

Stereo Hi-Fi Speaker Setups

POPULAR ELECTRONICS

NOVEMBER 1958

35 CENTS

Computer Plays Tic-Tac-Toe



Suburban Hi-Fi QSL'ing the Satellite

E-29-147762-10
 LOUIS HAFORD
 18108 WINDWARD
 CLEVELAND 19 OHIO

trade-in your old amplifier for

STEREO NOW



Your Bell dealer is ready to offer you \$30 or more for your old amplifier to help you buy Pacemaker Stereo today.



Regularly \$129.95

Now ONLY

\$99.95*

with trade-in

*price includes charcoal grey cover
Slightly higher west of Rockies

PACEMAKER
MODEL 2221

A complete Stereo Amplifier. Plays Stereo records, Stereo tuner, Stereo tape. The only component you need for stereo NOW.

Here's your opportunity to have stereo for the price of ordinary hi-fi. A way for you to get the stereo amplifier you've always wanted—and receive a fair trade-in price for your old monaural amplifier, besides.

The Pacemaker Stereo Amplifier, pictured above, regularly sells for 129.95. But to make it possible for you to have Stereo in your home NOW, your Bell dealer is ready to offer you a big \$30 for your present monaural amplifier when you trade-up to Pacemaker Stereo. This means you pay only 99.95 for a complete 2-channel stereo amplifier, little more than the cost of ordinary hi-fi.

With Pacemaker Stereo, you can play your regular monaural recordings . . . then, flick the switch and you're all set to play Stereo — from records, tuner and tape.

Made by Bell, who developed the first 2-channel stereo amplifier, this new Pacemaker is conservatively rated for Stereo at 10 watts RMS each channel. A full 20 watts monaural through any speaker system. The only one of its kind to have dual inputs for ceramic *and* magnetic stereo phono.

For more details, and a demonstration, see your Bell dealer today. Be sure to bring along your old amplifier . . . Just in case!

Why your Bell dealer dares make this offer!

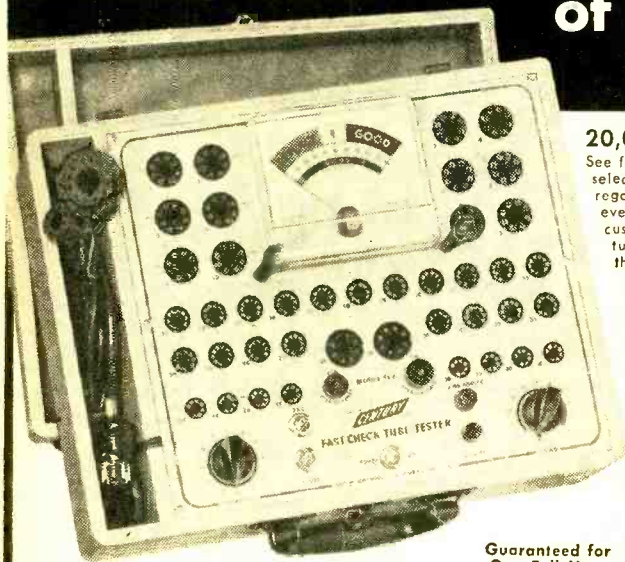
The big switch to stereo is on. Requiring, as it does, two amplifier channels, you *could* add another monaural amplifier to the one you now own. Unfortunately, your present amplifier may not have the features you want for stereo. And, frankly, we think you'd prefer the convenience of *one* set of controls for both stereo channels. That's the reason why your Bell dealer offers you this trade-in plan to help you get a real Stereo amplifier NOW.

Pacemaker Stereo has all these features

- One set of controls operates both stereo channels simultaneously.
- Single Knob Balance Control maintains correct acoustical balance between any two speakers.
- Dual inputs for Magnetic *and* Ceramic Phono, Tape, Tuner, Auxiliary.
- Separate Rumble and Scratch Filters.
- Stereo Reverse Switch.
- Combined Output Switch.

Bell Sound Systems, Inc., Columbus 7, Ohio
A division of Thompson Products, Inc.
IN CANADA: Thompson Products Ltd., Toronto

NO OTHER TUBE TESTER MADE- AT ANY PRICE—can MATCH the VALUE of the CENTURY FAST-CHECK



Dimensions: Width: 14 $\frac{5}{8}$ "
Height: 11 $\frac{1}{4}$ " Depth: 4 $\frac{3}{8}$ "

Special compartment ac-
commodates line cord and
Picture Tube Test Adapter

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Model FC-2 — housed in rugged oak carrying case complete with CRT adapter...

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\$69⁵⁰
Net

20,000 SERVICEMEN CAN'T BE WRONG!

See for yourself—AT NO RISK—why over 20,000 servicemen selected the FAST-CHECK above all other tube testers—regardless of price. With the FAST-CHECK you will make every call pay extra dividends by merely showing your customer the actual condition and life expectancy of the tube. The extra tubes you will sell each day will pay for the FAST-CHECK in a very short time.

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Circuitry is engineered to accommodate all future tube types as they come out. New tube listings are furnished periodically at no cost.
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- **NO ANNOYING ROLL CHART CHECKING**
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COMPARE FAST-CHECK WITH OTHER TESTERS RANGING FROM \$40 TO \$200

RANGE OF OPERATION

- ✓ Checks quality of over 650 tube types, which cover more than 99% of all tubes in use today, including the newest series-string TV tubes, auto 12 plate-volt tubes, OZ4s, magic eye tubes, gas regulators, special purpose hi-fi tubes and even foreign tubes.
- ✓ Checks for inter-element shorts and leakage.
- ✓ Checks for gas content.
- ✓ Checks for life-expectancy.

IMPORTANT FEATURES

- Checks each section of multi-section tubes and if only one section is defective the tube will read "Bad" on the meter scale
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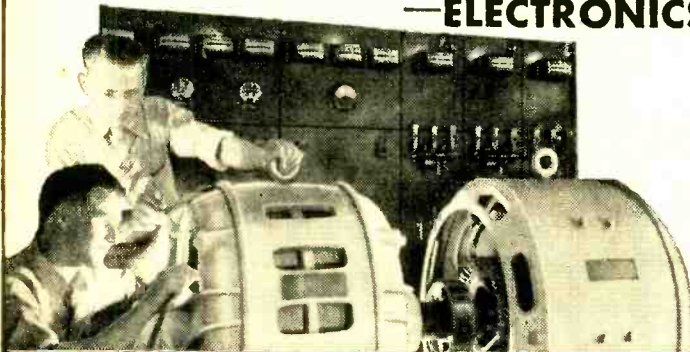
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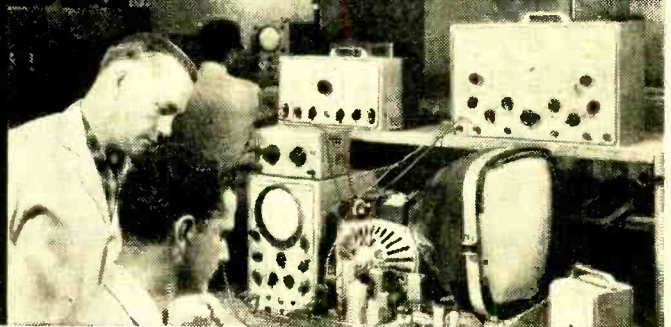
(Shown at left—Instructor explaining operation and testing of a large Motor Generator in our A.C. Department.)

AND TELEVISION-RADIO

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(ON SALE NOVEMBER 20)

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December and its holiday spirit will be reflected on our cover next month. Two robots and their offspring are seen decorating the POP'tronics Christmas tree. A story on the human behavior of a robot computer will be of interest to the entire family. Also, a construction article on an electronic robot will please the hobbyist.

Other construction articles of interest are—a Power Failure Alarm, a High-Voltage Neon Tester, an Appliance Tester, and many others. Tips on soldering techniques will help in improving home projects.

Two feature articles about electronics in the steel industry and the electronics of fluorescent lamps will provide informative reading. And the hi-fi fan will be introduced to the problems of designing a stereo cartridge.

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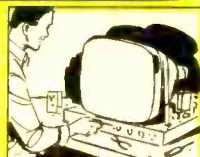
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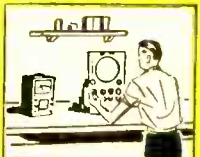
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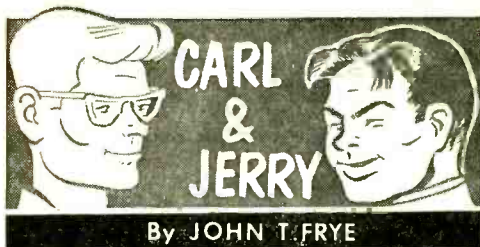
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Command Performance

CARL AND JERRY were walking home from school in the slanting rays of the autumn sun. It was later than usual because they had stayed to practice for the play the Latin Club was giving. As they scuffed along through the thick carpet of crisp fallen leaves, the boys talked about the play.

"Man and boy," Carl said in his deepest voice, "I've seen some pretty corny plays, but that thing tomorrow night will top them all."

"You're not kidding there," Jerry agreed morosely. "I'd rather bend the needle on my volt-ohmmeter than prance around out there on the stage in that breezy Roman warrior outfit playing pattycake with you with those tin swords."

"Yeah, and our last scene, the fight of the gladiators, is the best part of the show; so that clues you as to how bad the rest of it is. I simply wouldn't go through with it, but it means so much to Miss Jellicoe; and she's so doggone nice—for a Latin teacher, anyway."

"Hm-m-m-m," Jerry said thoughtfully, "I'm wondering if we couldn't pep up that last scene a bit some way."

"Don't see how. We can't really fight. She's afraid we'll hurt one another."

"Say, you know something? Since you can't wear your glasses, I'm with her. Realizing how poorly you see without them, I'd as soon be on that stage with a rotary mower with the guard off as with you really trying to sword-fight. Last night you chopped half the leaves off the rubber plant before you found out I was standing behind you."

"You and that rubber plant look a lot alike when the stage is darkened for our fight," Carl muttered. "With it in that big pot, the two of you have the same kind of figures."

Jerry ignored this nasty remark. "Don't you think it would be real George if every

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Antone Mello, 68 Union Street, Nantucket, Mass.	1st 10
John Ward, 407 E. Cowden Ave., Midland, Texas.	1st 10
F. T. Verga, 538-7th Street, Buffalo, N.Y.	1st 12
Philip J. Hooks, 4825 N. Capitol, N.W., Washington, D.C.	1st 12

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MAIL COUPON TO SCHOOL NEAREST YOU

Carl & Jerry (Continued from page 8)

time our swords touched fire would fly?"

"Sure, but how could we manage that?"

"With electricity, natch! My idea is to have the swords complete an electrical circuit when they contact. If we had our Tesla coil, we probably could cool it down so it would work; but I shipped it out to my cousin in New York. Maybe we can use that neon transformer. The secondary puts out five thousand volts at a fraction of a milliamperere of current. We could use some of that indoor antenna wire to go from each side of the secondary to a sword. That wire is small and very flexible, and wouldn't be seen from the audience. We can tape the handles of the swords with high voltage tape to keep from being shocked."

"Let's use plenty of tape. I've been bitten by that transformer a few times, and it really jolts you."

"Yes, it carries about the same wallop as the spark plug of a car. While the very limited current greatly reduces the danger of that high voltage, any shock, even one

of only a few volts, can be fatal under the right circumstances; so we'll take every precaution to keep from being shocked."

"You going to tell Miss Jellicoe about this?"

"N-o-o-o-o, I don't think so. Let's surprise her. If we told her, she'd start worrying and probably not let us do it. You meet me backstage at lunch tomorrow, and we'll hook things up."

"Fine. See you at noon," Carl agreed.

IT DIDN'T take the boys long to hook up their little gadget the next day. They taped the sword handles heavily, and fastened the small insulated wires to the blades. The transformer was placed near one end of the curtain, and a wire went from one side of the secondary to a sword placed nearby. A wire from the other side of the secondary ran beneath the stage and came up near the other end of the curtain. The other sword fastened to this wire would be placed at that point. They made both wires long enough so that the swords could reach any part of the stage. "Just before our fight scene starts," Jer-

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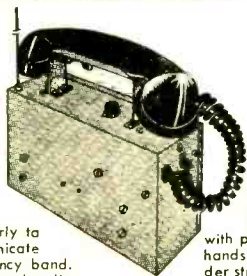
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TRX-50-A Similar to above except tunes 50 to 54 MC and uses six high frequency triodes and one transistor. \$18.98

TRX-28-A Similar to above except tunes 28 to 30 MC. \$18.98



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Dr. Claude Shannon, known to the readers of *Popular Electronics* for his invention of the electronic mouse, that runs a maze, learning as it goes, formerly a research mathematician for Bell Telephone Laboratories is now a research associate at MIT. His books include publications on Communication theory and the recent volume "Automat Studies" on the theory of robot construction. He has prepared a paper entitled "A Symbolic Analysis of Relay and Switching Circuits" which is available to purchasers of the GENIAC. Covering the basic theory necessary for advanced circuit design it vastly extends the range of our kit.

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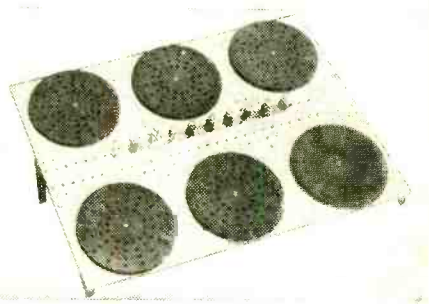
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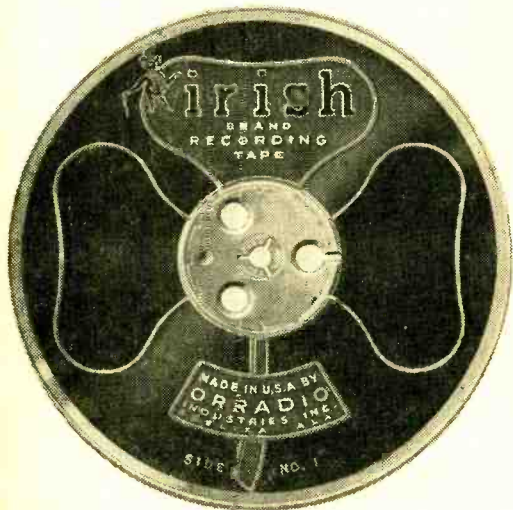
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Carl & Jerry (Continued from page 10)

ry said, "I'll plug in the transformer and enter from this side, like so. You pick up your sword and come in from that side. Let's touch swords and see what happens."

As metal touched metal, there was a great hissing red spark that changed to blue as the blades parted. Even on the well-lighted stage it could be seen easily. The boys grinned in happy anticipation.

"That's really going to show up when the lights are dimmed," Carl said; "but we better scram to class before the bell rings."

When the boys peeped through the curtain that night, they saw that the large high school auditorium was literally jammed. Even the balcony was full to overflowing. A combination of circumstances brought about the large attendance: admission was free; there was no competing attraction in town that night; the weather was ideal; and the cast was large. That meant that the family of each player, down to grandparents, aunts, and uncles, had turned out in force.

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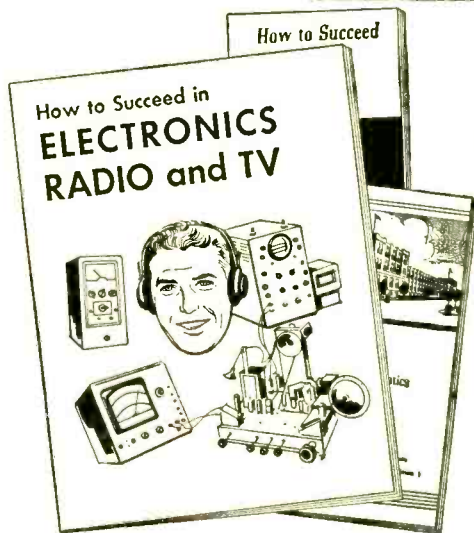
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Carl & Jerry (Continued from page 12)

boys, the audience enjoyed the play. They did not expect a polished professional performance, and the flubbed lines only aroused sympathetic amusement. Time after time the auditorium roared with laughter and applause. The loudest laugh of all came when Mr. Stagg, the portly high school principal, strode onto the stage dressed as Nero. His hairy, bare legs beneath his short tunic and his bald head garlanded with ivy gave him an appearance that was grotesque but still imposing.

"Perfect casting if I ever saw it," Carl muttered to Jerry; "but that ivy really should be poison ivy."

"Now, now; let's not be bitter because he caught you goofing off," Jerry said with a grin. "Get ready. We're on next."

BUT THE CURTAIN did not go up. The boys saw the school janitor talking excitedly to Mr. Stagg.

"... and it seems to have started in the closet of the office," he was saying. "I called the fire department, and they should be here any minute. I'm sure they'll have no trouble putting it out, but I hate to think what will happen if that crowd out there panics."

"Maybe I should step out on the stage and talk to them," Mr. Stagg said.

The janitor shook his head. "I wouldn't. Just let them hear the word 'fire' and they're gone."

The sounds of impatient clapping of hands and stamping of feet came through the curtain.

"Why don't you go and see how bad it is?" Jerry suggested. "We'll go on with the play and try to keep their attention. The scene coming up is pretty exciting."

"Okay," Mr. Stagg agreed. "Carl, you tell the members of the orchestra to play as loud as they can. That's one thing they can do: play loud. I'll be back as quickly as I can."

As soon as Carl came back from the orchestra pit, the curtain went up. Jerry had plugged in the transformer; and the two boys, dressed as Roman gladiators, strode toward each other across the dimly lit stage.

"Hold, Claudius," Carl said menacingly. "Take a last look at the darkening sky. A few minutes hence your glazed eyes will see it no more."

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Carl & Jerry (Continued from page 14)

us the Talker," Jerry taunted. "Let's see if your Roman blade is as nimble as your Roman tongue."

Gingerly the boys drew their swords from the scabbards, being very careful that the blades did not touch their bodies. Then they warily approached each other and crossed swords. As they did so, the sparks crackled, and a gasp of astonishment came from the audience.

On this cue the orchestra roared to life. Each player was giving his instrument all it would take, paying scant attention to the other instruments or to the leader; and the effect was tremendous. But the cacophony of sound went well with the desperate action taking place on the stage.

Carl and Jerry were carried away with the occasion and put on a real sword fight. Blade clanged against blade with a sound heard even above the thunder of the orchestra. At each contact hissing sparks of blue and red lighted the dim stage with a fitful lightning. The smell of ozone filled the air.

Carl's long arms gave him a reach advantage, but Jerry's deceptive quickness overcame this. As minute after minute passed, however, Carl's good athletic condition began to tell. He was scarcely breathing hard, while Jerry's round face was bathed with sweat, and his breathing was open-mouth panting.

Still the fight went on. Ordinarily it would have been over quickly, but the boys were determined to keep it going until they had some sign that the danger



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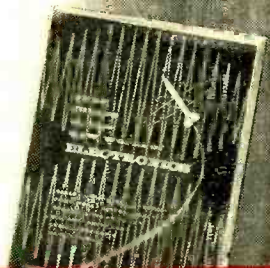
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Carl & Jerry (Continued from page 16)

was over. That sign arrived at last as Mr. Stagg and the fire chief came in the rear of the auditorium and walked up the aisle to the stage.

THE BOYS stopped fighting, and all the lights in the house went on. Mr. Stagg strode on the stage and held up his hand.

"Folks, I can tell you now we had a little excitement across the hall that was not on the program. Some oily rags caught fire in a closet and we had a pretty good fire going until the chief here and his men put it out. Now that your minds are off the stirring action on the stage, you will probably notice that you can smell the smoke.

"We were afraid of panic. While I went to investigate the fire, these two young men you have been watching on the stage essayed to keep your attention away from the smell of smoke, the sound of sirens, or anything else that could easily have precipitated a dangerous panic; and they were aided and abetted by this sterling collection of frustrated soloists we call our orchestra. Even across the hall that music,

if I can apply the term loosely, was excruciatingly loud."

Mr. Stagg beckoned with both hands for Carl and Jerry to draw near to him. He placed an affectionate arm across the shoulders of each embarrassed, squirming boy as he remarked: "I like to think that in this school we teach more than the three R's. We try to teach character. And from the evidence these two boys have given us tonight, I am encouraged to believe that we are succeeding. When I think about how calm, how level-headed, how resourceful these two were tonight, it puts a gladness in my heart, a proud gleam in my eye, a new spring in my step—yowwwww!" he screamed as he gave a sudden great leap that took him clear over the footlights to plunge both sandaled feet squarely through the kettle drum.

He had hugged the boys to him a little too strongly, and the bared swords they still carried in their hands had been forced into contact with his naked shins at precisely the same time.

THIS REALLY brought down the house. The audience rose from their seats and

HERSHEL SHOOTS THE MOON!

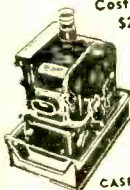
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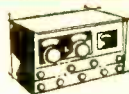
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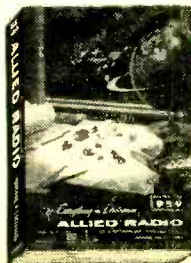
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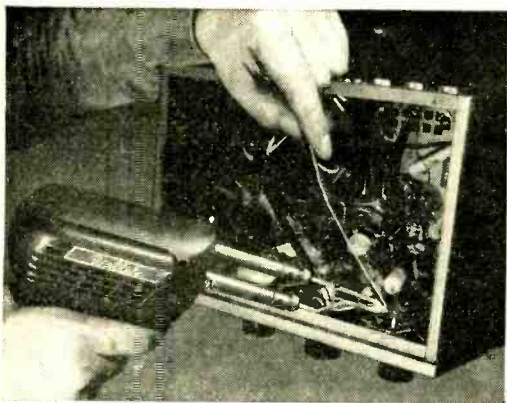
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Carl & Jerry (Continued from page 18)

surged to the orchestra pit to help the principal out of the drum. Carl and Jerry took advantage of the confusion to jerk the wires loose from the swords and to recover their transformer. Then they sneaked out the rear door and walked home through the bright, clear harvest moonlight.

Every few steps they stopped and leaned against each other in helpless laughter as they recalled the picture of Mr. Stagg sailing over the footlights.

"Just tell me one thing, Jer," Carl finally gasped. "Did you do it deliberately?"

"Honestly I don't know," Jerry said, wiping his eyes with his handkerchief. "I saw the blade getting closer and closer to his leg, and when he said, 'a new spring in my step,' well, it was as if no power on earth could stop it."

"I know, I know!" Carl broke in. "It seemed that someone else's hand had hold of my sword. But I'll bet the final act of this year's Latin Club play will be remembered in this town for a long, long time to come."

-30-



. . . "It puts a gladness in my heart, a proud gleam in my eye, a new spring in my step—yowwww!" he screamed as he gave a sudden great leap . . .

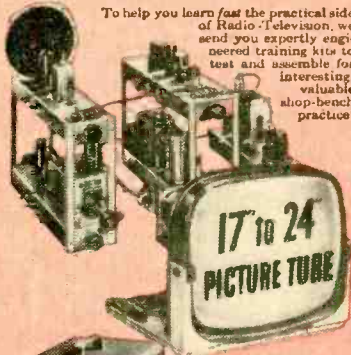
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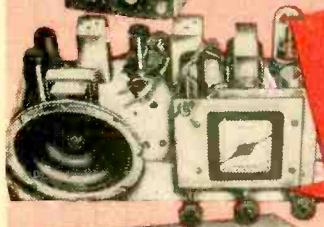
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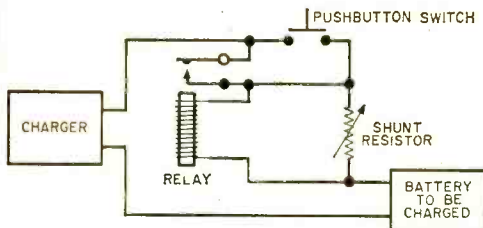
Suggestions for Battery Charger

■ Regarding Julian H. Hoffman's problem of how to cut off a battery charger automatically, I suggest that he use a d.c. solenoid. The coil should be put in series with the output of the battery charger. The plunger should be connected so as to drop and open the primary circuit of the power transformer when the current falls to a predetermined value.

SAL CASSAR
Brooklyn, N. Y.

■ A very simple and inexpensive solution would be the use of a d.c. relay. The relay coil and its contacts could be wired in series so that the charging current or a part of it flows through both. Relays which are capable of closing on as little as a fraction to 100 ma. are readily available. These have maximum current-handling capability of 10 to 20 times their minimum value.

The values may be juggled proportionately by use of shunt resistances. With such an arrangement, some temporary means for shorting the re-



lay contacts must be provided. A push button works well. This must be done to permit the relay coil to energize.

Shunt resistance may be selected to handle any amount of peak charging current. The relay will de-energize and open the contacts when the charging current has fallen below the minimum necessary to keep it closed.

I have used this system for automatic shutoff with complete success many times.

D. B. KRET
Scottsdale, Ariz.

■ Herewith is an idea which I have not tried, but would try if I felt need of such a device. First, I would appreciate comment on the following two points:

One: It is said that a storage battery will give best service if it is rather well discharged before being charged up again; if it is recharged when only slightly down, the action is all on the surface of the plates. The deeper portion becomes hardened from lack of use, so that the cell is unable to deliver the amount of current it should.

Two: As the battery nears full charge, the flow tapers down to a negligible amount, so no harm is done in leaving it on charge—at least, that's how it's supposed to be. If the battery goes above six volts, the line voltage is too high for the

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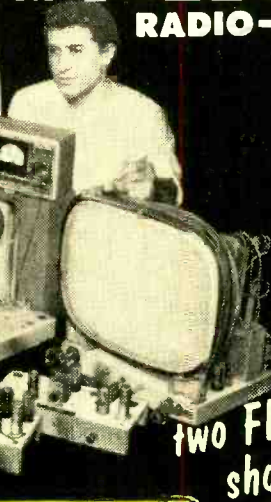
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Letters (Continued from page 22)

charger, and can be regulated by an adjustable auto-transformer.

For the automatic disconnect: Since the charging current varies over quite a range, I suggest two relays in parallel, one heavy-duty and one light-duty, with actual values determined by the maximum and minimum current flow expected. The heavier relay, set by hand, is to hold the charger on the line until the charging rate drops too low to hold it. When it opens, the inductive kick should close the smaller relay, so that the charge continues until tapered down too far to hold the smaller relay engaged. Power interruptions or line voltage fluctuations would take the charger off ahead of time, but no harm would be done.

ARTHUR F. MILES
San Diego, Calif.

Which Fuse Blows First?

■ I recently built a small transmitter from a kit, and since it did not have any provision for a fuse, I decided to use one of those small fused plugs with 3 AG fuses. Using the rated specified wattage input of 160 watts, I computed the total input current to be about 1.4 amperes.

Figuring on a 33% overload, I found the correct fuse size to be about 1.8 amp. Since this value is between 1.5 and 2 amp, I figured that the smaller one would blow too easily and the larger one would not offer adequate protection.

Since resistors and capacitors are sometimes used in series or in parallel to change their total ratings, I wonder whether fuses in parallel could be used to get the odd ratings sometimes required. Can any one of your readers supply an answer?

I have read your magazine for two-and-a-half years and find it interesting and educational. After *Class*, *Kit Builders' Korner* and your *Among the Novice Hams* helped me to get my license. I use a DX-20 and NC-88 receiver with Q-multiplier.

HENRY ZYKORIE
2561 E. 29th St.
Brooklyn 35, N. Y.

Has any reader experimented with fuses and collected data on which type of combination would do the job?

Extras from Scratch Filter

■ Thank you for the article "Wipe Out Record Scratch" (June, '58, p. 54). I put the filter in my 20-watt amplifier and now my LP's sound like tape recordings. Besides eliminating scratches, it boosted the bass response, filtered out hum (I had a little trace), and gave the whole works a richer, deeper tone.

I am using a changer and a three-speaker system (one 15" coaxial, a 12" woofer, and a 4" tweeter).

TOM (COSMO) KARKAIS
Cicero, Ill.

More on Tremolo

■ In your *Letters* column in the August '58 issue, Mr. Joseph F. Curran, of Neptune, N. J., leads readers to believe that the tremolo effect in a pipe organ is caused by reverberation, phase cancellation, etc. Actually, in the pipe organ, which

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all these units*

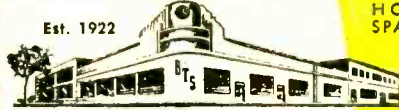


*tubes
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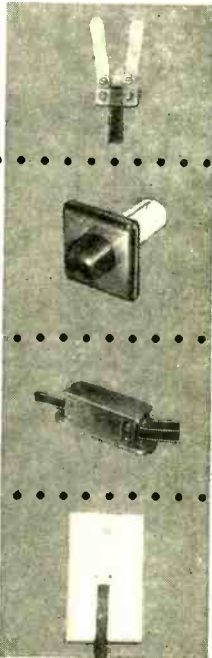
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Letters

(Continued from page 24)

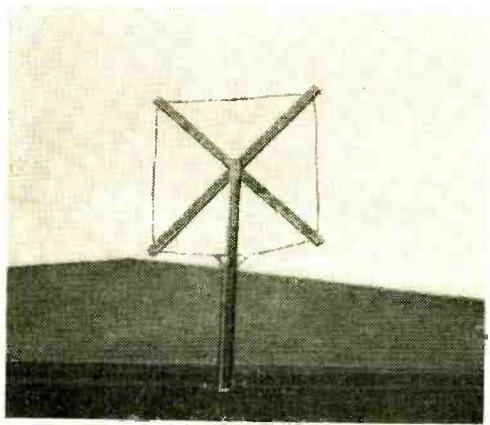
has a stop (or tab) marked "Tremolo," there is a device which causes the air at the pipes to change from a smooth flow of pressure to a varying one, or in puffs. The variation in pressure thus causes a slight change in pitch and loudness, the combination of which gives the effect called tremolo.

As to the beauty of organ music, the effects he mentions, plus the fact that a pipe organ is practically always very slightly out of tune, makes this instrument hard to imitate electronically or otherwise.

C. E. HOOVER
 Ames, Iowa

DQ Antenna for FM

Here's a photo of an adaptation of the Demi-Quad antenna from POP'tronics, January '58. It is cut $\frac{1}{4}$ -wave on a side at 98 mc. for reception



across the FM band, and is fed by 300-ohm twin-line. It works very well in spite of a probable mismatch.

STEVE ZEIS
 Decatur, Georgia

Mobile Hi-Fi

I made the auto hi-fi cabinet (July, 1958). Its amazing to note the clean sound that it produces. I connected it to the 4-ohm tap on my WM5 Heathkit amplifier, and it produces a clean reproduction down to a low 50 cycles with no strain . . . that's with a normal listening level inside my home.

I connected it to my car radio and had it lying in the back seat of my 1955 Ford. Everybody who listened to it accused me of installing hi-fi in my car. What most people don't realize is that AM stations are playing a better quality of records than ever before.

I sure wish someone would come out with a perfect FM car radio. If they can install television in a car, it should be possible to install stable FM receivers.

H. W. HOBURG
 Glendale, Calif.

Inexpensive Guitar Pickup

Here is an inexpensive pickup for guitar, uke, or similar instrument. Use an old crystal 78-rpm

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containing two reels of Soundcraft tape with "Sweet Moods of Jazz in Stereo" recorded on one of the reels.

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Letters

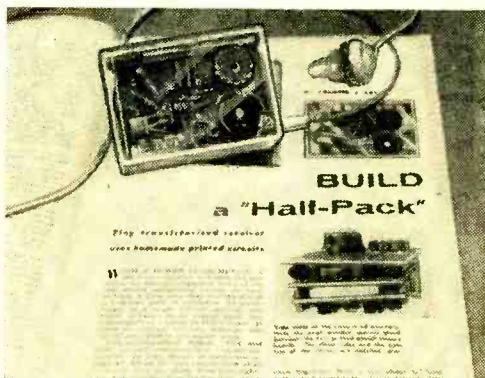
(Continued from page 26)

record player cartridge. Place the cartridge so that the needle touches the metal clamp that holds the guard on. Then tape it in place and hook it to your hi-fi set or a regular guitar amplifier. You can experiment by moving the cartridge to different places around the guitar guard.

LYNWOOD TRASK, JR.
Springfield, Mo.

Pocket Receiver Does Job

■ Here is a photo of the "Hali-Pack" receiver built from the plans in your May '58 issue. It really



works very well and the volume obtained is indeed ear-splitting.

B. V. VINKUNS
Binghamton, N. Y.

Numbering the Quizzomat

■ Readers who have trouble checking the Quizzomat circuits (August, pages 46, 47), will find that by numbering the panel up instead of down, as shown, it will come out right. I think it would have been simpler to number both switches and lamps from right to left on the schematic; they would then agree with the panel photo as it stands.

ARTHUR F. MILES
San Diego, Calif.

Versatile Instrument

■ I thoroughly enjoyed your volt-output meter in January 1958. After building it, I found I could not limit its uses to a voltmeter and an output meter but could use it for other gadgets too. So far the new uses I've found for it are an ohmmeter, signal tracer, and continuity tester. I hope to find even more.

JAMES LIPMAN
Forest Hills, N. Y.

More Tuners

■ Your AM Tuner ("Tuner + Audio = Radio") in the July '58 issue is excellent. Is it at all possible to publish a circuit for an FM tuner that is as small and simple to build as this one?

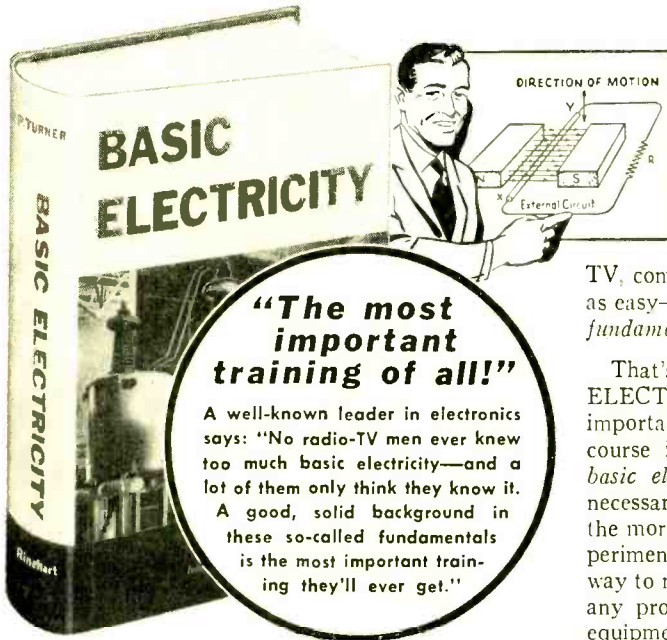
J. C. SOMERS, JR.
Washington, D. C.

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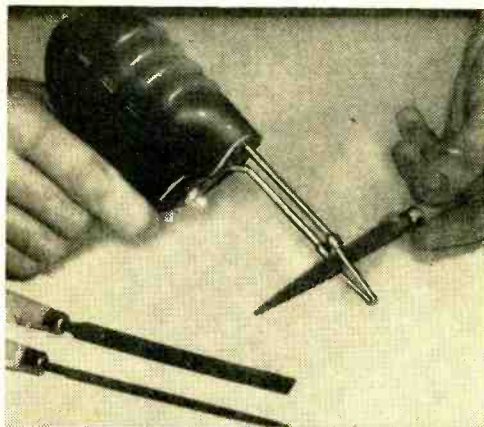


TIPS and TECHNIQUES



GUN DEMAGNETIZES FILES

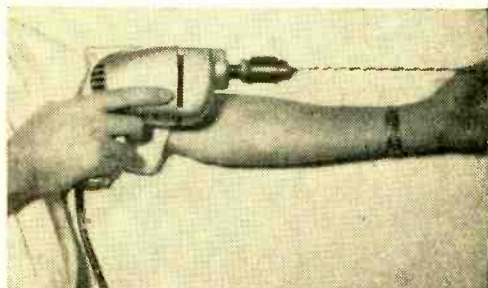
Files used in radio-electronics work sometimes become magnetized by stray magnetic fields. This causes magnetic filings to stick to the file and clog the teeth. To demagnetize the magnetically "charged"



file, pass the tip of a soldering gun over it while you squeeze the gun's trigger. The changing magnetic field surrounding the tip will demagnetize the file. —A.C.

TWISTED PAIR

Have you ever been in need of twisted wires of different colors? Here is a novel idea for twisting a pair that gives a pro-



fessional look to any project. Insert the wires in the chuck of an electric drill and tighten. With one hand holding the wire, a quick pull and release of the trigger will

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To match the musical tastes of everyone, Precise Developments Inc. provides two versions of the great new ORPHEON—one Monophonic and the other Stereophonic. The MONOPHONIC ORPHEON offers 40 watts of undistorted listening pleasure plus every important feature you'd expect to find in a luxury-class amplifier. The STEREOPHONIC ORPHEON provides the greatest flexibility ever offered an audiophile. It comprises two systems in a single chassis—each one identical with the monophonic version described above. They may be used together to reproduce brilliant, clean, linear stereophonic sound, or may be used separately to serve two separate areas monophonically with different music... or they may be used together as an elaborate mixer for recording.

