special Report on 'Electronic Hypnosis''

POPULAR ELECTRONICS

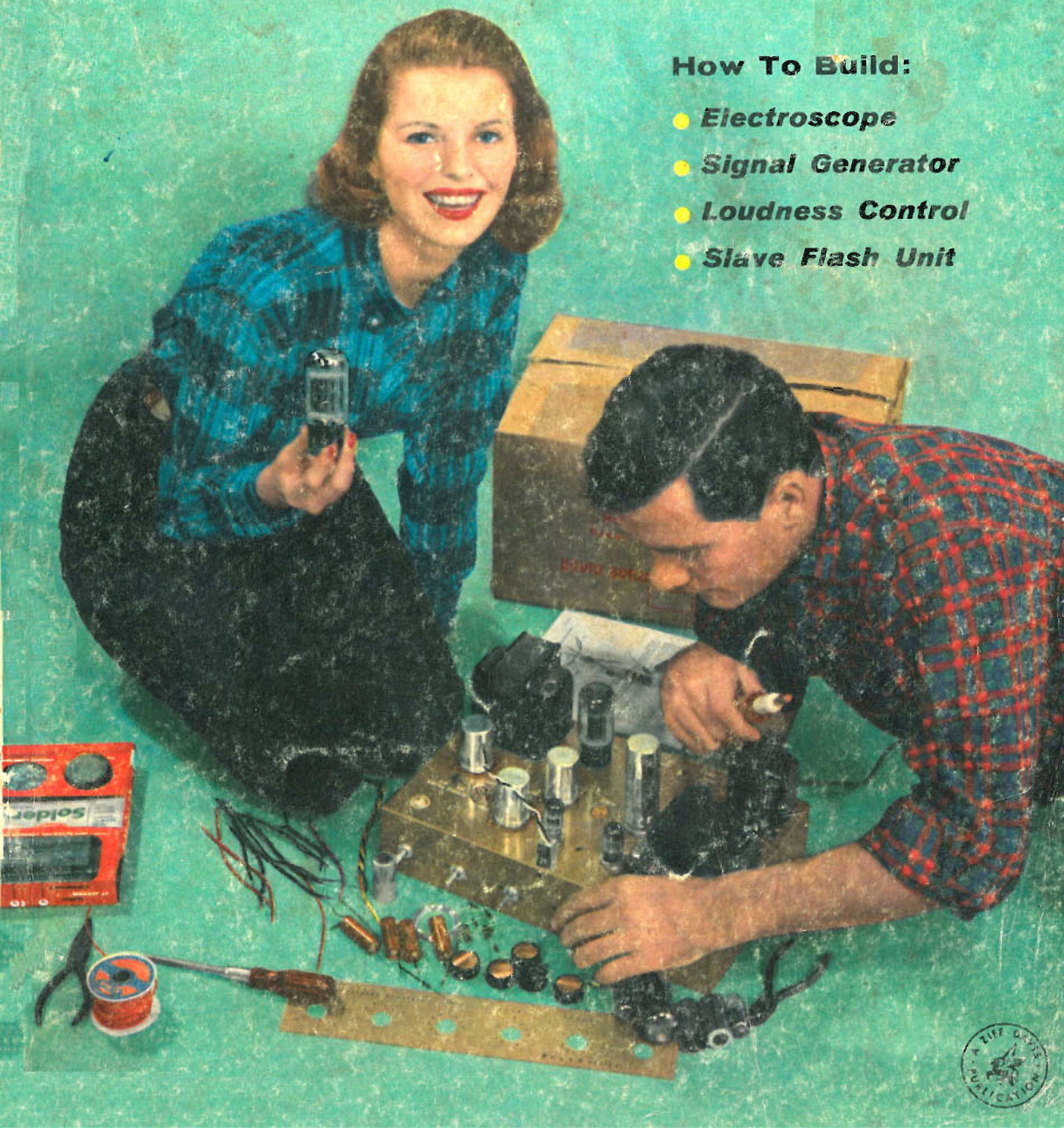
APRIL 1957

35 CENTS

Selecting Your Hi-Fi Kit

How To Build:

