the first of its kind in the area, according to CBS. It is a circularly-polarized antenna for WCBS-FM, designed to improve reception on FM portables and car radios with vertical antennas. Four of the eight modules in the CBS antenna are visible. Each module (the dark truncated pyramids) contains two transmitting elements.

Flood of Facts . . . Dr. Norman H. Crawford of Stanford University is not planning his vacation. That map under his right hand represents a river valley and Dr. Crawford is busy feeding information from the map to an IBM System/360 Model 67 computer that can simulate flood conditions under given conditions of water resources, rainfall and snow runoff. Purpose is to forecast the effect of flood control measures and determine optimum time to open floodgates. Or the computer can figure out best water conservation measures in time of drought.

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Good Reading

By Tim Cartwright

PRIVACY AND FREEDOM. By Alan F. Westin. Atheneum Publishers, New York. 487 pages. $10

This is the second time in recent months that we have given top review billing to a book dealing with the topic of individual privacy vs electronic (and other) invasion thereof. And I don't think it's doing anyone any good at this point to gloss over the fact that increasing numbers of electronic hobbyists have been drawn to the dubious brand of fun represented by various forms of electronic snooping on others. There's no doubt, too, that some people are parlaying a hobbyist's acquaintance with electronics and communications into a lucrative side (or full-time) business.

I think that anyone drawn to electronic privacy invasion, or already dabbling in it a bit, should take a good hard look at Alan Westin's book on the legal, ethical and moral implications of this kind of activity. From all three standpoints this is a superb examination of the subject, heavily documented with facts of current practices and the clear danger involved for all—practitioner and victim alike. If you think that the objections to electronic fun and games are old-maidish or somehow outdated by modern possibilities of electronics, read this book and think again.

SKILLFACT LIBRARY. Editors & Engineers, Ltd., New Augusta, Ind. $1 each

All of the books that follow are part of the Skillfact Library, a cohesive series of paperbacks presenting the basics of various electric and electronic subjects. To my mind, the series is probably the best of its kind. It has good, clear writing with a minimum of padding, good printing, clear illustrations. At a dollar each, they are all good bargains by current paperback standards. (I'm often mystified by the $3.95 numbers that look like they were put together in someone's basement with the help of an electric typewriter, paper hooked from the office and a bad stapler.)

It's Easy to Read Electronics Diagrams by Donald E. Herrington (96 pages). Sure you can *talk* about electronics but what do you do when someone hands you a schematic? All those with red faces had better get this one.

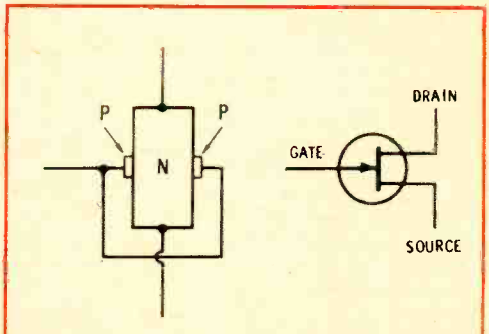
Introduction to Basic Electronics by Louis M. Dezettel (96 pages). A nice, compact introduction, free of stuffy tutoring or dense and unnecessary examples.

Basic Electronics Circuits by Farl J. Waters (96 pages). A good supplement to the above, covering amplifiers, oscillators, modulators, frequency mixers and converters, detectors and rectifying power supplies. There's not quite as much transistor coverage as I'd like but it's entirely adequate, all in all.

Computer Programming Fundamentals by Allan Lytel and Lawrence Buckmaster (96 pages). A surprisingly good treatment that makes a nice division between what a programmer has to know and the computer theory needed for more abstruse purposes and jobs.

Care and Repair of Your Small Home Appliances by Jack Darr (two volumes, 96 pages each). If you can log Pago-Pago but can't make the toaster stop burning the muffins, this pair will help stop the XYL's smirk. The first volume covers heater-type appliances, the second motor-type gadgets—both of them well. Good, money-saving suggestions.

Other titles worth noting in the Skillfact Library: *Electronic Test Equipment* by Louis M. Dezettel; *Understanding Fundamentals of Computers* by Allan Lytel; *Learn to Use the Slide Rule by* Electronic Teaching Labs; *Dictionary of Electronic Terms* by Donald E. Herrington.



FET diagrams from Basic Electronics are typical of illustrations in the Skillfact series.

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How to Protect Electronic Gear in Your Car

By JAMES JOSEPH

IT'S a grand feeling the first time you drive down the block with a long whip swaying in the wind and special plates proclaiming your call letters. Everyone's sure to spot you as a mobile ham. They sure will! Every member of the itchy-finger clan in town will know just where to look for a prize haul.

Anything and everything electronic is, in fact, among the prime targets of auto burglars. Los Angeles police report that stereo tape players are No. 1 on the most-wanted list nowadays. Close behind, in nationwide theft-from-car preference, are record players, speakers, CB outfits, mobile ham stations and even your car's AM-FM radio.

Common sense tells you to camouflage the transistor radio you leave behind on the car's seat—throw a coat over it, perhaps, or conceal it behind a sun visor. Out of sight, out of mind.

More valuable electronic gear deserves greater snatch-proofing. If it's portable use quick-disconnect couplings and lock it in the trunk or the rear-deck vault if you have one in your station wagon. Muntz Stereo-Pak, for one, sometimes installs its tape players in a lockable glove compartment. Custom car builders report they're often asked to contrive electronic hiding places—hollow armrests, kick panels that open with the push of a hidden button and under-dash hideaways big enough to stash the most theft-prone of gadgets. A Chicago CBer who carries a portable CB unit in his car conceals it in an under-dash tissue dispenser. Recently, somebody filched a cigarette lighter he'd left on the seat

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How to Protect Electronic Gear in Your Car

but his CB escaped detection.

There are other ways of avoiding conspicuousness. For example, there's a dual-purpose antenna marketed by Raytheon which, though it looks like the garden-variety car-radio type, serves *both* your CB gear and AM-FM radio. But you needn't take any chances at all if you bug your car with one of the new, complex (and sometimes expensive) systems calculated to thwart the most brazen of electronics thieves.

While any electronics whiz (like yourself) can throw together a workable anti-burglary system the fact remains that professional electronics thieves are clever. Usually it takes a specialist—plus carefully engineered systems and components—to do the job *really* well. Moreover, several of the new auto anti-theft systems serve a useful double purpose—they'll also monitor your car's operation and alert you to potential trouble.

Here, for your security on wheels, are some of the newest and best of automotive electronic watchdogs:

Perhaps the hottest new car-bugging system comes from PMC (Packaged Modular Components Co., Culver City, Calif.) It is the Sonic Car Alarm SCA-1000 whose five encapsulated ceramic crystal microphones (high impedance permits as many as 25 of them to be paralleled in the circuit) are hidden strategically under the hood, in the trunk, near doors and windows and even under the chassis.

The console's delay circuit, once activated, gives you 15 to 30 seconds to get out of the car and lock it. Then the slightest vibration or sound will trigger a concealed CB transmitter that beams a warning buzz to a receiver you carry with you should anyone tamper with your car. Sensitivity of the mikes can be adjusted so that even a screwdriver toying with your license plate will trigger the warning.