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- Tape and monitor outputs on each system segment
- Calibrated Microphonic Acoustical Probe for AAS* can also be used as public address microphone or for tape recording
- 24 positions of equalization for each system segment
- DC on Input filaments

- At least 18 db of bass and treble boost attenuation plus additional 20 db with AAS*
- Volume and Loudness controls on each system segment; 5 mv full output
- Output meter reads power output in watts or tape output in volts on each system segment. It is also a Sound-level meter with AAS*
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Model AM40A—Monophonic, 40 watts (80 watt peak), with AAS*—factory-wired complete \$169.50

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Model ST40 — 20-watt stereo system (80 watt peak, monaural), without AAS* and Acoustical Probe, factory wired, complete \$189.50

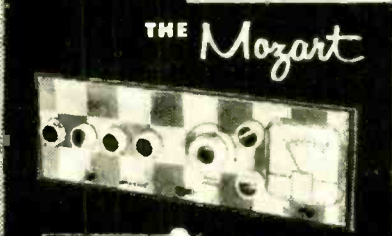
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Tips

(Continued from page 30)

twist the wires until they are tight. If a very long pair is needed, put one end on a hook and repeat the operation. —M. S.

WASHER MARKS TAPE'S END

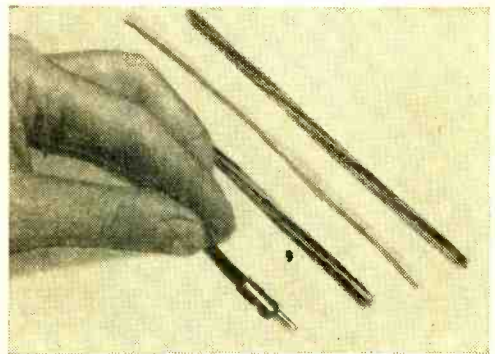
Ever pick up a roll of electrician's plastic or friction tape and have to search for that almost invisible loose end? Next time



you use some of the tape, put a large metal washer under the end. This will mark it so it can be found and lifted easily. —J. C.

STRAW INSULATES PHONE TIPS

To insulate bare phone tips, use short lengths of plastic drinking straw. Select a straw that makes a good firm fit over the plug, then cut it to the length desired with a sharp knife or razor blade. The plastic



straws are inexpensively available (about three-dozen for a quarter), in various colors and sizes at grocery and five-and-dime stores. —J. A. C.

GDO METAL LOCATOR

If you ever have the problem of finding some metal screws concealed under a fine wood finish, here's a good way to solve it. Turn on a communications-type receiver with the BFO switch in the c.w. position. Select a grid dip coil which will tune to the receiver and then adjust the dipper until
(Continued on page 112)

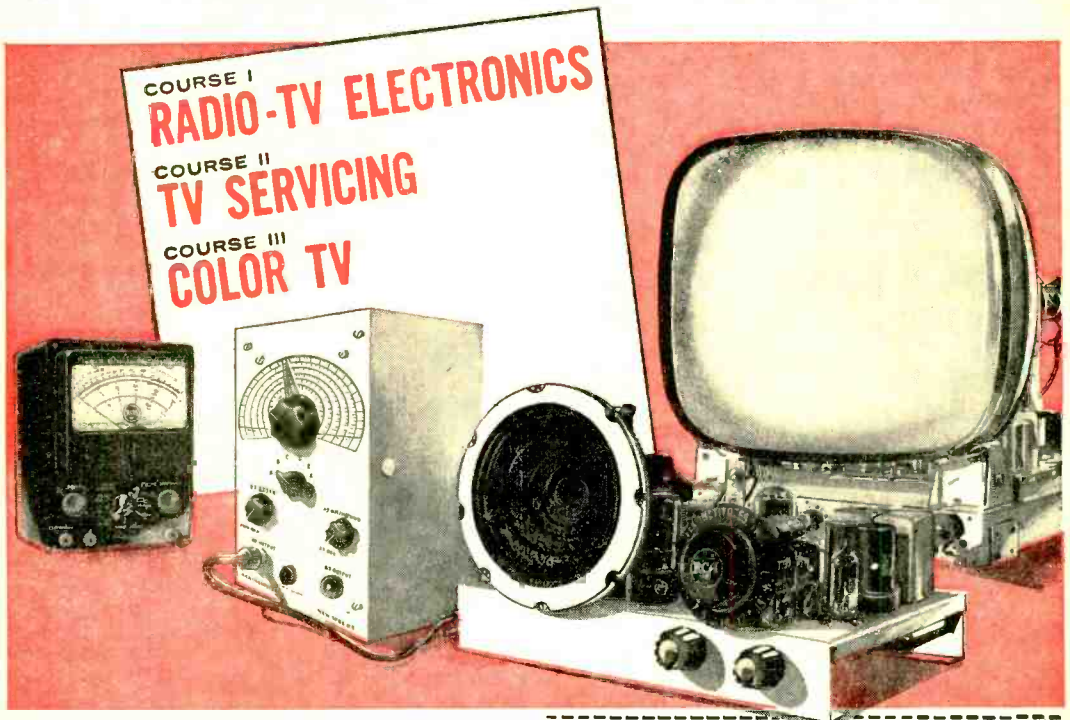
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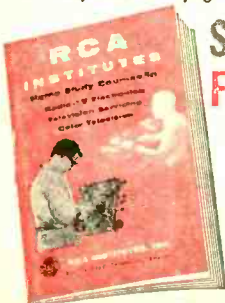
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"NUCLEAR ENERGY" by Dr. Alexander Efron. Published by John F. Rider Publisher, Inc., 116 West 14th St., New York 11, N. Y. 72 pages. Soft cover. \$1.25.

Here is a compact study of a subject that interests both the layman and technical person. In concise language, the atom, its make-up and uses are completely explained. General historical background, the electron, the proton, the neutron, natural radioactivity, alpha, beta and gamma rays, detectors and isotopes are some of the topics covered in the early portions of the book.

Later discussion centers on more advanced concepts, such as the mass-energy relationship, accelerators, induced radioactivity, uses of radioactive isotopes, nu-

clear fission, research and power reactors, and the hydrogen bomb. Illustrations and questions and problems at the ends of chapters contribute to make the text easy to understand.

Recommended: to students and laymen alike as a worthwhile basic book dealing with questions of vital concern to us all.

"SERVICING HI-FI AND ASSOCIATED AUDIO EQUIPMENT" Published by Photofact, Howard W. Sams & Co., Inc., Indianapolis 6, Ind. 148 pages. Soft cover. \$2.95.

This is the second volume of a series published to meet the specific demands of the service industry and an ever-growing audience of technically minded audiophiles. Servicing procedures, using the Photofact technique, are given for a selected group of popular audio components.

Twenty-seven models of high-fidelity power amplifiers, preamplifiers, AM-FM tuners and receivers are covered, as well as public address amplifiers. A special section is included on the planning and installation of stereophonic home music systems, and a

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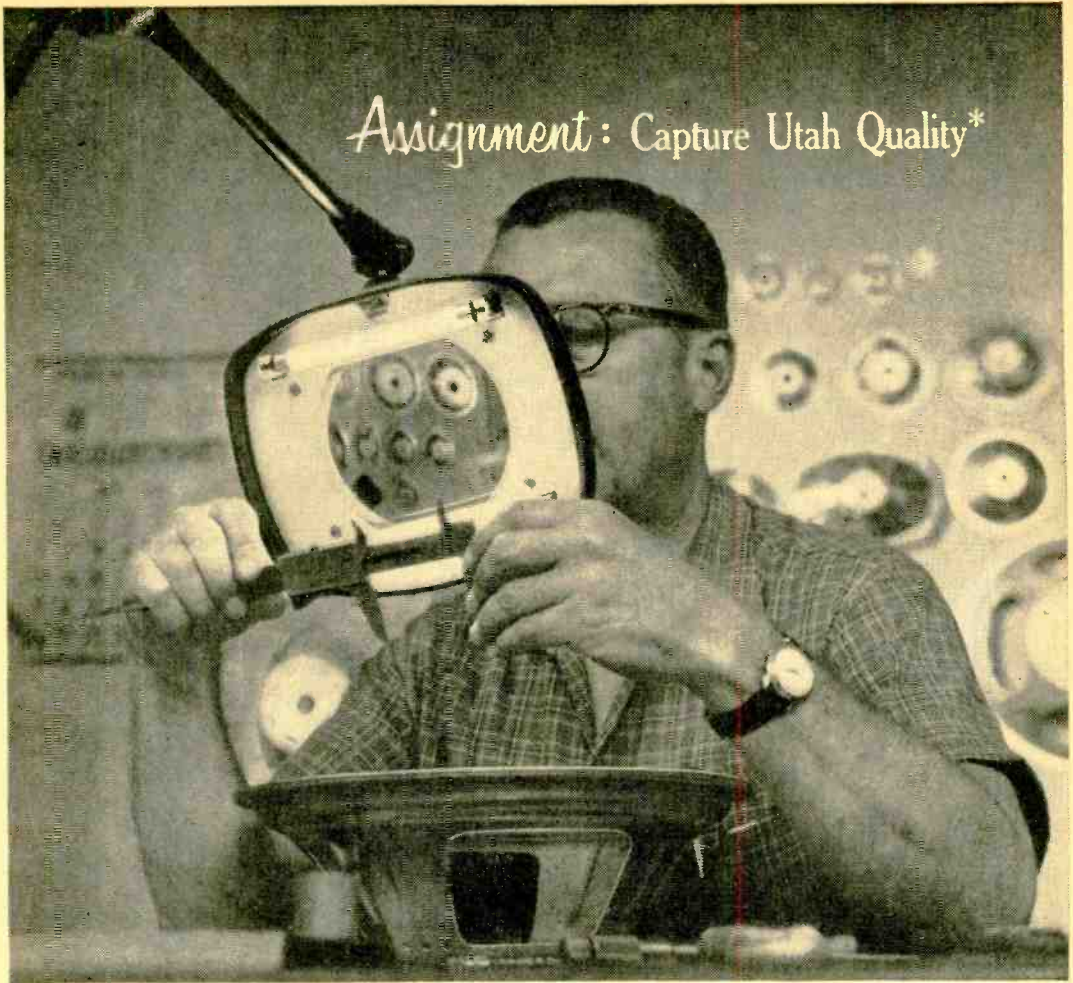
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Bookshelf (Continued from page 34)

handy index to both Volumes 1 and 2 is provided for quick and easy reference.

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"EXPERIMENTAL BASIC ELECTRONICS" by R. N. Evans and C. B. Porter. Published by McKnight & McKnight Publishing Co., Bloomington, Ill. 104 pages. Hard cover. \$3.00.

This is an excellent basic text which contains 18 step-by-step experiments as well as theory. Each experiment includes a list of equipment, a schematic drawing and a photograph of the layout of parts, a word description, and questions for study.

Recommended: to beginners in electronics as a good starting point.



"BASICS OF DIGITAL COMPUTERS" by John S. Murphy. Published by John F. Rider, Inc., 116 West 14th St., New York 11,

N. Y. 416 pages. Soft cover, \$2.50 per volume; three-volume set, \$6.95. All three volumes in single cloth binding, \$7.95.

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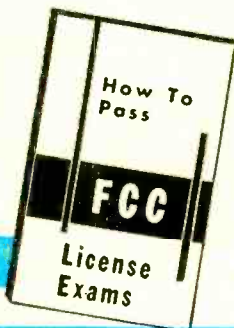




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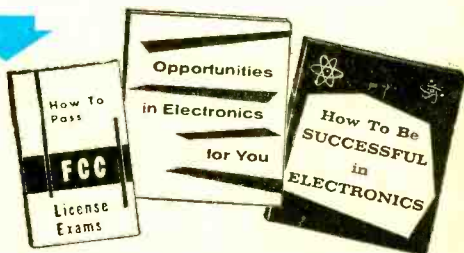
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Bookshelf (Continued from page 36)

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Comprehensive listings of electronic components and equipment for industrial use are contained in a new 184-page electronic parts catalog available from Interstate Supply Company, 4445 Gustine Ave., St. Louis, Mo. Although designed primarily for industrial users, this catalog carries extensive listings of parts and equipment for service and replacement applications.

Vaco's current solderless terminal catalog features quick-connect terminals and adapters, the new No. 1902 bolt cutter and crimping tool, solderless terminal packs, plastic service kits, and a variety of merchandising displays. Catalog T-70 is available from Vaco Products Co., 317 E. Ontario St., Chicago 11, Ill.

Perma-Power radio control systems, which can be used to control any electrical device, are described and illustrated in Catalog B-138. Technical data and prices are included. Write to Perma-Power Co., 3100 N. Elston Ave., Chicago 18, Ill., for your copy.

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"There's a Big Difference in Television Picture Tubes" is the title of a 16-page illustrated booklet which has been issued by Sylvania Electric Products Inc. It describes precision manufacturing materials and techniques that contribute to the life and performance of quality picture tubes. Copies may be obtained from Sylvania Electric Products Inc., 1100 Main Street, Buffalo 9, N. Y.

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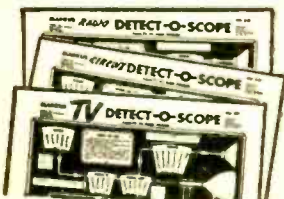
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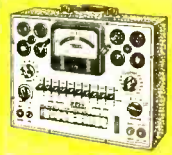
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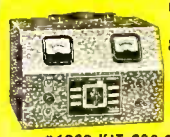
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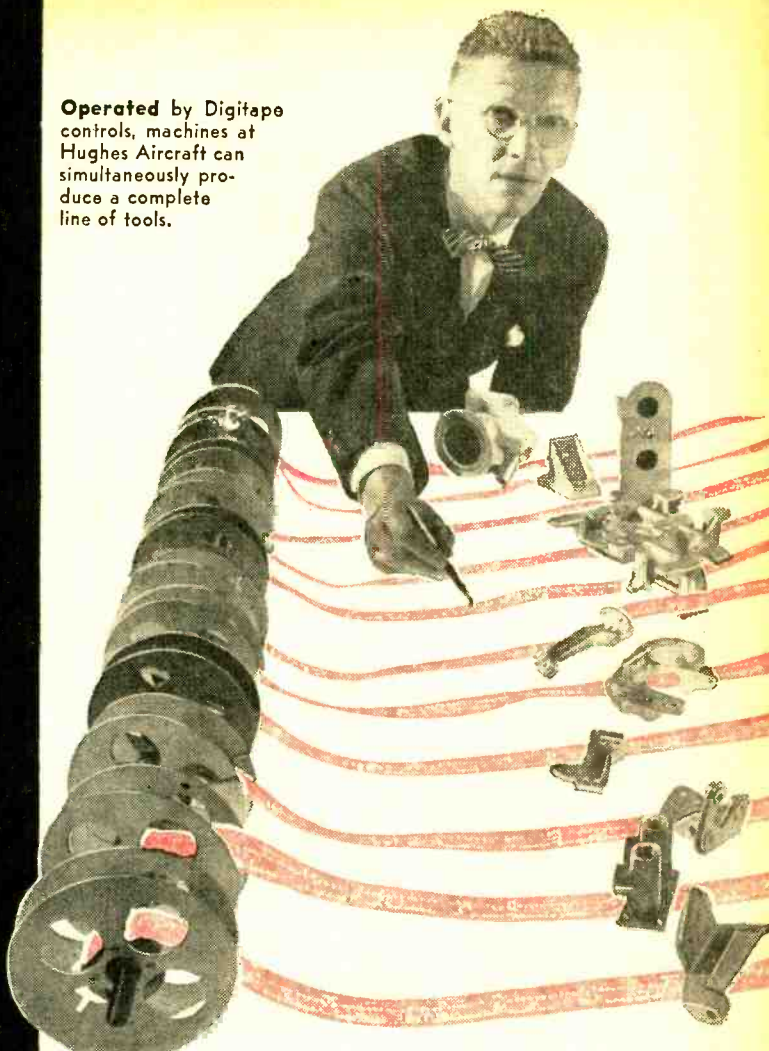


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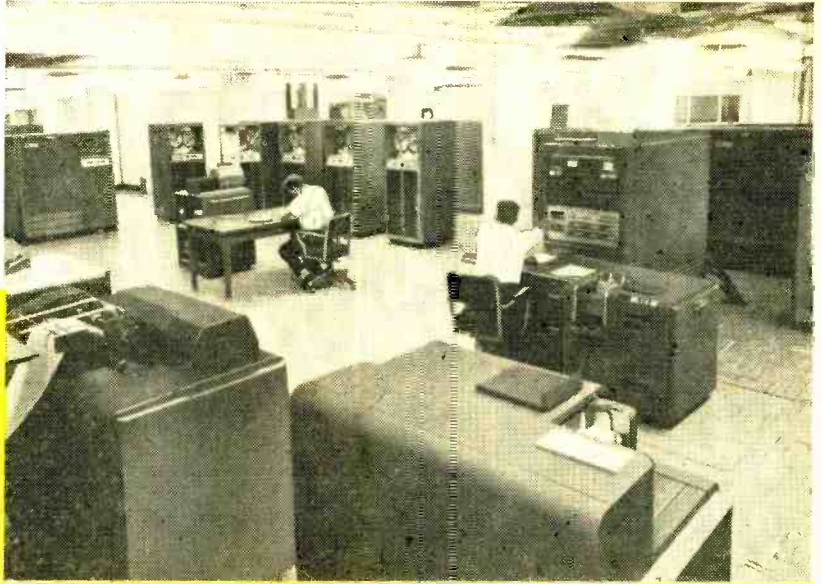


Tape Recording in Industry

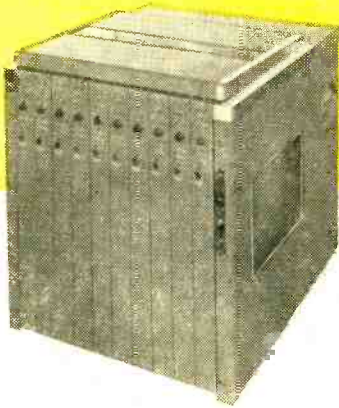
By ALLAN LYTEL

TAPE RECORDERS were a novelty only ten years ago. Today, tape is used to record guided missile test data, control machine tools, play back television programs, provide news reports, instruct students, provide the "memory" of computers, and produce stereophonic sound for motion pictures and for the home.

Very soon tape will enable you to record television



The IBM 704 computer stores its solutions regarding missile calculations on magnetic tapes. The answers can be printed from the tapes at a rate of 150 type-written lines per minute.

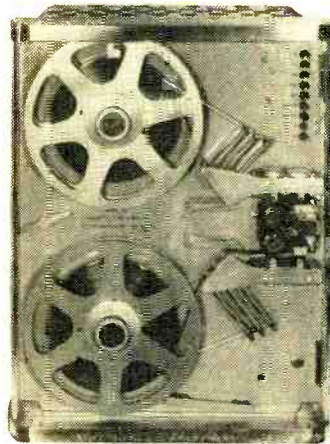


Magnetic tape handlers are capable of high speed and quick starts and stops. The Potter Model 905 (below) has a tape speed up to 75 ips and will come up to full speed or stop in only 3 milliseconds. At left is a typical tape bin which stores large amounts of data.

programs *at your home* for later playback, and automated machine tools will have tape "libraries" for the practically instantaneous production of hundreds of items.

Advantages of Tape. Why is industrial tape recording growing so fast? One reason is that tapes can record a fantastic amount of data in a very short time. The IBM 705-III, for example, receives more than 60,000 characters per second from tape. At this speed, the computer can read or write (record or reproduce) the equivalent of a full-length novel in 15 seconds.

Another reason is the space-saving fea-



Magnetic tapes permit indefinite storage of data. The information contained in an issue of POP'tronics can be stored on a 10-second run of the magnetic tape recording setup shown at right.



An electronic outline of world history from 4 B.C. to the present can be stored in this IBM "RAMAC" computer. Any portion of it can be located by RAMAC in less than two-thirds of a second and printed in any of ten languages.

ture: a single 2400-foot roll will hold the same amount of information as 60,000 punched data cards, and one seven-inch roll will store the information contained on all the punched cards in 27 cubic feet. General Electric uses tape for its quarterly social security report covering 30,000 employees; one reel (10½ inches, two pounds) replaces 900 typed pages. Space saving alone is a strong factor in the use of magnetic tape to store business information.

Tape has still other advantages. It can be erased, and it can be spliced. Splicing permits the recording to be edited, or several tapes can be put together to make one

master recording of the best portions of each. This technique is often used in recording radio and TV programs.

TV Picture Recording. Video tape recording in black-and-white is now in use, and growing. Television broadcasters look forward to "compatible" tape recorders which will record and play back both black-and-white and color TV programs.

Prerecorded TV can make for more flexible programming and overcome the need for filming programs for rebroadcast. The Ampex Model VR-1000 can record over an hour of black-and-white television on a single 12½-inch reel. (See "They're Put-

ting TV on Tape" in the November 1957 issue of POP'tronics.)

RCA engineers have made and demonstrated a Hear-and-See machine—a magnetic tape player plugged into a home television receiver. When this device is ready for the market, you will be able to buy a reel of your favorite program or record a show for later use.

Data Recording. Digital data recording is becoming increasingly significant. In data-processing, where rapid access to large amounts of information is required, the tape transport mechanism must be capable of high speed and quick starts and stops.

An instrument of this type is the Potter



Output data from a computer using magnetic tape can be fed directly to a printer such as the IBM 704 line printer shown here. General Electric is using this equipment in connection with missile development.

Model 905, with a tape speed up to 75 inches per second. It will come up to full speed or stop in only 3 milliseconds. Sensing mechanisms halt the machine if the tape breaks, and fast rewind—2500 feet in 2½ minutes—is available. On a 1¼-inch tape, 16 channels are provided.

Missile Testing. Testing of any complex system provides tens of thousands of individual readings. In missile testing, for example, careful recordings are made of a whole series of measurements for each test. For its ballistic missile development contracts, General Electric's Missile and Ordnance Systems Department has installed a data-processing computation center for the recording and use of test data employing the IBM 704 computer.

About 90% of the test information comprising many hundreds of measurements are recorded. On playback, the tape pro-

vides direct voltage output which permits automatic computing and handling of the data. Output data from a computer using magnetic tape frequently can be fed directly to a printer such as the IBM Line Printer.

General Electric's goal is to provide its engineering groups with both analog and computed data within three days after receipt of the taped data. These tapes are sent in from flight test, ground test and component development sources all over the United States and include quarter-, half- and one-inch widths.

Other Applications. There seems to be no limit to the varied uses of tape. Almost any form of information can be converted into electrical signals and stored on tape.

Recorded lectures for schools are not only possible, they are available; the National Tapes for Teaching repository at Kent State University, Kent, Ohio, has more than 6000 master lecture tapes by authorities on a wide range of topics. A school may obtain a copy of any of these tapes at a nominal charge. More than 12,000 were sent out last year.

At Tidewater's oil refinery in Delaware, there are 88 different

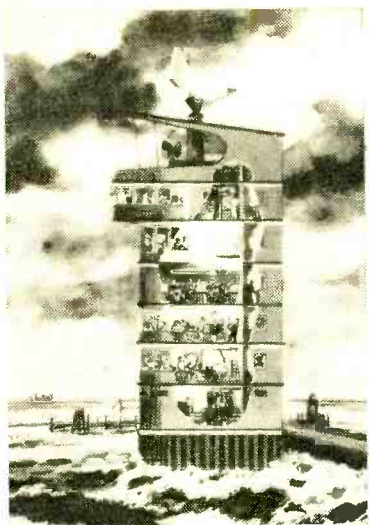
storage tanks for petroleum products. The level in each tank is read automatically and the information fed into a computer. Using magnetic tape, the computer measures, calculates, and records the exact liquid content for automatic inventory control.

Banks are joining the trend toward automation with computer-controlled recordings. Each account can be kept on tape which may be brought up to date quickly for each deposit or withdrawal; one master tape set can serve any number of main banks and branch offices. The Chase Manhattan Bank, for example, is installing the *Diana* computer developed by Laboratory For Electronics.

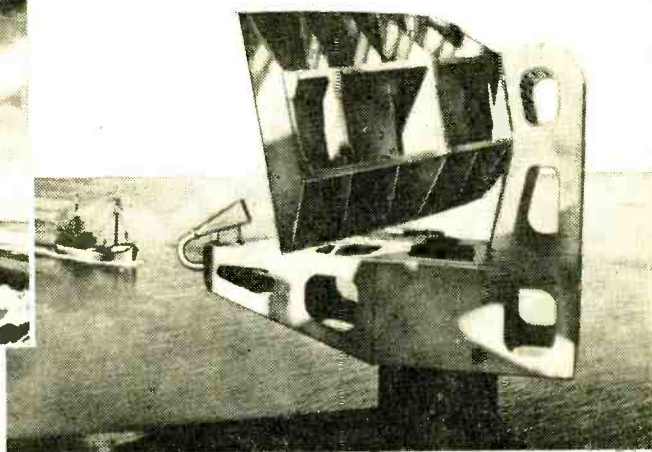
Department stores are also using magnetic-tape in data-processing systems to speed up customer service and to provide

(Continued on page 124)

Radar Pilots Ships



Radar spots ships entering harbor in bad weather. Control tower radios back their position and warns of dangers.



FOG AND LOW VISIBILITY, dreaded by all navigators, will no longer slow up shipping moving into the German harbors of Bremerhaven and Hamburg. A chain of radar stations stretching far out to sea will automatically plot the position of all incoming ships and harbor traffic. If an incoming ship wants radar guidance into harbor, it contacts the radar control center by radio. This control center acts very much like the control tower of an airport. It sees the ship on a radar screen, and sends back its position by radio. It also warns the ship of other ships and obstacles. A ship miles out at sea can keep in continuous radio contact with the central control tower and be guided right to its dock.

A seven-story control tower is the heart of this radar pilot. All the other stations in the radar chain are remotely operated from there. The remote stations feed information back to the control center into eight radar screens. These screens give a complete picture of harbor approaches and all the ships in the area. By pressing a button, the radar operator can project a standard map of the region onto the radar screen. Each ship's position is then pinpointed on the map. This may well be the harbor pilot of the future for busy harbors.

-30-

Inside control tower, radar screens show views of ships and harbor from each relay station. Operators can see complete picture of harbor traffic and can route ships safely by radio.



The Last Word in Hi-Fi



Thirty speakers are lodged in the corners, walls, and ceiling of this 16' x 18' den. An ionic tweeter and its power supply are in the left-hand corner. The large overhead speaker enclosure is flanked by two air chambers.

A HI-FI enthusiast from Naches, Washington, L. A. Lemley, believes in doing things in a big way. Crammed into his modest two-room den are thirty speakers, backed up with an amplification system capable of the tremendous peak power output of 730 watts.

Yet from this souped-up system flows some of the highest-fi imaginable.

The speakers run the gamut from a full-range job salvaged from a 15-year-old juke box to the very latest Electro-Voice ionic horn tweeter.

In operation, the system takes the output from one of two conventional turntables, a turntable and stereo tone arm/cartridge combination, or the stereophonic tape unit, and then feeds it into a preamplifier and six amplifiers. Frequency is divided seven ways at 350, 500, 750, 2500, 3500, and 5000 cycles and fed to the appropriate speakers.

The speakers are: two 18-inch woofers, eight 15-inch woofers; one 18-inch full-range and four mid-range University "Cobraflex" units; and two Goodman "Midax" units. The thirteen tweeters include two

By
PHIL McCAFFERTY

ring-radiators and one ionic treble horn.

Nearly all of the speakers are housed in elaborate cabinets of Lemley's own design and construction. Piano wires and turnbuckles keep the cabinets drum-tight.

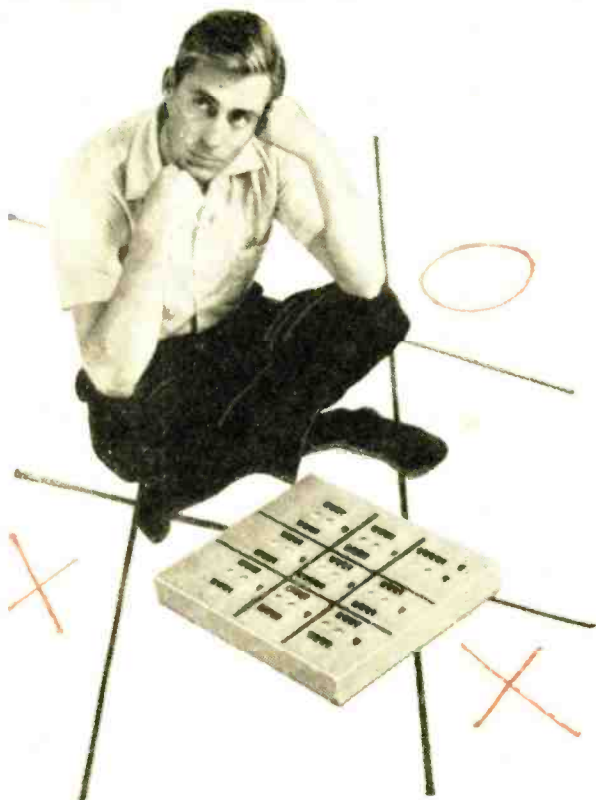
The quality of reproduction is impressive. Thirty speakers, however, is probably not the end.

Lemley alerts, "Listen," as the choir nears the end of a passage. "Hear the singers inhale?"

Sure enough, the mass inhalation is easily perceptible.

With a twinkle, he adds, "Next time you come, I'll have it rigged so you can hear their heartbeats!"

-30-



Tic-Tac-Toe Mate

A computer that plays tic-tac-toe can be a tough opponent

By **DAVID D. LOCKHART**

YOU CAN PLAY "Tic-Tac-Toe" against a computer programed to beat you—if you let it. Although no UNIVAC, the machine will play a competent game against all comers. But, if you drive it into a corner, like any sore loser, it will quit sometimes before you can make the winning move.

The wiring, if approached systematically, should present no problem. Cost of the components is about \$20.

Assembly can be broken down into three separate steps: (1) mounting the slide switches and lamp sockets; (2) wiring the *Select* switches; and (3) wiring the *Setup* switches.

Mounting the Parts. The switches and lamps are mounted on a 14" x 18" piece of

Masonite. All references to part placement and terminal numbering are from the rear of the panel. Switch and lamp placement are the same for each of the nine squares except Square C, where an extra lamp socket is placed behind the "O" indicator hole and an extra switch is mounted.

Before installing the lamp sockets, bend their mounting brackets backwards. The socket mounting nut is then below the solder lugs and out of the way of the bulb. Mount the sockets *after* the switches to insure sufficient clearance.

All switches are d.p.s.t., except the *Select* switches, which are three-pole double-throw, and the three s.p.s.t. types.

The indicator lamp holes are $\frac{5}{8}$ " in diameter and are masked with as many layers of

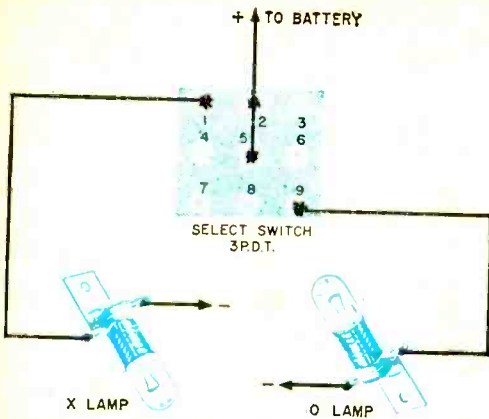


Fig. 1. Wiring of Select switches except Square C.

PARTS LIST

- 68—D.p.s.t. slide switches (Wirt SW-725)
 - 9—Three-pole, double-throw slide switches (Stackpole SS-6)
 - 3—S.p.s.t. slide switches (Carling S60A)
 - 19—6.3-volt pilot lamps (#40)
 - 4—Standard flashlight batteries or one 6.3-volt filament transformer
 - 19—Miniature screw sockets with mounting bracket (Dialco 505)
 - 1—Masonite panel
 - Misc. wire, nuts, bolts, etc.
- All switches are available from Allied Radio

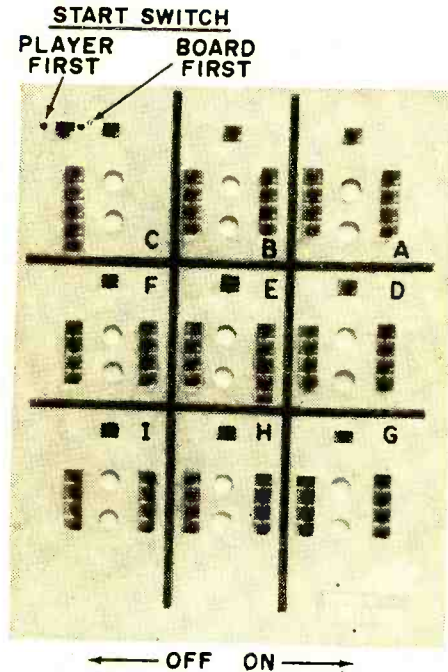
HOW IT WORKS

Activation of a *Select* switch (1) lights an "X" lamp in the chosen square, (2) connects all *Setup* switches into the circuit, and (3) connects the circuit paths of the *Select* switches back to the *Setup* bank for an alternate choice.

The closing of any *Setup* bank establishes the play sequence. Current from a *Select* switch is routed through the closed *Setup* switch to some other predetermined *Select* switch. If this *Select* switch is in the "off" position, the current is passed to the "O" lamp. If the *Select* switch is in the "on" position, the circuit through the *Setup* switch may or may not activate a different square. Any play sequence can therefore be incorporated by modification of the *Setup* switch wiring.

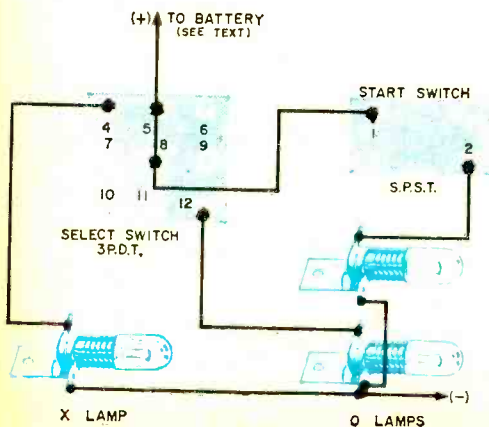
tracing paper as necessary to achieve the desired effect. Mark the top hole of each square with an "X" and the bottom hole with an "O." A sharp colored pencil or India ink can be used to make the letter. You might try colored tissue or bulbs for interesting effects.

Connecting the Switches. When all switches and sockets are mounted, the *Select* switches (located just above the indicator holes in each square) should be wired as shown in Fig. 1. Do not wire either of the top switches of Square C at this time.



Layout of front panel shows "on-off" positions of switches. See *Setup* switch wiring on next page.

Fig. 2. Square C has extra bulb and Start switch.



The *Setup* switches are wired next, as shown in Fig. 3. Each switch terminal is coded with a number and a letter which refer to a specific *Select* switch lug in a specific square. (Refer to Fig. 1 for *Select* switch terminal numbering).

Begin wiring the *Setup* switches by interconnecting all terminals in Fig. 3 marked A4. Then connect this series to *Select* switch terminal 4 in Square A. Proceed with all terminals labeled B4, and connect this group to terminal 4 in Square B. Fol-

(Continued on page 114)

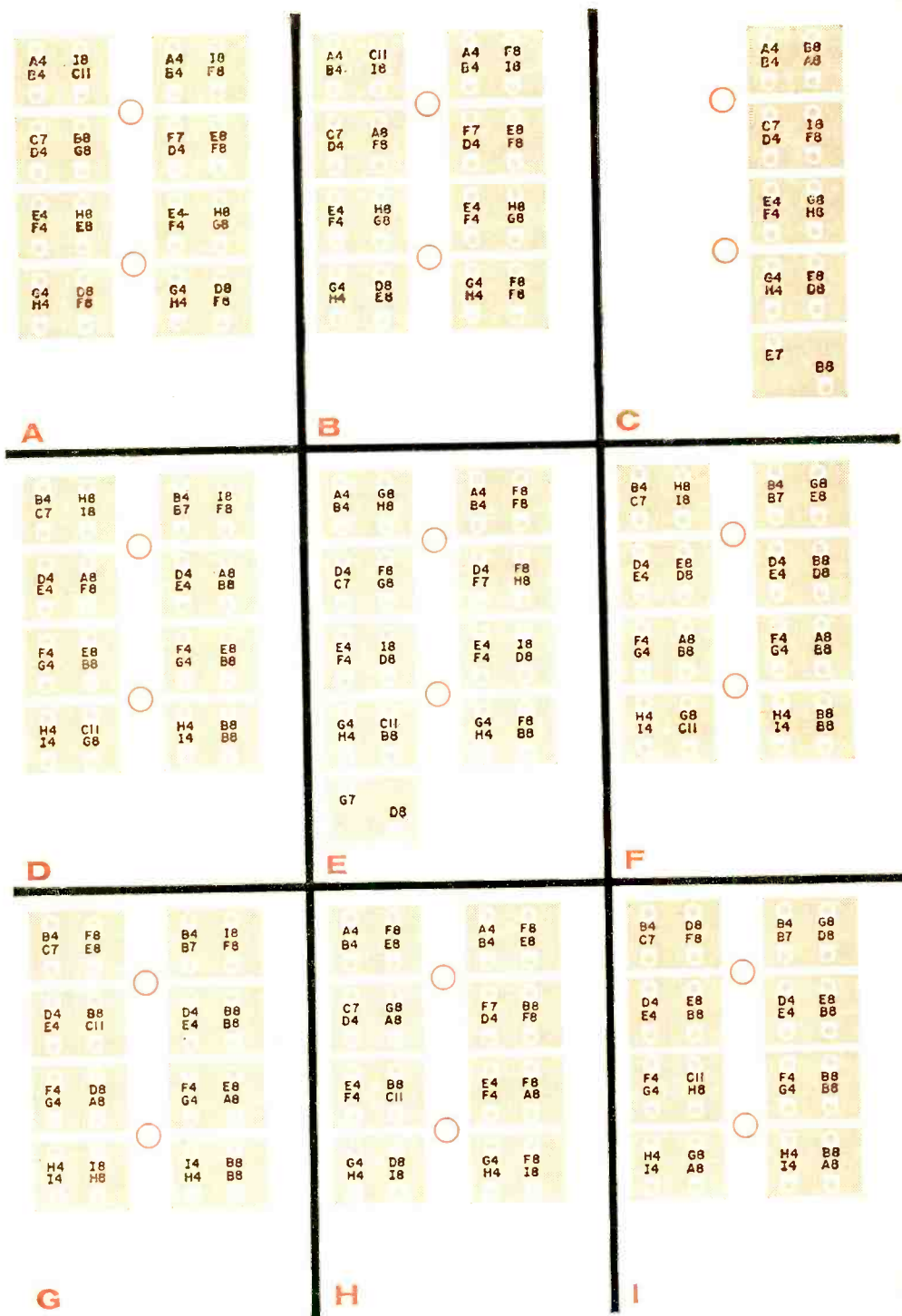


Fig. 3. Setup switch wiring code. To simplify this diagram, the switches have not been drawn to scale, and the Select and Start switches have been omitted. They will be found in Figs. 1 and 2.