- *Electroscope*
- *Signal Generator*
- *Loudness Control*
- *Slave Flash Unit*



A ZIFF-DAVIS PUBLICATION

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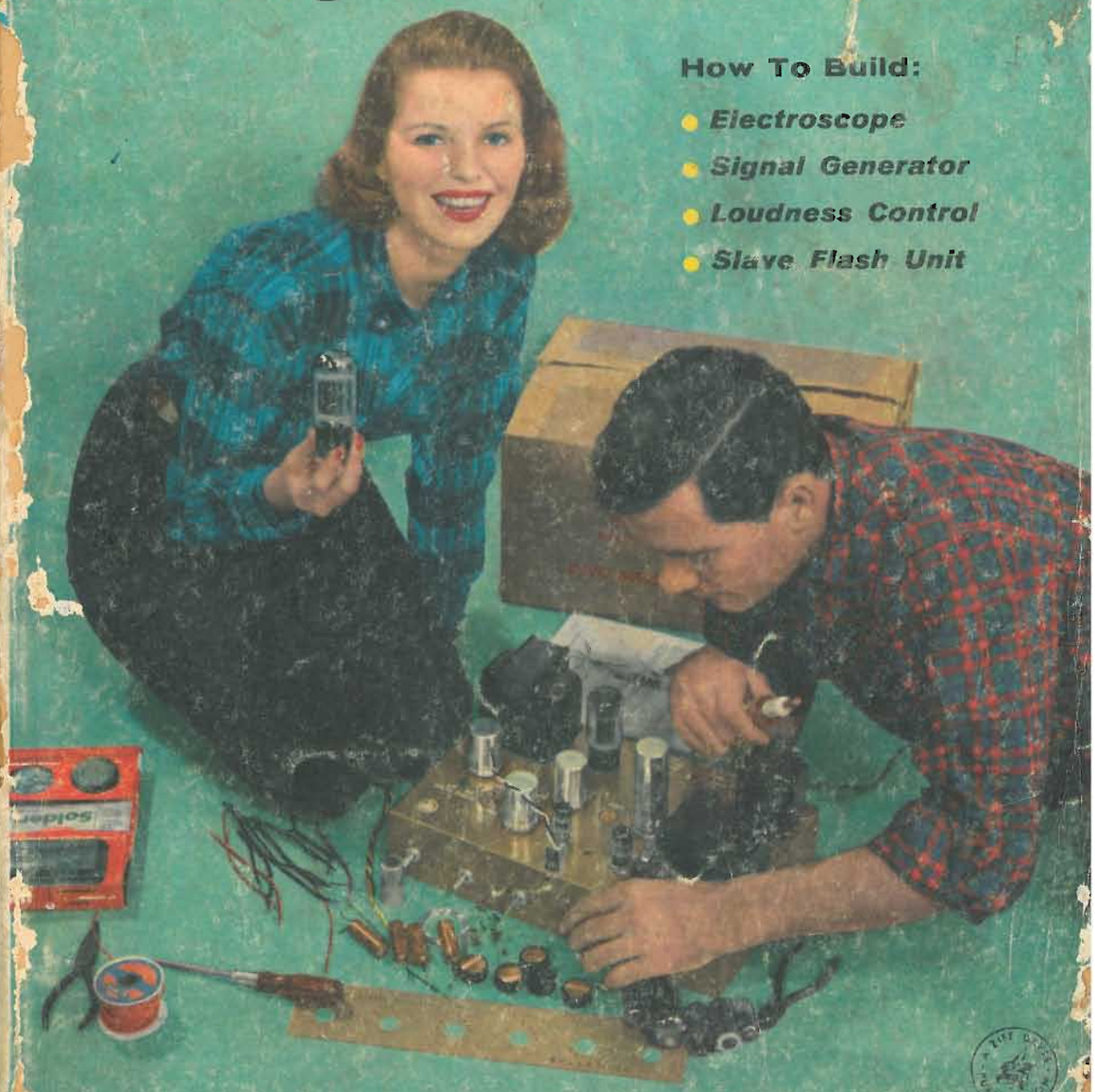

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POPULAR ELECTRONICS

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DEPARTMENTS

COMING NEXT MONTH (MAY)

(ON SALE APRIL 18)

The lead article in the May issue will develop a theme of tremendous interest to small boat owners. It is the use of aeronautical beacons (in the 200 to 500 kc. range) as a means of finding your way while on the water. "Robbie" Robberson, a well-known author on electronics and boating, has come up with several unusual ideas.