The basic Sonic Car Alarm with five mikes costs about $129.50; additional mikes, $7.50; the single-purpose CB transmitter and pocket receiver, $99.95.

Operation of another new PMC system is based on the premise that when a burglar opens a door, switches on the ignition, steps on the brake, etc., he causes a minute voltage fluctuation in the car's electrical system. Any voltage drop, sensed by a detector, is boosted by a single-stage, transistorized amplifier and used to activate an SCR switch connecting the horn relay to ground through a thermal type (Tung-Sol #650) flasher. The flasher keeps honking your horn at 1-sec. intervals until you or the police arrive. No would-be burglar is likely to wait around for that.

Should a thief somehow bypass common surge sources, a motion sensor, on the dash, reacts to vibration or noise and lights a small, unit-contained lamp—again causing a voltage drop. The motion detector consists of two mercury switches, set at nearly right angles, that act like a carpenter's level. Held to your dash by a suction cup, the detector's mercury is normally in null (or no-contact) position. Any vibration tilts one or the other, completes the circuit and sounds the horn.

PMC's BMA (Battery Monitor Alarm) costs about $19.95; the motion detector, another $11.95. A clamp-on key switch ($3.95) gives more protection than the standard concealed toggle switch that arms or disables the system. You can substitute bell or siren for the horn alarm. An isolater is also available for auto appliances like electric-rewind clocks that might produce surge in a parked car, causing false response.

The latest wrinkle in PMC's system is the SRI-100 Sonic Radar Intruder Alarm. It plugs into the cigarette lighter and, through a pair of crystal transducers, floods the car's interior with sound. When anything moves within the car a third transducer senses the resulting Doppler shift in sound frequency and triggers a light on the unit.

The current surge occasioned by the light then triggers the BMA system. Or a separate horn relay can be attached to output terminals on the SRI-100, making it self-sufficient. Price of the SR-100 without horn relay is $98.50.

Terralarm has a six-way network whose various systems, paralleled and set to sound a concealed alarm, warn of car trouble as well as car thieves. Sensors monitor your car against fire and theft, the engine against low oil or over-heating, transmission and differential against oil loss and provide, in addition, a backup warning alarm.

While this last feature, particularly, is

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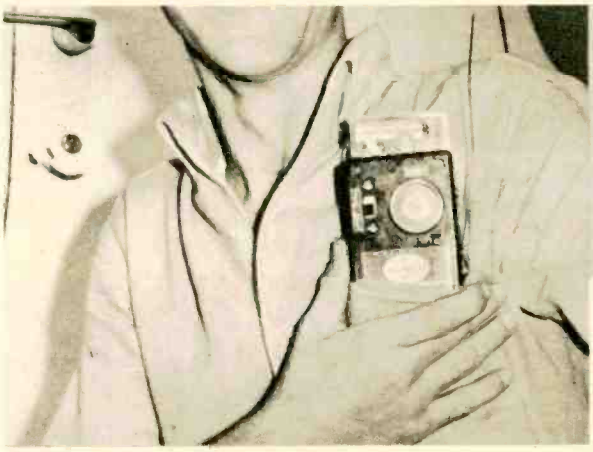
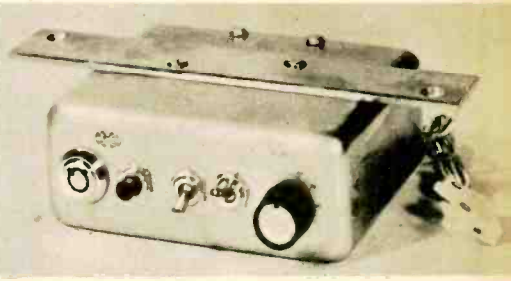
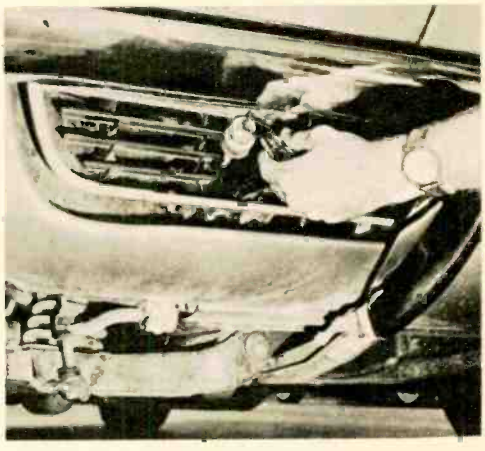




In some anti-burglary systems the warning device (left) is carried by the driver and triggered by radio from base unit in the car (above). This system uses CB to transmit a buzzing alarm tone.

Switches on hood (above) and other car openings trap tamperers. When hood is opened switch (beneath thumb) closes, rings alarm bell (center).



Most systems provide for a hidden defeat switch to allow you to enter car without tripping alarm. Here it is controlled by special lock in grillwork.

designed with trucks in mind, the versatility of the Terralarm system will appeal to many car owners.

Engine sensors screw into special T fittings, permitting dashboard gauges to operate normally. The thermocouple fire sensors sound the alarm when temperatures rise to 135° F (under the hood or in your camper or trailer) and automatically reset themselves when temperatures fall to about 100° F. Anti-burglar door or window switches can be wired into the system.

Terralarm says that any reasonable number of the low-cost sensors (prices $5 to $7.50, depending on the type) may be added to the basic bell alarm circuit, about $40).

The Muntz Stereo-Pak all-around car alarm bugs doors, hood, windows and trunk. The system differs from some others in that its switches must be installed in such a way that a switch is depressed when you close each of the car's openings.

Having locked your car, you arm the system with a special key in a lock hidden somewhere on the outside of the vehicle (under the frame, in a wheel well, beneath a bumper). Should anyone open a door or window, its switch pops out, juicing the circuit and clanging the alarm.

Most Muntz Stereo-Pak drive-in stations on the West Coast charge $29.95 for the bell, installed, plus another $5 for each opening you want bugged.

[*Continued on page* 111]

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Hi-Fi Today

By John Milder

* * *

The Light-Beam's Back
Heads Up
Onward with Dolby

HERE we go again—maybe. There have been rumors for years about photoelectric, beam-of-light phono cartridges that somehow have never really made it in the marketplace. And now we have an out-in-the-open announcement by Kenwood of just such a pickup. It uses a conventional stylus cantilever to trace the wiggles on the record grooves but converts them into sound by mounting a diaphragm (shutter) on the cantilever between a light source and a pair of light-sensitive diodes. Movement of the diaphragm controls the light falling on the diodes and hence the signal through them.