Your ~~STEREO~~ STEREO Listening Area

By LEONARD FELDMAN

GOOD STEREO EFFECT can only be obtained when proper placement of the speakers *and the listeners* is achieved. Since no standards exist for size and shape of rooms, each hi-fi fan has an individual problem.

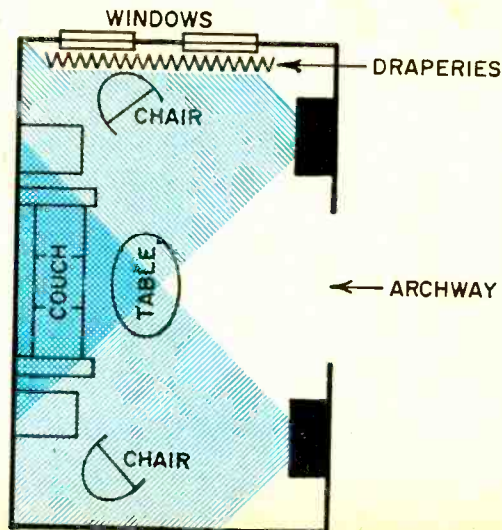
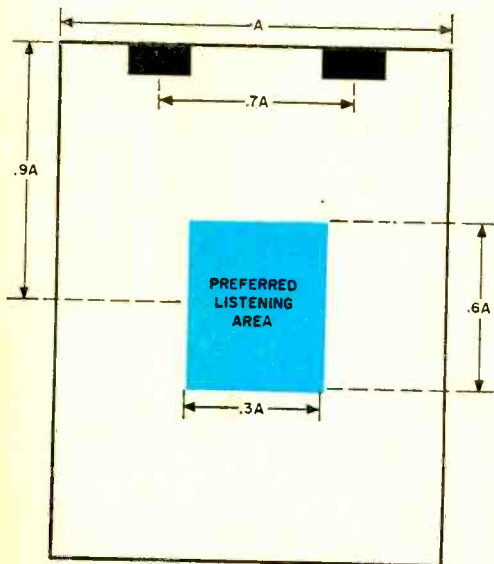
Several room layouts which have worked successfully and which do not require breaking down walls or throwing out furniture will be described. One of these suggested arrangements may provide satisfactory stereo listening for your setup.

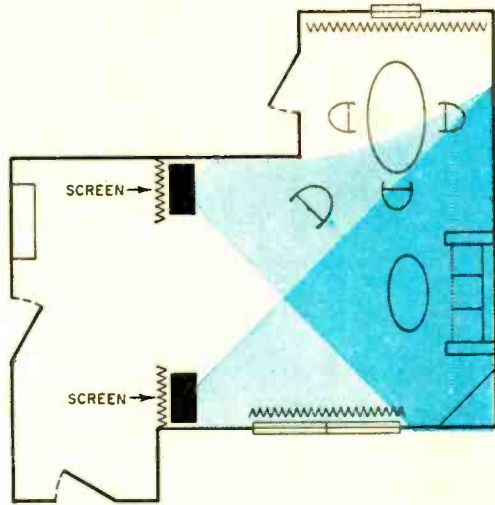
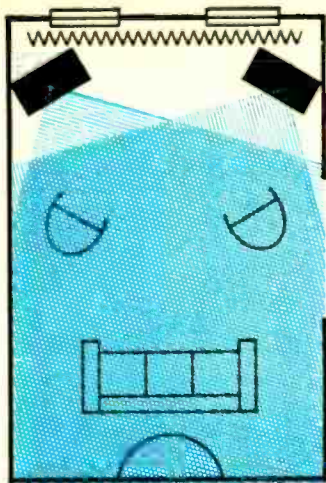
A general formula for speaker placement

is shown in Fig. 1. The size of the room governs the distance between the loudspeakers and also the distance from each loudspeaker to the listener, who should be situated in the "preferred" listening area.

Long and Rectangular. While the speakers are simple enough to arrange in an empty apartment, we cannot overlook the problems created by such items as sofas, tables and armchairs. Figures 2 and 3 treat the problem of a long, rectangular room in two ways, depending upon your present furniture arrangement.

If your major seating is along one wall, a pair of speakers along the opposite wall suggests itself as the ideal solution, as in Fig. 2. Many installations have the two speakers placed in opposite corners of the long wall, and the result is much the same as if two separate orchestras were playing in opposite corners of the room—all sem-





area closer to the sources of sound, as shown in the diagram.

The L-Shape Problem. An acoustical nightmare, although it is the decorator's delight, is the L-shaped combination dining-room/living-room. This form of main living area is practically without true corners. What's worse, these rooms generally don't have more than one really long wall (and that may be *too* long).

One solution is illustrated in Fig. 4. While it does not fulfill all the requisites

blance of integrated sound distribution is lost and there is a big "hole in the middle."

In Fig. 2, however, the speakers have been moved from the corners to points at about one-quarter the length of the wall. This simple change results in an immediate acoustic "fusion" and the entire listening wall comes alive with sound.

The same basic room dimensions are repeated in Fig. 3. Here, the speakers have been placed in opposite corners of the room, but this time along a wall of short dimension.

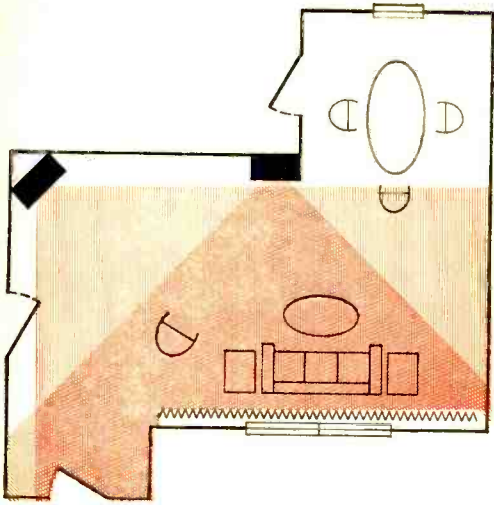
If the sofa in this arrangement were against the opposite short wall, you would find that the stereo effect would be almost zero. At such a great distance from *both* loudspeakers, the sound would tend to fuse and most of the directional stereo effect would be lost. (The very last row of the top balcony, even in a live performance, is not the best place for picking out instruments of the orchestra.) In this case, the solution lies in bringing the main seating

for proper speaker location, it does place the listener in proper relative position with respect to both speakers and, in terms of listening, we must place that requirement above all others for the present.

An obvious disadvantage arises here because the speakers aren't backed up by anything, and the backs of most enclosures are not generally "furniture finished." If the style of your furnishings permits, you might back them up with folding screens, which can be decorative as well as acoustically absorbent.

Balance Control. We purposely saved Fig. 5 (another L-shaped layout) and Fig. 6 (a rectangular room with more archways and doorways than actual wall space) for last because they lend themselves to the use of a balancing control. With this control placed near your listening chair, it is possible to shift the sound-center to the left or to the right, depending upon the size and layout of your room.

As shown in Figs. 5 and 6, the major

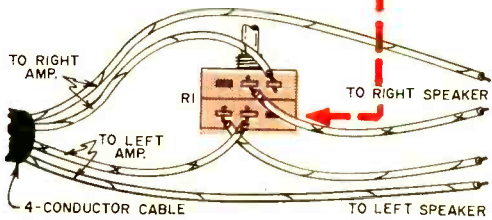
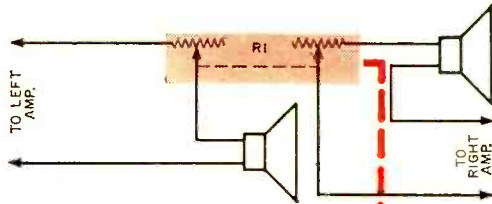


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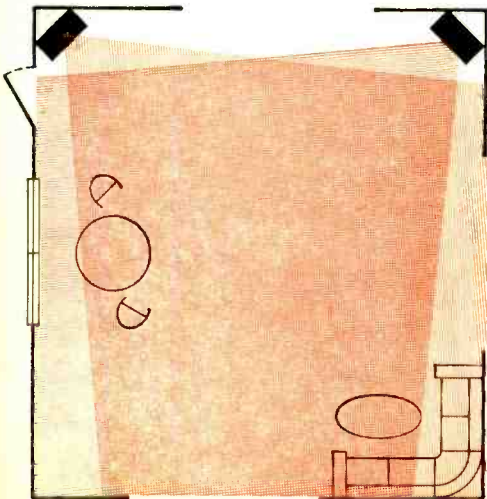
seating arrangement can't be centered between the two speakers. In this case, if you have to be farther from the left speaker than from the right, simply play the left speaker a little louder than the right, or vice versa.

If you own one of the new stereo amplifiers or preamps, you will find a control labeled *Balance*, which does just that. When you turn the control away from the center, the left-hand speaker gets louder while the right plays more softly. Turning the control the other way reverses the action.

Using an L-Pad. A familiar "L-pad" can serve the same purpose with two separate amplifiers. Just follow the schematic in Fig. 7. By using multi-conductor



6



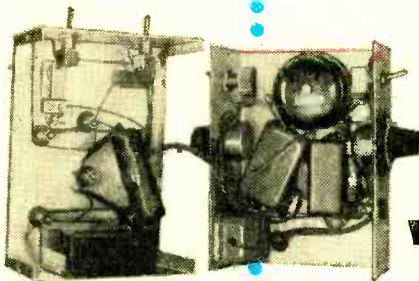
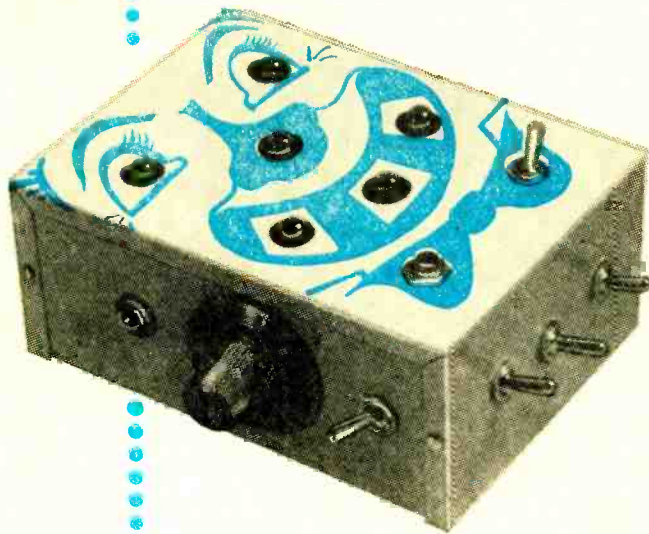
cable between the two speakers and your armchair, the control can rest at your side, wherever you sit.

The L-pad impedance should match that of your two speakers. They are generally available in 4-, 8- and 15-ohm varieties. The amount of control available comes to 6 db for each speaker, which is enough to catapult the apparent sound source from one side of your particular listening room to the other.

-30-

Editors Note: The frequency response of some speakers may be affected by the series resistance introduced by the modified L-pad. In such a case, you may wish to balance the speakers using the amplifier volume control.

By
DONALD A. SMITH



Interior view of the "Clown" showing one possible parts layout.

Make the Kids Happy with a Clown

Buzzers, bells and bulbs

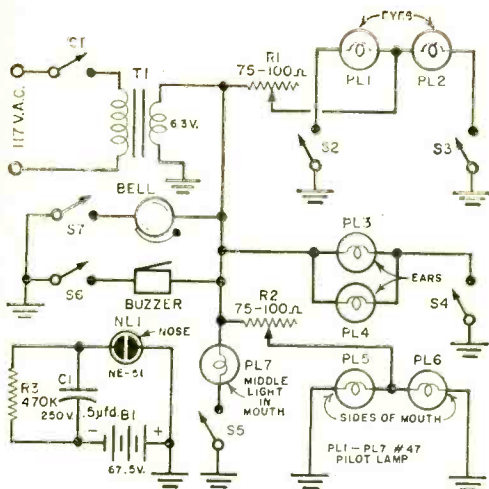
make an electronic toy for small fry

HERE'S a different kind of "baby sitter" to keep the kids amused. It buzzes and rings, has switches to throw, knobs to turn, and lights to go on.

You can use the schematic on the next page as a guide or try other circuit variations. Either way, this clown is a sure-fire toy to present to the kids at Christmas time. It is completely safe for any small child to play with since a 6.3-volt filament transformer is used to power the entire circuit.

Use of a battery supply was considered, but children tend to leave switches on, and the batteries would not last very long. One battery is employed, however. It powers the neon lamp for the clown's "nose." This lamp is used in a relaxation oscillator circuit with a blink rate of two or three a second. As the battery will last five or six months, there is no switch for turning off the "nose."

Switch *S1* is the a.c. "on" switch. The clown's eyes consist of two #47 pilot lamps;



Schematic of "Clown" at left may be followed or hookup used can be based on the contents of your junk box. Potentiometers R1 and R2 should be 2-4 watt wire-wound types to prevent burn out.

The mouth is made up of three #47 lamps. Both edges of the mouth can be varied in brilliance by R2. Switch S5 controls the middle lamp in the mouth. The ears are made up of one #47 lamp each, switched on by S4.

Switch S6 is a spring-return toggle type which operates the buzzer. Push-button switch S7 operates the bell. The buzzer and the bell are standard hardware-store items which cost less than a dollar each.

Most of the parts used in this toy may well be in your junk box. In any case, the investment of a little time and very little money will really pay off.

Need something to "keep 'em happy" on a rainy day? Get to work!

-30-

ELECTRONIC ABBREVIATIONS PUZZLE

By John A. Comstock

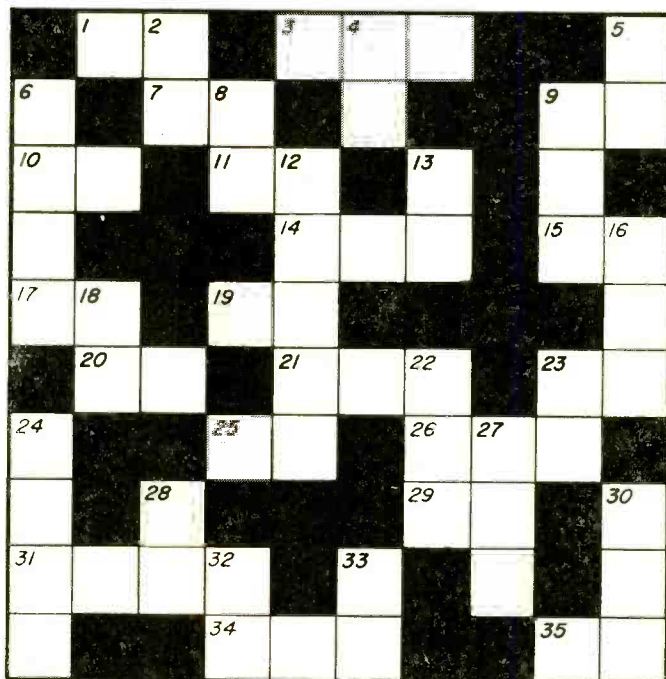
Are you familiar with electronic abbreviations? Here's a puzzle that pertains entirely to electronic abbreviations and letter symbols. Instead of filling in complete words, you fill in only the abbreviation or letter symbol which you feel is correct. Work the puzzle and see how abbreviation-conscious you are.

ACROSS

- 1 Type of current that alternately changes direction of flow.
- 3 Type of junction transistor.
- 7 Type of resistor.
- 9 Type of speaker.
- 10 Broadcast band or broadcast in general.
- 11 Type of electron tube.
- 14 Effective voltage of a sine wave.
- 15 Device or circuit that maintains a constant voltage in a circuit.
- 17 Unit of power equal to one-thousandth of a watt.
- 19 Unit of current equal to one-thousandth of an ampere.
- 20 Unit of inductance.
- 21 Type of junction transistor.
- 23 Amplitude of carrier varies during modulation.
- 25 Electron tube terminology meaning series screen resistor.
- 26 Potential.
- 29 Designation for mutual conductance.
- 31 Neutralization.
- 34 Type of oscillator circuit.
- 35 Frequency range between 3 and 30 mc.

DOWN

- 2 Type of radio wave transmission.
- 4 Neon.
- 5 Carrier frequency is varied during modulation.
- 6 Type of frequency modulation.



- 8 Capacitor voltage rating.
- 9 Maximum working voltage that a capacitor can withstand without breakdown.
- 12 Transformer, transistor or transmitter.
- 13 Electron tube structure designation applicable only to glass tubes.
- 16 Speed of motors, turntables, etc.
- 18 Unit-time power consumption unit.
- 22 Opposite of positive.
- 23 Frequencies in audio range.
- 24 Synchronization.
- 27 Magnetic potential difference.
- 28 Unit used to express audio levels.
- 30 Frequency range between 300 and 3000 mc.
- 32 In wave-guide propagation, H-waves.
- 33 Opposite of H.I.
(Solution on page 124)



By
GEORGE MOBUS

ACCESSORIZE Your TV Antenna Installation

*and make for easy
television living*

A PROPERLY installed and oriented roof-top antenna will improve the performance of almost any TV set. With a few accessories, a roof installation can provide every desirable convenience and facility and, as a bonus, deliver brighter, more stable ghost-free TV pictures.

The roof-top antenna installation in its basic form consists of a TV antenna mounted on a mast or other appropriate supporting device, and sufficient TV lead-in line to reach from the antenna to the television set. It may contain the seeds of future problems, and often leaves much to be desired in neatness and convenience.

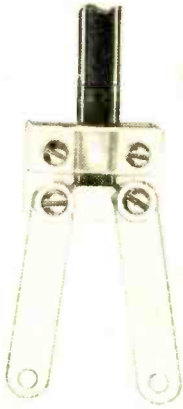
Let us examine the faults of this basic system and see how they may be corrected by using simple, inexpensive accessories.

Prevent Lead-in Trouble. The antenna lead-in — usually 300-ohm flat line — may

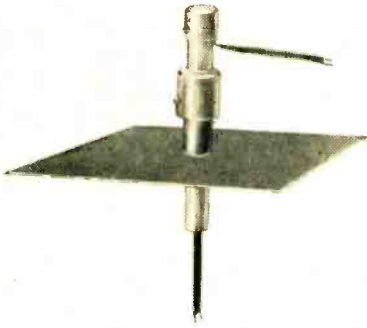
break at the point where it is connected to the TV antenna, and it can, under certain conditions, deteriorate rapidly so that excessive signal losses are created which greatly impair performance.

A small device costing less than \$1 will effectively eliminate this hazard. The Y-TY, consisting of a plastic clamping member which grasps the TV line around the insulation, connects to the antenna terminals by means of brass strips. This takes the strain off the stranded wires, and is cheap insurance against having to climb up on the roof to reconnect the line to the antenna.

Ultraviolet rays from the sun and some



"Y-TY." This strain relief connector prevents lead-in from breaking at point of connection to antenna. It is especially valuable in regions of high winds.



"Roof-Thru." Completely weatherproof, this device permits the lead-in to be brought directly through roof into attic.



"Wall-Feed." It can be used to bring lead-in through attic walls up to 13" thick.

types of chimney fumes can cause deterioration of the polyethylene insulation used in most 300-ohm line. Thus, to extend the life of such line, it is advisable to get it in out of the weather as quickly as possible. This can be done by using one of several types of "roof-through" devices. One such device consists of a plastic "shingle" with an opening covered by a weather-hood. Another, somewhat more expensive but longer lasting, is comprised of a copper flashing with a polystyrene bushing, the opening of which is covered by a polystyrene cap.

A "roof-through" can be installed in the roof at a position near the TV antenna. It permits the line to be brought directly from the antenna into the attic or crawl space. Thus, all but a short piece of the line is completely protected and should last indefinitely.

There is a further advantage to this through-the-roof type of installation. The TV line installed in this manner will be considerably shorter in length than one routed over the roof, down the side of the house to a basement window, across the basement joists and up through a hole in the floor to the TV set. The shorter line means less signal loss and, in turn, better pictures.

As an alternative to the roof entry, the line can be brought into the attic through the wall by means of any one of several devices made for the purpose. The "Wall-Feed" for example, is a unit especially designed for attic wall use. It consists of a short length of plastic tubing with a hood extending over the opening in the exterior face plate. This hood prevents direct entrance of moisture and also forces the formation of a drip-loop in the line so that water cannot trickle in along the wire.

Several types of feed-through devices are available which will go through walls up to 13" thick. Some of these latter types will handle tubular as well as flat 300-ohm line, and will take rotator cable as well. Some provide anchor points for open-wire line.

What About Portables? The portable television set that must be connected to a fixed antenna lead-in line is no longer portable. Many people buy such sets with the idea of using them as second sets—only to find that the built-in antenna or the "rabbit-ears" will not deliver sufficient power to provide a good picture.

The answer to this problem is two-fold. First, you can install plug-in connections at

various points so that the portable set can be hooked into the antenna system. Second, you can incorporate a multi-set coupler in the system to enable you to operate two or more sets from the single antenna at the same time.

Television lead-in sockets come in a wide range of types and styles. Simple baseboard-mounted types will provide adequate plug-in convenience if it is not possible or desirable to hide the line in the wall structure. However, the ultimate in TV wiring systems is provided by flush-mounted wall plate outlets that resemble electrical convenience outlets.

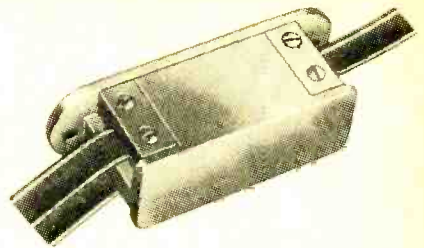
These outlets usually have mounting centers identical to electrical outlets and can be installed on standard electrical boxes. One type (Mosley Electronics) is packaged complete with a set of wall-mounting brackets adaptable to almost any type wall other than solid masonry. Such brackets greatly simplify installation of outlets in existing buildings where it would be a tedious and relatively expensive job to put in flush outlet boxes. They have little or no effect upon the characteristic impedance of the lead-in line and, thus, introduce no signal loss.

In the average home, at least three or four outlets are desirable. There should be an outlet in the living room or family room and certainly one in the master bedroom. An outlet in the children's room will be useful, too.

The multi-outlet system will function best if each outlet line is electrically *isolated* from the others. This can be accomplished by means of a multi-set coupler. There are two general kinds—the resistor bridging type, most satisfactory in areas of good signal strength, and the inductive type, more suitable for use in fringe areas. Such couplers eliminate the possibility of "stub effect" and prevent radiation from one TV set from causing interference to another.

A Good Installation. One of these systems is simple to install and quite inexpensive. The accessories mentioned (sufficient for a four-outlet system) can be purchased for about \$10 from almost any radio and TV parts distributor or obtained from any of the mail order electronic parts jobbers.

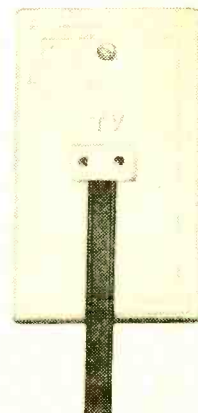
The neatness of the modern installation and the increased convenience and TV enjoyment it provides will more than repay its modest cost and the few hours of labor involved.



Two-Set TV Coupler. This is a resistor bridging type for areas of good signal strength. It enables you to use two separate TV sets on one antenna and will serve for combination FM/TV as well.



Four-Set TV Coupler. Also a resistor bridging type of coupler for strong signal areas, this enables you to use as many as four separate television sets or combination TV/FM sets on one antenna.



Lead-In Wall Outlet. Several of these outlets located throughout the house will permit you to plug in your TV set to its roof-top antenna almost anywhere.

Photos on pages 56 and 57
courtesy of Mosley Electronics, Inc.

**Computers invade a new field to ease
the logjam of translation**

By JACOB ORNSTEIN, Ph.D.

Breaking the Language

AN ARTICLE on the application of matrix algebra to relay contact networks appeared in the Bulletin of the Soviet Academy of Sciences in 1950. So few of our scientists read Russian, however, that the article was overlooked. Professor William Locke of the Massachusetts Institute of Technology estimates that the resulting cost to us in the duplication of research, not to speak of the delay, was about \$200,000. Developments in a new field—"language engineering"—promise to help prevent cases like this, by using electronic computers for a variety of tasks ranging from translation to information retrieval.

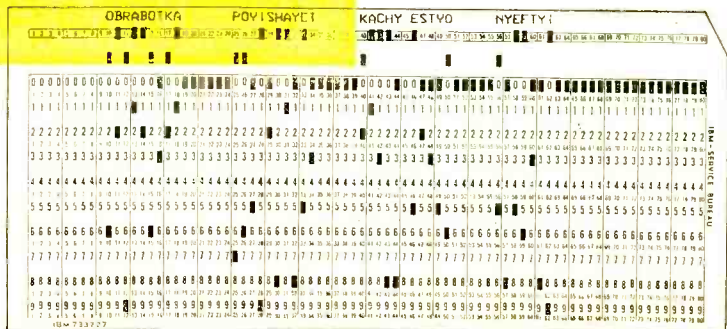
Machine translation until a few years ago belonged strictly to the realm of science

fantasy. Now, although still in the pioneering stage, it is a reality. On January 7, 1954, a group of linguists, scientists, government officials and reporters gathered at the International Business Machines headquarters in New York to witness the launching of the joint IBM-Georgetown University translation venture.

Russian Translated. A stenographer who knew no foreign language typed the following Russian words onto a card punch: "*Myschdunarodnoye ponyimaniye yavlyetsya vazhnym faktorom v ryeshyeniye politicheskikh voprosov.*"

In about 10 seconds out came a perfect translation: "International understanding

A Russian sentence is punched into and printed on a standard IBM card for translation by the "701" computer. The English translation is: "Processing improves the quality of crude oil."



Barrier



Illustrations courtesy of International Business Machines Corp.

is an important factor in the solution of political problems."

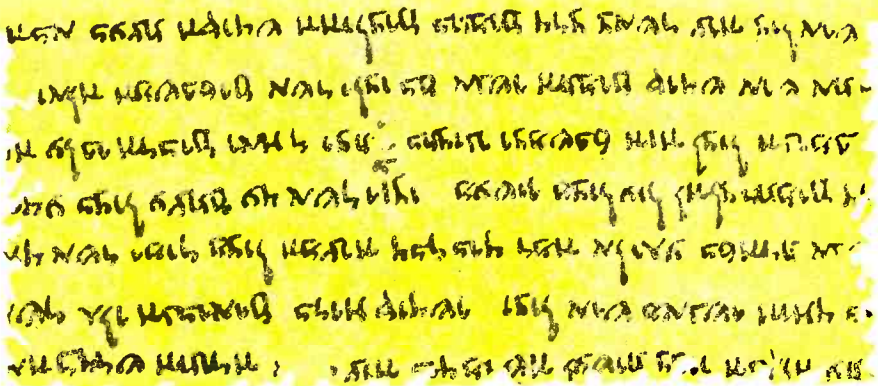
Sixty more sentences from the workaday fields of science, technology and international affairs were then rendered into faultless English by the "linguistic robot."

"MT" Project. Professor Leon Dostert, Director of Georgetown University's Institute of Languages and Linguistics, and developer of the United Nations' simultaneous interpretation system, was one of the first Americans to realize the potentialities of translation by mechanical means. Fired by enthusiasm after attending a 1952 conference on "MT" in Cambridge, Mass., he called his staff together to draw up a plan for a 250-word Russian-to-English trial run.

A trip to IBM won Prof. Dostert immediate support for the project. Cuthbert C. Hurd, now IBM's director of electronic data processing machines, and Peter Sheridan, mathematician, assumed the technical aspects of the undertaking. Responsibility for the linguistic analysis was delegated to Dr. Paul Garvin, a master of 15 languages.

Two years of painstaking labor followed, in which Georgetown and IBM pooled their brain power to analyze the underlying bases of "MT."

"How "MT" Operates. To perform the successful 1954 experiment, each of the 250 words was punched on a card, together with its English equivalent or equivalents, and three codes. The data on the cards was



At the console of the IBM "705" (see photo at top of page), a facsimile of a Dead Sea Scroll manuscript is being examined while the machine processes the index of the ancient writings. A close-up of part of a page analyzed by the computer is shown above. The "705" fills in the gaps in the writing.

stored in the form of plus and minus charges on the magnetic drums. Then the programs for translation were run into the machine.

The three codes indicated which of the six rules of "operational syntax" applied to each word. These rules governed the choice of meanings, rearrangement, omission or addition of words. Their role was to prevent the translation from coming out a mere jumble.

A very small example will give an idea

a \$100,000 grant to that institution to develop further the techniques of "MT." Professor Dostert was then able to set up a large-scale project, with some 20 people concentrating on the linguistic and technical questions involved.

The Georgetown "MT" team boasts some of the finest linguists and mathematical logicians in the country, a Russian-trained chemist, and polyglot clerical personnel. After the problems of translating from Russian to English in the fields of chem-

SOURCE

SENTENCE: vyelyichyina ugla opryedelyayetsya
otnoshenyem dlyini dugi k radiyusu.

ANALYSIS:

RUSSIAN WORD	ENGLISH EQUIVALENTS		1st CODE	2nd CODE	3rd CODE	RULE NO
	I	II				
vyelyichyina	magnitude	---	---	---	..	6
ugl-	coal	angle	121	---	25	2
-a	of	---	131	222	25	3
opryedelyayetsya	is determined	---	---	---	..	6
otnoshenyi-	relation	the relation	151	---	..	5
-yem	by	---	131	---	..	3
dlyin-	length	---	---	---	..	6
-i	of	---	131	---	25	3
dug-	arc	---	---	---	..	6
-i	of	---	131	---	25	3
k	to	for	121	---	23	2
radiyus-	radius	---	---	221	..	6
-u	to	---	131	---	..	3

Given the source sentence at left, the IBM "705" is able to come up with the proper translation, using rules of syntax programed into it. It is "smart" enough to choose the correct meaning of the second Russian word shown here, "ugl-," which can be either "coal" or "angle."

TARGET

SENTENCE: magnitude of angle is determined by
the relation of length of arc to radius.

of the type of problem faced by the machine. In Russian, the two words *nauka o* literally mean *science about*. In the Russian-English glossary, stored in the computer's magnetic memory, *nauka* had affixed to it the rule 242, while *o* carried the rule 141.

The instructions to the machine indicated that wherever 141 was encountered, it was necessary to go back and search for 241 or 242. If 241 was encountered, the first English meaning was to be selected; if 242 appeared, it was the second meaning which was chosen.

Accordingly, the computer read 141, looked for and found 242, selected the second meaning given for *o*, which was *of*, and printed correctly: *science of*.

Further Development. Impressed by the results achieved at Georgetown, in 1956 the National Science Foundation awarded

istry, physics, mathematics and electronics are solved, the German, French, Chinese and Arabic languages will be attacked.

In future experiments, the IBM-701 will be replaced by the IBM-705 Electronic Data-Processing System, capable of higher speeds and greater flexibility in its computations. This machine functions on the basis of magnetic cores, which are minute, doughnut-like objects, that can "remember" information and recall in a few millionths of a second.

Interest in the challenge of mechanical translation is at a high pitch, with important research being carried on by at least a dozen American institutions, including Harvard, M.I.T., and various centers in Great Britain, Israel, and the USSR.

Indexing Scrolls. Intelligent machines are also being harnessed to handle still
(Continued on page 126)

EVER SINCE the successful development of a stereo tape playback machine, music lovers have had available a new kind of hi-fi reproduction.

The first popularly priced portable tape recorders introduced by Bell, VM, RCA and Webcor two years ago showed that magnetic tape could be used for noise-free music reproduction with a quality seldom achieved with conventional disc recordings. The exceptional dynamic range and signal-to-noise ratio of tape playback were as

By
ANDREW LORANT

Make Your Own



**S
T
E
R
E
O**

Tape Recordings

much responsible for the success of tape stereo as the stereo effect itself.

But these packaged recorders, as they were called, had one disadvantage—while they were all capable of recording monophonically, none of them would record stereophonically.

Such was not the case in the hi-fi components field. For here, both Ampex and Bell provided the special stereo recording heads and electronic circuits to match their tape transport mechanism. And recently, Viking and others have announced their versions of a stereo-record tape transport. Stereo recording in the home is possible at last!

Live Stereo. There once was little reason to consider a stereophonic recorder

Live hi-fi stereo tapes

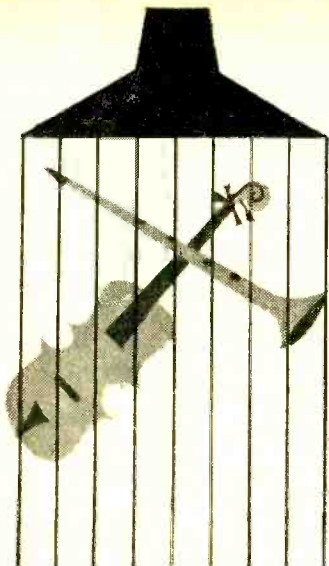
can be made in your own home

with an inexpensive

stereophonic tape recorder

as essential to your hi-fi system. Now, however, there are a number of good reasons why you should own a stereo tape recorder.

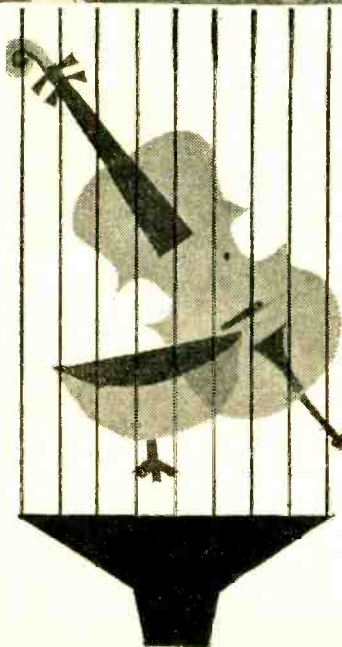
First of all, you can make live stereo musical recordings of your *own* perform-



ance for analysis and study. And, of course, you can take the tape recorder with you to catch a live performance of your local concert or band group.

Special effects can be achieved like those used by Les Paul and Mary Ford. All you have to do is set the recorder for playback of previously recorded material on one channel. The other channel mixes the output of the first channel plus the new material via the microphone input. You'll have a lot of fun experimenting with this kind of stereo recording, especially if you belong to an instrumental group.

Last July, CBS and NBC started network radio programs in stereo with AM on one channel and FM on the other. WQXR, in New York, and a number of local sta-



tions have regular stereo schedules. Check your local paper for listings.

Equipment Needed. The stereo recorder should be equipped with dual erase heads. This will eliminate the need for bulk tape erasure and will allow you to make half-track monaural recordings.

In order to avoid distortion in the recording process, a high-frequency "bias" voltage is introduced into the record head along with the "program." This high-frequency current is supplied by a supersonic oscillator which, in the case of Bell record preamplifiers, serves the stereo erase head as well. Most recorder manufacturers recommend that only their preamplifiers be used to insure proper match to the record heads found on their units.

Recording Level Indications. An accurate level indication is essential for making stereo recordings. It must be re-

membered, however, that when adjusting volume levels by means of eye indicators, etc., they will not always read the same relative loudness since the actual sound level in both channels may vary considerably. If possible, make a test recording before you begin, to enable adjustment under actual recording conditions.

Each of the three tape transports shown here has a different method for indicating recording level. The Ampex, most expensive of all units shown, has vu meters, while the more popular priced Bell has a special type of cathode indicators, and the Viking uses "magic eyes." The price paid for a stereo tape recorder may range from under \$300.00 for the Bell to as much as \$1800.00 for the professional Ampex.

- A** Adjusting the stereo amplifier and recorder input to copy a stereo record.
- B** Each channel must be independently set for the proper recording level.
- C** Copying prerecorded stereo tapes is simple, if you have a stereo recorder.
- D** Taping an AM-FM stereo broadcast off the air for later playback.
- E** Any manufacturer's stereo playback unit can be used to feed the stereo recorder.



As soon as your tape recorder is properly set up, you can tape any stereo program source. If you wish, you can leave the tape machine permanently connected to your hi-fi system—so that you can record any signal passing through the amplifier at a moment's notice. Making recordings this way enables you also to listen to the program source, through your speaker system, as it is being recorded.

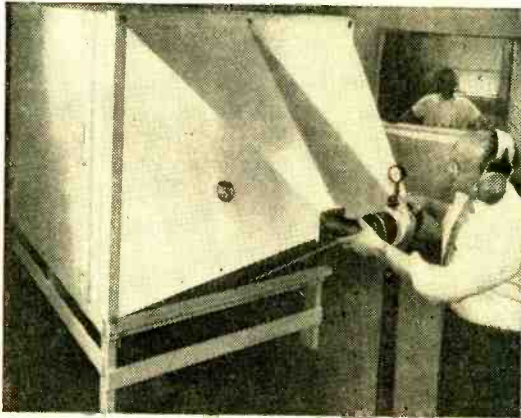
The signal fed to the recorder from the tape output jack is unaffected by the tone and volume settings of the stereo amplifier. The controls can therefore be adjusted for the best sound from your speaker, and a "flat" signal will still be fed to the tape recorder.