Hi-fi commands quite a bit of interest in May with a feature article on making a simple "Bell" wire crossover, plus another in Len Feldman's series—this one on a scratch and rumble filter.

Experimenters will like the six-transistor superhet that is surprisingly easy to assemble, the electronic fishing worm extractor, and many other projects.

IN THIS MONTH'S

RADIO & TV NEWS
(APRIL)

Why Loudness Controls?
Conelrad the Easy Way
Photoflash Synchronizer Checker

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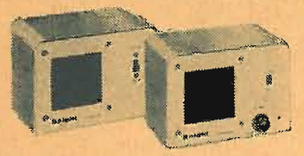

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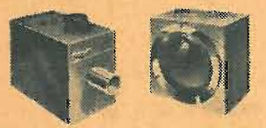

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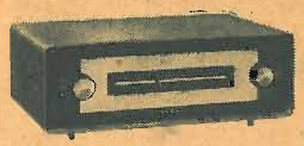

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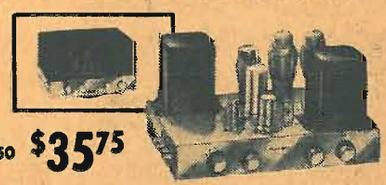

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By JOHN T. FRYE

Strange Voices

A SPRING THUNDERSTORM was going on outside as Carl burst into Jerry's basement laboratory.

"A great day for ducks!" was his unoriginal observation as he tossed his dripping slicker into a corner and walked over to where Jerry was listening on a pair of earphones plugged into a tape recorder.

"Hey, what are you up to?" Carl demanded, rudely lifting one earphone and shouting into his chum's ear. And, what's that crummy-looking loop antenna got to do with it?"

"I'm listening for 'whistlers'," Jerry announced, with a teasing grin on his face.

"If you think I don't dig what you're talking about, you're off the beam," Carl retorted. "I read those articles back in the December, 1956, issue of POPULAR ELECTRONICS. I'm a little hazy on the whole thing now, though. Refresh my memory. What *are* whistlers?"

"Whistlers are sounds produced by detecting the echoes of very-low-frequency radio waves emanating from lightning strokes in the vicinity of the detecting device and being returned from some point in the southern hemisphere," Jerry recited in a monotone. Obviously he had given considerable thought to this definition and was proud of it. "When there's a flash of lightning, the electromagnetic pulse produced describes a high arc into interplanetary space, following the curve of the earth's magnetic lines of force, and comes down somewhere in the southern hemisphere. Then it immediately starts retracing its exact path and returns to the vicinity of the lightning stroke. On the return trip, it produces a weak audio signal which—when tremendously amplified—is heard as a spooky sliding-down-scale note."

"What kind of a setup do you need to hear whistlers?"

"According to the article in POP'tronics, the one I have here should do it. That loop is wound with fifty turns of wire taken from an old dynamic speaker field coil. I wound it over nails driven into the four corners of a door, just as described, and stiffened the loop by wrapping Scotch tape

Carl & Jerry (*Continued from page* 10)

around the turns every few inches. Hanging the loop from the ceiling allows me to turn it about.

"As you can see, the loop leads run into this preamplifier which has a voltage gain of 1000. The output of the preamp goes into the input of the tape recorder amplifier, where it is amplified another 500 to 1000 times before it is put on the tape, and then it comes out of the monitor speaker."

"Hold it!" Carl interrupted. "You skipped over something. What's this little jigger with a couple of capacitors and resistors doing here in the cable between the preamp and the recorder?"

"Oh, that's a filter to cut off all frequencies below 800 cycles or thereabouts. Without it the 60-cycle a.c. hum picked up by the loop would mask the weak sound of the whistlers. I've also rotated the antenna loop for minimum hum pickup."

"WELL, if we're going to hear any whistlers, now sounds like the time," Carl observed, as there was a sudden sharp clap of thunder followed by a rolling echo.

Jerry turned on the tape recorder, removed the earphones, and switched on the monitor speaker. They heard the rushing

. . . Jerry loosened the strings that held the loop in position and slowly rotated it. As he did so, there came from the speaker the sound of a human voice . . .