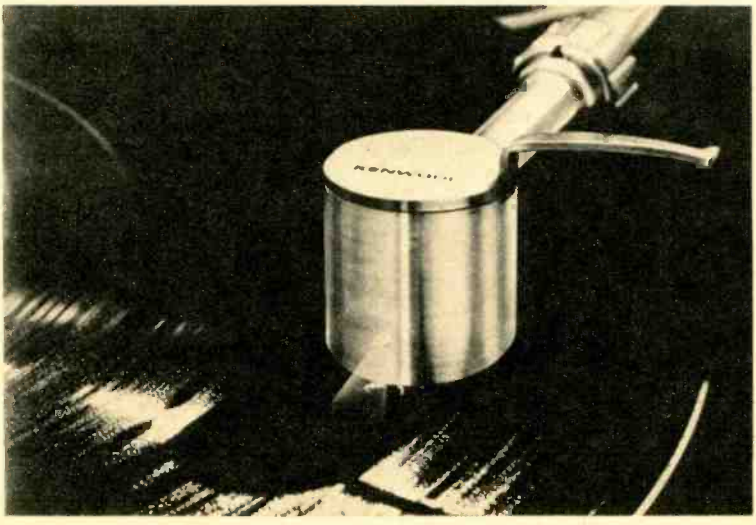
In theory, the problem with this sort of pickup is that if the moving diaphragm is too massive it will inhibit stylus motion but if it is too tiny alignment will be critical and easily disturbed. Frankly, I haven't had an opportunity to evaluate the performance of this one yet but the announcement of an honest-to-gosh beam-of-light pickup is, itself, exciting. It bears watching—and listening.

For all the listening I've done with headphones, I haven't been all that pleased. Sometimes I've had the feeling my ears have never been so close to such mediocre loudspeakers. Other times I've been annoyed by considerations of comfort—heavy earpieces, tangled wiring arrangements, stethoscopic sealing against the skull that gives you your heartbeat syncopated against the music.

So I'm pleased to discover my just-about-complete satisfaction with some new headphones from AKG of Austria (via Norelco)—the K-60 at $39.50. On balance, I think these are the best-sounding headphones I've heard, with high-frequency response approached only by the more expensive Beyer headsets and otherwise excellent overall quality. Just as important is the comfort. The K-60's are light, with a gentle grip, and thoroughly comfortable for long listening. My only reservation is that real low-bass response (under 70 cps or so), which is very much present, can be improved only by pushing the phones a bit tighter against the ears. All in all, though, I'm delighted—and delighted to be able to say so.

Last issue, I mentioned two new record labels that appear only on discs pressed from master tapes made with the Dolby Noise Suppressor. Further news here is that the first example I've heard from Vanguard's Dolby-only label, Cardinal Records, is my nomina-

[*Continued on page* 119]



Kenwood's Photoelectric Cartridge uses light modulated by diaphragm connected to stylus to control output of a pair of photo diodes. Basic principle was used by Philco in the '40s but otherwise has been afforded little application or fanfare.

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RF Generator with Calibrated Output

Knight-Kit KG-686

AN honest-to-goodness calibrated-output RF signal generator for under $300? Yep, less than $100! It's Allied Radio's KG-686. Price $95.

Because it has a calibrated output, you can use it to measure the sensitivity of receivers, transceivers, converters, and home-brew soup-up equipment like an RF preselector. You can even measure receiver selectivity and image rejection with a high degree of accuracy. This is because the KG-686 has a metered output which indicates directly in microvolts the voltage at the end of its output cable.

The KG-686 has a range of 100 kc to 54 mc in 5 bands. Maximum output voltage into a 50-ohm load is 120,000 μv. (0.12 V). Attenuators reduce the output to a minimum of 0.5 μv.

The output signal is either unmodulated, internally 400-cps modulated or can be externally modulated via a pair of front-panel binding posts. The output meter can be switched to indicate the modulation level from 0 to 50 per cent (30 per cent being the standard test modulation).

Both 100-kc and 1-mc calibrators are included and a beat detector and speaker are built into the generator. Both of the calibrators are used to precisely calibrate the dial, eliminating the need for a precision frequency meter.

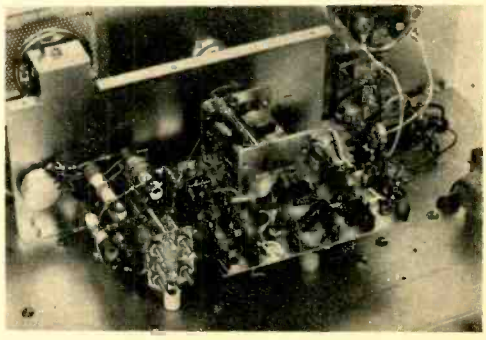
Can you expect any reliability from a $95 calibrated generator when a comparable lab-grade instrument starts at $600? The answer is a qualified yes. Solid-state devices have made possible minimum-acceptance lab-grade calibrated generators for about $300. The KG-686 is but another step down the price ladder. Tests within the range of 100 kc to 30 mc (the limits of our lab-grade test equipment) showed that the KG-686 was within 0.5 μv of the lab generator at the lowest output level range of 0.5 to 10 μv.

Allowing for the inaccuracy of both our lab generator and the KG-686 we consider this performance excellent. At higher output levels, where precise accuracy is not so important, the KG-686 was within its claimed specs.

The KG-686's frequency calibration was excellent, and even surpassed that of the lab generator. We attribute this to the crystal-controlled calibrator, which is used for the calibration.

On our model the modulation meter was somewhat inaccurate. When aligned as stated for 50-per cent modulation, the actual modulation level (when the modulation was reduced to a meter-indicated 30 per cent) was closer to 40 per cent. We suggest that you calibrate the modulating-level adjustment to 30 per cent. An oscilloscope is required for alignment of the modulation circuits.

Thorough shielding results in RF leakage well below the minimum output level of 0.5 μv. With a receiver's antenna wrapped around the KG-686 it was barely possible to receive any signal up to 30 mc as long as the antenna was kept away from the attenuator switches. There is some leakage, near the switches, but this also exists in another generator priced $200 higher and using the same type of



Heart of the KG-686 is the oscillator subassembly. To reduce signal leakage, this section has a cover placed over to which fully shield it.

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attenuator as the Knight.

The RF leakage through the output cable could be picked up in a receiver but could not be measured because it was well below 0.5 μv.

What, therefore, is the difference between the $95 KG-686 and a $600 lab generator? Stability and waveform purity. You can pound the lab-grade generator with a hammer and the frequency won't change, but touch the front panel of the KG-686 and the output frequency shifts. To cure this you either keep your hands off the panel or substitute a spring-isolated shaft coupling for the rigid coupling supplied with the kit.

The output RF waveform of the KG-686 is not symmetrical—not a perfect sinewave—and the positive and negative modulation is not symmetrical. But lack of waveform purity will not be a problem to the average ham, CBer and experimenter; it is common to the type of modulation circuit used and the same problem is found in a $300 lab-grade solid-state generator. All in all, the KG-686's performance far exceed our expectations and will be more than adequate.

Building The Kit. The kit assembly was an absolute delight due in part to straight-line wiring. Most components connect in a straight line between two terminal strips. Allied has even used extra terminals to insure that components connect this way. If the component you're installing doesn't fit in straight, better double check yourself; there's a 90 per cent chance you're making a mistake.

In addition to Allied's practice of supplying color-coded wiring pre-cut and pre-tinned and card mounted resistors, the diodes are also supplied card mounted to further reduce possibility of errors. There wasn't a single error in the instructions.