If no external speakers are available, you can monitor the program being recorded by the use of binaural headphones connected to the recorder output. —30—



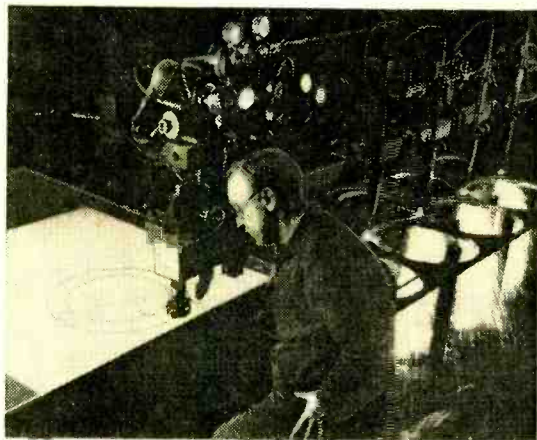
Divers can use this underwater wireless telephone to contact their ship or other divers. High-frequency pressure waves in water are transmitted and received by a battery-operated transistorized unit. Its range is $\frac{3}{4}$ mile to depths of 200 feet.

Electronics Today



World's loudest controlled noise tests space-age electronic equipment. A compressed-air loudspeaker with dual horns makes noise 10,000 times louder than the heaviest street traffic. It tests the effect of jet and missile noise on delicate instruments.

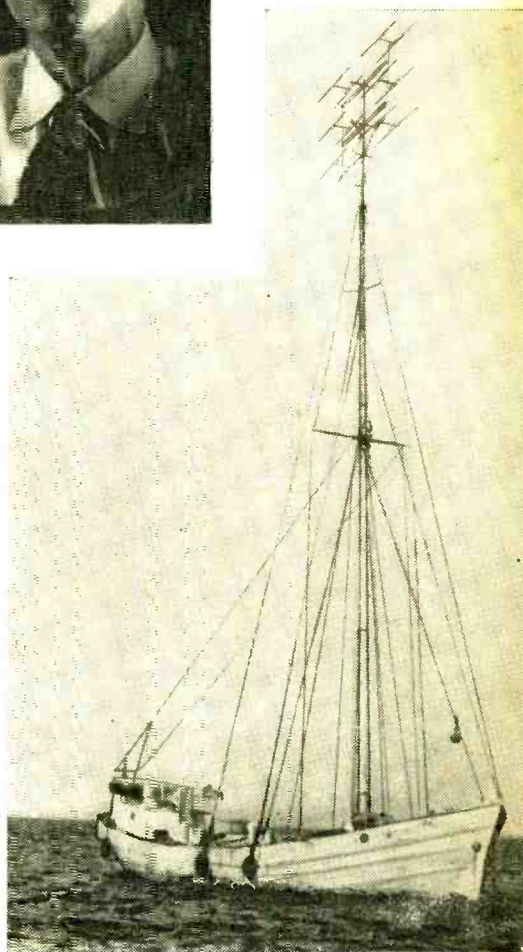
An electronic tracer automatically directs a battery of gas cutting torches, cutting a pattern in sheets of steel. A vibrating photosensitive cell accurately follows a penciled drawing. If the photocell leaves the pencil line, the torches are shut off. This eliminates tedious hand-tracing in cutting operations.



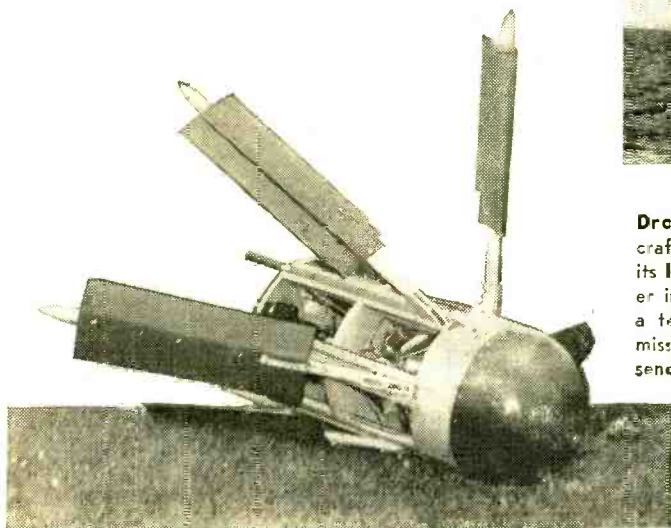


Helicopter pilots flying in fog or cloud formations can now tell which end is up and where they are. An image of the horizon, obstacles, and the earth below is projected on the pilot's front window. The picture changes with movement of the aircraft, eliminating pilot errors due to dizziness.

Radio "Mercur," a floating radio station, rides at anchor in international waters off Denmark. The 109-ton ship has a 60-foot aerial. It sends popular broadcasts to Danes limited to the official state radio.



Dropped by parachute from an aircraft, the Navy's Grasshopper unfolds its legs, stands up, and transmits weather information. A timing device erects a telescopic antenna and starts transmission. The station identifies itself by sending its call letters.





МОСКВА U.S.S.R.



This verifies your reception report on our transmission
 Date June 9, 1956.
 Time 2305 GMT
 Wavelength 9.83 mc.

RADIO MOSCOW



QSL from Sputnik!

Участнику наблюдений за первыми в мире Советскими искусственными спутниками Земли
Mr. C. M. Stanbury II

Благодарим Вас за присланные сообщения. Ваши наблюдения представляют научную ценность и используются нами при обработке материалов в соответствии с программой Международного геофизического года.

Мы надеемся и в дальнейшем получать Ваши сообщения.

Комитет СССР по МГГ

HAVE YOU heard Sputnik? Yes. Have you received your QSL? Unless you live on the other side of the iron curtain, chances are pretty good you haven't. Despite the fact that *Radio Moscow* has repeatedly asked for reports on the Soviet satellites, until now the highly prized space-QSL's have not been crossing the "red divide."

What's needed to verify Sputnik? An address? Yes, that will help a little. How about transmission data to prove your reception? Yes, knowing how to get this is essential. But even more important is your *approach*. Without the proper approach, a DX'er is a very dead duck so far as Sputnik veries are concerned.

The Proper Approach. The key word of this approach is *frankness*. Most of you know that the opposite seems to be the standard for at least 90% of the broadcasts coming from *Radio Moscow*. The same evasiveness carries over into their handling of DX reports. The following excerpt is typical.



**How one SWL managed
 to get his prized
 space verification**

By C. M. STANBURY, II

The call letters of the Chinese language transmission you heard are the same as the ones used for the North American broadcasts—the first bars of Dunaevsky's "Song of the Motherland."

To meet this kind of thing with more evasion would result in an endless series of correspondence which would net the
 (Continued on page 118)



By
ART ZUCKERMAN



YOU'VE ALWAYS ADMIRER the clean, true sound of that neat, inexpensive music system your friend has in his cozy city apartment. Perhaps he has an 8" or 12" speaker in a small—but ample—enclosure, and a sweet little 10-watt amplifier. Together with his record changer and modestly priced FM tuner, they serve up many happy hours of listening.

So you've decided that it's time you tried high-fidelity, too. After all, you're a man of property in the suburbs. With your own house and all that space—space, your city friend doesn't have—a hi-fi rig should fit in perfectly.

Naturally enough, you see no reason not to duplicate your friend's system. It sounds great, and why pay more than he did? But would his system work as well in your

Hi-ing the Fi to the Suburbs

***That city apartment setup might need a lot
of changes when you move away***



suburban setup? Maybe . . . or then again, maybe not.

Problems of Reception. Location is bugaboo number one, at least as far as the tuner is concerned. Your friend's inexpensive FM tuner is fine for city living. Since the stations are near at hand, sensitivity is no problem.

If your home is not-too-far removed from the city, it may be that reception won't be substantially different. But if your manse is located way out yonder, the weak signal reaching the tuner may call for remedial measures. The least expensive place to look for improved reception is the antenna.

Chances are your friend has been using the tuner's built-in line antenna. If it doesn't work at your address, you might try an indoor folded dipole. This can be constructed from a 60" length of 300-ohm twin-lead flat line. Solder the leads together on each end. In the center of the 60" length, cut into the wire on one side of the ribbon, and solder a lead-in strip to the new leads formed by the break.

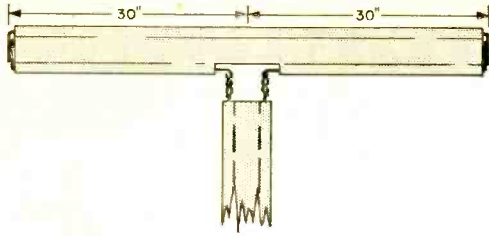
An indoor folded dipole can be spotted on the floor, along the wall, or tacked to the back of your equipment cabinet if you are near the city. Experiment until you get best reception. If you are far from stations, you'll need to mount the antenna high in the house, perhaps in the attic.

Should you find that the best position leaves the antenna exposed in an unsightly manner, you can tuck it out of sight when you aren't using the tuner.

If you have an outdoor antenna for TV, you can use that to feed your tuner. Television antennas generally work out quite well because the FM band is located between the low and high v.h.f. TV band.

The easiest way to connect to your TV antenna is with a two-set coupler. This simple, low-cost device has one pair of terminals that attaches to the antenna lead-in wire and two additional pairs which are connected to the antenna terminals of your television set and FM tuner. The network built into the coupler eliminates any undesirable interaction between the two receivers.

A Better Tuner? If better FM reception isn't forthcoming now, chances are you're simply too far away from a station. In that case, you need a more sensitive tuner. While a sensitivity rating of 5-10 microvolts for 30-db quieting is more than



Make a folded dipole out of antenna twin lead by measuring off a 60" strip, soldering the ends together to form a closed circuit, then cutting into the center of one wire for the lead-in, as shown above. The antenna can be tacked to the wall, to the back of the hi-fi cabinet, or even mounted in the attic, for better reception.



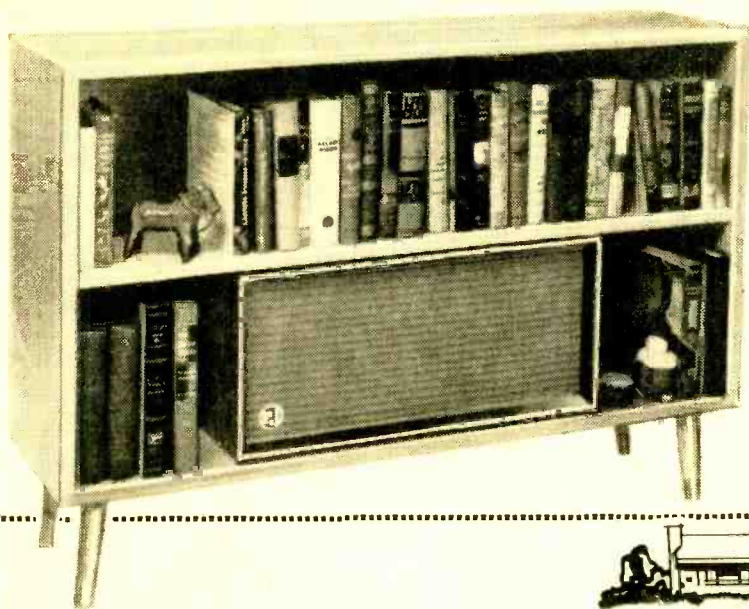
An inexpensive outdoor unit is the MLC University coax weatherproof speaker above. The RJ/Wharfedale (on next page) is excellent for that second speaker.

adequate in the city, you'll need at least 3-5 microvolts in a weak-signal area—or even more.

If the best instrument your budget allows doesn't help enough, a signal booster may lick the problem. Put in the line between the antenna and your tuner, it will amplify the signal before it reaches the tuner. The Blonder-Tongue B-23 two-set booster, for instance, not only beefs up the signal but couples your tuner and TV set to the antenna as well, eliminating the need for an extra coupler.

As a last resort, there is always the motor-driven antenna. FM transmissions are highly directional in nature, and a motor-driven antenna can be set to point right at an individual station for the most efficient pickup.

Acoustics Are Important. Any other problems that may arise will be almost



exclusively due to the extent of your "ambition."

There's the matter of where in your home your music system will be located. For your city friend, living in an apartment house probably dictates the only possible place—the living room. *You* may have a finished basement, a general fun room. This creates its own set of problems, but they're easy to solve.

The acoustical qualities of a room can be just as important to the sound of your system as the quality of the components. If a room has bare walls, floor, and ceiling, and the starkest of furnishings, it tends to be "live." It is highly reflective and makes sound waves bounce around, reverberating like crazy. The resulting sound isn't pretty.

A deeply carpeted room with extensive draperies, plush furniture, and over-generous fabric hangings tends to be "dead." Because all its surfaces are highly sound-absorbent, general sound levels are reduced, and highs are swallowed up.

The ideal is a room with a moderate number of sound-absorbent surfaces. The average living room, with its carpeting, drapes, and upholstered furniture, is usually acoustically suitable.

In a finished basement, you're likely to find linoleum or asphalt tile for a floor covering, knotty pine wall paneling, and simple wood or metal furniture. Such a

room is unduly "live." Part of the solution lies in lining your ceiling with acoustic tile, to offset the lack of carpeting. Simple drapes will help, too.

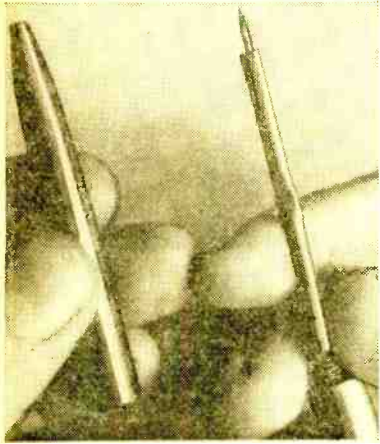
You might want to cover one wall, or a few wall panels, with acoustic tile. Selected and applied imaginatively, such a facing may provide an appealing visual contrast to the other walls. Foam cushions on the furniture, or some form of porous, absorbent cushioning—in place of hard-glazed, plastic-faced cushions—will also help a good deal.

Another problem is the noise created by an adjoining central heating or air-conditioning plant. Even a washing machine in an adjacent room can make for difficult listening. The measures you take to create a good "live-dead" room balance will help overcome this problem. Acoustic tiles on the ceiling, and possibly walls, of the laundry room should cut out most of the remaining noise. And padding beneath the washing machine should help.

Speaker Coverage. The room you use will probably be substantially larger than the living room in your friend's city apartment. The larger the room, the more sound you'll need to fill it to your taste.

An 8" speaker may prove inadequate. Though new methods of packing solid bass into a small container have been developed, such speakers are fairly expensive. Gen-

(Continued on page 120)



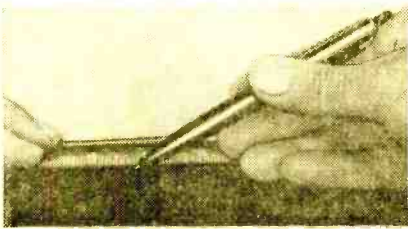
BALL-POINT PEN SCRIBER

When you lay out tube, meter and mounting holes, accuracy is a must if you want a professional-looking job. In just a few minutes time, and at practically no expense, you can make a pocket metal scriber with a retractable point for this purpose.

Remove the pen filler of a discarded ball-point pen and cut off the narrow writing point where it enters the filler tube. File it smooth. When this is done, a bushing remains in the tip of the tube which permits a snug fit for a standard-steel 78-rpm phonograph needle, inserted point outward.

You now have a handy scriber whose point disappears at the push of a button. The sharp-tipped phonograph needle will scribe metals as well as plastics and similar materials.

—Peter Barna

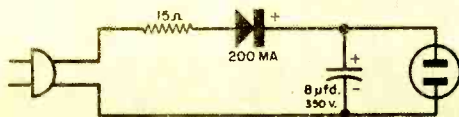
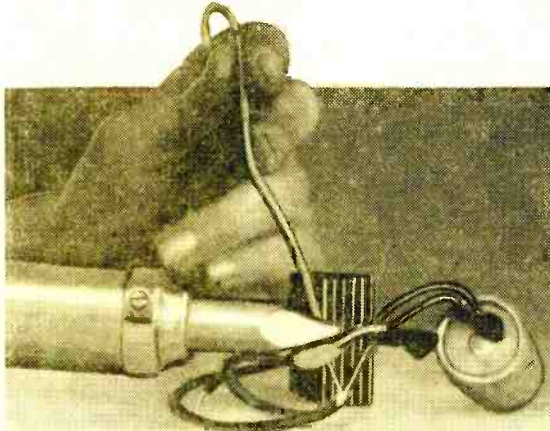


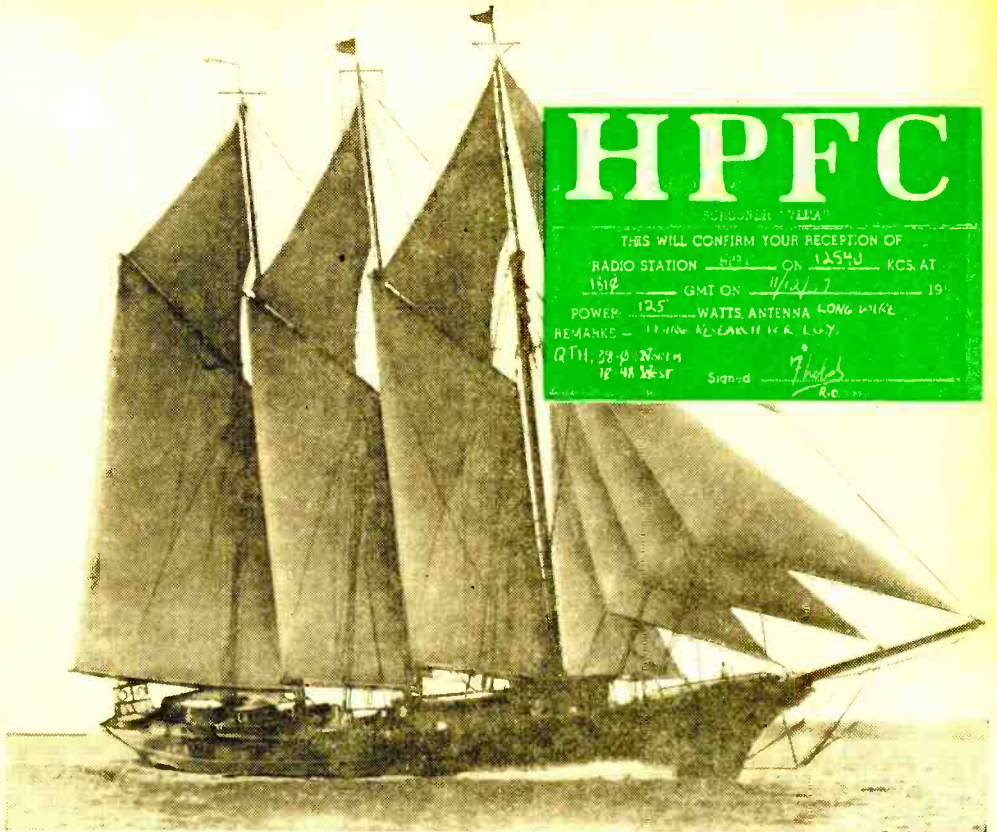
SMOOTHER SHAVING

WITH SIMPLE A.C.-D.C. CONVERTER

You can make a simple converter at a fraction of the cost of a commercial unit by assembling a few electronic components in a small plastic box. The heart of the device is a 100-ma. selenium rectifier which provides sufficient current for most razors. If your shaver is a heavy-duty type that draws around 15 watts, a 200-ma. rectifier will provide adequate safety margin. It's best to line the box with asbestos paper or pieces of a thin asbestos shingle.

—Harry J. Miller





Columbia University's IGY ship "VEMA"

DX Ahoy!

You can pick up some rare QSL's by monitoring the maritime phone and c.w. bands

By TOMMY KNEITEL

● **I**F YOU ARE a DX'er, you undoubtedly boast QSL cards from Stations WCBS, KXEL, KDKA, and WOAI. But do you have any QSL's from Stations WDQJ and KGXR?

● You say that you've been a DX'er for lo these many years and you are willing to bet that there are no such stations? Put your money back in your pocket, friend. I can back up my statement with two valued "pasteboards" selected from a collection which contains other calls such as WEDI, KAEG, WNBR, and KFEN, all of which are equally unknown to you.

● Stop looking frantically through your broadcasting station list for these stations—you won't find them. WDQJ is located on

board the steamship "Mormacswan," and KGXR is on the steamship "Esparta."

Just like the city dweller who moves to the country to escape the congestion, I have packed up my ham call book and broadcast station lists and moved out of the swarming QSL-hungry masses into the "sticks." By that I mean that I have joined a growing group of listeners who are inconspicuously racking up loggings and QSL's by the score by DX'ing on the maritime phone and c.w. bands.

The number of stations that can be heard here is almost unlimited. They range in power from 35 watts to more than a kilowatt, and in size from plush private yachts to thousand-foot luxury liners, from tough little harbor tugs to crusty old freighters in the banana trade wending their way through the Caribbean to a tropical port. Coast Guard rescue vessels, Great Lakes steamers, fishing trawlers, small coastal tankers—they're all here for the listening!

Where do you listen? There are so many places that it is almost hard to decide where to begin. The most plentiful and easily accessible maritime radio stations are in the medium-frequency phone band, which roughly covers 2000 to 2850 kc. Prime frequencies in this band are: 2003 kc. (Great Lakes inter-ship); 2182 kc. (international calling and distress); 2638 kc. (general intership—all areas); 2670 kc. (U. S. Coast Guard); 2738 kc. (intership—except Great Lakes and Gulf of Mexico); 2782 kc. (Mississippi River—ships and land stations); and 2830 kc. (Gulf of Mexico inter-ship).

Many medium-frequency phone stations can be heard QSO'ing coastal harbor telephone or "marine operator" stations. Listeners located near busy seaport areas will most likely have better luck DX'ing these stations because harbor boats operating on the frequencies listed cause a jumble of QRM during certain hours. Stations working the "marine operator" operate one-at-a-time on the channel. This means no QRM, and low-powered phone stations have been heard on these frequencies several thousand miles distant.

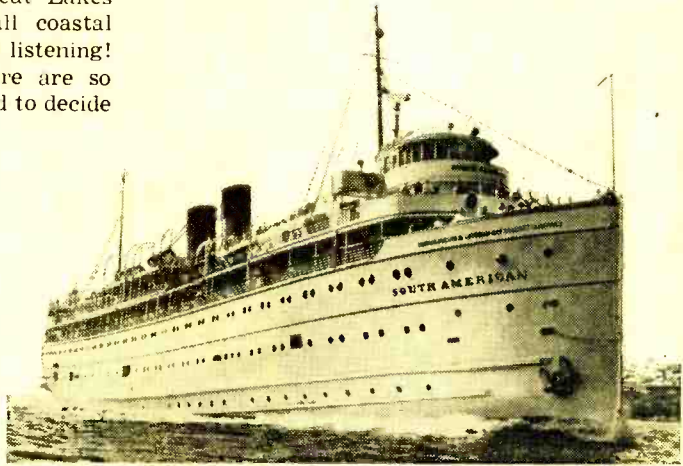
Phone stations located on the high seas

can often be heard in the 4-, 8-, 16- and 22-mc. bands.

If you can copy c.w., even poorly, you have the key which unlocks the door to a multitude of stations located throughout the world. Even if you copy c.w. at a snail's pace, you can try your hand at the maritime c.w. game. The whole trick is to locate the "calling" portion of the maritime c.w. bands.

Here the ships repeat over and over the call letters of the coastal telegraph station they are trying to raise, followed by "DE" and their own call letters repeated several times, usually at a fairly slow speed.

If you miss the call letters the first time, don't fret; you are almost sure to hear the entire transmission repeated a few minutes later. The c.w. bands are located from 143



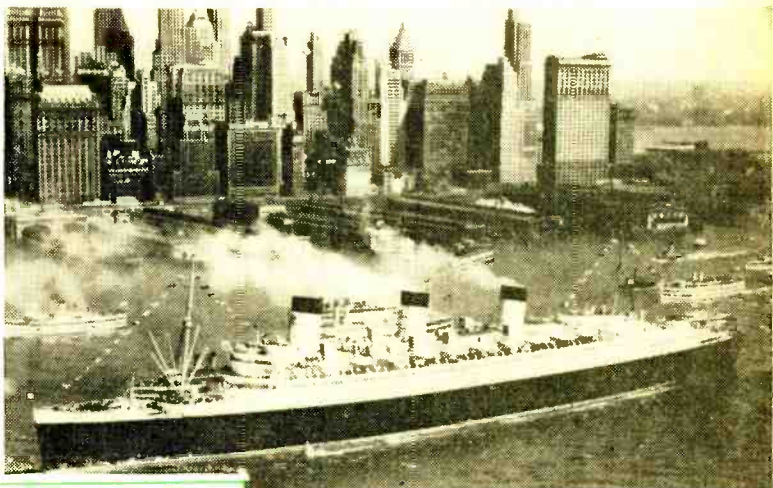
Great Lakes vessels like this passenger cruise ship, the Chicago, Duluth & Georgian Bay Transit Company's "South American," and sister ship "North American," can generally be heard on 2003 kc.

to 158 kc., 410 to 500 kc., and in the 4-, 6-, 8-, 12- and 16-mc. bands.

When you log a station, you have won only half the battle. You must now identify the station; and you have at your disposal various international publications to assist you.

If the station heard was on c.w., the vessel-name can be looked up in the *Alphabetical List of Call Signs*, published by The Secretary General, International Telecommunications Union, Geneva, Switzerland. Check with them for price.

The I.T.U. also has a publication for



GBTT
QUEEN MARY

THIS WILL CONFIRM YOUR RECEPTION OF

RADIO STATION GBTT ON 9067.0 KCS AT
2240 GMT ON 8th January 1938

POWER 200 WATTS ANTENNA Vertical

REMARKS - Routine contact with transatlantic phone station SC43
QTY 2200 GWT 1921N Signed Samuel Young
18-25 W Technical RO

The "Queen Mary" (shown above) can be heard very often working coastal phone stations. She QSL's promptly. The "Eclipse" (shown below), a Socony Mobil tanker, can be heard on the marine phone and c.w. bands.

KJFA
TANKER "ECLIPSE"

THIS WILL CONFIRM YOUR RECEPTION OF

RADIO STATION KJFA ON 1110 KCS AT
0350 GMT ON September 14 1957

POWER: 150 WATTS ANTENNA vertical on ft.

REMARKS - Temp antenna, main antenna lost in hurricane Audrey together with lifeboat.

Signed David H. Brown



phone DX'ers, the *List of Coast and Ship Stations*. This is a listing of all ships, alphabetically by name, giving the call letters, power output and hours of radio watch on each, and the names of the owners of some of the foreign ships. It is not completely up to date on U. S. ships, but no matter; the last word on U. S. vessels is *Merchant Vessels of the United States*, which is issued

yearly by The Superintendent of Documents, U. S. Government Printing Bureau, Washington 25, D. C. Priced at \$6.25, this is a thousand-page volume which lists more than 40,000 U. S. ships. Listings

are arranged by vessel-name, call letters, and owner. The QTH of all owners is also given.

The most accurate guide to the owners of foreign ships is *Lloyd's Registry of* (Continued on page 123)



Victimized by a

Record

A RECORD "MOOCHER" is one of the lowest forms of human life. He has no particular habitat but can be found wherever there is a record owner. His only identifying characteristics are: (1) he has a pleasant, disarming personality, and (2) he always owns a tape recorder.

Having been the victim of a record moocher, I submit the following case his-



"... he was small, polite ..."

stories as a warning to audiophiles around the nation.

Case History #1. I was sitting serenely in my bachelor apartment watching the turntable spin and listening to *Music To Make Home Blood-Transfusions By* as done in the inimitable style of "Leucemia" O'Shanughnessy and his Anemic Eight, when a strange sound came through the din. It was the doorbell.

As I crossed the room, I silently prayed that it was not my upstairs neighbor again since he is bigger than I am. I was in luck. It was a small, polite-appearing little man.

"Allow me to introduce myself. I am Anthony Barrington Wellingsworth III, your new downstairs neighbor," he said.

"Anthony Barrington Wellingsworth III?" I asked, in awestruck disbelief as I stopped myself from collapsing from lack of

breath. He looked harmless enough so I invited him in.

"Er, I see you have a hi-fi system," he said, cautiously feeling me out.

"Yeah! Great hobby," I replied, turning the volume down to a level which wouldn't vibrate the pictures off the wall.

"I'm kind of interested in hi-fi, myself. I have a tape recorder and was thinking of putting one of those fancy amplifiers, a turntable, and some speakers in my new apartment."

If only I had recognized the danger signal—he had a tape recorder. But no. "How about my helping you," I eagerly offered, thinking that this might grow into a healthy audiophile friendship. I may as well have said: "Lead me to the slaughter."

"That would be quite neighborly of you," he said, and I went to the kitchen to get something to drink. Since I'm a bachelor, you can be sure it was something slightly more intoxicating than milk.

We sat up 'til 2 o'clock making plans for his rig. If only I had known what all this was building up to.

I was put in charge of purchasing, so the next day I found myself in the local hi-fi shop reading to Mr. Heminger a long list of components (including such things as a Glokendeek Model X-5933 triple hodgepodge amplifier with genuine silver filigree knobs with pearl inlay and built-in electric plate). Mr. Heminger kept a "have-you-stripped-your-gears" stare glued to me since he knew I already had a rig with which I was perfectly satisfied.

He finally broke down and said: "Ah... is everything all right... I mean, you haven't been thrown out of your apartment or anything, have you?"

I didn't feel like explaining, so I said: "No, I just thought I'd put hi-fi in my mailbox." This confused him more than ever, but I figured that he led about as normal a

Moocher



life as anyone in his business could so I just left him guessing.

Well, to make a long story short (and to save me the misery of thinking about the gruesome details again), we got the outfit set up and all was fine.

All was fine until one fateful evening, that is. Mr. W. "dropped in for a minute."

Then came the bombshell! . . .



" . . . long list of components . . . "

"By the way, may I borrow some of your records to put on tape? That equipment just about busted me so I can't afford to buy any records of my own right now."

Like the sucker that I am, I said, "Sure. Go ahead and pick out what you want."

As the pile grew, I began to realize that I had created a Frankenstein that I couldn't stop.

When the stack reached about two feet, I went to the kitchen, fried a chicken, ate it, and did the dishes. I returned to find the pile reaching the five-foot mark and my cabinet bare except for one old 78 of "Cave-man" Johnson singing *I Could Have Danced All Night But You Kept Stepping on My Corns* which I didn't know I had.

Mr. W. picked up the stack and headed for the door.

"Ah, do you think you can carry all those

By **NORMAN VAN TUBERGEN**

at one time?" I inquired with some irony.

"Oh, sure," he replied, confidently.

Suddenly I realized a danger and shouted: "Look out for the . . ." I was interrupted by a sound comparable only with that of a herd of wild elephants running amuck in a glass factory, ". . . throw rug," I finished, meekly.

Mr. W. pulled himself up through the two feet of black chips. "Heh, heh. Well, I guess now we know why it's called a throw rug, don't we, *friend*," he said, making a feeble and rather unsuccessful attempt at levity.

No comment.

"Just one of those things, *pal*."

No comment.

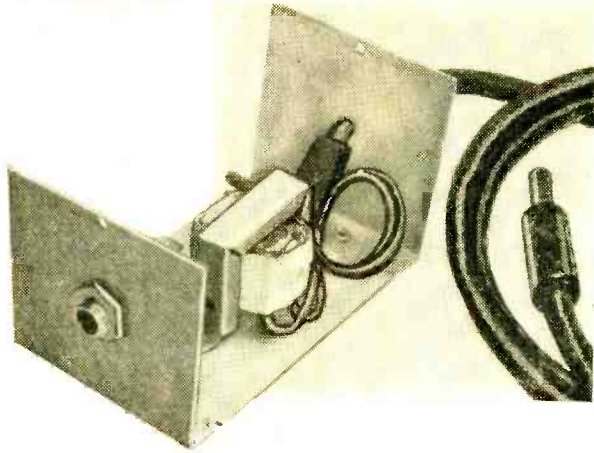
"I'm sure you're insured, *buddy*."

No comment.

(Continued on page 120)



" . . . just one of those things, *pal* . . . "



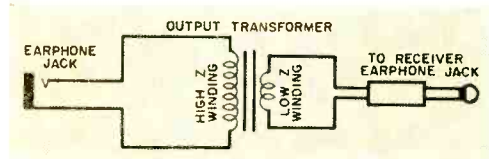
REMATCH FOR A MISMATCH

Do you happen to own one of those receivers that has the phone jack wired to the low-impedance winding of the output transformer? Since the secondary impedance of the receiver's output transformer is about 4 ohms, the mismatch to the phones (which have 1000-ohm impedance or more) causes a loss of earphone volume. Here is a simple impedance-matching device that will greatly improve your headphone reception.

The only parts needed for the "re-

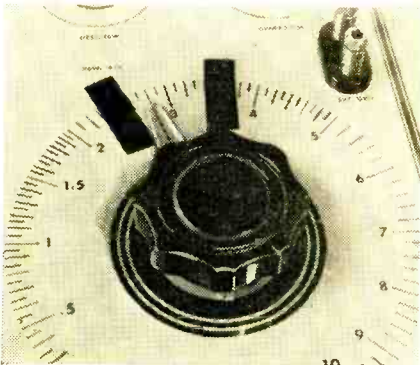
matcher" are a case, an output transformer, and two connectors to fit your receiver and earphones. In the unit shown, the transformer has a primary impedance of 3.2 ohms—the exact value is not critical as almost any output transformer will help achieve a better match.

—M. J. Westrem, WØHOB



TIME-SAVER FOR CHECKING COMPONENTS

Many experimenters periodically use a service-type RC tester or impedance bridge in sorting stocks of resistors, capacitors, etc., according to value and tolerance.



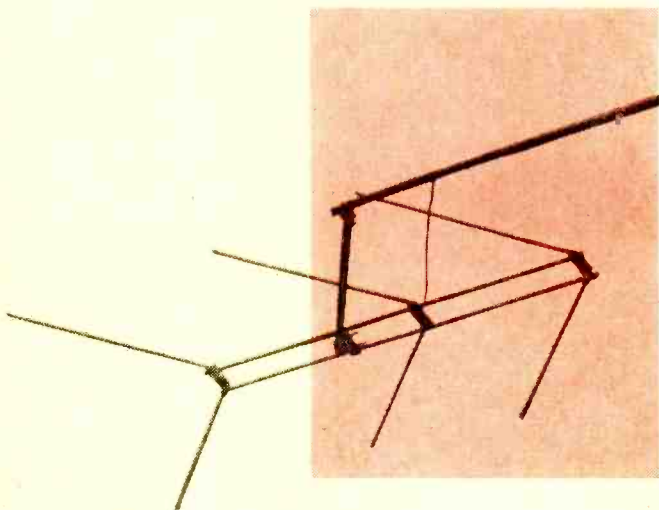
Considerable time can be saved if the tolerance limits for a particular value are indicated directly on the instrument's dial. Just apply short pieces of black electrical Scotch tape directly to the dial at appropriate points. This type of tape peels off cleanly after use and does *not* leave a sticky residue.

If your instrument has a decade switch for different ranges, you can use one step for checking a number of values. For example, suppose you wanted to select 100,000-ohm resistors to a 10% tolerance. You would place pieces of tape on the dial at the 90,000- and 110,000-ohm positions. Then, by adjusting the decade selector switch, you could make the same tapes serve for checking resistors rated at 100, 1000, 10,000 and 1,000,000 ohms to the same tolerance.

—E. G. Louis



The Super-Satelliter Antenna

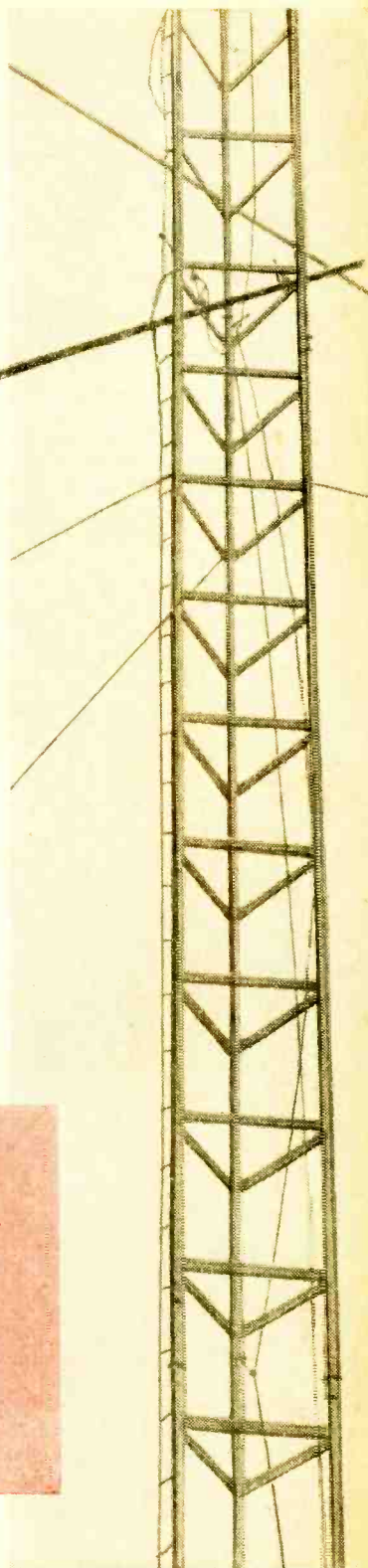


Convert a simple TV antenna into a souped-up job for satellite signals

By DONALD L. STONER, W6TNS

OUR EARTH SATELLITES can be heard clearly with the help of the Super-Satelliter. As this is written, the whir of the six-inch "Vanguard" and the bell-like tone of the "Explorer" make them easy to identify. Occasionally they interfere with each other—the first QRM from outer space.