Carl & Jerry *(Continued from page 12)*

tube sounds accompanied by various clicks, pops, and scratching static sounds.

"Listen especially hard for a second or so right after a lightning flash," Jerry instructed. "That's when the whistler should be arriving back from its round trip to the southern hemisphere."

As he finished speaking, there was a brilliant flash of light followed by a moment or so of silence; then, just before the boom of thunder, a faint eerie sound came from the tape recorder speaker like a sigh of air escaping from a bicycle tire.

"Hey!" Jerry said excitedly, "that was one! That was a whistler!"

"Yeah," Carl agreed dubiously, "I guess it was; but it certainly sounded pooped. Let's try turning the loop a bit and see if we can't get more moxie into the next one."

Jerry loosened the strings that held the loop in position and slowly rotated it. As he did so, there came from the speaker, along with the crackling and popping of static, the sound of a human voice. It was a thin, weak, and high-pitched voice, but it was definitely human and feminine.

"Come you back! Come you back! Come you back!" it was begging.

"Holy cow!" Carl gasped in awe, "Whistler's mother!"

"Shut up and listen!" Jerry commanded.

But the voice was gone. In its place, the boys now heard faint and outlandish music. Neither Carl nor Jerry could recognize a familiar instrument in the cacophony of clanging sound, although it did have a definite rhythm and a sort of wild beauty. Suddenly this, too, terminated in the middle of a bar, and nothing more was heard except the crackle of static. Even the thunderstorm had passed over, taking with it the likelihood of hearing any more whistlers.

"WHAT do you make of it?" Jerry demanded as he switched off the tape recorder.

"Don't look at me," Carl said. "It's your whistler-listener. But I don't mind telling you that the whole thing sounds mighty, mighty spooky to me."

"Take your finger off the panic button!" Jerry commanded impatiently. "This thing's got to have a sensible, logical explanation, even though I'll admit I never heard any music like that before."

"What could be happening?"

"That's what I'm trying to figure. This very sensitive setup would respond to any faint magnetic field producing signals within the range of the audio amplifier—which in this case is from about 800 to 14,000

Carl & Jerry (*Continued from page* 15)

cycles. But what kind of apparatus would produce a field that could be intercepted at some distance?"

"Have we anything else to go on?" Carl questioned.

"Well, I guess the directional characteristics of this very low frequency loop are the same as those used on higher radio frequencies; that is, the null points are on a line perpendicular to its plane while maximum reception is had from points in the plane of the loop. When the loop was parallel to the street, we didn't hear the strange sounds; but when I turned it at right angles to the street, they came in. That would seem to indicate that the mysterious signals are coming from in front or in back of the house."

"Yeah, but how *far* in front or back?"

"I might know you'd run me out of answers," Jerry admitted with a sigh. He switched the tape recorder back on and, as the tubes warmed up, a hot rock-and-roll number came faintly but clearly from the speaker.

"If that's Mars, Elvis has already landed!" Carl said. "Let's see if we can run this down while it's still going on. I'll go back across the alley and keep listening for that cool tune. You go across the street and do the same thing. If either of us finds something, he can let out a yelp."

FORTUNATELY the rain had stopped, and the two boys skipped up the outside basement steps and went in opposite directions. Carl didn't hear the music as he went out the back gate and looked up and down the deserted alley, but he did notice a light in the large cement-block garage just across the alley from Jerry's place. Without the least hesitation, he walked over to where he could see through a small window and took a long, astonished look. Then he turned around and motioned violently for Jerry, who was standing across the street, to join him.

Soon the two boys were standing shoulder to shoulder, peering through the window into the large room of the garage. In the middle of the floor, a boy of about their own age was dancing wildly about. Going round and round over in the corner was a record player feeding into what looked like a pretty husky audio amplifier; yet the two boys outside could not hear a bit of music although they could plainly hear the boy's shoes scuffing on the cement floor. The youthful dancer was wearing a pair of earphones different from any Carl and Jerry had ever seen. A shiny metal band came

(*Continued on page* 20)

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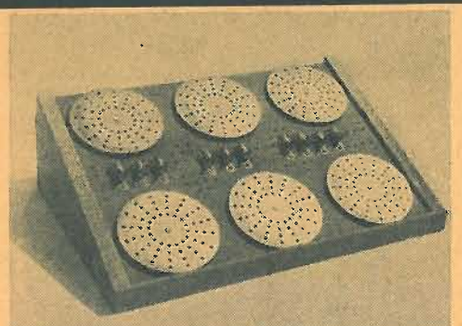

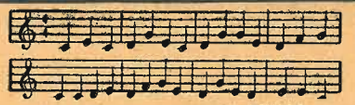

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City..... Zone..... State.....