The only trouble spot is the RF coils, whose terminals are so fragile they snap off under the slightest pressure (we broke three coil terminals). Use a light touch on the coils and under no circumstances bend a coil terminal to reach a wire—bend the wire instead.

If you can't figure out from the manual how to install the oscillator shield, you're not alone. It turns out it *drops* on from the top. And you must not forget to thoroughly sandpaper all joining metal surfaces of the shield for minimum RF leakage.

The final performance is very dependent on construction. Every connection should be very rigid, with *wrapped* leads. In other words, the generator should work even if you forget to solder some terminals. Make certain every screw is tight and lockwashers are used exactly where specified. Soldered ground connections must be solid; use at least a 75-watt iron.

Construction time is about 10 hours, with two more hours required for alignment. The built-in calibrator serves as a frequency meter. One note of caution. When using the calibrator you'll hear very weak beats across the dial. This is normal. Tune for the strongest beat which represents 100 kc or 1 mc.

To sum it up, take extreme care during construction and alignment and you'll have an instrument you cannot duplicate for less than $300 at this time.

New York's TV-Tower Crisis

Continued from page 33

According to Kear, more than 3.6 million homes in the metropolitan area will suffer. Of these, perhaps 1 million have rooftop antennas that can be reoriented to minimize ghosting—at a cost of up to $69.90 each. It could mean a total expenditure of as much as $15 million.

As Scheuer saw it, his constituents stood to suffer severe ghosting while the WTC was going up and from some ten months afterwards, until transmitters could be moved. Then the Bronx would lose a good deal of the multipath—and a good deal of signal along with it.

But the move to the WTC seemed a foregone conclusion until someone remembered the 170-mile rule. Some years ago, the FCC set a minimum separation of 170 mi. between TV stations on the same channel. At the Empire State Building, WCBS, WPIX and WNDT are exactly 171 mi. from the transmitters of WMAR, WBAL and WJZ in Baltimore, sharing channels 2, 11 and 13 respectively. At the WTC, the distance would be cut to 169.09 mi. Similarly, danger of adjacent-channel interference with Philadelphia stations would be increased.

The FCC is now pondering the case of the 0.91-mi. deficiency. Is it electronic hair-splitting or does it constitute incipient erosion of the 170-mi. rule that might mean poorer pictures in many American communities in the future? The FCC's answer will decide whether Bronx living rooms may be filled with ghosts or with snow.

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Bare-Essentials Transmitter

Continued from page 31

and connect its four leads, then check your work once more. If you're going to work 40, plug a 40-meter crystal into its pin connectors. Plug in the tube, connect an antenna (using 50-ohm coax) to the antenna nails and a key to the key nails. Be sure that you have a water-pipe ground connected to NL1.

Now plug in the transmitter. If NL1 glows, reverse the AC plug. Wait about 30 seconds for V1's filament to reach operating temperature and press the key. Quickly adjust C4 until oscillation starts. Oscillation can be determined by listening to a receiver tuned to the crystal frequency. Or hold a neon lamp against the plate transformer. If the transmitter is working the lamp will glow. Adjust C4. When the lamp glows at maximum brilliance, tuning is correct.

In loading the transmitter into an antenna some adjustment of T1's secondary may be necessary. Closer coupling can be achieved by moving the coil higher up over the primary winding. An input of about 50 ma at about 350 V (17.5 watts) is about right.

Do not operate the transmitter without an antenna because this may cause C4 to break down if the key is held down for an extended period of time.

Spiel Stopper

Continued from page 47

from the TV's output transformer—and connect the transformer lead to the *xformer.* screw on TS1. Then connect the free speaker terminal to the *spkr.* screw on TS1.

Using the Spiel Stopper. Turn on the TV and adjust the volume to your maximum listening level. Then adjust sensitivity control R3 to the minimum level needed to have the whistle trip the relays. If gain is too high, both the whistle and the TV sound will trip the relays. Blow the whistle until the TV sound is at maximum, then readjust the receiver's volume control to the maximum listening level.

All set? Soon as that shrieking commercial comes on give one or two blasts and it will be like that commercial never existed. Another tweet or two when the commercial is over and the sound is back to normal.

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The Power Hoax

Continued from page 43

the curve rises so steeply. Amplifier B uses little negative feedback, getting by with fewer stages of amplification but increasing distortion all along the line.

So our 360-watt amplifier will produce a good deal of distortion but each channel separately will deliver 50 watts. *Separately* is the key word here. In most amplifiers of this sort the power supply just isn't beefy enough to keep both channels chugging away at full power. But you've got to listen to both to have stereo, so reputable manufacturers drive both while making tests. Otherwise we must subtract, say, another 15 per cent. Now we've got a 42.5-watt amplifier on each side.

So that's the power output—at 1,000 cps. That one reading is all the EIA requires. It doesn't say a thing about the rest of the audio range—the power bandwidth (see Fig. 2). But the real problems are not at 1,000 cps. It takes big, expensive parts to build an amplifier that will grind out lots of watts at, say, 20 cps. And going all the way to 20 kc costs money, too. Good amplifiers do it. With this job, we'd be lucky to get 10 watts at the extremes. But let's be generous and call them a pair of 25-watt amplifiers in a big, expensive box.

This devaluation of the watt comes from the inflationary phrases that have been coined by advertisers. Each wanted his products to sound big (and powerful) and so the race was on. The man who could find a way of assigning the biggest number was figured to win.

To bring some order into the galloping chaos, two industry organizations—the EIA and IHF (Institute of High Fidelity)—each have set up standards. The EIA standards (as the preceding example shows) hardly are worth the trouble. The IHF has done better. Their first standards in 1959 provided, in general, that participating manufacturers would rate their amplifiers in terms of both power output and distortion. In other words, an amplifier would carry a rating of something like 50 watts at 1 per cent distortion. The power rating could be in terms of either steady-state or music power but it would have to say which. And the manufacturer would have to specify power bandwith.

Late in 1965 the IHF came out with more detailed, stricter standards. Amplifiers had to be rated for both continuous and music power (now renamed *dynamic power* to distinguish it from the EIA's music-power rating). And both readings must be made with both channels operating. Now, at last, we're beginning to know what a hi-fi watt is.

Not all amplifiers are built by IHF members and rated under their standards, though. And, so long as manufacturers are convinced that they can sell audio equipment by making exaggerated power claims, watt weaseling is bound to continue.

One writer has suggested a way out. For non-IHF-rated equipment simply divide the advertised power by ten. (And even then it still may be on the high side.)

In the meantime, it seems to me that manufacturers of other products are missing a bet. Light-bulb makers, for example, could start rating 50-watt bulbs as 100-watt (peak power) bulbs. With a little imagination they could be selling 10-watt bulbs labeled LBIA [Light Bulb Industries Association] power rating, 100 watts. All it takes is a little positive thinking.