This antenna is used in conjunction with the satellite converter described in April, 1958, POPULAR ELECTRONICS. On the basis of several months of experience, it has provided the most outstanding



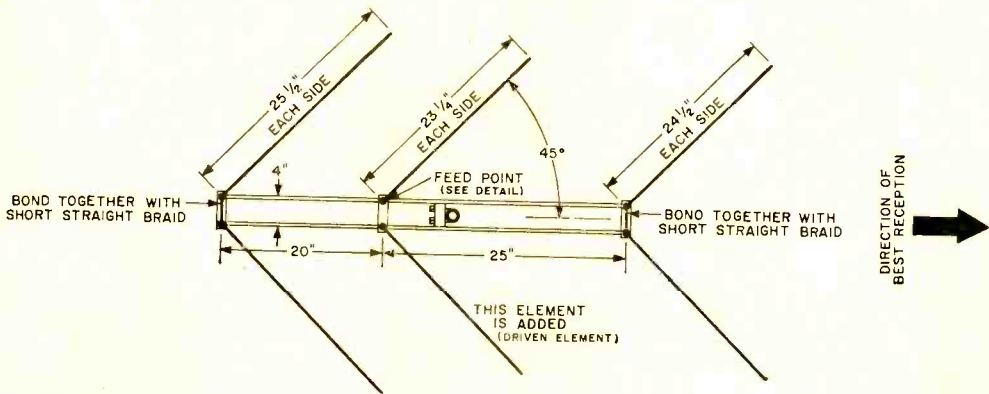
reception, on 108 mc., of the various designs tested.

As the transmitter of the satellite generates only a tiny amount of power, a high-gain antenna is best for receiving the signal. Although a Yagi is very sensitive, it is also very directional. For best results, it must be turned toward the satellite to "track" it as it zooms along its orbit. A vertical dipole or ground-plane antenna is not directional, but it's not very sensitive either. The Super-Satelliter is a compromise between these extremes. Although

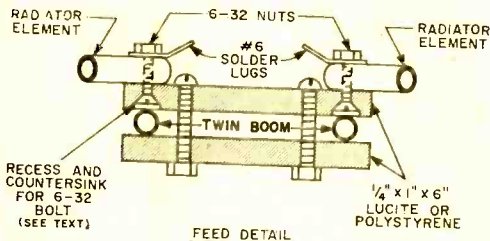
positioned at a 45° angle to a bisecting line to make the antenna less directional.

Start the modifications by cutting each of the front elements (the director) off at 24 1/2". Next, cut the rear elements (the reflector) down to 25 1/2". Now, since open tubes will wail in the wind, crimp the ends of the rods.

Drill a 1/16" hole in each reflector rod at the boom end. With self-tapping screws, connect them with a short length of braid. You can get braid by stripping it off a length of shielded cable. If you are unable



Modify double-Vee antenna as shown in diagram above. Detailed drawing of feed point is given below.



technically a Yagi, it is less directional.

In this installation, the antenna is permanently directed west. It receives all passes of the satellite equally well. One pass may be from southwest to northeast. Approximately 12 hours later, it may pass the same point traveling northwest to southeast. The antenna is sensitive in both directions, with the signals from the front favored slightly.

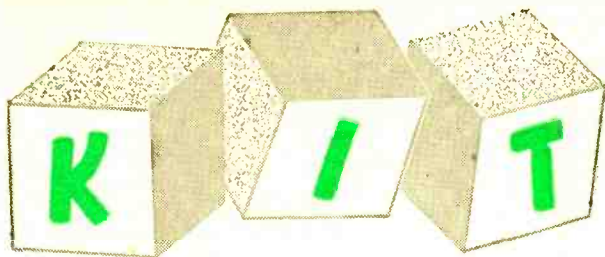
You can make the Super-Satelliter by modifying a standard double-Vee television antenna. Originally it consisted of four rods supported on plastic blocks mounted on two 1/4" aluminum booms. These elements are

to obtain braid, a short piece of copper wire will make a satisfactory substitution although it will have a bit more loss. Connect the director rods together the same way.

To complete the antenna, you'll have to construct new driven elements. These consist of two additional rods, 23 1/4" long and the same diameter as the reflector and director. Your local television repair shop should be able to sell you some rod material. You will also need two pieces of polystyrene or Lucite measuring 1" x 6" x 1/4". Refer to the detail drawing to see how these plastic pieces clamp on each side of the boom and also secure the driven elements.

Drill two 1/8" holes in each block between the booms. Keep the holes close to the booms to prevent the plastic from bending. Directly above the point each boom will run, drill a 1/8" hole and countersink it to a 1/8" depth. File two grooves in the top side of this block, at a 45° angle, to support each rod. The radiator mounting screws should not contact the twin booms.

Drill and mount each rod with countersunk 6-32 bolts, installing a solder lug under
(Continued on page 122)



BUILDER'S KORNER

AMATEURS who want an easy start on moderate power using the more popular bands will find the Johnson Viking Adventurer kit a basic 50-watt transmitter. Designed for c.w., the unit can be modulated for phone operation later.

Driven either by a crystal or external VFO, the transmitter lineup comprises a 6AG7 oscillator-multiplier followed by an 807 power amplifier. The final is a straight

the circuit diagram but not on the parts list) seem to be missing. These are wound quickly from wire furnished, as described in the instruction book.

Putting It Together. As directed, the grommets are set into their holes first. From here on, practically all the hardware (with two exceptions) can be assembled according to instructions. Written to help the most confused beginner, the directions



Johnson Viking Adventurer

amplifier on 80, 40, 20 and 15 meters and doubles on 10 or 11 meters.

The output circuit is a familiar *pi*-network type and will match loads of 50 to 600 ohms, including a considerable amount of reactance.

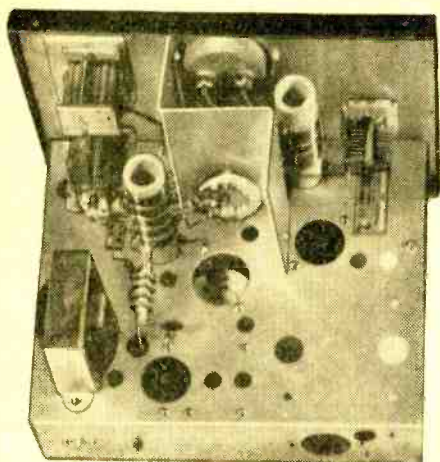
For hams with orderly minds, the Adventurer kit will be a joy to unpack. Besides the list of parts supplied in the instruction book, a master packing slip shows how many individual boxes and containers should be found within the carton. Each container has its individual detailed listing of components and parts.

Don't be alarmed if radio-frequency chokes *RFC2*, *RFC3*, and *RFC4* (shown on

need not be scorned by an amateur with some experience for they show the proper sequence of assembly. In many instances, the same nut that fastens one ear of a socket mounting holds down a terminal strip or a ground lug.

The slide switches used for main power and grid-plate meter selection stick out slightly from the front skirt of the chassis. For this reason, the front panel cannot set flush against the chassis. Accordingly two thick spacing washers are provided to maintain the same clearance between panel and chassis where the jewel assembly and key jack pass through.

Unfortunately, the threaded studs of

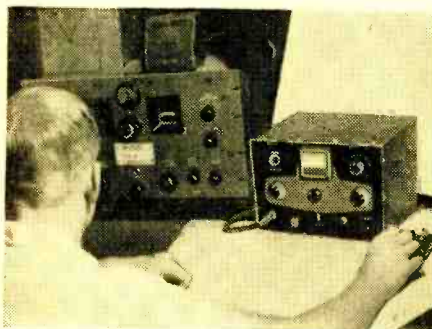


The Adventurer makes an excellent addition to the ham shack. Designed for c.w., it fits the needs of Novices or Generals. Shown above is the top of the chassis after the major components have been installed.

(in the rectifier filter circuit) because several wires must be soldered to the same point. Pin 5 on socket X3 was difficult to reach because of the number of components nearby.

***Final Check.** Before putting the chassis in the cabinet, the kit builder is advised to give the wiring a final check by the simple procedure of keying the transmitter. If the meter shows that the power output tube draws plate current, it can probably be assumed that all the circuits have been properly wired.

Before plugging in to the power line, a



jewel assembly and jack are much too short to accommodate chassis, spacer and panel. For this reason, omit the spacer. It will be a job for four hands to press chassis and panel close enough together to get the appropriate nuts threaded onto the studs. The panel will be bowed in a trifle at each of these mounting points but it will be scarcely noticeable.

Connecting the Components. Lugs are first fastened mechanically to the chassis and elsewhere (including the meter) before wires are soldered to them. While this is convenient mechanically and generally causes no difficulty, soldering requires more heat under these conditions than if a wire were soldered to an unattached lug.

Particularly when connecting the meter, it may be found desirable to solder to the lugs before fastening.

Practically all wiring will have been completed before mounting the power transformer. The leads from this unit do not interfere with previously placed radio-frequency leads. After the transformer is mounted, the filter capacitors and the radio-frequency chokes in the power line and keying circuit are mounted and connected.

Most connections are easy to make because adequate spacing has been provided and the sequence of operations has been well planned. There was some difficulty in wiring to terminal 3 of terminal strip X6

good ground should be made to the chassis of the transmitter. This ground is doubly protective. It protects the operator in the event that there is a potential existing between case and ground (we drew a slight spark between case and ground because we first plugged in power). The ground connection also insures that television interference will be at a minimum. The ground is necessary for proper functioning of the output circuit.

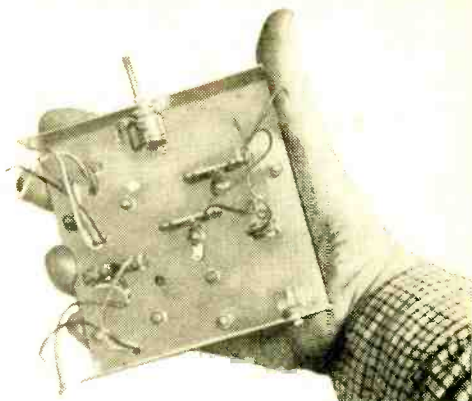
Test Tuning. Instructions are given for tuning up the transmitter into a dummy load consisting of a lamp and also a transmission line or antenna. The beginning radio amateur will do well to heed the excellent warnings.

The output circuit of the transmitter is one that is in general use and is most satisfactory when properly handled. If the instructions are ignored, a misadjustment can cause off-band operation with lack of amateur contacts but strong return signals from the Federal Communications Commission.

The real test of a transmitter is how well it can be heard. We plugged in a crystal and our first contact gave us an excellent report.

MANY electronic items currently being transistorized do not, in terms of their function, really warrant the redesign required. Some products, such as the Lafayette kit described below, benefit from use of transistors. Minimum hum pickup, instant warmup, and compact dimensions are achieved.

The KT-131 is a four-transistor amplifier fed by an inductive telephone pickup and operating a 4" speaker. The unit will permit the whole family to enjoy long-distance phone conversations with relatives and friends. It's invaluable for group listening on business calls and conferences. Other



Lafayette Telephone Amplifier

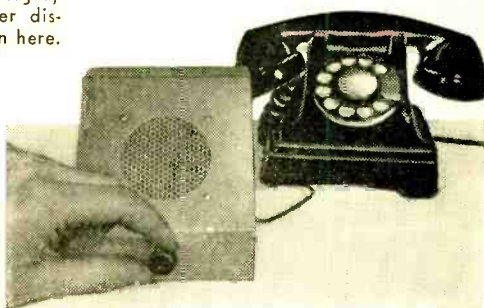
Note size of chassis in photo at upper right. Completed amplifier (below, right) can be installed at a much greater distance from the telephone than shown here.

uses may suggest themselves to you after you have built the amplifier.

Putting It Together. The components come neatly packaged in polyethylene bags and plastic boxes. Construction directions follow the step-by-step method.

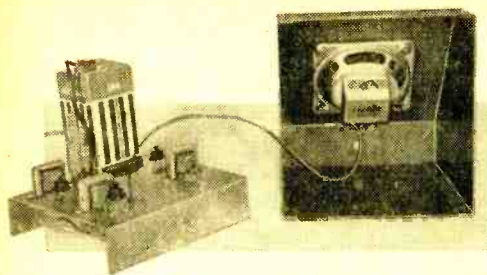
The pictorial diagrams are so clear, and there are so few components to work with, that your reviewer abandoned the step-by-step procedure about halfway through. If Lafayette had marked the component values on the pictorial, the wiring time would have been less than 2½ hours.

All subminiature components require a small-tip iron for soldering; the transistor socket lugs, in particular, require special care to prevent shorts from developing.



The speaker is mounted separately in the sloping-front cabinet and wired to the amplifier in the last steps of the manual. Required for operation, but not supplied with the kit, are an inductive telephone pickup coil and a small 9-volt battery.

Circuit Features. Despite the use of four transistors, the telephone amplifier



Amplifier chassis before installation in cabinet.

has surprisingly few components to be soldered into place. Transformer coupling between the driver stages accounts both for the small number of parts and the very high gain of the amplifier.

All four of the transistors are CK722 or 2N107 types in a standard base-fed circuit. A class "B" push-pull output stage drives the speaker.

The telephone amplifier operated from the moment it was turned on. The Lafayette telephone pickup coil, when used with a high-gain tube amplifier, tends to be particularly responsive to hum and noise unless a great deal of care is taken to avoid ground loops and spurious inductive pickup. The transistor amplifier, however, has a low input impedance and hence is not particularly sensitive to a.c. hum pickup.

You may have to shift the pickup coil about the base of the phone or bell box before you locate the point of maximum response. Both sides of the conversation will be picked up; your side, as the one closest, will naturally have the greater amount of volume.

If a howl or squeal results when you try to operate the amplifier, it's usually a case of acoustic feedback. Reducing the amplifier volume or moving the speaker further from the handset will cure it.

-30-

AMPLIFIER QUIZ

BY ED BUKSTEIN

When Lee DeForest developed the three-element tube in 1907, electronic amplification made the transition from science fiction to reality. Since then, amplifier circuits have become refined, varied and versatile. Today, such circuits are used in a variety of applications ranging from watch-tick amplifiers to brain-wave recorders.

If you know your amplifiers, you should be able to match those listed by number below with the letters of the statements best describing them. Each letter should be used only once. A score of 19 or 20 correct is excellent, 15 to 18 is superior, 11 to 14 is average, and 10 or less is poor. Answers are given on page 123.

- | | |
|-------------------------------|---|
| 1 Paraphase amplifier | A Horizontal amplifier of cathode-ray oscilloscope |
| 2 Magnetic amplifier | B Input is 3.58 mc. |
| 3 Grounded-grid amplifier | C Biased at or near cutoff |
| 4 Impedance-coupled amplifier | D It changes sine-wave input to square-wave output |
| 5 Class B amplifier | E Gain varies directly with amplitude of input signal |
| 6 EEG amplifier | F Two outputs produced 180° out of phase |
| 7 Z amplifier | G Control is achieved by varying saturation of iron core |
| 8 X amplifier | H Input is applied to base |
| 9 Chopper amplifier | I Input is applied to cathode |
| 10 D.c. amplifier | J Brain-wave potential amplifier |
| 11 Operational amplifier | K Vertical amplifier of oscilloscope |
| 12 Common-emitter amplifier | L Tuned to difference between signal and local oscillator |
| 13 Q amplifier | M Interrupter used to modulate input signal |
| 14 Y amplifier | N It performs mathematical operations such as summing, differentiating, etc. |
| 15 Cascode amplifier | O Two triodes connected in series |
| 16 Volume expander amplifier | P Plate load impedance is an inductor |
| 17 Preamplifier | Q Oscilloscope's intensity modulation amplifier |
| 18 Clipper amplifier | R Plate is connected to following grid either directly or through a resistor |
| 19 Coincidence amplifier | S Output produced when signals are applied simultaneously |
| 20 I.f. amplifier | T It boosts low-level signals to higher level required by amplifier which follows |



Transistor Topics

By LOU GARNER

SEVERAL major automotive manufacturers have hinted that electronic devices will achieve a real breakthrough in 1960 models. Transistor fuel injector controllers, regulators, self-rectifying a.c. generators, built-in tape recorders, and television receivers are but a few of the devices planned.

An electronic "highway of tomorrow" is being tested at RCA's David Sarnoff Research Center at Princeton, N. J. Detector units are connected to loops buried in the entrance road and transistors count each car entering the grounds, measure its speed, and automatically flash a polite *Slower*

capable of discriminating between vehicles 8 feet apart and of measuring speeds from 2 to 80 mph with an accuracy within 1 mph.

Reader's Circuit. Many individuals, including advanced hobbyists as well as beginners, think of superhet receivers only in terms of four-, five-, or even six-stage receivers. Not so reader Paul Heinsch, of 2910 McLoughlin Blvd., Vancouver, Wash. He has designed an interesting circuit which combines the selectivity and sensitivity of a superhet with the simplicity, low cost, and ease of construction of a *two-transistor* set.

All the components used are standard

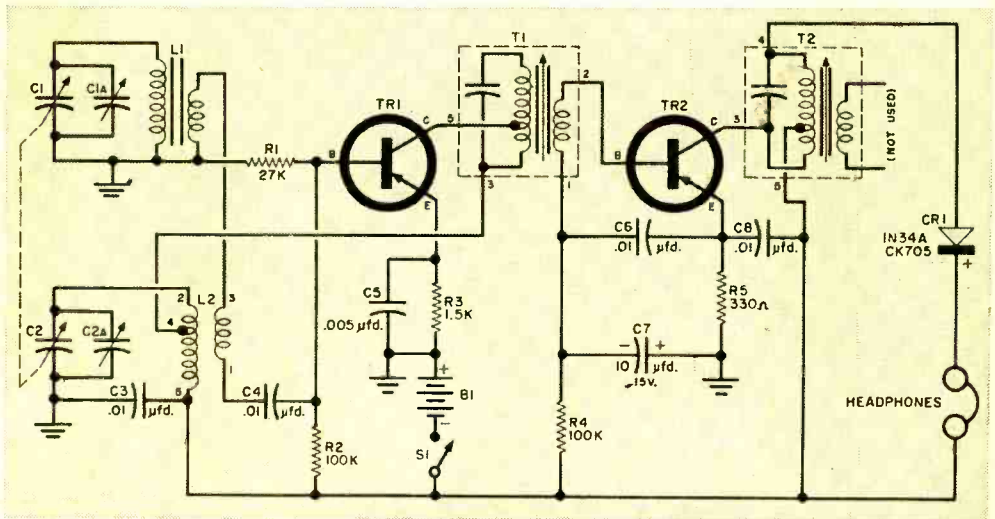


Fig. 1. Two-transistor superhet receiver designed by reader Paul Heinsch.

Please warning to every driver exceeding the established speed limit.

A British firm, Marconi Wireless Telegraph Co., Ltd., has developed a partially transistorized speed-checking radar system. The complete equipment, including the antenna, transmitter-receiver assembly, and indicator, weighs only 21 pounds, yet is

and readily available. Referring to Fig. 1, *L1* is a Miller No. 2005 transistor loop antenna coil, *L2* a No. 2022 oscillator coil, and *C1-C2* a No. 2110 two-gang variable capacitor (J. W. Miller Company, 5917 S. Main St., Los Angeles 3, Calif.). *C1a* and *C2a* are trimmer capacitors mounted on the No. 2110. *T1* and *T2* are Lafayette No. MS-268 455-kc. transistor i.f. transformers.

As far as the smaller components are concerned, the capacitors are all disc cer-

amic types. The d.c. working voltage of all of them should be greater than the 6- to 9-volt battery supply voltage. A standard transistor battery such as a Burgess P6 or RCA VS309 is used.

TR1 and TR2 are *p-n-p* r.f. transistors. Paul used a G.E. Type 2N136 for TR1, a Type 2N135 for TR2. Other r.f. types may be substituted here but if *n-p-n* transistors are employed, all d.c. polarities should be reversed.

Instead of a conventional crystal diode, Paul used a G.E. 2N107 transistor which had been damaged accidentally. The col-

ical than in more conventional receivers. All signal leads should be short and direct and the input and output circuits should be well separated.

The set should be *aligned* for maximum performance with a standard r.f. signal generator. Peak the i.f. transformers with a 455-kc. modulated signal. The oscillator trimmer (C2a) is adjusted for proper dial tracking at about 1500 kc. and the r.f. trimmer (C1a) for maximum output at about 1200 or 1400 kc.

In operation, r.f. is picked up by tuned circuit L1-C1 and coupled to TR1's base.

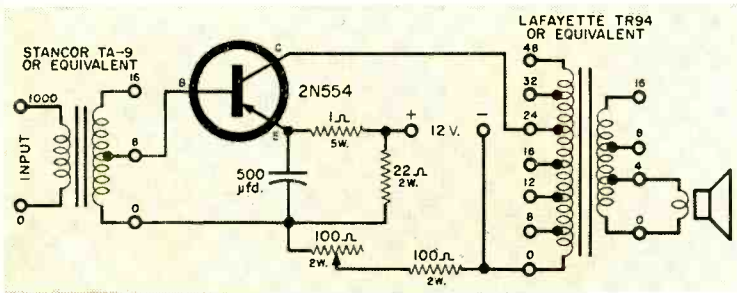
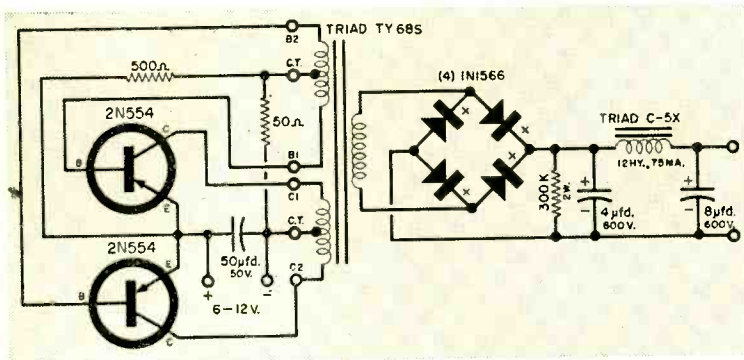


Fig. 2. One-stage power amplifier featuring Motorola's new 2N554 transistor.

Fig. 3. D.c.-to-d.c. converter using a pair of 2N554 transistors. With a 12-volt supply, this circuit is capable of delivering 250 volts at 60 ma.—ample power for low-power transmitters or for the B supply of receivers.



lector lead was missing and connections were made to the base and emitter leads. He indicates that the results were superior to those obtained with a conventional diode. However, you can use a type 1N34A, CK705 or other diode in the circuit.

For best results, high-impedance magnetic or dynamic earphones should be used. If you can, obtain 'phones with an impedance of 4000 ohms or more.

Layout and lead dress are no more crit-

TR1 serves as a combination local oscillator mixer, with L2 functioning as a "tickler feedback" oscillator coil.

The i.f. signal of 455 kc. appears at TR1's collector and is coupled by T1 to i.f. amplifier TR2. The amplified i.f. output of TR2 is then coupled directly through a simple diode detector to a pair of magnetic headphones. Note that T2 serves only as a tuned collector load for TR2—the trans-

(Continued on page 128)



Short-Wave Report

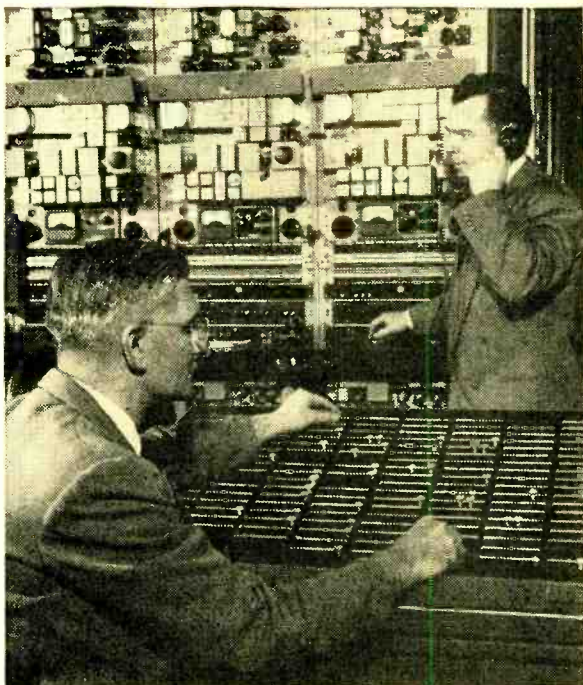
By HANK BENNETT

THIS is a test transmission by a station of the American Telephone and Telegraph Company for purposes of receiver adjustments." Similar announcements by stations of telephone companies in widely scattered parts of the world are being picked up every day by the SWL. They are not usually found in the standard short-wave bands but are in between the standard bands, varying from 3 mc. to 26 mc. and higher.

You can listen to one of these stations transmitting in a country where there is little or no activity on the broadcast channels. It is interesting to listen to such stations while they are in direct contact with each other or while an actual radio-telephone call is in progress.

Many DX'ers have sent reception reports to these telephone stations and asked for verifications. Although the majority do not obtain veries, the reports may be acknowledged. The following letter, sent by an A. T. & T. official, was received by Donald Arrow-smith, Trenton, N. J.

"With reference to your letter concerning your interception of one of this company's radio stations, the transmission which you report is a test sentence from a speech recording, which we transmit only for the benefit of our overseas associates, to assist them in adjusting their equipment. The radio stations of the A. T. & T. do not broadcast programs, but are engaged solely in the international radio-telephone service to many different countries, and must comply with the regulations covering the secrecy of communications. Under these circumstances, we are



Test transmissions originate from tape machines in A. T. & T.'s various control offices in the United States. This is the coordinator's peg board in the New York Overseas Control office. In the background are control terminals from which the test transmission is sent to radio transmitting stations.

certain you will understand that we cannot verify reports of reception of our transmissions, or provide information as to our facilities and operations. However, we appreciate your interest in our company and its activities."

In not verifying reports, these stations are entirely within their rights and the DX'er should not send reports or follow-up letters asking for verification. While often highly appreciative of reports, the stations cannot verify for the same reason that you and I could not wire-tap into private telephone calls.

The telephone service is covered by FCC
(Continued on page 136)

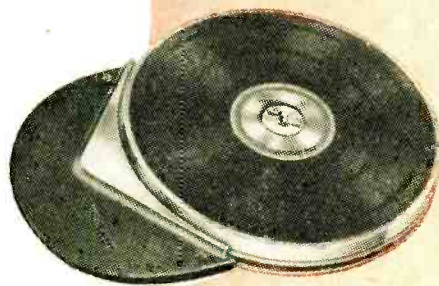
Hi-Fi Highlights

MANY READERS have been writing in to inquire about new and novel developments in high-fidelity equipment that they have heard about. To help supply such information quickly, POPULAR ELECTRONICS presents a roundup of the most interesting high-fidelity accessories crossing our desks in recent weeks. Each brief description is numbered and a box appears on page 127 along with additional items. Just circle the numbers in the box pertaining to the items that interest you and send the box in to the address given. You'll receive complete information on those items. —30—



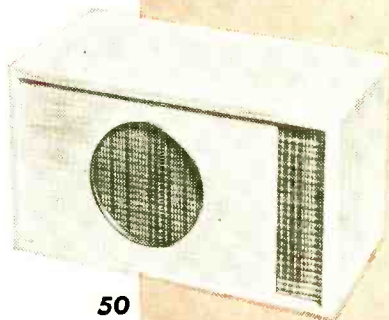
48

48 Aluminum outdoor speaker enclosure is fungus- and moisture-proof. It is 21" square and uses an 8" speaker. The one-piece folded horn has a response from 50 to 16,000 cps. Electro-Voice.



49

49 Turntable kit can be assembled in 30 minutes. Designed by Rek-O-Kut, it has a belt drive and 4-pole induction motor. Single speed at $33\frac{1}{3}$ rpm.



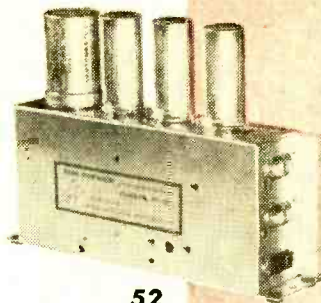
50

50 Shelf-type speaker enclosure for 8" loudspeaker. The "Caprice" by Sonotone can be used as second system for stereo conversion. Response ranges all the way from 55 to 15,000 cps.



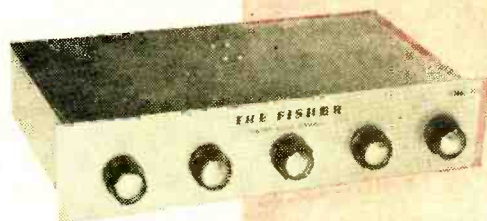
51

51 Variable control crossover network can adjust level of mid-range and tweeter speakers to taste. Usable with speakers of mixed impedance. Shield model VC-208 has crossovers at 500, 3300 cps.



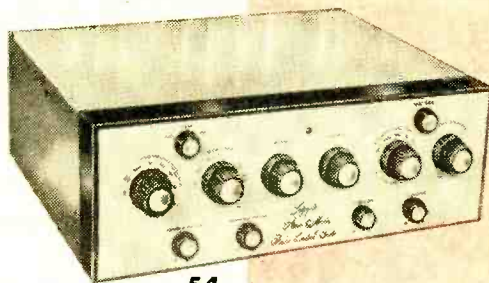
52

52 Designed for remote operation, the Fisher PR-66 stereo preamp has no controls. It's for low-level stereo cartridges or stereo tape playback heads.



53

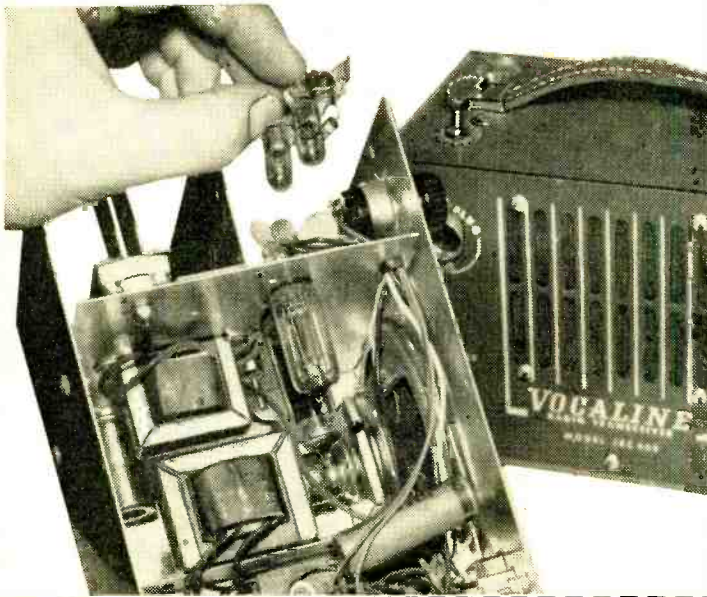
53 This compact preamp-control unit can easily be stacked for stereo. The Fisher Model 30-C has seven inputs and two outputs. Included are equalization, loudness control, rumble filter.



54

54 Stereo preamplifier kit has third channel output to eliminate "hole in the middle" effect. There is a bridge type control for proper speaker balance. The Lafayette KT-600 provides separate turnover and roll-off controls.

More hi-fi items on page 127



By
BOB WATSON
W8PBF

Transceiver Noise Suppressor

THE LITTLE Vocaline JRC 400 and 425 and similar transceivers enjoy widespread use in Citizens band applications. But they have one characteristic which is annoying to some owners, and that's the hiss inherent in their superregenerative circuits.*

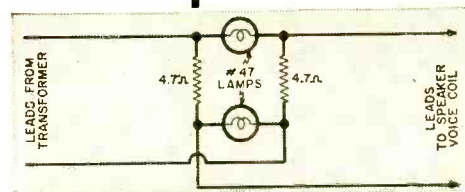
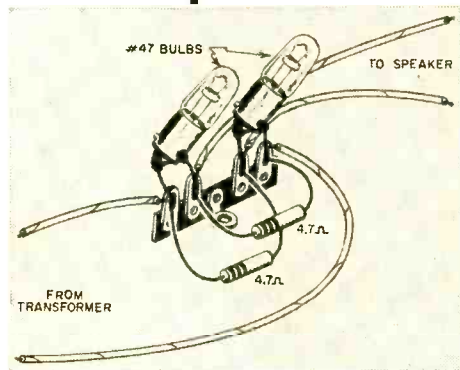
A standard squelch circuit could be added for hiss elimination, but this would mean extra tubes, parts and additional drain on the power supply. However, a simple squelch action can be obtained with a minimum of parts by using the old audio volume expander trick.

Just install a pilot lamp across the voice coil terminals of the speaker. A No. 47 bulb will do nicely in either Vocaline unit and will drop the no-signal noise noticeably. When a signal is received, the audio will cause the light to glow, which will increase the bulb's resistance and thus allow more signal to reach the speaker's voice coil.

(Continued on page 119)

* Without a signal input the superregenerative detector has a high degree of amplification, and tube and circuit noise build up to an annoying level. When a signal is received, the hiss level drops. Strong signals make the hiss disappear completely.

Wired as shown below, this simple audio volume expander functions as a noise suppressor. Bulbs may be socket-mounted or soldered directly to the tie lugs





Among the Novice Hams

By HERB S. BRIER, W9EGQ



SEE NEXT PAGE FOR
list of those who request help
in obtaining their ham licenses

IN THE September issue, we learned that when a vacuum tube is used as a class A amplifier its output signal is an amplified replica of its input signal. In addition, it normally draws no grid current in operation, and its average plate current does not change with signal.

In the written examination for a General, Conditional, or Technician Class amateur license, you may be requested to: *Draw a diagram of a coupling system between two audio-frequency amplifier stages employing resistance elements.* Such a diagram is shown in Fig. 1. You should learn to draw it from memory in preparation for the exam-

positive with respect to the ground point by that amount, or stated in another way, the common ground point is negative with respect to the cathode. Therefore, because the grid is connected to ground through its

Fig. 1. Resistance-coupled audio amplifier. You may be asked to draw one of these in any amateur examination except that for a Novice license.

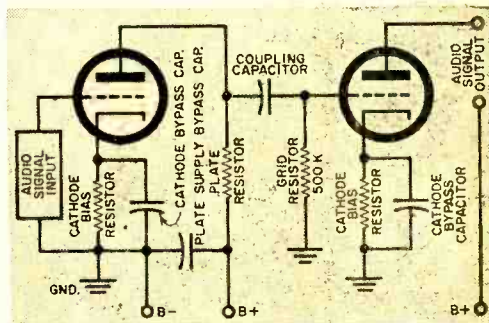


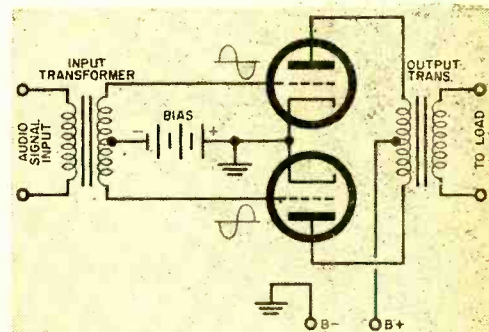
Fig. 2. Basic transformer-coupled push-pull audio amplifier. See text.

ination. And, as it is an example of a two-stage, class A voltage amplifier, let us see how it works.

Resistance Coupling. Direct current is fed to the B- and B+ terminals. Electron current flows from the B- or ground terminal, through the cathode resistor, to the cathode of the first tube, out its plate terminal, through the plate resistor, and back to the power supply via the B+ terminal.

The plate current causes a small voltage drop across the cathode resistor (because its resistance is comparatively low, a few thousand ohms) and a large voltage drop—equal to one-third to one-half of the total B voltage—across the plate resistor, which may have a resistance of about 50,000 ohms.

The voltage drop across the cathode resistor makes the cathode of the first tube



input circuit, it is effectively biased negative with respect to the cathode.

If we apply an audio signal to the grid, the signal will "swing" the bias voltage, resulting in a similar variation in the plate current of the tube. This, in turn, will cause the voltage drop across the plate resistor to vary in step with the applied signal.

The signal is coupled from the plate of the first tube to the grid of the second by
(Continued on page 130)

HELP US OBTAIN OUR HAM LICENSES

Prospective amateurs requesting help and encouragement in obtaining their licenses are listed here. To have your name listed, write to Herb S. Brier, W9EGQ, c/o POPULAR ELECTRONICS, One Park Avenue, New York 16, N. Y. Please print your name and address clearly. Names are grouped geographically by amateur call areas.

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Russell Newton (14), 32 Ferrante Ave., Greenfield, Mass. Phone: PR 3-8762. (Code and theory)

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AFTER CLASS

Special Information on Radio, TV,



Radar and Nucleonics

UNDERSTANDING DECIBELS

THE DECIBEL is probably the least understood unit in electronics. Ask what an ampere is and you'll get the answer, "It's a unit of current measurement." Ask for the definition of an ohm and, "It's the unit of electrical resistance," is your answer. Now try and get the straight information on what a decibel is. You'll go all around the circuit and back again, and still not have an understandable explanation.