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Protect Electronic Gear

Continued from page 105

By contrast, the Muntz Stereo-Alarm guards only a single electronic unit. The unit consists of a small, cylindrical alarm relay (attached to the vehicle's metal fire wall) and two leads—a red hot wire attached to a bracket screw on the electronic accessory or console you want to protect. Unscrewing the bracket or pulling loose the ground wire (as a burglar must to steal the unit) causes the alarm relay to close, sounding the horn.

The device obviously can be used only on vehicles with a negative ground system. But it's inexpensive—$7.98 installed.

More complex (and costly) is Babaco's time-tested vehicular anti-pilferage system. Originally designed for large highway trucks, Babaco's system is claimed foolproof. It bugs all doors and windows, the hood and even the ignition. Moreover, a system innovation is parking protection. If thieves try to push your car to a secluded spot for more privacy while stripping it, the alarm will sound.

When your car is rigged the Babaco way its standard ignition is wired through the anti-theft circuit to a separate battery in an armored box so the ignition can't be jumpered or started by tamperers. Nor can you forget to set the parker alarm. Since you *must* use the special anti-theft ignition key to lock the vehicle, you *must* take the key with you. Locking up automatically sets the alarm. In some Babaco systems even the bell-and-battery box is bugged.

Babaco systems can be as simple or as complex as you wish and cost anywhere from $100 to upwards of $400 for the most burglar-proof.

The various systems we've described are by no means the only ones available. They represent some of the most effective. Simpler (and cheaper) devices may offer effective protection in most cases of attempted pilfering but usually allow circumvention by a sophisticated thief.

One $10 system, for instance, is easily wired to courtesy lights to cut off ignition and sound the horn when a door is opened. But it must be specially wired if the hood (and the system itself) is to be protected. Since the unsuspecting burglar will head for the door first, you're at least half-safe.

But that may not be enough.

compact sets

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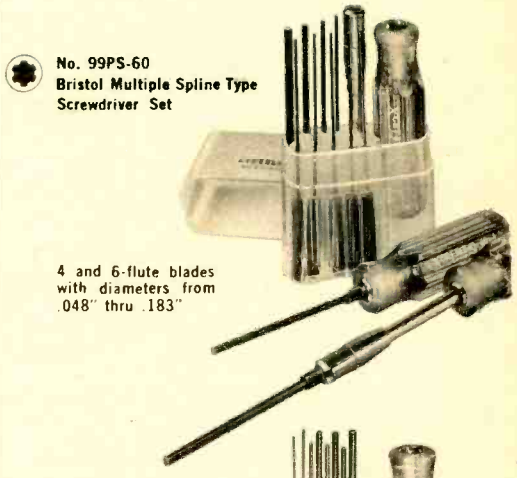

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Swap Shop

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

KNIGHT Star Roamer—factory-aligned. Want Knight T-60 or similar. Don Ratcliff, Box 177, Spring Arbor, Mich. 49283.

GRAYMARK regen receiver with coils. Will swap for best offer. Dave Guyer, Rt. 3, Box 645, Shelton, Wash. 98584.

REALTONE 4-band receiver, AC power pack. Want Knight Star Roamer. Bob Buchheister, 35757 Balclair, New Baltimore, Mich. 48047.

KNIGHT Span Master. Will swap for best offer. Jeff Strieter, 470 W. Wadsworth Hall, Michigan Technological Univ., Houghton, Mich. 49931.

GENERAL ELECTRIC FM/AM/SW/LW receiver, accessories. Will swap for Hallicrafters S-200, S-210 or best offer. Art Studebaker, Box 74, Seward, Ill. 61077.

HEATH GR-64 receiver. Will swap for best offer. Roy Herman, 11 Garvey Pl., Glen Rock, N.J. 07452.

KNIGHT R-55 receiver. Will trade for FM tuner. Larry A. Heberlein, 5730 Coal Mine Rd., Littleton, Colo. 80120.

HEATH Twoer. Will trade for 40-meter receiver. Terry Steeden, WN5RLC/WA5RLC/5, EBD 121, Phillips Univ., Enid, Okla. 73701.

KNIGHT Space Spanner. Want Rek-O-Kut R-34 turntable and amp. Lou Sabatini, 5820 W. 83rd St., Oak Lawn, Ill. 60453.

LAFAYETTE Explor-Air receiver. Will trade for general-coverage receiver or ham gear. Warren Tuiskula, 386 Stafford St., Cherry Valley, Mass. 01611.

KNIGHT Ocean Hopper. Will swap for Heath HW-29A, HW-30, HG-10B or similar. Jeff Morton, 8 Beechwood Dr., Elnora, N.Y. 12065.

HEATH GR-54. Want good mono record player. Marianne Eppley, 2049 S. York #3, Denver, Colo. 80210.

ZENITH receiver, 530 kc to 180 mc. Would like Knight T-60, Heath DX-20, DX-40 or DX-60A. David Nolan, 205 E. Foley St., Alvin, Tex. 77511.

KNIGHT Star Roamer. Will trade for Lafayette RK-142T tape recorder. Michael Lonnquist, 10523 Penn Ave. S., Bloomington, Minn. 55431.

HALLICRAFTERS SX-110 receiver. Will swap for 2/6/10-meter transceiver. J. Kuhnemund, Yarmouth Rd., White Plains, N.Y. 10604.

KNIGHT Span Master. Will swap for best offer. Don Rogers, 218 W. Glendale, Appleton, Wis. 54911.

KNIGHT Star Roamer. Will swap for Knight R-55A receiver. John Moore, 3416 S. 55th C., Cicero, Ill. 60650.

LAFAYETTE Explor-Air receiver. Want 6- or 2-meter converter, speech compressor or best offer. Michael P. Martin, WB2VVO, Box 313, Kerhonkson, N.Y. 12446.

KNIGHT Span Master. Will swap for Knight R-55A or Ameco R-5, Dean Flaris, 4242 Sheffield Ave., Hammond, Ind. 46327.

KNIGHT Ocean Hopper. Will swap for BC-455. Michael Schettler, WN6YAO, 4034 South F St., Oxnard, Calif. 93030.

KNIGHT Ocean Hopper. Will swap for crystal calibrator, 500-ohm phones or best offer. Karl Geier, 145 E. Grand View Ave., Sierra Madre, Calif. 91024.

CITIZENS BAND

PORTAFONE 73 Walkie-talkies. Want Western Electric lineman phone. H. Wilson, 1256 S. Kansas, Wichita, Kans.

GONSET 12 transceiver. Will trade for short-wave receiver or surplus gear. Paul H. Gorrell, Box 228, Mashpee, Mass. 02649.

HEATH GW-22 transceiver. Want VFO or surplus gear. Duffy Hoyt, 3127 Upper Lake St., Horseheads, N.Y. 14845.

TRANSCEIVERS. Want quality tape deck or turntable. Kent Hanawalt, 2610 Third St., LaVerne, Calif. 91750.

REGENCY Range Gain I. Will trade for transistorized transceiver. John Palencak, 2714 Keyes, Flint, Mich. 48504.

LAFAYETTE HA-99 transceiver. Will swap for short-wave receiver or best offer. David A. Lund, 1014 Jefferson Ave., Mamaroneck, N.Y. 10543.

CB STATION. Will swap for ham gear or best offer. Larry Stafford, 553 Victory Ave., Lebanon, Tenn. 37087.

MIDLAND 13-108 130-mw walkie-talkie. Will trade for Heath Twoer or similar. Alan R. Sacks, 305 Ocean Pkwy., Brooklyn, N.Y. 11218.

RCA Mark VII transceiver. Will swap for D-104 mike or Heath Twoer. Glen Gustafson, 54 Stockman St., Springfield, Mass. 01104.

AUDIO & HI-FI

EICO 2536 36-watt stereo receiver. Will trade for Knight KG-870 amplifier. Larry Persley, 31031 Eveningside, Fraser, Mich. 48026.

SILVERTONE 5234 tape recorder, accessories. Want good stereo tape deck. Kevin Hansen, Fleming Rt., Aitkin, Minn. 56431.

ANCHOR ARC 101-50 preamp. Want CB transceiver or Knight KG-221A VHF receiver. Paul Behrens, Aura-Willow Grove, Newfield, N.J. 08344.

BELL LABS 35-watt amplifier. Want Knight Star Roamer or best offer. Dan Walsh, 8361 Trinette Dr., Garden Grove, Calif. 92641.

KNIGHT KP-70 tape record/playback preamp. Want antique radios, magazines. Alan Douglas, Box 225, Pocasset, Mass. 02559.

LAFAYETTE KT-615 15-watt mono amplifier. Will swap for portable police-band radio or best offer. Ed Byrnes, 42129 Macrae, Utica, Mich. 48087.

ELAC mono V-R cartridge. Will swap for changer or service gear. Mike Brown, 720 S. Sherrill St., Anaheim. Calif. 92804.

TAPE RECORDER. Want crystal calibrator or best offer. T. Kirby, Jr., 49 Manwaring Rd., Norwich, Conn. 06360.

AMATEUR RADIO

HOMEBREW all-band transmitter—813 final, accessories. Will swap for 6-meter transceiver. Henry Dobson, K3AKZ, Pineview Estates, Elysburg, Pa. 17824.

AMECO AC-1T transmitter. Want TV service equipment, motorcycle or best offer. Nathan Gregory, Jr., 120 E. Water S., Flemingsburg, Ky. 41041.

SURPLUS BC-348Q receiver. Want DX-60 or similar transmitter. Robert Smith, 444 Newport, Denver, Colo. 80220.

HAMMARLUND HG-150 receiver. Will swap for four-speed automatic turntable or AM/FM tuner. Mike Dahlstrom, 1511 Beaver St., Anchorage, Alaska 99504.

JOHNSON Viking Ranger. Will swap for Heath SB-2 linear or equivalent. H. Anderson, 639 N. Wahstach Ave., Colorado Springs, Colo. 80903.

EICO 753 transceiver. Will swap for Heath HX-20 transmitter. Terry Loveless, WB4EOD, Altamont, Covington. Va. 24426.

KNIGHT R-100 receiver. Want Hammarlund HQ-110A receiver. Richard D. Valenta, 61 Pine St., Bangor. Me. 04401.

HEATH HR-10 receiver. Will swap for communications receiver. Tom Blank, 315 E. Harrison, Maumee, Ohio 43537.

GLOBE antenna matcher—maximum 500 watts. Will trade for tunable converter, oscillator, receiver in 155-mc range. George Oom, WB4EGM, 434 Lansbury Dr., Dansville. Va. 24541.

HEATH HX-11 CW transmitter. Will swap for Knight T-60. Rex Bradshaw, WN6VMP, 188 Colt La., Thousand Oaks, Calif. 91360.

KNIGHT R-100A communications receiver. Will swap for best offer. Charles Cook, 602 E. Huisache, Kingsville. Tex. 78363.

HALLICRAFTERS S-402. Will swap for novice transmitter. Gary A. Lang, 532 North 27th St., Sheboygan, Wis. 53081.

HEATH DX-35 transmitter. Will swap for stereo tape deck or recorder. Jim Roseberry, 1021 Harrington. Borger, Tex. 79007.

KNIGHT C-22 transceiver. Will swap for ham transmitter. Tim Bailey, 126 Highland Dr., Sparta, Tenn. 38583.

ANTIQUE ELECTRONICS

PHILCO 38-89 AM/MB receiver. Want ham transmitter or best offer. David Wilk. 3174 Wabash Ave., Pittsburgh, Pa. 15234.

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SILVERTONE wire recorder/78-rpm phono/radio combination. Will swap for best offer. Tom Galloway, 119 Vaughan Pl., San Antonio, Texas 78201.

RADIOS, PARTS. Will swap for De Forest radios, parts. Art Trauffer, 120 Fourth St., Council Bluffs, Iowa 51501.

WEBSTER-CHICAGO 80-1 wire recorder. Will swap for Knight Star Roamer or similar SW receiver. Mark S. Foster, 1515 Ave. B, Eau Claire, Wis. 54701.

ZENITH Trans-Oceanic receiver. Will swap for mono or stereo amplifier. Steve Kufrovich, 70 Fruitree Rd., Levittown, Pa. 19056.

RCA 811K short-wave receiver. Want communications receiver, home movie gear or best offer. John Mayo, 219 McClanahan, Oxford, N.C. 27565.

ANTIQUE SPEAKER. Will swap for best offer. Jim Bajor, 20748 Cyman, Warren, Mich. 48091.

ASSORTED TUBES. Will swap for best offer. Milton Margoles, 223 E. 203 St., Bronx, N.Y. 10458.

NATIONAL receiver—14-640 kc, ca. 1938. Will swap for astronomy equipment or best offer. W. N. Weaver, 617 Camrose Dr., Charlotte, N.C. 28205.

CAR-RADIO speakers—'38 La Salle, '38 Buick, '50 Packard. Will swap for tools or best offer. Dave Nelson, 1218 N. 3rd St., Oskaloosa, Iowa 52577.

RCA Radiola IIIA. Will swap for best offer. Larry Fidler, 1109 Queen St., South Bend, Ind. 46616.

CROSLEY Super-Trirdyn receiver—vintage 1914. Will trade for CB transceiver, service equipment. Roy M. Nicholas, Box 214, New Berlin, Ill. 62670.

PHILCO, RCA radios. Want ham gear or best offer. James Womick, 426 Stockbridge Ave., Buffalo, N.Y. 14215.

OTHER EQUIPMENT

EICO 232 VTVM. Will swap for VOM. Ken Pasch, 55545 E. Helen, Tucson, Ariz. 85716.

REGULATED POWER supply—transistorized, 0-15 V. Will trade for ham, service gear or best offer. Howard Denney, 9-15 127th St., College Point, N.Y. 11356.

TRANSFORMER—15,000-V secondary. Will swap for tape recorder or R/C equipment. David Alkens, 4116 Brandes, Erie, Pa. 16504.

EICO 221 VTVM. Will swap for AM/FM tuner or receiver. Joseph F. Saccente, Jr., 117 Nelson Ave., Jersey City, N.J. 07307.