Here's the big secret—a decibel is nothing more than a unit of comparison between two sound intensities or loudnesses.

Sound Intensities. Back in the early 1920's, the telephone engineers were trying to measure the ability of the human ear to detect differences in sound intensity. It was a simple matter to measure a change in light intensity. The light became brighter and this change in brightness could be read off in foot-candles on a photocell.

Similarly, a change in temperature could be recorded on a thermometer in degrees. However, when a sound became louder, how would you measure that, and in what units? There was no unit available, so one was devised.

The unit for measuring sound levels was called the "bel" and was named in honor of the inventor of the telephone, Alexander Graham Bell. A decibel (db) is one tenth of a bel, this being a more practical unit with which to work.

Once again, the decibel is a unit of comparison of sound intensities. Comparison is the important word here. A decibel is not an absolute unit as is the volt, or ohm, or ampere.

The basis for this comparison of sounds is the ability of the human ear to detect a difference in loudness between two sounds. To put it another way, when your ear can just distinguish that one sound is louder than another, there is a difference of 1 db between the two sounds.

Human Reactance. Let's examine the way in which the human ear reacts to

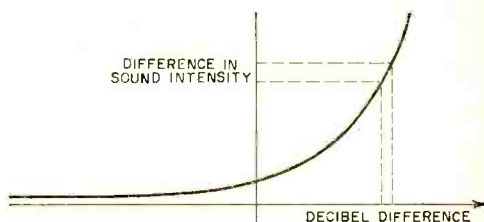


Fig. 1. Logarithmic curve expresses the relationship between sound intensity and the reaction of the human ear.

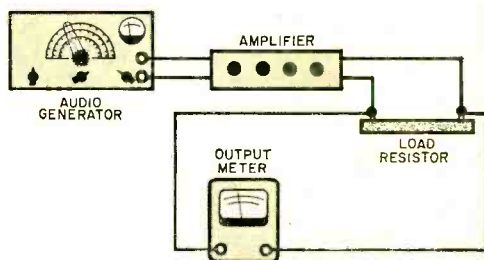


Fig. 2. An output meter is connected across a load resistor for db measurements.

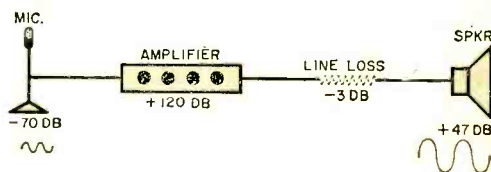
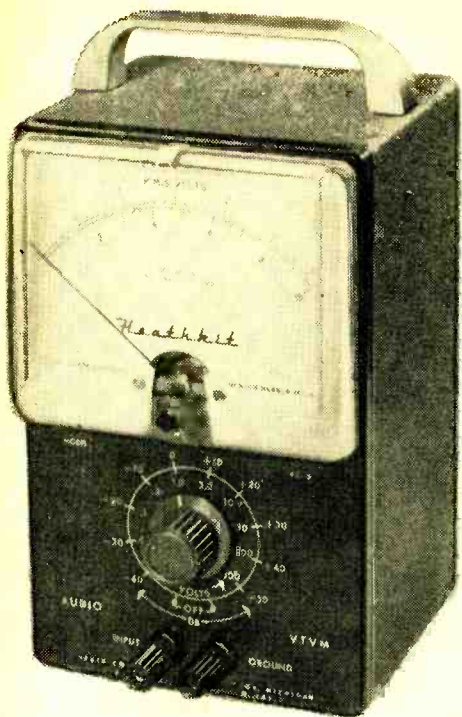


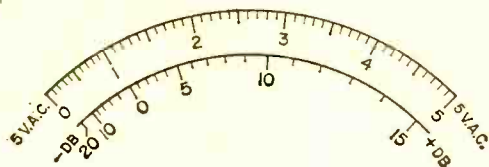
Fig. 3. Microphone level of -70 db is built up by amplifier with a gain of +120 db to a level of +47 db at speaker.

sound. Imagine you are visiting a dog show and fifty dogs are all barking at once. Loud, isn't it? Now imagine that fifty more dog fanciers arrive with their pets and that these fifty dogs all add to the din. Louder? Yes, but how much louder?

The sound intensity has doubled, but loud



An audio VTVM available in kit form at low cost is shown above. Note relationship between the db scale and the 0-5 volt a.c. scale (above, right).



as it is, it doesn't sound twice as loud to your ear as the barking of the original fifty dogs. Not until five hundred dogs were all barking at once could your ear detect a sound twice as loud as the initial sound, that is, if you could stick it out that long.

Your ear responds to sound on what is known as a "logarithmic curve." Because of this, when the engineers were devising the equation for the comparison of two sound intensities they had to make it obey the same mathematical curve as did the logarithm. This curve is shown in Fig. 1. The decibel measurement, being a logarithmic function, gives a true picture of sounds as they affect the ear.

We will now relate what we have learned to decibel measurement in electronics.

Decibel Measurement. If we call the input power to an amplifier P_i and the out-

put power from the amplifier P_o , and then express both quantities in watts, the formula for obtaining the number of decibels, Ndb , gained through use of the amplifier is: $Ndb = 10 \log P_o/P_i$. Note that the logarithms used are to the base 10.

The steps in using this formula are:

1. Compute the ratio of P_o/P_i expressed in watts.
2. Look up the value of the logarithm of this ratio in the log tables.
3. Multiply this logarithm by ten to get your answer in decibels.

Here is a practical example to illustrate the workings of this very important formula: If the input power to an amplifier is 0.2 watt and the output power of the amplifier is 10 watts, then:

$$Ndb = 10 \log 10/0.2$$

$$Ndb = 10 \log 50$$

$$Ndb = 10 \times 1.70$$

$$Ndb = 17 \text{ db}$$

This shows that an increase of 50 times in the input power due to the amplifier action

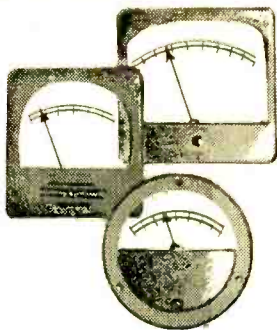
increases the power level of the output by 17 decibels. You can readily see that the decibel relationship compares the two powers, input and output, in the manner of their effect on the human ear when they are converted into sound.

Figure 2 shows, in block diagram form, one means of actually measuring decibels.

The amplification of any amplifier will vary according to the frequency being amplified. For that reason, amplifier ratings will show a figure such as, "Frequency response; ± 2 db, 20 to 20,000 cps." This indicates that the frequency of the input to the amplifier, when varied over a range from 20 to 20,000 cps, will cause a variation in the output power of ± 2 db. The smaller this variation of output with change of frequency, the better the frequency response of the amplifier and the less distortion of the output.

If you are using two or more amplifiers in a circuit and want to know the over-

(Continued on page 112)



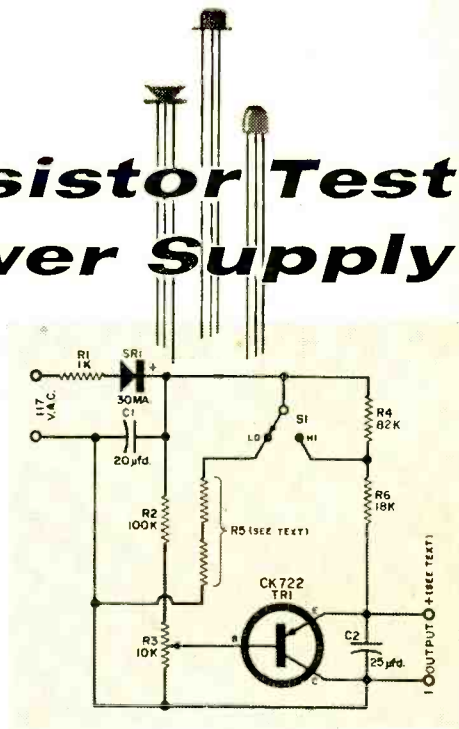
Transistor Test Power Supply

ONE of the handiest little units around the shop when you are working on or designing new transistor circuits is a variable low-voltage, low-current power supply. This unit supplies 0-9 volts in two current ranges, 0-0.8 and 0-4 ma. With current drain above these values (0.83 ma. on low and 4.15 ma. on high), the voltage drops to zero. An accidental short circuit across the output terminals does no damage and the voltage can be varied at will.

Standard components are employed and their arrangement is not critical. A pointer knob is used on voltage control potentiometer *R3* and the panel is marked from 0 to 9 volts in 1.5-volt steps. Calibration is accomplished by connecting a VTVM or other high-input-resistance voltmeter across the output terminals. *R5* serves as a shunt on the low range so that the voltage scale for both current ranges will coincide.

Resistor *R5* should be the last part wired in. Its operation is checked by connecting a voltmeter across *C1* with the output terminals shorted. *R5* is then selected using two 1-watt resistors whose combined value achieves the smallest shift in output voltage when the current range is switched.

Set *S1* for desired current range, set *R3* to zero, and connect the device to be pow-



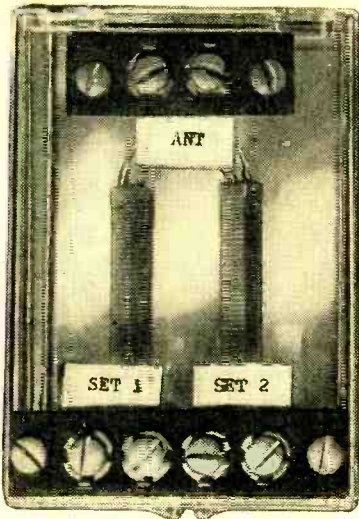
This circuit can be constructed on any type of chassis. Built-in current limiting factor prevents transistor burn out. *C1* is a 150-volt unit; *C2*, 25 volts.

ered. *R3* is then reset to the desired voltage value. The voltage knob should never be turned quickly to zero as the charge on capacitor *C2* could overload the transistor.

This instrument is used only to find the voltage required to operate the circuit under test correctly and not damage it with excess voltage or current. An isolation transformer, such as the Lafayette TR-91, could be added for safety. If a transformer is used, omit *R1*.

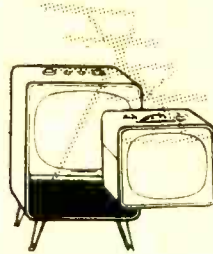
CONTROL SETTING	OUTPUT VOLTAGE							
	8.95	8.90	8.80	8.25	8.85	8.70	8.50	8.20
9.0	8.95	8.90	8.80	8.25	8.85	8.70	8.50	8.20
7.5	7.45	7.40	7.35	7.20	7.40	7.25	7.10	6.90
6.0	5.95	5.90	5.85	5.80	5.90	5.75	5.55	5.40
4.5	4.47	4.43	4.40	4.30	4.40	4.30	4.20	4.05
3.0	2.97	2.94	2.90	2.80	2.93	2.86	2.80	2.70
1.5	1.48	1.46	1.43	1.38	1.45	1.40	1.35	1.25
CURRENT DRAIN (ma.)	0.2	0.4	0.6	0.8	1	2	3	4

By
R. B. DODSON

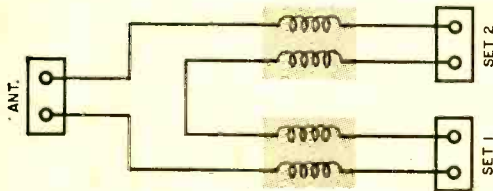


Front view of the two-set coupler showing screw terminal arrangement used for maximum convenience.

Make Your Own Two-Set Coupler

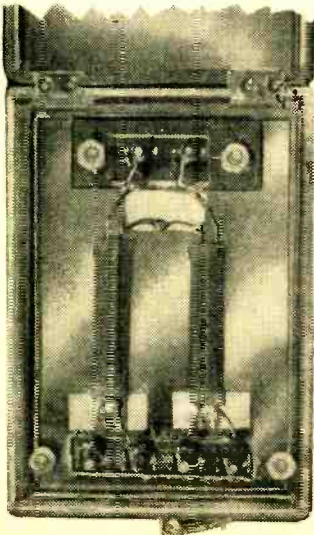


By
RUDOLF F. GRAF



Shaded areas in schematic above represent coils.

Rear view of coupler. Cutouts in the plastic may be made with hand grinder or with drill and file.



TWO TV receivers, or one TV and one FM receiver, or two FM receivers can perform satisfactorily using the signal from just one antenna. A little device called a two-set coupler does the trick. Here's how it works.

The signal from the antenna is fed down from the roof by way of the transmission line, then connected to the coupler (see diagram). Inside this coupler, the signal is divided and sent to both sets. In many locations, the fact that the entire signal voltage is not available to either set will have no noticeable effect on the picture quality.

Two-set couplers are available commercially, but it's fun to make one. And you'll find that it is easiest to build the coupler in a small plastic box.

The coils are known as "bi-filar" or "balun" coils and are commercially available from Lafayette (TS-269), Olson Radio Warehouse (L-68), or your local parts jobber.

The schematic and the inside view of the coupler show how the coils are wired. The two leads from one end of each coil go to the *Set* terminals, and the other ends are in series and connected to the *Ant.* terminals. Since there are no primary or secondary connections to worry about, the wiring job is simple.

If you want to operate one TV receiver on the coupler with the other set disconnected temporarily, installing a 300-ohm resistor at the unused coupler terminals may improve reception.

-30-

Announcing the United States Army's Graduate Specialist Program 1958 ~ 1959

The Purpose: This program is offered to provide qualified high school graduates with the technical schooling which will enable them to join the Army's key group of specialists, its select team of experts in every field from electronics to rocketry and guided missiles.

The Program: This plan offers young men their choice of 107 technical training courses—young women, their choice of 26. These courses are conducted at special Army schools which utilize the most modern technical facilities and equipment available. All instructors are experts in their fields. Completion of schooling qualifies young men and women as skilled specialists—ready to begin careers in their chosen specialties.

The Qualifications: To qualify as a Graduate Specialist, you must pass certain qualification and aptitude tests and be a high school graduate. However, you may apply while you are still in your senior year and, if qualified, enter the program after graduation. It is advisable to apply early, since quotas for each course are limited and qualified applicants are selected on a first-come-first-served basis.

The Procedure: To apply for the Graduate Specialist Program, visit your local Army Recruiting

Station. Your Army Recruiter will give you an enlistment screening test. After passing this initial qualification test, you will be interviewed by the Recruiter who is an experienced counselor. He will discuss your academic background and interests with you. Based on your own abilities and desires, he will help you select a first choice course and two alternates. If quotas for your first choice course are filled, you may still become a Graduate Specialist in one of your selected alternates. Your Army Recruiter will then forward your application for processing. You will later receive a formal letter notifying you that a place in a course of your choice is waiting for you. Not until after high school graduation and shortly before your course begins will you actually enlist, and then only for three years. Before enlistment, you will take two final tests, the Armed Forces Qualification Test and the Army Qualification Battery. After making qualifying scores in these tests relating to your particular chosen field, you are ready to enlist as an Army Graduate Specialist.

The Benefits: Through this unique program, today's Army offers qualified high school graduates an outstanding educational opportunity—a tremendous headstart toward a successful specialist's career—as well as the chance to join the Army's select group of key personnel.

*Get choice, not chance,
in
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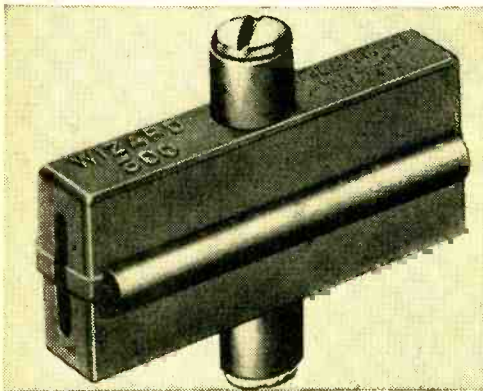
HIGH-IMPEDANCE VTVM

With an input impedance of 22.0 megohms, the Model 311 vacuum-tube voltmeter provides peak-to-peak readings of complex a.c. voltages as well as sine waves. It features a d.c.-a.c./ohms probe with clip-on tip. An r.f. accessory probe is also available which is capable of handling a.c. voltages up to 150 volts r.m.s. or 400 volts peak-to-peak up to 100 mc. Price, including d.c.-a.c./ohms probe, \$64.95. (Simpson Electric Co., 5200 West Kinzie St., Chicago 44, Ill.)



TV-FM COUPLER

In normal signal areas, the Wizard 300 TV-FM coupler will operate 20 or more sets from one antenna without amplifica-



tion. It is simple to install and requires no maintenance. Outlets can be located throughout the home so that a single set may be moved from room to room. The coupler slides onto the antenna lead-in and

does not require cutting or soldering of the line. List price, \$1.95. (Charles Engineering Inc., 6053 Melrose Ave., Los Angeles 38, Calif.)

MAGNETIZER/DEMAGNETIZER

You can instantly, conveniently and economically magnetize or demagnetize any



small tools with the "Magneformer." Operating on 117-volt a.c., it will magnetize or demagnetize screwdrivers, nut runners, pliers, small wrenches, etc., in less than 10 seconds. List price, \$7.50. (Perma-Power Co., 3100 N. Elston Ave., Chicago, Ill.)

MULTI-PURPOSE TESTING DEVICE

A combination voltage/continuity tester and flashlight, the "Meter-Lite" No. 100 comes encased in an unbreakable case no larger than a regular pack of cigarettes. It will test continuity of high resistance circuits, determine whether a power source is a.c. or d.c., and locate the ground side of a power line. List price, \$3.45, less batteries. (Cessco Industries, 55 Church St., Albany, N. Y.)



RADIO DIRECTION FINDER KIT

Easy to build and costing only pennies to operate, the Heathkit Model DF-2 is a two-band superheterodyne radio direction finder. This portable, self-powered, six-transistor model covers the beacon band from 200 to 400 kc. and broadcast band

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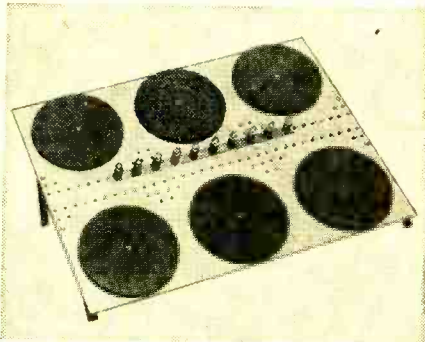
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Be careful before you answer. GENIAC the first electrical brain construction kit is equipped to play tic-tac-toe, cipher and encipher codes, convert from binary to decimal, reason in syllogisms as well as add, subtract, multiply and divide. Specific problems in a variety of fields—arithmetic, policy claim settlement, physics, etc.—can be set up and solved with the components. Connections are solderless and are completely explained with templates in the manual. This covers 125 circuits and shows how new ones can be designed. You will find building and using GENIAC a wonderful experience: one kit user wrote us: "This kit has opened up a new world of thinking to me." You actually see how computing, problem solving, and game play (Tic-tac-toe, nim, etc.) can be analyzed with Boolean Algebra and the algebraic solutions transformed directly into circuit diagrams. You create from over 400 specially designed and manufactured components a machine that solves problems faster than you can express them.

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from 540 to 1620 kc. It is designed to take directional "fixes" on both aircraft and marine beacons as well as standard broadcast stations, while providing the enter-



tainment of a high-quality transistor portable radio. Power is supplied by six flashlight batteries. Price, \$69.95. (Heath Company, Benton Harbor 10, Mich.)

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A high-pass filter to eliminate TV noise, Model HPX-45 has a cutoff frequency of 45 mc. It is a two-section type with an attenuation greater than 80 db at 14 mc. and below. At 10 meters, it has 40-db



attenuation. Designed for 300-ohm line, the HPX-45 boasts negligible insertion loss. (American Electronics Co., 1203-05 Bryant Ave., New York 59, N. Y.)

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The 16 readily interchangeable tips and triplets in the No. 250 de luxe soldering kit provide a tip temperature variation from 650° to 1000°. Adaptable to any soldering assignment, from the largest to the small-

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LAFAYETTE LA-90



GARRARD RC121/II

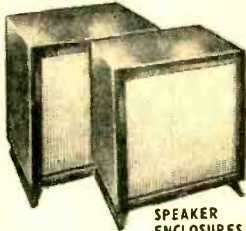


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HF-374 Stereo Phono System, with mahogany or blonde wood changer base (please specify) Net **167.50**

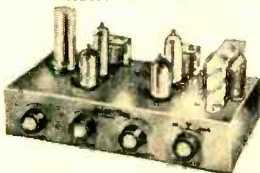
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STEREO FM/AM-PHONO SYSTEM

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KT-126 — Complete Kit, with tubes.....Net 18.95

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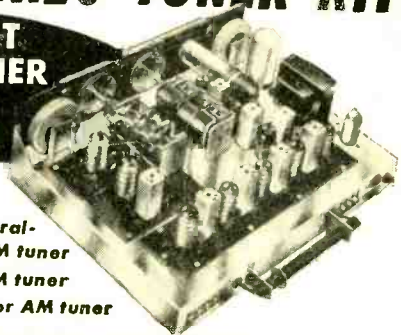
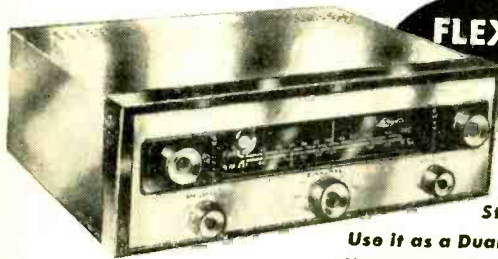
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More than a year of research, planning and engineering went into the making of the Lafayette Stereo Tuner. Its unique flexibility permits the reception of binaural broadcasting (simultaneous transmission on both FM and AM), the independent operation of both the FM and AM sections at the same time, and the ordinary reception of either FM or AM. The AM and FM sections are separately tuned, each with a separate 3-gang tuning condenser, separate flywheel tuning and separate volume control for proper balancing when used for binaural programs. Simplified accurate knife-edge tuning is provided by magic eye which operates independently on FM and AM. Automatic frequency control "locks in" FM signal permanently. Aside from its unique flexibility, this is, above all else, a quality high-fidelity tuner incorporating features found exclusively in the highest priced tuners.

The 5 controls of the KT-500 are FM Volume, AM Volume, FM Tuning, AM Tuning and 5-position Function Selector Switch. Tastefully styled with gold-brass escutcheon having dark maroon background plus matching maroon knobs with gold inserts. The Lafayette Stereo Tuner was designed with the builder in mind. Two separate printed circuit boards make construction and wiring simple, even for such a complex unit. Complete kit includes all parts and metal cover, a step-by-step instruction manual, schematic and pictorial diagrams. Size is 13 3/4" W x 10 3/8" D x 4 1/2" H. Shpg. wt., 22 lbs.

The new Lafayette Model KT-500 Stereo FM-AM Tuner is a companion piece to the Models KT-300 Audio Control Center Kit and KT-400 70-watt Basic Amplifier Kit.

KT-500..... Net **74.50**
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LAFAYETTE KT-600 — Stereo Preamplifier kit..... Net **79.50**

NEW! LAFAYETTE STEREO/MONAURAL 36-WATT BASIC AMPLIFIER



KT-310
47.50
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- 36-WATT STEREO AMPLIFIER
- 4 PREMIUM-TYPE 7189 OUTPUT TUBES
- RESPONSE 35-30,000 CPS \pm 1/2 DB
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A superbly-performing basic stereo amplifier, in easy-to-build kit form to save you lots of money and let you get into stereo now at minimum expense! Dual inputs, each provided with individual volume control. The unit may be used with a stereo preamplifier for 2 18-watt stereo channels, or at the flick of a switch, as a top-quality 36-watt monaural amplifier; or, if desired, it may be used as 2 separate monaural 18-watt amplifiers! **CONTROLS** include 2 input volume controls, channel reverse switch (AB-BA), monaural-stereo switch. **DUAL OUTPUT IMPEDANCES** are: 4, 8, 16 and 32 ohms (permitting paralleled monaural operation of 2 speaker systems of up to 16 ohms). **INPUT SENSITIVITY** is 0.45 volts per channel for full output. **TUBES** are 2-6AN8, 4-7189; GZ34 rectifier. **SIZE** is 9-3/16" d (10-9/16" with controls) x 5 1/4" h x 13 1/4" w. Supplied complete with perforated metal cage, all necessary parts and detailed instructions. Shpg. wt., 22 lbs.

KT-310 Stereo Power Amplifier Kit..... Net **47.50**

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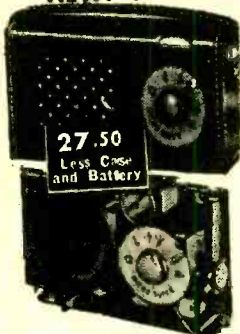
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Superb Performance! Incomparable Value!

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3 TRANSISTOR SUPERHET POCKET RADIO KIT

- A TRUE POCKET SUPERHET RECEIVER-NO EXTERNAL ANTENNA
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A remarkable sensitive, super-selective pocket superhet receiver with astonishing performance over the complete broadcasting band. Uses 2 high-frequency and one audio transistor plus efficient diode detector and features 2 specially matched IF transformers for maximum power transfer. The components are housed in a professional looking beige plastic case, a distinctive built-in ferrite antenna eliminates need for external antenna. A designer's dream in a true pocket superhet receiver! Complete with all parts, transistors battery, case, dial and easy to follow step-by-step instructions. 4 1/4" x 3 1/4" x 1-1/16". Shpg. wt., 1 lb. **KT-116** - Complete Kit, less earphone. **Net 14.95**

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- BATTERY Burgess 2**..... **.13**
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Precision loudness meter. Calibrated in Volume Units and percent, with 20 db variable attenuator. Ideal for setting output level in paging and music systems; removes guesswork when used as record level indicator with tape recorders. Highly damped meter; responds to average level of voice and music. Impedance 10,000 ohms; sensitivity 1.4 volts for 0 VU. With capacitor for blocking DC to prevent burnout, 4" w x 2-3/16" h x 1-3/8" d. Shpg. wt., 1 lb.

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- 20,000 OHMS PER VOLT DC - 10,000 OHMS PER VOLT AC
- 40 MICROAMPERE 3" D'ARSONVAL METER MOVEMENT
- HIGH INPUT RESISTANCE ON ALL DC AND AC RANGES
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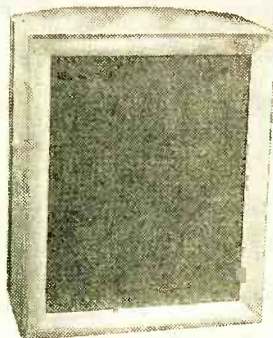


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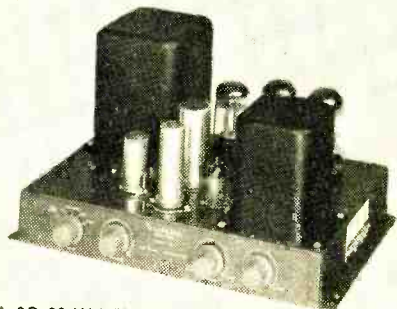
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RANGE EXTENDER



A-9C 20-WATT AMPLIFIER

**HEATHKIT "BASIC RANGE"
HIGH FIDELITY SPEAKER SYSTEM KIT**

This amazing speaker system can fulfill your present needs and still provide for future expansion. Fine hi-fi performance the result of using high quality speakers in an enclosure especially designed for them. Features two Jensen speakers to cover 50 to 12,000 CPS within ± 5 db. Power rating is 25 watts, and impedance is 16 ohms. Enclosure constructed of veneer-surfaced plywood, $\frac{1}{2}$ " thick, and measures $11\frac{1}{2}$ " H x 23 " W x $11\frac{3}{4}$ " D. Precut and predrilled for quick assembly.

Model SS-2
\$39⁹⁵
Shpg. Wt. 26 lbs.

**HEATHKIT RANGE EXTENDING
HIGH FIDELITY SPEAKER SYSTEM KIT**

Designed especially for use with SS-2 "Basic" system. Contains 15" woofer and compression-type super tweeter. Extends basic unit to 35-16,000 CPS. ± 5 db. Impedance 16 ohms. Measures 29" H x 23" W x $17\frac{1}{2}$ " D, and is constructed of $\frac{1}{4}$ " veneer-surfaced plywood.

Model SS-1B
\$99⁹⁵
Shpg. Wt. 80 lbs.

**HEATHKIT A-9C HIGH FIDELITY
AMPLIFIER KIT**

This model incorporates its own power supply and preamplifier. Plenty of power with full 20 watt rating. Four separate inputs, selected by panel-mounted switch, and separate bass and treble controls. Ideal for home or PA applications. Output transformer tapped at 4, 8, 16 or 500 ohms. Response within ± 1 db from 20 to 20,000 CPS.

Model A-9C
\$35⁵⁰
Shpg. Wt. 23 lbs.

HEATHKIT HIGH FIDELITY FM TUNER KIT

Now you can have full-fidelity FM performance from 88 to 108 mc at reasonable cost. Features temperature-compensated oscillator—built in power supply, and beautiful cabinet. Components prealigned at factory!

Model FM-3A
\$25⁹⁵
Shpg. Wt. 8 lbs.
(with cabinet)

HEATHKIT BROADBAND AM TUNER KIT

Tunes standard AM band from 550 to 1600 kc with fine sensitivity and broadband characteristics. Features include built-in power supply and low-distortion detector. All RF circuits pre-aligned for simplified construction.

Model BC-1A
\$25⁹⁵
Shpg. Wt. 9 lbs.
(with cabinet)

**HEATHKIT "MASTER CONTROL"
HI-FI PREAMPLIFIER KIT**

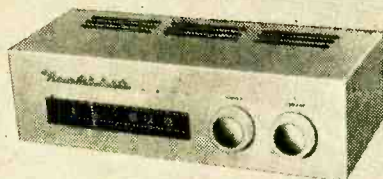
Provides extra amplification, selection of inputs, volume and tone controls, and turnover and rolloff controls, for Williamson-type amplifiers. Beautiful satin-gold enamel cabinet. Derives operating power from amplifier.

Model WA-P2
\$19⁷⁵
Shpg. Wt. 7 lbs.
(with cabinet)

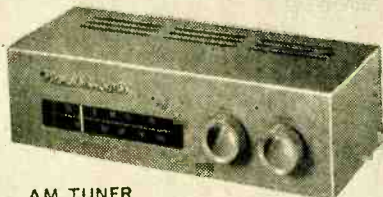
**HEATHKIT 25-WATT HIGH FIDELITY
AMPLIFIER KIT**

Outstanding 25-watt Williamson-type amplifier employs KT66 tubes and Peerless output transformer, tapped at 4, 8, and 16 ohms. A fine amplifier for the "deluxe" system. WA-P2 preamplifier required for operation. Express only.

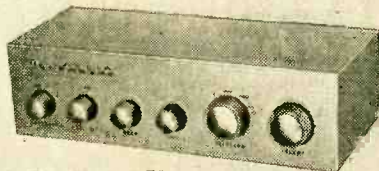
Model W-5M
\$59⁷⁵
Shpg. Wt. 31 lbs.



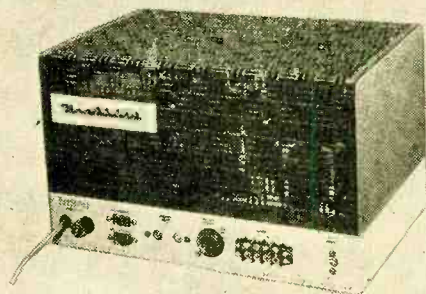
FM TUNER



AM TUNER



PREAMPLIFIER



W-5M 25-WATT AMPLIFIER

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Now you can have radio
wherever you go —
with the portable
that plays anywhere!

HEATHKIT MODEL XR-1P TRANSISTOR PORTABLE RADIO KIT

This easy to build transistor radio is designed for lifetime operation. Features 6 name-brand (Texas Instrument) transistors for extra good sensitivity and selectivity. A 4" x 6" speaker for "big set" tone, built-in rod-type antenna, and uses 6 standard size "D" flashlight cells for extremely long battery life (between 500 and 1,000 hours). Cabinet is two-tone blue molded plastic with pull-out carrying handle. Measures 9" L. x 7" H. x 3 3/4" D. Transformers are prealigned eliminating special alignment equipment. Shpg. Wt. 6 lbs.

MODEL XR-1L: Identical to XR-1P except in leather case. Carrying strap included. Shpg. Wt. 7 lbs.



NEW LOW PRICE!

Model XR-1L
\$34⁹⁵

Model XR-1P
\$29⁹⁵

Note: Prices are with cabinet-less batteries.

HEATHKIT BROADCAST BAND RADIO KIT

Covers 550 to 1600 kc with good sensitivity and selectivity. Has 5 1/2" PM speaker for good tone quality. Features transformer power supply and built-in antenna. Signal generator recommended for alignment. Cabinet, as shown, available separately. Shpg. Wt. 10 lbs.

Model BR-2
\$18⁹⁵

(less cabinet)

HEATHKIT CRYSTAL RADIO KIT

Features a sealed germanium diode to eliminate critical "cats whisker" adjustment. Employs two tuning condensers for good selectivity, and covers the broadcast band from 540 to 1600 kc. Requires no external power. Kit price includes headphones. Shpg. Wt. 3 lbs.

Model CR-1
\$7⁹⁵

HEATHKIT ENLARGER TIMER KIT

The dial of this handy timer covers 0 to one minute calibrated in five-second gradations, so that the timing cycle of a photographic enlarger can be electronically controlled. Built-in relay handles up to 350 watts, and enlarger merely plugs into receptacle of front panel. Also provision for plugging in safe-light. An easy-to-build device that makes a fine addition to any dark room. Shpg. Wt. 3 lbs.

Model ET-1
\$11⁵⁰



TABLE-MODEL RADIO

CRYSTAL RADIO

ENLARGER TIMER

HEATHKIT FUEL VAPOR DETECTOR KIT

The FD-1 is a safety device to detect fuel vapor in the engine compartment or other sections of your boat. The detector unit mounts in the area to be checked, and the indicating meter and controls mount on the control panel. Will operate intermittently or continuously, and indicates dangers of fire or explosion to protect your boat and its passengers. Models FD-1-6 (6 volts DC) and FD-1-12 (12 volts DC) operate from boat batteries. Kit even includes spare detector unit. Shpg. Wt. 4 lbs.

6-volt FD-1-6,
12-vt. FD-1-12
\$35⁹⁵
each

HEATHKIT RF POWER METER KIT

This handy device measures the RF field in the vicinity of a transmitter, whether it be marine, mobile, fixed, etc. Requires no electricity, nor direct connection to the transmitter. Provides a continuing indication of transmitter operation. Merely place it in proximity to the transmitter antenna and it will produce a reading on its 200 ua panel meter when the transmitter is in use. Operates with any transmitter between 100 kc and 250 mc. Includes a sensitivity control for meter. Shpg. Wt. 2 lbs.

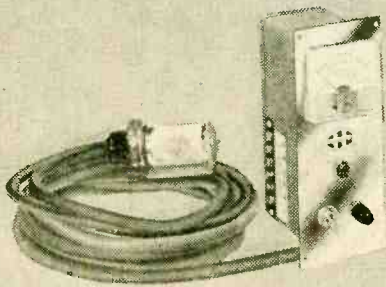
Model PM-1
\$14⁹⁵

HEATHKIT TRANSISTOR RADIO DIRECTION-FINDER KIT

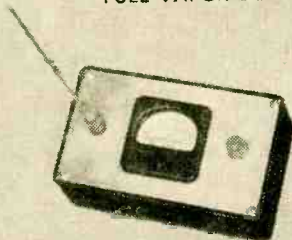
The Heathkit Transistor Radio Direction-Finder model DF-1 is a self-contained, self-powered, 6-transistor super heterodyne broadcast radio receiver incorporating a directional loop antenna, indicating meter, and integral speaker. It is designed to serve primarily as an aid to navigation when out of sight of familiar landmarks. It can be used not only aboard yachts, fishing craft, tugs, and other vessels which navigate either out of sight of land or at night, but also for the hunter, hiker, camper, fisherman, aviator, etc. It is powered by a 9-volt battery. (A spare battery is also included with the kit.) The frequency range covers the broadcast band from 540 to 1600 kc and will double as a portable radio. A directional high-Q ferrite antenna is incorporated which is rotated from the front panel to obtain a fix on a station and a 1 ma meter serves as the null and tuning indicator. The controls consist of: tuning, volume and power (on-off), sensitivity, heading indicator (compass rose) and bearing indicator (antenna index). Overall dimensions are 7 $\frac{1}{2}$ " W x 5 $\frac{1}{8}$ " H x 5 $\frac{3}{8}$ " D. Supplied with slip-in-place mounting brackets, which allow easy removal from ship bulkheads or other similar places. Shpg. Wt. 4 lbs.

Model DF-1
\$54⁹⁵

NEW! Heathkits for the boating enthusiast



FUEL VAPOR DETECTOR



POWER METER



RADIO DIRECTION-FINDER

HEATHKIT



DX-20 TRANSMITTER



RF SIGNAL GENERATOR



GRID DIP METER



HANDITESTER

HEATHKIT DX-20 CW TRANSMITTER KIT

This Heathkit straight-CW transmitter is one of the most efficient rigs available today. It is ideal for the novice, and even for the advanced-class CW operator. It employs a 6DQ6A tube in the 50-watt final amplifier circuit, a 6CL6 oscillator and a 5U4GB rectifier. Single-knob band switching covers 80, 40, 20, 15, 11, and 10 meters. The DX-20 is designed for crystal excitation, but may be excited by an external VFO. Pi network output circuit is employed to match antenna impedances between 50 and 1000 ohms.