STEREO-VERB car reverberation unit. Will swap for TV antenna or booster. Phil Dudley, 11954 Manhattan, Des Peres, Mo. 63131.

ELECTRIC GUITAR with three pickups. Want VHF CB or gear. M. Gagle, 108 Judson Rd., LaPorte, Ind. 46350.

HOMEBREW signal injector. Will swap for best offer. Pablo Alvarez, 413 N.W. 51st St., Miami, Fla. 33127.

ASSORTED TUBES. Want tunable bongo drums. Lister Victory, Box 296, Savannah, Tenn. 38372.

WESTERN ELECTRIC regulated power supply—0-200 V. Will swap for Lafayette HA-500 or similar. David Smith, 11 Towns End Rd., Mendham, N.J. 07945.

KNIGHT VFO—80-10 meters. Will swap for VHF receiver or best offer. Donald Bartone, 62 Mill Rd., E. Longmeadow, Mass. 01028.

MOBILE police receiver. Will swap for 2-meter ham gear. Jack Shoemaker, 574 Varsity Rd., South Orange, N.J. 07079.

TV PARTS. Will swap for short-wave receiver or novice transceiver. Benney Garrett, Box 74B, Rt. 2, Lubbock, Tex.

3712-KC CRYSTAL. Will swap for CB crystal between channels 9 and 18. Jeffrey Sykes, 6442 Canastota Dr., Hamilton, Ohio 45011.

HEATH GD-125 Q-multiplier. Want VTVM, VOM or walkie-talkie. Mike Ferrara, 212 Grant Blvd., Syracuse, N.Y. 13206.

POWER TRANSFORMER—117-V primary; 700-V, 6.3-V, 5-V secondaries. Will swap for field-strength meter. Larry Dahl, Box 487, Beaverlodge, Alberta, Canada.

LUMINCUS-TUBE TRANSFORMER—115-V primary, 7,500-V (30 ma) secondary. Will swap for best offer. Jeff Walker, 3630 Brisban St., Harrisburg, Pa. 17111.

MOBILE POWER SUPPLIES—regulated 6 to 215 V. Want ham gear, components, accessories. John Fanning, RD 1, Drums, Pa. 18222.

AIRCRAFT TRANSCEIVER. Want image orthocon camera. Tom Gocsze. WN2APK, Iselin, N.J. 08830.

MECHANICAL FILTER with mount—455-kc IF. Will swap for VFO. Charlene Seboys, 1604 Chestnut, Alameda, Calif. 94501.

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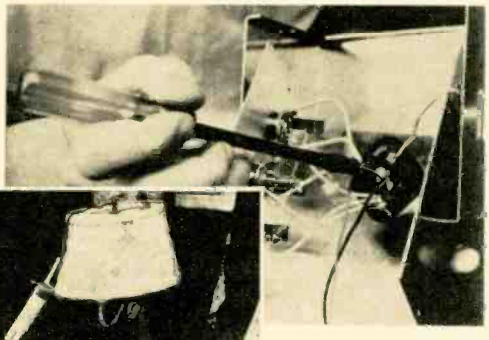
MAKING LIKE MURRAY THE K ON 1/10 WATT

MURRAY the K, whose early and noisy appearance on the Beatles bandwagon heralded a new era in pop music, probably is the world's best-known disc jockey. His now-famous coverage of the Beatles' arrival was aired by New York's Station WINS to a potential audience numbering something like 15 million.

Bob Brown of San Diego is not quite in that category yet. But you'd never know it to hear him sign on as KFRB on 540 kc "under authority granted by the Federal Communications Commission"—meaning that Bob's power (100 mw) and antenna height (10 ft.) sneak in under the FCC wire for license-free operation.

Although his audience is small (he claims a two-mi. radius), Bob's ambitions for his station are without limit—well, almost. Once he showed up to give live coverage to a Miss America contest and ran afoul of the exclusive contract held by one of his commercial colleagues. And he calls one corner of his living room CBS Gemini Control.

His transmitter is a wireless phono oscillator module (shown at right, below during frequency adjustment). With it Bob maintains a pretty reliable schedule for a teen-ager with scholastic commitments. And when things *do* go awry it just gives him something more to talk of on the air.



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How To Get A CB License

Continued from page 77

OF ANY CRIME FOR WHICH THE PENALTY IMPOSED WAS A FINE OF $500 OR MORE, OR AN IMPRISONMENT OF 6 MONTHS OR MORE?

Answer *No* unless you've been convicted of a serious crime. If *Yes,* you'll have to explain the circumstances in detail.

17. IF APPLICANT IS AN INDIVIDUAL OR A PARTNERSHIP, ARE YOU OR ANY PARTNER LESS THAN 18 YEARS OF AGE?

If you're over 18 years of age answer *No.* If you're under 18 you're not eligible for a license.

18. IF ITEM 3 SHOWS P.O. BOX OR RFD NUMBER, GIVE A LOCATION WHERE THE LICENSEE OR THE STATION MAY BE FOUND.

FCC personnel must be able to locate you. If you've given a street address in Item 3, enter *Same.* If you've shown a P.O. Box or RFD number in Item 3 give directions for locating your station.

Only corporations or associations need answer questions on the back of the form (Items 19 and 20). An individual, however, must sign and date the bottom of the form. The application no longer has to be notarized since false statements are punishable by fine and imprisonment under federal law.

Transistor Breadboard

Continued from page 67

you don't have to use transistors specified here—many universal replacement and experimenter types work as well. Try to use a milliammeter set to read about 100 ma when designing. (Connect it in place of the jumper.) If you're juggling values and current suddenly soars, kill the power fast and see where you've caused a short or possibly overloaded a transistor (usually by too little resistance between a base and the negative bus).

Finally, if you intend to use the board for experimenting with high-power transistors, you'll have to beef up the power supply. Its current capacity is intended for small general-purpose transistors, not big power transistors. The solution, and one that makes the board even more versatile, is a variable DC power supply. It might provide for example, voltage up to about 30 VDC at currents up to about 200 ma. This, plus the board, are just the ticket for serious experimenting, or just plain tinkering.

ABC's of Record Care

Continued from page 85

cover. Unless your turntable is mounted in a pull-out drawer you'll need a way of keeping dust off the turntable. Most manufacturers supply plastic covers tailored for their own equipment; larger radio supply houses stock several universal models, one of which should fit. At around $10, this is cheap.

Other gadgets that may be useful to solve specific problems (if you have them) include turntable spirit levels, self-leveling turntable legs, foam rubber turntable pads, stylus-pressure gauges. A turntable that isn't level distributes tracking force unequally on the two walls of the groove. The foam rubber mat can provide extra traction for badly warped records.

Otherwise, the gadgeteers so far have ignored the question of record warpage. To prevent warpage in the first place keep your records stored vertically, well away from heat. Records should be packed tightly enough to support each other but not so tightly that it's difficult to remove one when you want it. Those table-top wire racks are open invitations to warpage.

If one of your records warps anyway take two pieces of plate glass, each at least 12 in. square and the heavier the better. Find a sunlit window sill or other flat surface. Insert the record between the pieces of glass and leave the sandwich in the sun. Eventually, the sun will soften the record and the weight of the glass will flatten it out.

Sound like a lot of fuss? How much are your records worth to you?

SIA-Tiniest Antenna

Continued from page 61

poor signal strength. SIA claims include an option for creating a somewhat directional pattern. Even the simplest TV antenna with two elements, says Finneburgh, does a better job of rejecting off-axis, ghost-producing spurious signals.

Finneburgh's skepticism is echoed by another big antenna maker, Winegard, which actually tried the SIA. After laboratory tests and TV viewing, Winegard was quoted as saying that "signal pickup of the SIA is quite good for its size." But this was demolished in

[*Continued on page* 117]

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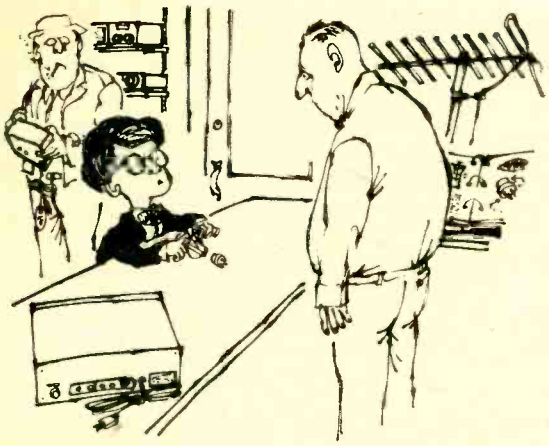
Over and Out

rodrigues



"Would you know offhand the frequency of RF emissions from the star Regulus, sir?

". . . . do solemnly swear I will not divulge any parts or components sold to Major Biggs. . . ."

"I'd like $5 worth of capacitors gift-wrapped for a birthday present."

"Did you say .01 at 600 volts?"

"Building a stereo amplifier?"

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the next statement: "In no way did it compare in performance with an ordinary pair of rabbit ears." The company also estimates that cost for an SIA could be close to $20 by the time it reached the consumer.

Developers of the SIA came right back with optimistic statements, now curiously shorn of the spectacular-breakthrough flavor. In fact, they contain more hedging than you'd find around an English castle. Dr. Meinke, for example, was reported in the trade press as saying it was unlikely that the SIA antenna would replace conventional rooftop TV antennas. He added that the subminiature antenna may be achievable but it probably would have to be size of rabbit ears. He commented that the main problem in TV is ghosts rather than noise.

Edwin Turner also answered the critics, comparing the SIA to an automobile radio. He explained that an automobile antenna is brought to the grid of a tube that acts as a voltage amplifier. The SIA is no more mysterious than this, he goes on, but it uses a device that amplifies current, rather than voltage (meaning a transistor, not a tube).

The auto antenna comparison is no less perplexing than Dr. Meinke's report. For one thing, the auto antenna is spectacularly inefficient. It is merely a short appendage to the radio's first tuned circuit. It works because AM stations operate at high power and low frequency, a combination that pours signal around obstacles.

So the SIA has yet to prove it can do more than dream the impossible dream—combining minute size with the ability to haul in hefty signal. But saying it won't ever be done is as foolish as asking a discount store for a portable radio with tubes. Meanwhile, if you want more signal, put up more metal.

The Listener

Continued from page 56

within range of a VHF link. This would reduce the QRM from that Caracas telephone station and at the same time account for the discrepancy in signal patterns.

At this writing RL is using only three frequencies—1404 (BCB), 9297 and 15050 kc.

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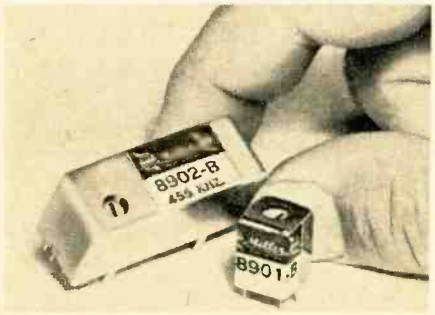

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(signed) Paul Simmering

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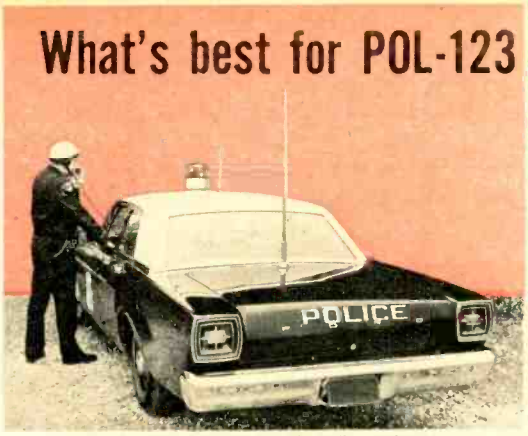

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CIRCLE NUMBER 21 ON PAGE 11

ing the most active satellite band—136 to 137 mc.

The 1968 Allied catalog lists (10 B 4362 X) a portable that covers all VHF utility stations 108 to 142.7 mc and 143.8 to 177.38 mc plus bands for FM, the BCB and some short wave (5-12 mc). At $59.50, of course, circuits are simple, permitting reception of only the strongest satellite signals—from birds passing directly overhead.

During the past year the Manufacturers Liaison Committee of ANARC (Association of North American Radio Clubs) had been trying to talk Allied into marketing just such a unit. Perhaps organized distant radio listening has at last received some minor recognition from a manufacturer.

Hi-Fi Today

Continued from page 106

tion for the best recording of 1967. It's a performance of Mahler's Second Symphony by the Utah Symphony Orchestra under Maurice Abravanel. This is a really stunning recording (even better than London's recent Dolby recording of the same work, to my mind), with stupendous dynamic range, clarity, and everything else. If there's a single best demonstration record, with both musical and technical qualities of the first order, I think this is it.

Hi-fi advertising is usually pretty restrained and close to the facts these days. But there remain exceptions. One recent example that bothers me intensely is the approach taken by Compass in promoting the Triphonic 75.

Now, I have no idea of the level of quality achieved by Compass. And the principle of using a single speaker for bass frequencies (combining both channels) and a pair of mid/high speakers for actual stereo placement is valid enough, particularly if the crossover to the common bass speaker is at a low enough frequency. But Compass is advertising its arrangement as "three-channel stereo" that obsoletes good old-fashion two-channel stereo.

Nonsense. There's no extra channel involved. Technically, in fact, the system is delivering somewhat less information than would be present in two full-range channels—even if your ear can't tell the difference. All that the system is likely to obsolete is somebody's advertising department.

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You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble shooting, using the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester, Square Wave Generator and the accompanying instructional material.

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

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

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

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

You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

Included in the "Edu-Kit" course are Receiver, Transmitter, Code Oscillator, Signal Tracer, Square Wave Generator and Signal Injector Circuits. These are not unprofessional "breadboard" experiments, but genuine radio circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

THE "EDU-KIT" IS COMPLETE

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

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

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- PRINTED CIRCUITRY

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FROM OUR MAIL BAG

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

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

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

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CIRCLE NUMBER 10 ON PAGE 11

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