Model DX-20
Shpg. Wt. 19 lbs. **\$35⁹⁵**

HEATHKIT GRID DIP METER KIT

An instrument of many uses for the ham, experimenter, or service technician. Useful in locating parasitics, neutralizing, determining resonant frequencies, etc. Covers 2 mc to 250 mc with prewound coils. Use to beat against unknown frequencies, or as absorption-type wave meter.

Model GD-18
Shpg. Wt. 4 lbs. **\$21⁹⁵**

HEATHKIT RF SIGNAL GENERATOR KIT

Produces rf signals from 160 kc to 110 mc on fundamentals on five bands, and covers 110 mc to 220 mc on calibrated harmonics. Output may be pure rf, rf modulated at 400 CPS, or audio at 400 CPS. Preadigned coils eliminate the need for calibration after completion.

Model SG-8
Shpg. Wt. 8 lbs. **\$19⁵⁰**

HEATHKIT HANDITESTER KIT

Measures AC or DC voltage at 0-10, 30, 300, 1000 and 5000 volts. Direct current ranges are 0-10 ma and 0-100 ma. Ohmmeter ranges are 0-3000 and 0-300,000 ohms. Sensitivity is 1000 ohms/volt. Features small size and rugged construction in sleek black bakelite case.

Model M-1
Shpg. Wt. 3 lbs. **\$17⁹⁵**

HEATHKIT ETCHED-CIRCUIT VTVM KIT

Sensitivity and reliability are combined in the V-7A. It features 1% precision resistors, large 4 1/2" panel meter, and etched circuit board. AC (RMS) and DC voltage ranges are 0-1.5, 5, 15, 50, 150, 500, and 1500. Peak-to-peak AC ranges are 0-4, 14, 40, 140, 400, 1400 and 4000 volts. X1, X10, X100, X10k, X100k, and X1 megohm.

Model V-7A
Shpg. Wt. 7 lbs. **\$24⁵⁰**

HEATHKIT ALL-BAND RADIO KIT

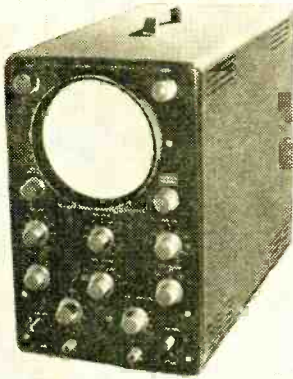
This receiver covers 550 kc to 30 mc in four bands, and is ideal for the short wave listener or beginning amateur. It provides good sensitivity and selectivity, combined with good image projection. Amateur bands clearly marked on the illuminated dial scale. Employs transformer-type power supply—electrical band spread—antenna trimmer—separate rf and af gain controls—noise limiter and headphone jack. Built-in BFO for CW reception. Cabinet, as shown, available separately.

Model AR-3
Shpg. Wt. 12 lbs. **\$29⁹⁵**
(less cabinet)

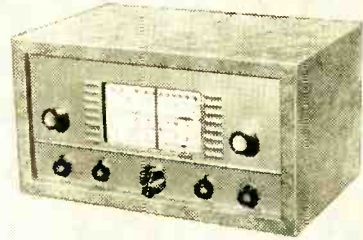
HEATHKIT "GENERAL PURPOSE" 5" OSCILLOSCOPE KIT

This oscilloscope sells for less than the previous model, yet incorporates features for improved performance. The OM-2 provides wider vertical frequency response, extended sweep generator coverage, and increased stability. Vertical channel is essentially flat to over 1 mc. Sweep generator functions from 20 CPS to over 150 kc. Amplifiers are push-pull, and modern etched circuits are employed in critical parts of the design. A 5BP1 cathode ray tube is used. The scope features external or internal sweep and sync, 1-volt peak-to-peak reference voltage, three-position step attenuated input, and many other "extras."

Model OM-2
Shpg. Wt. 22 lbs. **\$39⁹⁵**



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press agency at time of delivery. On parcel post orders include postage for weight shown. Orders from APO's must include full remittance. NOTE: All prices are subject to change without notice and are F.O.B. Benton Harbor, Mich.

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Without experience or knowledge, this guaranteed new method of servicing TV sets enables you to DIAGNOSE TV troubles as rapidly as an expert. **NO THEORY—NO MATH**—you can locate all faults in record-breaking time regardless of make or model. "TV TROUBLE SHOOTING METHOD" is the most valuable aid to TV servicing ever written. Be a TV Trouble Diagnostician. Increase your present earnings. Open Your own Profitable Business or get a high-paying skilled job.

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Alphabetically listed are 85 picture troubles, over 68 raster and 17 sound troubles. By this unique copyrighted method you know EXACTLY WHERE the trouble is; plus step-by-step instructions, including 69 RAPID CHECKS, help to find faulty part. **13 IMPORTANT PRELIMINARY CHECKS NEED NO INSTRUMENTS!** Of the 69 Rapid Checks, **OVER 65 ALSO REQUIRE NO INSTRUMENTS!** Rapid checks include emergency checks for distorted pictures, defective tubes including PIX tube, plus 57 others, **ALL EXPLAINED IN SIMPLE LANGUAGE. PERFORMED WITHOUT INSTRUMENTS. MANY CHECKS USE THE PICTURE TUBE AS A GUIDE.**

H. G. Cisin, the author, is the inventor of the AC/DC midjet radio. He licenses RCA, AT&T, etc. He has also trained thousands of technicians now owning their own prosperous TV service organizations or holding highly paid TV positions. 11½ years of experience are embodied in this remarkable new book.

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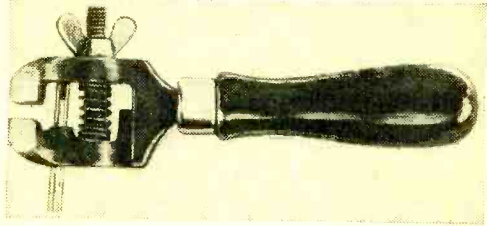
est connection, the kit comes in a metal carrying case, complete with handle and



clasps. List price, \$25.00. (Ungar Electric Tools, Inc., 4101 Redwood Ave., Los Angeles 66, Calif.)

SPRING-ADJUSTED HAND VISE

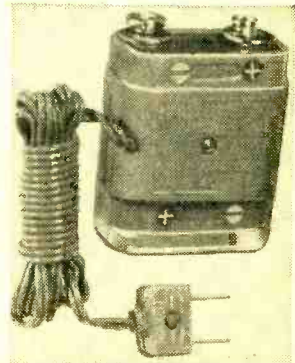
This spring-adjusted hand vise has been designed to adapt for single-contact electric soldering or any small job where hand pres-



sure is not sufficient. Length is 6" over-all, with wooden handle. Price, \$1.00, prepaid. (Panther Ltd., 108 E. 16th Street, New York 3, N. Y.)

BATTERY ELIMINATOR/CHARGER

This substitute B+ voltage power pack for 67.5-volt battery-operated radios also functions as a charger. Plug it into a 117-volt power outlet and the 67.5-volt battery charger goes to work immediately. You can use it while the radio is playing or afterwards. Price, \$4.95, ppd. (Victoria Merchandising Co., Dept. DA, 153 Bay 26th St., Brooklyn 14, N. Y.)



—30—

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The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL. You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner; how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit chassis. 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 practice code, using the Progressive Code Oscillator. You will learn and practice and practice code, using the Progressive Code Oscillator, Progressive Signal Injector, Progressive Trouble-Shooting, using the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Hi-Fi, Electronics Tester and the accompanying instructional material.

You will receive training for the Novice, Technician and General Licensees, F.C.C. Radio Amateur Licenses. You will build 16 Receiver, Transmitter, Code Oscillator, Signal Tracer and Signal Tracer 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 electronics 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 price of \$22.95. The Signal Tracer alone is worth more than the price of the entire Kit.

THE KIT FOR EVERYONE

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

ages and backgrounds have successfully tried the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice 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 technique. 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 sixteen Receiver, Transmitter, Code Oscillator, Signal Tracer, 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 16 different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, various electronic, mica, ceramic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, Instruction Manuals, hook-up wire, solder, etc. In addition, you receive Printed Circuit materials, including Printed Circuit chassis, a special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Hi-Fi and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, Tester. In addition to F.C.C. License Questions and Answers for Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive Membership in the Radio-TV Club, Free Consultation Service, New Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

PRINTED CIRCUITRY

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

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

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

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- CONSULTATION SERVICE • FCC AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

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

J. Statatits, 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."

FROM OUR MAIL BAG

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 the 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 radio field so quickly. The Troubleshooting Tester that comes with the Kit is really swell, and finds the trouble, if there is any to be found."

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024	3AU6	5W4GT	6BF5	658GT	7F8	125A7	35/51
1A5GT	3AV6	5X4G	6BG6G	65A7	7G7	125GT	35A5
1A7GT	3BA6	5X8	6BH6	65B7Y	7H7	125I7	35B5
1B3GT	3BC5	5Y3GT	6BH8	65C7	7I7	125K7	35C5
1C5GT	3BE6	5Y4G	6B16	65F5	7K7	125N7GT	35L6GT
1C6	3BN6	5Z3	6BK5	65F765G7	7L7	125O7	35W4
1C7	3B8U	5Z4	6BK7	65H7	7N7	125R7	35Y4
1H4G	3B76	6A8	6B17GT	65I7	7O7	12V6GT	35Z4GT
1H5GT	3B26	6A8A4	6BN6	65K7	7R7	12W6GT	35Z5GT
1L6	3C7	6AC7	6B06GT	65L7GT	7S7	12X4	37
1L44	3C86	6AF4	6B07	65N7GT	7V7	12Z3	39/44
1L46	3Cf6	6AG5	6BR8	65O7	7W7	14A7	#41
1L84	3C56	6AG7	6BS8	65R7	7X6	14AF7	#42
1LCS	3D16	6AH4GT	6BYSG	614	7Y7	14B6	#43
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1P5GT	48C8	6AL7GT	6C85	6V3	12A85	14Q7	50C5
1Q5GT	48Q7A	6AM8	6C86	6V6GT	12A05	14S7	50C6G
1R5	4858	6AN8	6C0DG	6W4GT	12A76	17AX4GT	50L6GT
1S5	48U8	6A05	6Cf6	6W6GT	12A17	17D06	50Y6
1T4	48Z7	6A06	6C07	6X4	12A08	19A14	50Y7
1T5GT	4C86	6A07GT	6C08	6X7	12A07	19B06G	#57
1U4	5A8B	6A75	6C88	6X8	12AV6	19C8	#58
1U5	5A8B	6A55	6C16	6Y6G	12A7V	19J6	#80
1V	5A05	6A58	6C66	7A4	12AX4GT	19T8	#81
1V2	5A58	6A76	6CM7	7A5	12A7X	19X8	117L7GT
1X2	5A78	6A04GT	6CN7	7A6	12A27	25A5C5	117N7GT
2A3	5AV6	6A05GT	6CU6	7A7	12B7	25AV5GT	117P7GT
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2A4FA	5B7	6AV5GT	6D16	7R5	12Bf6	25B06	117Z6GT
2B7	5B8R	6AV6	6E5	7B6	12BH7	25C06G	807
2B4	5B07	6AW8	6H6	7B7	12BK5	25C06	9002
2D21	5B27	6AX4GT	6J4	7B8	12B06	25L6GT	9003
2E5	5C06	6AX5GT	6J5	7C4	12B87	25W4GT	9006
2X2A	5J6	6A2B	6I6	7C5	12CA5	25Z5	
3A2	5T8	6BA6	6K6GT	7C6	12C06	25Z6	
3A3	5U8	6B5C5	6K7	7C7	12D06	#27	
3A4	5U4G	6B8C8	6I6	7E6	12J5	#30	
3A5	5V4G	6B06	6I7	7E7	12L6GT	#31	

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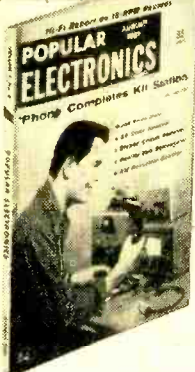
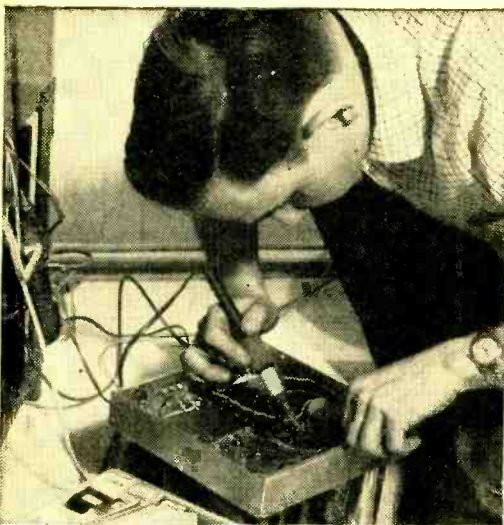
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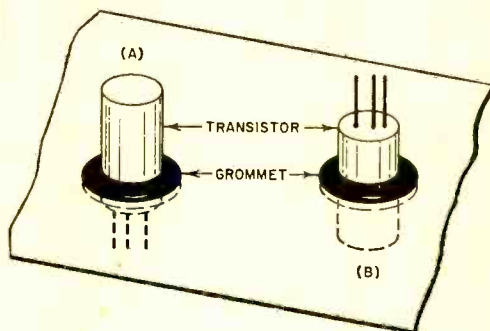
Tips and Techniques

(Continued from page 32)

a heterodyne is heard on the speaker. Move the dipper coil perpendicular to the area where the metallic object is believed to be hidden. As the coil passes over the metal object, its inductance is changed and a frequency shift is indicated by a change in the pitch of the heterodyne note—J. M. C.

GROMMET TRANSISTOR MOUNT

A rubber grommet used as a wire feed-through insulator in electronics gear also makes a convenient mount for some types of transistors. Simply select a grommet that fits over the transistor's case snugly,



drill the correct-size hole in the chassis, and snap the grommet into place. Push the transistor into the opening in the grommet either up through from underneath (A) or down through from the top (B). The grommet will protect the transistor against mechanical shock and will make for a neat-looking chassis layout. —S. P.



After Class

(Continued from page 92)

all rating of the system, you add the decibel rating of each one, assuming that the two units are perfectly matched. Decibels can be given as a minus (-db) figure indicating a loss as well as a plus (+db) figure indicating a gain. See Fig. 3 on page 91.

Since the manufacturer of an amplifier does not know how it will be used in your system, he must establish some sort of zero reference point in order to figure a decibel rating for the particular unit under consideration. The zero levels generally used are 0.006 watt or 0.012 watt. These would represent the power input, or P_i in the formula we have discussed. There is also

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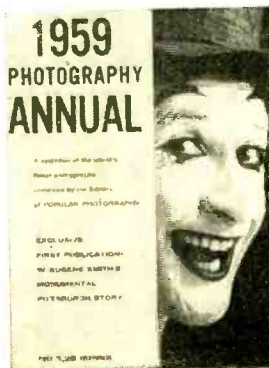
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a standard impedance termination, or load, across which the output meter is connected in the measuring circuit. This value of load resistance must be the same for any comparative measurements.

Using a Meter. If you have occasion to use a direct-reading decibel meter, you will note that the scale spacing is uneven. This is due to the fact that the scale is laid out in logarithmic spacing rather than linear spacing, which in turn is due to the logarithm in the decibel formula. A good example of the difference between a logarithmic scale and a linear scale can be seen by comparing the scales on a slide rule and on a ruler. The slide rule is logarithmic and the ruler is linear.

Actually, the output decibel meter is a d.c. voltmeter and rectifier combination. The meter measures output volts, but the scale reads in decibels. The zero point on the meter is that point on the scale where the zero reference level wattage is measured. Any reading over this zero point is read plus db, any reading below it, minus db.

It is important that you understand what decibels mean and what they tell you about the equipment you use. You will meet them often in your electronics work.

—Saunders Harris



Tic-Tac-Toe Mate

(Continued from page 48)

low this procedure until all switch terminals with the same code have been tied together and connected to the proper *Select* switch terminal.

Now wire the two top switches in Square C as shown in Fig. 2. Connect all switch terminals labeled "+" to one side of the battery or transformer 6.3-volt secondary, and all lamp socket terminals labeled "—" to the other side. The finished panel is mounted on a wooden frame cut to fit.

How to Play. Either the player or the board may start first. If the player begins, he starts by closing one of the nine *Select* switches and the entire row of *Setup* switches to the *right* of the indicators in the same square. An "O" will appear in one of the other squares. The player now makes his choice—"X"—in any of the other unlit squares by activating its *Select* switch.

If the board is to go first, the *Start* switch (top switch in the upper left-hand corner)

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1U3	.59	6CS6	.59
1U5	.59	6CT7	.78
1V2	.57	6CU6	1.19
1X2A	.79	6DB8	.69
3A4	.59	6DE6	.59
3AL5	.54	6DQ8	1.14
3AU6	.75	6DT6	.59
3B05	.71	6H5	.79
3BE6	.63	6J5	.49
3BN6	.86	6J6	.69
3BY6	.68	6K6	.75
3BZ6	.68	6L6	.69
3CB6	.59	6S4	.59
3CS6	.68	6S4T	.69
3AT8	.69	6S5	.66
3Q4	.69	6S5F	.66
3S4	.69	6S17	.79
3G6	.69	6S17L	.79
4807	1.14	6S7	.68
4827	.99	6S7L	.68
5001	.85	6S7N	.68
5AN8	1.02	6S7N	.68
5A05	.59	6TR	.85
5AT8	.59	6V8	.85
5AV8	1.11	6V8	1.11
5B7A	.98	6V6	.59
5J6	.59	6W4	.61
5T8	.98	6W6	.71
5U4	.59	6X4	.48
5U8	.59	6X5	.59
5V4	.77	6X6	.79
5X6	.93	12A7E	.49
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70 HI-Q RESISTORS
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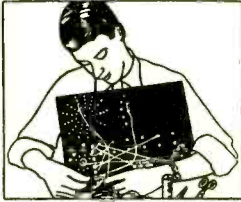
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is closed. This will cause an "O" to appear. The player then makes his selection by closing the *Select* switch and the *left-hand* row of *Setup* switches in some other square. The game then goes on as before. Note that only one bank of *Setup* switches is closed for any one game.

Toward the end of some of the games, as was mentioned, the machine may fail to make a counter-selection. This is an indication that the computer has given up because it sees no chance of winning. -30-

QSL from Sputnik

(Continued from page 66)

DX'er nothing but propaganda. On the other hand, following a straight-line approach, cutting through the Soviet curves, will—nine chances out of ten—bring you what you are after.

The following are the final paragraphs of the letter that brought home my SPUTNIK QSL.

I am going to speak frankly. Even if you had not promised to verify reception of your Sputniks, it would be an act of bad faith not to do so. Many listeners all over the world took the time and trouble to receive and report reception of your satellites. They certainly deserve QSL cards or letters for their efforts.

Thank you very much for the cards and letters you have sent me in the past. I do hope you or somebody else will correct this most unfortunate QSL situation.

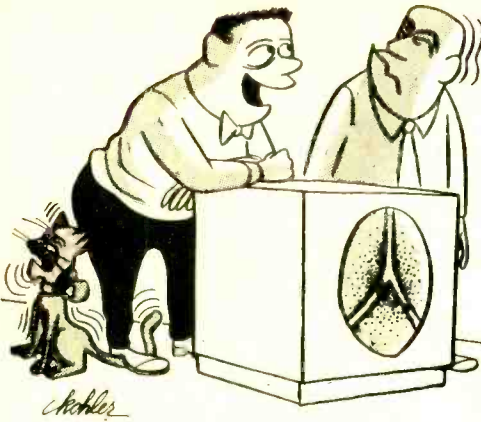
Radio Moscow, like any other International Short-Wave Service is dependent upon the world's SWL's. A letter such as that above would seem to leave them very little choice but to fulfill their obligations. You'll note, however, that the letter is courteous. Any station has the right to ignore a rude or insulting DX report.

Transmission Data. You will need transmission data to prove your reception. Easiest to obtain are the number of beeps per minute. Merely count the beeps in a 30-second period and multiply by two.

If you have a slightly musical ear, you can make your report considerably better. Estimate the modulation frequency by comparing the Sputnik signal with the alternate 440- and 600-cps tones transmitted by Station WWV.

If your receiver is poorly calibrated on the upper short-wave frequencies, the

Always say you saw it in—POPULAR ELECTRONICS



"Man, just dig those crazy highs!"

rating, to keep matching problems at a minimum. But you must bear in mind that funny things happen to impedances once you start adding speakers. For instance, two 16-ohm speakers wired in parallel present only eight ohms of impedance to your amplifier. They must be hooked to the amplifier's eight-ohm terminals when used together.

You will often want to use only the main speaker, or only the extension. A switching system must be set up so that the individual speaker, or speaker combination, in use is always connected to the properly matched amplifier terminals. A switch such as the Mallory 1231L can be wired for such matching, and installed on a wall or on one of the panels of your hi-fi equipment cabinet.

If the distance from amplifier to extra speaker isn't excessive, conventional line cord or 300-ohm flat line may be used. But if the distance exceeds 40 feet, heavier wire will prove more satisfactory since it will present less electrical resistance.

Different types of speakers may not operate at the same level of efficiency. A given volume setting on your amplifier might make one speaker blast while another is barely audible. You will want to provide independent control for each speaker. A simple level control—"T" or "L" pad—will do the trick. Mallory and Labtronics, for example, make suitable units. Be sure your unit matches the impedance of the speaker it will control.

Outdoor System. Should you want to bring music outdoors to the patio or lawn, your best bet is a specially designed, trumpet-type horn speaker. When a speak-

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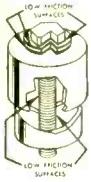


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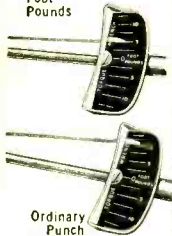
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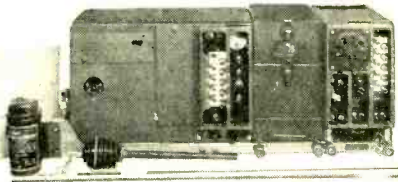
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er is removed from the enclosing walls of a room, its output tends to disperse in all directions, and both highs and lows are lost. A conventional enclosure can't solve this problem but a trumpet-type design beams the sound directionally.

Several all-weather units, \$50 or less, are particularly suitable. Electro-Voice offers a compound diffraction projector, with a claimed frequency response of 100-to-10,000 cycles, using a single diaphragm driving two coaxial horns. University's inexpensive MLC speaker has separate woofer and tweeter horns and claims a response up to 15,000 cycles. Both units can be employed with 25-watt or higher power amplifiers.

For a small patio, if you want to use a pair of less expensive baffled speakers, place them on opposite sides of the area to be covered and aim them directly at one another. This will reduce loss.

There is no way of weatherproofing conventional speaker systems without interfering with their operation. A rig of this type must be set up when you want to use it and taken in afterward.

Does all this sound expensive? Actually, you can control expense to the degree that you can curb your ambition. The beauty of a system built of separate components is that you can start with basic units and add on extras. Rome wasn't built in a day, either. With a little careful thought, you can buy excellent listening to fill your immediate needs and at the same time lay a foundation for your dream system of tomorrow.

-30-

Super-Satelliter Antenna

(Continued from page 78)

each nut used to secure the rod. To the solder lug of one, connect the braid; to the other, connect the center conductor of a length of 52-ohm coaxial cable (either RG/8U or RG/58U). The coaxial cable runs between the antenna and the satellite converter input. Clamp the plastic pieces across the booms with 6-32 bolts long enough to hold.

Before erecting the antenna, check the countersunk bolts visibly, and with an ohmmeter. There should be no danger of a short between the bolt heads and the boom. If they touch, the antenna's performance will be greatly impaired.

-30-

DX Ahoy!

(Continued from page 73)

Shipping, but this is priced too high for the average DX'er. An inexpensive and handy weekly magazine called *The Shipping Digest* will supply sufficient information to pin down almost any ocean-going freighter or passenger ship you will hear, giving the QTH of the ship's owner. It costs 25 cents per issue, and is published at 8 Bridge Street, New York 4, N. Y.

You will want to have a copy of *FCC Rules, Part 8—Stations on Shipboard in The Maritime Services*. This costs only 35 cents and is distributed by the U. S. Government Printing Office, Washington, D. C. It contains a listing of all frequencies—both phone and c.w.—used by American ships, and gives the locations and frequencies of all U.S. "marine operator" stations.

In making out a report of reception to a ship station, include the usual information useful to any radio station, such as signal strength, time of transmission, station called or contacted, frequency, and type of receiving equipment used. Address your report to "Radio Officer"; name of ship; %

owner. In the case of a yacht, which would not normally carry a radio operator, mail your report to the owner.

If you include a stamped reply card with your report, you will probably receive—within a few weeks—a QSL from a grateful maritime radio operator. (All maritime radio operators are known as "Sparks"; very often "Sparks" will be overjoyed because someone heard him that time he was calling the coastal station for 45 minutes and thought that his only monitors were the sea gulls and the mermaids.)

When sending a report to a ship station, do not refer to the text of any messages transmitted. And do not disclose the text to anyone.

Follow these instructions and you too can shock your DX colleagues by coolly stating that you just received a QSL from Station WDQJ.

-30-

ANSWERS TO AMPLIFIER QUIZ ON PAGE 82

1 F	6 J	11 N	16 E
2 G	7 Q	12 H	17 T
3 I	8 A	13 B	18 D
4 P	9 M	14 K	19 S
5 C	10 R	15 O	20 L

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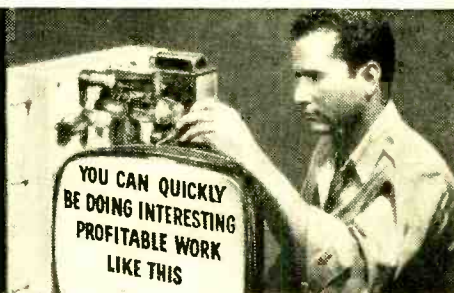
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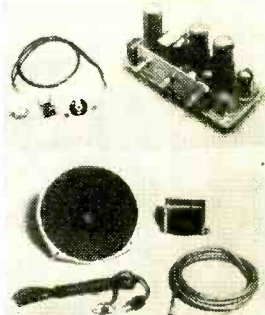
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111 GAZZA BLVD. FARMINGDALE, L. I., N. Y.

Tape Recording in Industry

(Continued from page 44)

complete sales data and inventory results in hours. By other methods, this takes several days. Burdine's, in Miami, Fla., has the first such system.

Machine tools are producing complex parts of jet aircraft, guided and controlled by magnetic tape. A Giddings and Lewis Numerically Controlled Milling Machine has been delivered to a number of manufacturers, including Lockheed and Hughes. Lockheed is employing the tape-controlled mill to improve tolerances, eliminate human error and cut machining costs by over 50%. Hughes engineers add their electronic Digitape control system to automate not only milling operations but drilling and boring as well.

From these first installations, tape-controlled machining shows promise of reducing the time between drawing board to production by 60 to 70%. With this system, the "complete sets of tooling" are now reels of magnetic tape, and they can be stored as neatly as a row of books in a tape library. Additional production runs can be made with minimum setup time using the prerecorded programs.

Magnetic tape can make 200 commands per second, each one defining exact tool positions for machines in three linear coordinates. A signal can control as little as 0.000125 inch of tool motion, and up to one-and-one-half hours of machine time can be programed on one reel of tape. —30—

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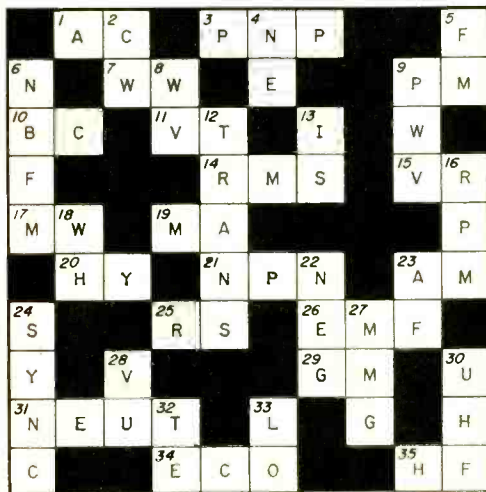
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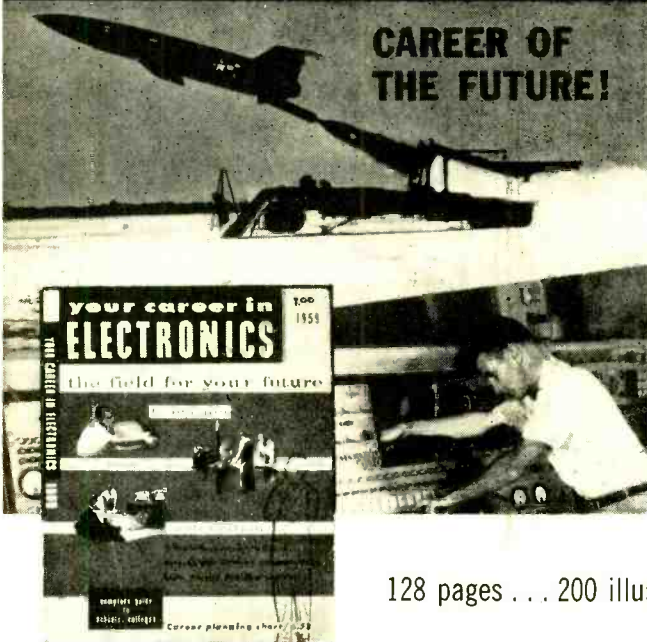
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Solution to puzzle which appears on page 54.

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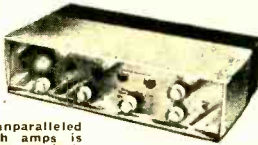
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Breaking the Language Barrier

(Continued from page 60)

other linguistic tasks. For example, the IBM-705 has played an important role in helping unravel the mysteries of the recently discovered Dead Sea Scrolls.

By transposing prose into a series of mathematical relationships, the computer is making it possible to reconstruct the words originally written in the mutilated sections of the Scrolls. The "705" analyzes the words preceding and following each gap. Thousands of words are then electronically scanned until the computer finds one that most nearly fits into the context.

Under the direction of Father Robert Busa at the Literary Data Processing Center of the Jesuit College of the Aloisianum in Gallarate, Italy, the machine was assigned the vital task of preparing an index of the Dead Sea Scrolls.

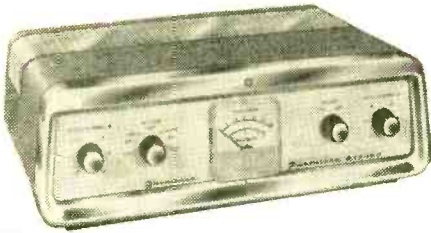
A card was punched for each of the almost 3000 words, indicating its exact location and its distinguishing features. The entire set of cards was then sent to New York where the data was converted to two reels of magnetic tape by the IBM computer in approximately two hours. Then the final alphabetical summary lists were printed in Hebrew by the printing unit of the "705" at the rate of 150 lines a minute.

Thanks to the index prepared in record time by the computer, Biblical scholars like Dr. James Muilenburg of the Union Theological Seminary are able to bring acceptable interpretations of the controversial Scrolls much closer.

New Horizons. Data-processing machines, applied to the tasks of information retrieval in such areas as legal, scientific and scholarly research, are saving hundreds of thousands of man-hours, and what is perhaps more important, are reducing the time lags in information processing which might conceivably be dangerous to national survival.

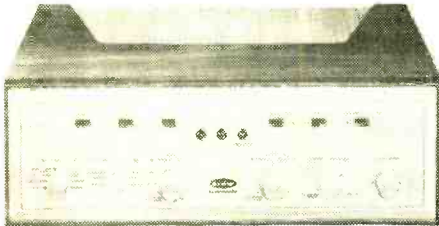
The field of language engineering, still in its infancy, is opening new horizons for knowledge. It has already proved that it can help man cope not only with the written records of the past but also with the staggering volume of technological and intellectual data now being produced in so many lands and languages. Perhaps the time will come when department stores will retail economy-size portable translators for world travelers.

Hi-Fi Highlights
(Continued from page 87)



55

55 Stereo power amplifier has twin level controls. Metered output and balancing on both channels. Grommes.



56

56 Dual 20-watt power amplifiers and preamps on a single chassis. Scott Model 299 has stereo balance control, loudness control, and phase reverse switch.



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Transistor Topics

(Continued from page 84)

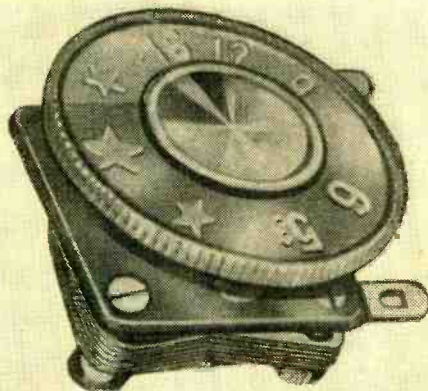
former's secondary winding is not used. The common emitter circuit configuration is employed in both stages.

Performance-wise, Paul's two-transistor receiver should have better sensitivity and much better selectivity than simpler two- and three-transistor sets, but its performance will not, of course, equal that of superhets containing four or more transistors. If sensitive earphones are used, the receiver should provide satisfactory reception of strong local broadcast stations using only its built-in antenna. For more distant . . . or weaker . . . stations, an external antenna should be connected to L1.

Oops!!! In our June column, we featured the circuit of a transistorized short-wave receiver submitted by reader Tom Keifer. The receiver used a type "1N876" diode. Although there are more than 2500 different types of diodes, the "1N876" is not an available type . . . as a result, we have been literally swamped with letters and post-cards from readers who have tried, quite unsuccessfully, to obtain this component.

Actually, any standard diode can be used in this circuit. Popular types such as the 1N34A, CK705 or 1N68 will give good results. As a general rule, any standard diode can be used as a detector in broadcast-band or short-wave receivers. Special-purpose diode types are needed only as u.h.f. mixers or in special-purpose, computer, industrial control, and military applications.

Low-Cost Power Transistor. Motorola (Semiconductor Div., Phoenix, Arizona)



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has introduced a low-cost power transistor which should be of real interest to experimenters, hams, and gadgeteers. With a maximum collector current rating of 3 amperes and a maximum collector dissipation (at 25°C) of 45 watts, this unit, Type No. 2N554, nets at only \$1.35.

A "2N554 Applications Bulletin" (a six-page folder) has been issued which includes complete circuits and parts values for nine interesting projects, including battery chargers, power supplies, model controls, audio amplifiers, a Geiger counter, and an electronic organ. Two of the circuits featured in the new booklet are given in Figs. 2 and 3 on page 84.

Figure 2 shows a single-ended class A audio power amplifier. This unit is capable of delivering two watts with 7% (or less) distortion. Power gain is approximately 34 db. D.c. power requirements are 12 volts at ½ ampere.

A useful d.c.-to-d.c. converter circuit is shown in Fig. 3. This converter may be used as an efficient B supply for small mobile transmitters, modulators, or receivers. It can be driven with either a 6- or 12-volt supply. With 6 volts input, the con-

verter requires approximately 1.5 amps., and delivers 125 d.c. volts at, approximately, 60 ma. With 12 volts input, supply current remains at 1.5 amps., but the unit supplies 250 volts at 60 ma. The two 2N554 power transistors serve as a push-pull oscillator. The resulting a.c. is stepped up by the power transformer, and then rectified by a full-wave bridge and filtered by a conventional *pi*-type LC filter network.

Product News. There are a number of interesting transistor items in Lafayette Radio's new catalog including a transistor receiver kit which uses rechargeable batteries and a separate sun battery. Among the new components is a 59¢ sub-miniature tuning capacitor, variable from 10 to 365 μfd .

The Semiconductor Products Division of General Electric Co. has issued the Third Edition of its *Transistor Manual*. Selling for one dollar, this book is chock-full of practical transistor circuits, design information, transistor specifications and other valuable data.

That's the story for now, fellows. See you next month. . . .

Lou

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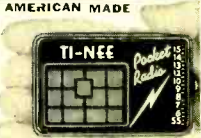
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Among the Novice Hams

(Continued from page 89)

the coupling capacitor*, which also serves to block the high d.c. plate voltage from the grid. Further amplification of the signal takes place in the second tube. The grid resistor of the second tube, which usually has a resistance of about 500,000 ohms, completes the circuit from grid to ground.

The output of the second tube may be fed to another stage for further amplification or to a loudspeaker or similar device through a suitable matching transformer.

Cathode Biasing. Going back a bit, the signal currents flowing through the cathode resistors would produce an audio-frequency voltage across them if it were not for the cathode bypass capacitor across each of them. These capacitors provide an easy path for the a.c. audio signal around the resistors, leaving only the direct current to flow through the resistors. If the bypass capacitors were omitted, the amplifier would still work, but its ability to amplify signals would be reduced.

The plate supply bypass (or decoupling) capacitor returns the audio signal appearing at the bottom of the plate resistor directly to ground instead of forcing it to take the long path through the power supply which is common to both tubes. This eliminates possible interaction between the two stages which might cause the amplifier to squeal or motorboat.

Both resistance coupling and cathode biasing can be used only in amplifiers where the average plate current does not vary with signal.

Class A Power Amplifier. Two power amplifier tubes can be connected either in parallel or in push-pull class A. For parallel operation, the corresponding elements of the tubes are connected together, and the combination is operated as if it were a single tube.

Figure 2 shows a transformer-coupled push-pull audio amplifier. Battery bias is used for discussion, although cathode bias is equally suitable for class A amplification and is usual in practice.

In operation, the input signal is applied to the primary of the input transformer and is inductively coupled to the center-tapped secondary winding. Because of the center

*Capacitor is the technically correct term, but condenser is also used in the exam questions.

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tap, when a "positive-going" signal is applied to one grid, a "negative-going" signal is applied to the other. Consequently, the instantaneous plate current of the first tube increases, and that of the second one decreases, with the action reversing on each half cycle of the input signal.

These instantaneous plate currents combine in the center-tapped primary of the output transformer and are then inductively coupled to its secondary winding, which feeds the load circuit, whatever it might happen to be.

One advantage of push-pull operation of an audio-frequency amplifier is that it tends to cancel out even harmonic distortion in the output signal (all tubes produce some distortion); therefore, compared to single-ended operation, distortion is slightly less for the same power output.

A class A power amplifier has a plate-circuit efficiency of about 25%. In practical amplifiers, it requires about four watts of d.c. power for each watt of output signal. This is obtained only when power output is maximum. When a class A amplifier is not delivering an output signal, its entire plate power input is dissipated as heat. This low

efficiency becomes an important factor in high-power installations, because of the size of the tubes required.

Class B Amplifiers. Referring to Fig. 2, suppose we increase the grid bias until the no-signal plate current is reduced almost to zero. Then, if we apply a signal to the grid circuit, the grid receiving the positive-going signal will cause the tube's plate current to increase in step with the grid signal.

However, the plate current of the tube receiving the negative-going portion of the signal cannot be decreased appreciably, because it is already almost zero. On the next half cycle of the exciting signal, the plate current of the second tube increases while that of the first one rests.

As a result, one tube delivers a signal to the output transformer on one half cycle, and the other tube delivers a signal to it on the opposite half cycle. The two half cycles combine in the transformer primary to reproduce a replica of the original grid signal.

In technical language, the output waveform of the signal from a Class B amplifier is a replica of the positive half of the input signal. Thus, it requires two tubes in push-

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pull to reproduce both halves of the input signal, unlike the class A amplifier which can be single-ended (using one tube).

Because the plate current of a push-pull, class B audio amplifier is low with no signal, the tubes won't cook without drive voltage. Also, by driving the amplifier from a source capable of supplying some audio power without distortion, the grids can be driven as far positive as will continue to increase the plate current linearly. This will give maximum output from the amplifier, but the grids will draw current on excitation peaks. This current must be furnished by the preceding amplifier stage.

The theoretical efficiency of a class B amplifier is more than 50%. Combined with the fact that the tubes get a chance to cool off when not delivering maximum power, this permits a pair of tubes to deliver five or six times as much power as class B amplifiers as they can deliver as class A amplifiers. Class B audio amplifiers are frequently used as modulators in amateur and commercial transmitters and other high-power audio installations.

Our next episode on vacuum tubes will cover radio-frequency amplifiers, class C operation, and multi-grid tubes.

News and Views

Rus, K9LXV, worked 27 states on one frequency in the 40-meter Novice band in his 83-day Novice career, using a "souped up" Johnson Adventurer transmitter and two receivers—a surplus ARC-5 and an old Howard 430. Rus will make a schedule with anyone wishing one and offers to help prospective amateurs get their licenses . . . **Paul, KN8III/K8III**, has just received his Technician Class license. So far, as a Novice, he has worked the 48 states, with 42 confirmed. He is waiting for cards from South America and Africa, so that he can apply for a WAC (Worked All Continents) certificate. KN8III uses a WRL Globe Chief transmitter at 75 watts input feeding a dipole on 40 meters and a three-element beam on 15 meters. He receives with a Hallicrafters S-85.

Jake, W6GCU, now has his General after about 150 contacts as a Novice. He spends most of his time on 40 meters and makes an occasional sortie to 15 meters. Jake uses an Adventurer transmitter and a Hammarlund HQ-110 receiver. Since getting his General, he has added a Knight VFO to his equipment. Jake also offers to help prospective hams get their licenses . . . **Ray, KN4UQA**, has made over 200 contacts in 31 states (all confirmed) with his Knight 50-watt transmitter feeding a 15' high, 40-meter dipole. He receives with a Hallicrafters S38-E.

George, KN9KYS, hopes the "N" is gone from his call letters by the time you read this. Operating on 40 and 15 meters with a Knight

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transmitter running 60 watts and a Hallcrafters SX-99 receiver, George has made 283 contacts in 40 states and Puerto Rico in six months on the air. His antenna farm has sprouted a two-element 15-meter beam, a 40-meter dipole, a "beer-can" vertical, and a 300' "long wire" so far . . . **Frank, W1WJY**, offers to schedule any of the gang needing a Rhode Island QSL card. He runs 65 watts on the usual c.w. bands, and he will keep trying until the contact is made, even if it takes three months . . . **Keith, KN2RXI**, has been on the air for three months with his "Sandwich Box" transmitter (March, 1956, POPULAR ELECTRONICS) running nine watts and

Citizens Radio Service

Effective September 11, 1958, the Federal Communications Commission reallocated the 26.96-27.23 mc. (11-meter) band from the amateur service to the Citizens Radio Service. A class C citizens license is available for radio control of model aeroplanes and similar applications to any citizen at least 12 years old. A class D license, available to citizens at least 18 years old, authorizes radiophone operation. Maximum power, with one minor exception, is 5 watts for either license. Concurrently, several modifications in the regulations governing the 460-mc. Citizens band were made.

Form 505, available from FCC, Washington 25, D. C., or regional offices, is used to apply for a Citizens Radio Service license. Part 19 of the Commission rules, containing the appropriate rules, will be available shortly in pamphlet form from The Superintendent of Documents, Government Printing Office, Washington 25, D. C., for a nominal fee.

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feeding a 40-meter dipole antenna, abetted by a Hallicrafters S-20R receiver which sports a Q-Multiplier. Keith has made 50 contacts and has a 60% QSL return.

Joe, KN5QJR, also uses a "Sandwich Box."

In two months, he has made over 100 contacts in 17 states. Six of the states and 25 of the contacts were on Field Day under the call of KN5QFL/5, using a borrowed 300-watt emergency power generator. "No thrill like a Field Day," says Joe. Joe was 19th in the Boy's Life Listening Contest this year, and he has heard hams in over 150 countries in one year of SWL'ing . . . **Byron G. Wells** wishes to thank the many, many fellows who have volunteered to teach him code and help him get his license since his name appeared in the "Help Wanted" column. However, Byron happens to be K2AVB, a very fine technical writer—among his works is a book on ham radio—and he teaches ham radio in the Levittown, N. Y., Adult Education program. Some of the operators who wanted to help were graduates of his classes! I wonder if all the fellows who went out of their way to try and help him thought the joke was as funny as the fellows who submitted Byron's name to the column in the first place.

Willi, K2TSW, suggests that Novices do not depend too much on claims like "transmitter X worked all continents, transmitter Y

Always say you saw it in—POPULAR ELECTRONICS

worked 100 stations, and transmitter Z worked miracles." The statements are all probably true, but Willi points out that it is usually the antenna that makes the difference. Willi runs 85 watts to a Globe Chief, plate-modulated, to feed a 40-meter folded dipole antenna, and he receives on an RME-4350A receiver. He has worked all states, all continents, and 28 countries, all on phone . . .

Joe, KNØMPL, operates 80, 40, and 15 meters. His favorite is 15 meters. He uses a WRL Globe Chief 90-A transmitter to feed a 15-meter folded dipole antenna, which he uses as a random-length antenna on 80 and 40 meters. Joe receives with a Hallicrafters S-38D, to which he has added a Heathkit Q-Multiplier and an antenna coupler (POPULAR ELECTRONICS, November, 1957) with improved results. In three months on the air, KNØMPL's record is 150 contacts in 30 states, 28 confirmed. Joe has passed his General Class examination and offers to help prospective amateurs obtain their licenses. He also reports that the St. Paul, Minn., Radio Club meets the first Friday of each month at Navy Island and offers Novice code and theory classes.

Bill, K4RDY, worked 28 states as a Novice on 80 meters. He uses a home-brew transmitter running 60 watts to a 6146 and receives on a Heathkit AR-3 reinforced with a Q-Multiplier . . . **Mike, K4PPK**, was a Novice for 11 months, working all states and seven countries in that time. He adds to the interference with a Heathkit DX-35 and listens to it with a Hallicrafters SX-99 receiver. Although now a General, Mike still likes to rag-chew with Novices and offers to help prospective amateurs . . . **Ron, KN8HSP**, has worked 42 states on 80 meters using a Heathkit AT-1, a 135' end-fed antenna, and a BC-348 receiver . . . **Bill, KN5QXF**, has made 53 contacts in 10 states as a Novice using his Globe Chief 90-A transmitter and two receivers—a National NC-46 and a surplus BC-342N. Bill is a member of the Military Affiliate Radio System (MARS) with the call sign AAF5QXF.

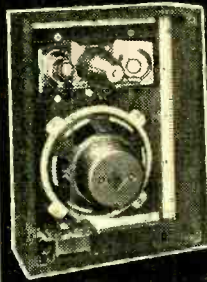
Contributors to News and Views: **Russell A. Beard, K9LXV**, R.R. #2, Mt. Carmel, Ill.; **Paul D. Wolfe, KN8III**, Route 87, Novelty, Ohio; **Jacob Jacobs, W6GCU**, 3019 El Monte Ave., Oakland 5, Calif.; **Ray Linnville, KN4UQA**, 1106 E. Tunis St., Pensacola, Fla.; **George Charles, KN9KYS**, 6047 Kensington,



Bob Riseman, KNIDEY, of Chestnut Hill, Mass.

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din (16), K4PPK, 1400 Exeter Ave., Middles-
boro, Ky.; Ron Snyder, KN8HSP, 524 Rosedale,
Detroit, Mich.; Bill, KN5QXF, Box 265, Shaw,
Miss.

I hope to be hearing from you before next
month. 73,

Herb. W9EGQ

Short-Wave Report

(Continued from page 85)

regulations which do not permit the con-
tents of transmissions to be divulged by
(or to) anyone not authorized. The FCC
has a penalty for anyone who wilfully vio-
lates this regulation.

Keep in mind that it is *not* against the
law to listen to the telephone stations but
that it is a definite violation to divulge to
anyone anything that you hear while you
are tuned to them. Other stations to which
these regulations apply are those in the
coastal services (ship-to-shore) which can
be heard from 2500 to 2600 kc. and in the
4000-kc. band.

Current Reports

The following is a resume of the latest re-
ports received. All times shown are Eastern
Standard, and the 24-hour system is used.
Stations change frequencies and schedules
with little or no advance notice, but all re-
ports are correct at time of compilation. We
hope you will understand if your report does
not appear in this listing—we have more re-
ports than we have space to put them.

Algeria—R. Algeria has been found at 1645
with s/off in French on a new 11,715-kc.
channel. (420)

Argentina—LRA, R. Nacional, Buenos Aires,
9690 kc., has Eng. to eastern N.A. Monday
through Friday at 2200-2300, and to western
states at 0000-0100. Programs consist largely
of news, music, and talks about the Argentine
theater. (WS, 286)

Australia—R. Australia, Melbourne, fea-
tures "My Song Goes 'Round The World" and
"Australia Calling DX'ers" on Sundays at
0715-0845 on 11,810 kc. This xmsn is usually
well heard over most of the USA, particularly
the eastern areas. (JC, RP)

Belgian Congo—OTC, Leopoldville, 9655 kc.,
is usually excellent when relaying ORU, Brus-
sels, on Sunday, Monday, Tuesday, Thursday
and Friday at 1930-2000. It features good
dancing and listening music, and frequent an-
nouncements in English. (61, 104)

OTH, Leopoldville, 9210 kc., has been tuned at 0045 in the African Service beamed to the Belgian Congo and Urundi Urundi. (LM)

Brazil—What was formerly *Radio Nacional* now ID's as *Radio Nacional do Brasilia* and is noted evenings on 11,720 kc. Brasilia is a new city and is reported to be the future capitol of Brazil. (396A, 420)

The 11,925-kc. outlet, ZYR78, *R. Bandeirantes*, Sao Paulo, has music and many commercials from 1940 to 2004. An announcement noted just prior to the 2000 newscast, "O Sociedade Ipiranga Informa," may confuse listeners who may believe that *R. Piritinanga* has moved to this channel. (396)

R. Tupidro, Rio de Janeiro, has been found on 9650A kc. at 1930-2040 with music and sports in Spanish. This may be a relay of *R. Tupi*. Further details wanted. (JB)

British Honduras—VPO, Belize, has been noted on 4900 kc. at 2230 with Eng. news. (DA) (Editor's Note: The call VPO is often given for this station and it is incorrect. VPO is assigned to a coastal station in the Bahama Islands. The former call of the Belize station was ZIK2 and now appears to be merely BHBS, the initials for the *British Honduras Broadcasting System*.)

Canada—According to *World Radio Handbook*, VE9AI, Edmonton, Alberta, 9540 kc., has ceased operations. This is not confirmed as yet. Is anyone, especially in Western areas, hearing this station?

R. Canada has dropped CHOL, 11,720 kc., in its Australasian xmsn at 0330-0410 and has

added CKNA, 5970 kc., which operates dual to CKLO, 9630 kc. This xmsn is well heard on both channels. English is broadcast to the USA at 2000-2040 on CKCX, 15,190 kc., and CKLP, 9585 kc. Program schedule is free upon request; they also print free forms on which listeners can report reception of *R. Canada's* xmsns. (PB)

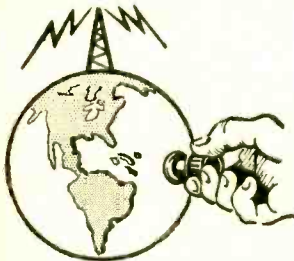
Chile—*R. Diego Portales*, Talca, is a new station operating on 6020 kc., 10-kw. power, at 0700-0000. The address is: Uno Norte No. 1075, Talca. (WRH)

China—*R. Peking* has Eng. on 15,480 kc. at 1400-1430 with news, talks, march music, and a strong signal in Western states, and is beamed to North Africa and the Near East. English continues at 1430, beamed to Europe. The remainder of the schedule reads: Chinese to North Africa and the Near East at 1500-1530; Spanish at 1530-1600 and Chinese at 1600-1630 to Europe; English to Europe at 1630-1700. The dual channel is 15,060 kc. until 1500. Another outlet has been found on 6810A kc. with news in Chinese at 0645-0700. (61, 226) (Editor's Note: The China Press Agency has a listed frequency of 6800 kc.)

Colombia—Anyone who does not have a verie from this country should try for *La Voz del Tolima*, HJLV, Bogota, on 6040 kc. It is heard well from 2130 (or earlier) to 2300 with music, announcements, and commercials, all in Spanish. The ID is fairly easy to catch, as are the call letters in Spanish (ah-chay, hoy, el-lay, vay). (LM)

Czechoslovakia—Prague has Eng. to Eu-

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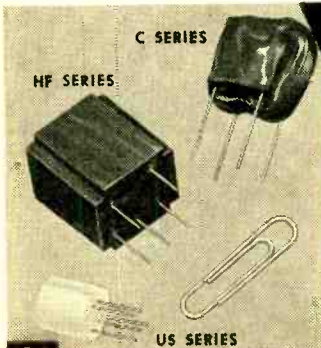


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rope at 1800-1830 on 6055 and 9550 kc. and to N.A. at 2030-2100 on 9550 and 11,835 kc. (MR)

Denmark—A Danish commercial station, *R. Mercur*, Maltegaardsvej 24, Gentofte, Denmark, will go on the air in the near future. *R. Mercur* will operate a 3500-watt xmtr on ultra short-wave, on 93,120 kc., from a ship in the Baltic Sea, and will be scheduled daily at 1200-1800. Behind this station is *Internationale Mercur Radio Anstalt Lichtenstein*, Zurich, Switzerland. (*Sweden Calling DX'ers Bulletin #456, via 44*)

R. Denmark, Copenhagen, operates to N.A. daily at 2030-2130 and 2200-2300 and to South America at 1800-1900 on Mondays, Wednesdays and Fridays. Other broadcasts include: 0400-0700 on Tuesdays, Thursdays and Saturdays to the Far East; and 1140-1240 on Tuesdays and Fridays to Africa. (409, 440)

Ecuador—A recent issue of *Sweden Calling DX'ers* reports that HCJB, Quito, has moved from 11,915 to 11,935 kc. Whether this is seasonal or permanent is not known. (JB)

Falkland Islands—To date the only report received on Stanley, 3958 kc., is from reporter #61. His recent logging of the station was from 1815 to 1912 although it was heavily broken up at times. Features include weather shortly before 1830 and news apparently starting at 1830. From 1900 they have a musical request program. Ham radio QRM makes this extremely difficult to log. Try a vertical antenna mixed with a great deal of patience!

Finland—The N.A. xmsn at 2200-0000 can be tuned on OIX2, 9555 kc., OIX4, 15,190 kc., and OIX5, 17,800 kc. The DX program, "Around the World," is aired on 17,800 and 15,190 kc. at 2300-2330 on the first Tuesday of each month. (409)

Formosa—*The Voice of Free China*, Taipei, is on the air daily at 0000-0100 (Eng. until 0030) on 17,810 kc. (BED63), and 15,345 kc. (BED57). They QSL promptly. (DA)

French Guiana—*R. Cayenne*, 6215 kc., comes in strong with French and pop music, daily, from 1930 to 2000 s/off. (104)

This station is scheduled at 1730-2200, 0400-0430, and 0930-1200 with 1-kw. power. Another kilowatt unit will be added shortly and operations will then begin on 6195, 4972.5, and 3385 kc. (MEC)

French Morocco—*Radio Maroc*, Sebba Aioun (not Rabat), has been noted at 0300-0335 in French with Arabic instrumental music and chanting, on 6006 kc. (61A)

Germany—*The Voice of Germany (Deutsche Welle)*, Cologne, has a DX program at 2100-2110 on 11,795 kc. on the second Monday of each month. All items are given in German and English. (336)

Ghana—Ghana B/C System, Accra, may be heard at 0100-0200 on 4915 kc. with Home and BBC news. The parallel 3366-kc. outlet was not heard. (344)

Greece—*Radio Athens* has been tuned on 15,345 kc. at 2040-2100 with election reports in Eng. despite an airmail letter from them stating that they were not on the air at that time. (LM)

Indonesia—*Voice of Indonesia*, YDF6, 9710 kc., Jakarta, is heard daily at 0600-0700 in Eng. with news at 0615, and is beamed to

Australia, New Zealand, Pacific Isles. (364)
Iran—R. Teheran has been noted on 15,135 kc. with Eng. news until 1520. Recorded music followed. This is a definite move from the listed 15,100-kc. channel. (420)

Israel—Voice of Zion, Jerusalem, 9008 kc., is heard well at 1600-1700 with Eng. news, recorded music, and discussions. They have also been found on a new outlet on 11,845 kc., apparently in parallel with the 9008-kc. outlet. Reports go to: Box 754, Jerusalem. (JF, PK, 420)

Kenya—ZHW2, Nairobi, 4934 kc., s/on at 0400 with music box IS and brief Eng. anmt; noted until 0430; all programs are broadcast in Swahili. (61A)

Malaya—R. Malaya, Singapore, 7200 kc., is heard well at 0700-0830. On Thursdays at 0800-0830 they have a program called "Your Number Is Up." (409)

Mozambique—CR7BG, Lourenco Marques, new on 15,158 kc., is tuned at 0000-0027 with records of all types, Portuguese anmnts, and male and female announcers. (396)

Netherlands—Hilversum is partially scheduled as follows: 2130-2210 and 1615-1655 on 9590 and 15,445 kc.; 0400-0440 to Australia, New Zealand and Pacific Isles on 21,480 and 17,810 kc.; 1045-1125 to South Asia and Africa on 21,480, 17,810, and 15,445 kc. All of these xmsns are in English. They are asking for reports on the 25,610-kc. outlet, in service at 0400-0440 daily except Sundays. They offer free plans for a small converter that will enable broadcast-band receivers to tune in short-wave frequencies. (BA, DA, CM)

Nicaragua—YNCA, R. Atlantico, Bluefields, 7754 kc., is noted at 1830-1930, all-Spanish,

Cuban Radio Club

Francisco E. Martinez, CO2PY, Animas 81, Casa Blanca, Havana, Cuba, writes that the Cuban Radio Club is starting a Short-wave Listener Section and that he is the Director of this project. Anyone interested in contributing to this club should write to: *Seccion Onda Corta, Radio Clube de Cuba*, Ayestaran 629, Havana, Cuba.

with instrumental melodies and commercial ads; usually a poor signal. (61)

Nigeria—Nigerian B/C Company (Ibadan Service) was heard on 4990 kc. at 0031 in language and at 0101 with BBC news. This station reportedly will verify *only* to listeners in West Africa. Can anyone confirm this report? (286)

Norway—Oslo broadcasts: to Eastern N.A. daily at 2000-2115 in Norwegian, and on Sundays with "Norway This Week" in Eng. on 9610, 11,735, and 15,175 kc.; and to western states at 2300-0015 on the same channels, plus 21,670 kc. (RD, CL)

Panama—HOF31, *Reloj de Panama*, Panama City, 9685 kc., was noted with news at 2330-0005. The time and ID is given every minute. HOU31, *Voz del Baru*, David, has been found on 6045 kc. at 2145 with L.A. music and commercials, all-Spanish. (LM, 344)

Peru—OBX4C, Lima, 15,190 kc., is noted at

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2200 with news and music. OAX4R, *R. Nacional*, Lima, 9562 kc., is tuned at 1930-2000, mostly music. (*JH, WS*)

Sarawak—Kuching is scheduled as follows: on 9565 kc., 7500 watts, at 2300-0000 in Malayan (Mondays and Wednesdays), in Chinese (Tuesdays and Fridays), in Eng. (Mondays, Thursdays and Saturdays), at 0000-0030 in Eng. (daily), at 0030-0130 in Eng. (Saturdays and Sundays), and at 0415-0545 in Chinese (daily); on 4950 kc., 7500 watts, at 0600-0730 in Iban, 0730-0900 in Chinese, and

SHORT-WAVE ABBREVIATIONS

A—Approximate frequency
anmt—Announcement
BBC—British Broadcasting Corporation
B/C—Broadcast
Eng.—English
FCC—Federal Communications Commission
ID—Identification
IS—Interval signal
kc.—Kilocycles
kw.—Kilowatts
L.A.—Latin America(n)
N.A.—North America(n)
QRM—Station interference
R—Radio
s/off—Sign-off
s/on—Sign-on
xmsn—Transmission from station
xntr—Transmitter used by station

0900-0930 in Eng. (all daily); on 4860 kc., 5 kw., at 0330-0530 in Malayan, 0530-0700 in Eng., 0700-0800 in Malayan and 0800-0930 in English (all daily). (378)

South Korea—*The Voice of Free Korea*, HLKA, Seoul, 9638 kc., is often noted around 0430-0500 with Eng. news, talks, and classical music. (386)

Turkey—*R. Ankara* has Eng. to Europe at 1800-1845 on 9465 and 15,160 kc. Their mail-bag program is aired on Sunday. (MR)

USA—*Broadcasting Magazine* reports that a permit has been issued by the FCC to KGEI, Belmont, Calif., to construct an international short-wave station. This former General Electric station is now owned by KGEI, Inc. Indications point towards a schedule of 47½ hours per week beamed to Central and South America. WRUL, Scituate, Mass., and KQ2ZAU, Cincinnati, Ohio, are also authorized international stations—others are government installations operated by the U. S. Information Agency. (URDXC)

The U. S. Signal Corps verifies reports of "moon bounce" xmsns. They feed 1.2 megawatts (1,200,000 watts) into a parabolic antenna on 108 megacycles, using code or frequency modulation, and on 151.11 mc. with pulse modulation and code. They ID in code. Reports go to *Diana*, c/o Radio Electronics, 154 West 14th St., New York 11, N. Y. (WR)

USSR—A new channel for *Radio Moscow* is 15,235 kc., noted at 1330-1630 in Eng. to Europe. (61, 63)

R. Tashkent has two daily xmsns in Eng. at 0700-0800 and 1130-1200 on 11,690 and 7100 kc. The mailbag can be heard on Saturdays only. (AR)

Vatican City—*R. Vaticana* is scheduled in Eng. at 1000 and 1315 daily on 9645, 11,685 and 15,120 kc., and at 1100 on Monday, Wed-

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nesday and Saturday on 15,120 and 21,740 kc. to India, Pakistan and Ceylon. They verify by airmail. (AR)

Venezuela—YVOG, R. Trujillo, 3295 kc., is heard very weakly at 0625 with chimes, anmts in Spanish and march music, and at 0630 with organ music and news. (396)

YVKT, R. Libertador, Caracas, 3245 kc., is noted at 1840-1900 in Eng. with pop music, talk, and many ads. Hard to hear in the south, this would be a good catch for listeners in northern and western areas. (344)

A station with the name *Radio Niamey* is reportedly operating on 5020 kc. Schedule and exact location (Venezuela?) is requested. (Editor)

Clandestine Arab Stations—The following have been noted recently: (1) unidentified station on 9455 kc. at 1300-1600 with Arabic music and on 6110 kc. at 1600-1800; (2) the pro-Hashimite *Voice of Iraq (Sawt al-Iraqiyah)* on 9553 kc. at 0000-0100, 0500-0600, and 1000-1100A; (3) the anti-Shamun *Voice of Free Lebanon (Sawt al-Lubnan al-hurr)* on 6028 and 12,000 kc. at 0000-0100 and 1200-1300; (4) the anti-Hashimite *Jordan People's Radio (Mahattat ash-sha'b al-Urduni)* using

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James Howard (440), Kansas City, Mo.
Universal Radio DX Club (URDXC)
World Radio Handbook (WRH)
A Middle East Correspondent (MEC)

6005 kc. at 0200-0300 and 1400-1500; (5) the pro-Government *Voice of Lebanon (Sawt Lubnan)* on 6580 kc. at 2330-0000, 0800-0830, 1230-1300 (in French), and at 1400-1430, and 1500-1530 (this is believed to be operated by the Lebanese Army, which previously broadcast on 6500 kc.); and (6) the anti-Shamun *Voice of the People (Sawt ash-Sha'b)* on 7209 kc. at 0500-0600, 1000-1100, and 1400-1500. As yet unheard stations include the *Voice of Arabism (Sawt al-Urubah)* and *Radio Torch (Huna mash'al)*. (MEC)

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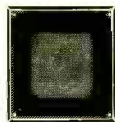
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NAVY Electronics training course, one of the finest compiled, is available to the public. Excellent electronics instruction for beginners. Designed especially for self-study. Used in training Navy Electronics technicians. 512 pages. 280 diagrams and illustrations. 16 thorough quizzes with answers. This is a high quality course, containing excellent writing, artwork and printing. An outstanding bargain made possible by U.S. Government Printing and Price Control. For your copy send \$2.00 to: New England Book Distributors, Box 311, Watertown, Connecticut.

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PHONOGRAPH Records cheap, postpaid. Catalogue. Paramount, Box 242-R, Williamsport, Penna.

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JOBS—High Pay; USA, So. America, The Islands. All Trades. Many companies pay fare. Write Dept. 71N, National Employment Information, 1020 Broad, Newark, New Jersey.

MISCELLANEOUS

SONGPOEMS And Lyrics Wanted! Mail to: Tin Pan Alley, Inc., 1650 Broadway, New York 19, N. Y.

EXTRAORDINARY Opportunity! Retire Now! Lead Leisurely Life. Remarkable Book Shows How. Free Details. Belmont, Wyckoff 92, New Jersey.

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The 276,000 purchasers of POPULAR ELECTRONICS are always in the market for good used equipment or components. So, if you have something to sell, let PE readers know about it in our classified columns.

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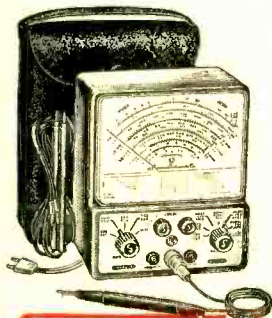
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Superior's New Model 77

VACUUM TUBE VOLTMETER WITH NEW 6" FULL-VIEW METER

Compare it to any peak-to-peak V.T.V.M. made by any other manufacturer at any price!



Model 77—Vacuum Tube Voltmeter—
Total Price \$42.50
Terms: \$12.50 after 10 day trial, then \$6.00 per month for 5 months

- Completely wired and calibrated with accessories (including probe, test leads and portable carrying case) sells for only \$42.50.
- Employs a sensitive six inch meter. Extra large meter scale enables us to print all calibrations in large easy-to-read type.
- Uses new improved SICO printed circuitry.
- Employs a 12AU7 as D. C. amplifier and two 0006's as peak-to-peak voltage rectifiers to assure maximum stability.
- Uses a selenium-rectified power supply re-

sulting in less heat and thus reducing possibility of damage or value changes of delicate components. • Meter is virtually burn-out proof. The sensitive 400 micro-ampere meter is isolated from the measuring circuit by a balanced push-pull amplifier. • Uses selected 1% zero temperature coefficient resistors as multipliers. This assures unchanging accurate readings on all ranges.

SPECIFICATIONS

- DC VOLTS — 0 to 3/15/75/150/300/750/1,500 volts at 11 megohms input resistance.
- AC VOLTS (RMS) — 0 to 3/15/75/150/300/750/1,500 volts.
- AC VOLTS (Peak to Peak) — 0 to 8/40/200/400/800/2,000 volts.
- ELECTRONIC OHMMETER — 0 to 1,000 ohms/10,000 ohms/100,000 ohms/1 megohm/10 megohms/100 megohms/1,000 megohms.
- DECIBELS: —10 db to + 18 db + 10 db to + 38 db. + 30 db to + 58 db. All based on 0 db = .006 watts (6 mw) into a 500 ohm line (1.73v).
- ZERO CENTER METER—For discriminator alignment with full scale range of 0 to 1.5/7.5/37.5/75/150/375/750 volts at 11 megohms input resistance.

AS A DC VOLTMETER: The Model 77 is indispensable in Hi-Fi Amplifier servicing and a must for Black and White and color TV Receiver servicing where circuit loading cannot be tolerated.

AS AN ELECTRONIC OHMMETER: Because of its wide range of measurement leaky capacitors show up glaringly. Because of its sensitivity and low loading, intermittents are easily found, isolated and repaired.

AS AN AC VOLTMETER: Measures RMS values if sine wave, and peak-to-peak value if complex wave. Pedestal voltages that determine the "black" level in TV receivers are easily read.

Comes complete with operating instructions, probe leads, and streamlined carrying case. Operates on 110-120 volt 60 cycle. Only

\$42.50
Net

The Most Versatile All-Purpose Multi-Range Tester Ever Designed!

Superior's New

Model 79

SUPER-METER

WITH NEW 6" FULL-VIEW METER

- A Combination VOLT-OHM MILLIAMETER.
- Plus CAPACITY, REACTANCE, INDUCTANCE, AND DECIBEL MEASUREMENTS.

- Also Tests SELENIUM AND SILICON RECTIFIERS, SILICON AND GERMANIUM DIODES.

The model 79 represents 20 years of continuous experience in the design and production of SUPERMETERS, an exclusive SICO development. It includes not only every circuit improvement perfected in 20 years of specialization but, in addition includes those services which are "musts" for properly servicing the ever-increasing number of new components used in all phases of today's electronic production.

- ANCE: 15 to 7 Henries, 7 to 7,000 Henries.
- DECIBELS: —6 to + 18, + 14 to + 38, + 34 to + 58.

The following components are all tested for QUALITY at appropriate test potentials. Two separate BAD-GOOD scales on the meter are used for direct readings.

- All Electrolytic Condensers from 1 Mfd. to 1000 Mfd.
- All Selenium Rectifiers.
- All Germanium Diodes.
- All Silicon Rectifiers.
- All Silicon Diodes.

- Specifications**
- D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500
 - A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000
 - D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
 - RESISTANCE: 0 to 1,000/100,000 Ohms. 0 to 10 Megohms.
 - CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd.
 - REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms
 - INDUCT-

Comes complete with operating instructions and test leads. Use it on the bench and on calls. Streamlined carrying case included, accommodates tester, instruction book and test leads. Only

\$38.50
Net

USE APPROVAL FORM ON NEXT PAGE

We invite you to try before you buy any of the models described on this and the following pages. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

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MOSS ELECTRONIC DIST. CO., INC. Dept. D-527 3849 Tenth Avenue, New York 34, N. Y.

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before you buy! **then** if satisfactory pay in easy, interest free, monthly payments. See coupon below.

Superior's New Model 82 **A truly do-it-yourself type**
TUBE TESTER

TEST ANY TUBE IN 10 SECONDS FLAT!

- 1 Turn the filament selector switch to position specified.
- 2 Insert it into a numbered socket as designated on our chart (over 600 types included).
- 3 Press down the quality button—

THAT'S ALL! Read emission quality direct on bad-good meter scale.

FEATURES:

- Tests over 600 tube types. • Tests OZ4 and other gas-filled tubes. • Employs new 4" meter with sealed air-damping chamber resulting in accurate vibrationless readings. • Use of 22 sockets permits testing all popular tube types and prevents possible obsolescence. • Dual Scale meter permits testing of low current tubes. • 7 and 9 pin straighteners mounted on panel. • All sections of multi-element tubes tested simultaneously. • Ultra-sensitive leakage test circuit will indicate leakage up to 5 megohms.

Production of this Model was delayed a full year pending careful study by Superior's engineering staff of this new method of testing tubes. Don't let the low price mislead you! We claim Model 82 will outperform similar looking units which sell for much more—and as proof, we offer to ship it on our examine before you buy policy.

Model 82 comes complete, housed in portable, hand-rubbed oak cabinet with removable cover. Only

\$36⁵⁰ Net



Model 82—Tube Tester
 Total Price \$36.50
 Terms: \$6.50 after 10 day trial, then \$6.00 per month for 5 months.

Superior's **STANDARD PROFESSIONAL**
 New Model **TUBE TESTER**
 TW-11

- Tests all tubes, including 4, 5, 6, 7, Octal, Lockin, Hearing Aid, Thyatron, Miniatures, Sub-miniatures, Novals, Subminars, Proximity Fuse Types, etc.

- Uses the new self-cleaning Lever Action Switches for individual element testing. All elements are numbered according to pin-number in the RMA base numbering system. Model TW-11 does not use combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.

- Free-moving built-in roll chart provides complete data for all tubes. Printed in large easy-to-read type.

NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier detects microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRAORDINARY FEATURE
SEPARATE SCALE FOR LOW-CURRENT TUBES Previously, on emission-type tube testers, it has been standard practice to use one scale for all tubes. As a result, the calibration for low-current types has been restricted to a small portion of the scale. The extra scale used here greatly simplifies testing of low-current types.

Housed in hand-rubbed oak cabinet

\$47⁵⁰ Net



Model TW-11—Tube Tester
 Total Price \$47.50
 Terms: \$11.50 after 10 day trial, then \$6.00 per month for 6 months.

We invite you to try before you buy any of the models described on this page, the preceding page and the following pages. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

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SEE OTHER SIDE

CUT OUT AND MAIL TODAY!

MOSS ELECTRONIC DISTRIBUTING CO., INC.
 Dept. D-527 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked on approval. If completely satisfied I will pay on the terms specified with no interest or finance charges added. Otherwise, I will return after a 10 day trial positively cancelling all further obligation.

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Superior's New Model 76

ALL PURPOSE BRIDGE

IT'S A CONDENSER BRIDGE
IT'S A RESISTANCE BRIDGE

✓ **CAPACITY BRIDGE SECTION**
4 Ranges: .00001 Microfarad to .005 Microfarad; .001 Microfarad to .5 Microfarad; .1 Microfarad to 50 Microfarads; 20 Microfarads to 1000 Microfarads. Will also measure the power factor of all condensers from .1 to 1000 Microfarads.

✓ **RESISTANCE BRIDGE SECTION**
2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms.

✓ **SIGNAL TRACER SECTION**
With the use of the R.F. and A.F. Probes included with the Model 76, you can

IT'S A SIGNAL TRACER
IT'S A TV ANTENNA TESTER

make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc.

✓ **TV ANTENNA TESTER SECTION**
Loss of sync., snow and instability are only a few of the faults which may be due to a break in the antenna, so why not check the TV antenna first? Locates a break in any TV antenna and measures the location of the break in feet from the set terminals.

Complete with R.F. and A.F. probes and test leads **\$26⁹⁵ Net**



Model 76—All Purpose Bridge
Total Price **\$26.95**
Terms: \$6.95 after 10 day trial, then \$5.00 per month for 4 months.

Superior's New Model TV-50A **GENOMETER**

7 Signal Generators in One!

- ✓ R.F. Signal Generator for A.M.
- ✓ R.F. Signal Generator for F.M.
- ✓ Audio Frequency Generator
- ✓ Marker Generator

- ✓ Bar Generator
- ✓ Color Dot Pattern Generator
- ✓ Cross Hatch Generator

This Versatile All Inclusive GENERATOR Provides ALL the Outputs for Servicing:

- A.M. RADIO • F.M. RADIO • AMPLIFIERS • BLACK AND WHITE TV • COLOR TV

R. F. SIGNAL GENERATOR: 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: Provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

MARKER GENERATOR: The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency.)

BAR GENERATOR: Pattern consists of 4 to 16 horizontal bars or 7 to 20 vertical bars.

DOT PATTERN GENERATOR (FOR COLOR TV): The Dot Pattern projected on any color TV Receiver tube by the Model TV-50A will enable you to adjust for proper color convergence.

CROSS HATCH GENERATOR: The pattern consists of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect. **\$47⁵⁰ Net**
Complete with shielded leads



Model TV50-A—Genometer
Total Price **\$47.50**
Terms: \$11.50 after 10 day trial, then \$6.00 per month for 6 months.

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