Carl & Jerry (*Continued from page* 16)

down from each hearing-aid type of earpiece and joined in a "V" beneath the boy's chin; at no point was any cord attached to the phones.

"We've gone deaf; that guy has flipped; or he has something we ought to know about," Carl whispered hoarsely.

"Let's find out which it is," Jerry suggested, starting toward the garage door.

THEY HAD TO KNOCK several times before the boy inside heard them and opened the door. He had removed the strange earphones and was holding them in his hand, smiling at his visitors in a friendly but questioning manner.

"My name is Jerry Bishop, and this is my friend, Carl Anderson," Jerry explained as he held out his hand. "We live right across the alley. I guess you folks just moved in last week. Carl and I thought we'd like to get acquainted."

"Fine!" the boy said, shaking hands with both and waving them inside. "My name is Bob Mallon. I've already heard about you two and have been wanting to meet you. From what the kids at school say, you boys know all there is to know about electricity. I'm interested in electronics, too, but I don't know much about it. Just now I was playing with these wireless earphones I got for a birthday present."

"Wireless earphones?" Carl questioned. "How do they work?"

"See that loop of copper wire running clear around the room about five feet from the floor?" Bob asked. "The output of the twenty-watt amplifier over there feeds directly into that loop. Magnetic flux from the loop is induced into the laminated high-permeability pole pieces that form the V-shaped band of these earphones. The induced magnetism drives special magnetic-type earphones at the top of the 'V.' Here, take a listen for yourself," he said, extending the phones to Carl.

Carl put them on and instantly began to sway to the music coming from the spinning record. He found he could walk anywhere in the room and still hear the music.

"Hey! That's all right!" he exclaimed, handing the earphones to Jerry to try. "Where can I get some dope on those?"

"Let's see," Bob said as he picked up a cardboard carton; "they're distributed by the Fenton Company, 15 Moore Street, New York 4, N. Y."

"BOB," Jerry said with a shamefaced grin as he handed back the earphones, "they say honest confession is good for the soul; so I want to tell you how Carl

Carl & Jerry (*Continued from page 20*)

and I really happened to drop in on you." He went on to explain their strange experience with the whistler-listener, and when he had finished, Bob laughed until the tears ran down his face.

"I'll bet you really did think you'd tuned in on Mars or something!" he exclaimed, "but I think I can clear up everything. Let me switch the amplifier into a speaker and change records."

He did so, and soon a woman's voice came from the speaker singing *On The Road To Mandalay*. It was unusual enough to hear a woman singing a song that usually is delivered in a rich masculine baritone, but when she came to the line, "Come you back, you British soldier," a defective groove in the record made her repeat, "Come you back, come you back, come you back," until Bob lifted the needle.

"And now for the out-of-this-world music," he announced with a broad grin, lowering the needle on another record. Instantly the weird music the boys had heard filled the room. It sounded much different now without the low-frequency filter taking out the lows as it had done on their whistler detecting arrangement—not nearly so spooky.

"That's a record of a novelty band on an island down in the Caribbean," Bob said. "Most of the instruments are made up of empty steel drums; so it's no wonder you didn't recognize any of them."

"Well, that certainly clears up the mystery," Jerry remarked. "This arrangement of yours puts out a strong enough field to be heard on our very sensitive arrangement over in the basement. By the way, Bob, wouldn't you like to come over and let Carl and me show you our lab? It may not look like much, but we're pretty proud of it, and we have a lot of fun there."

"I most certainly would," Bob answered promptly as he switched off the amplifier. "After all, you are my DX!" -30-

LETTERS
FROM OUR READERS

New Use for the "Soft Touch"

■ I used the Touch-o-Matic control circuit (September, 1956, page 39) as a lock on my workshop door. I hooked the door knob to one terminal as a contact plate and the other wire to a small nail hidden on the door surface. When I touch the knob and the hidden nail, a magnetic door lock opens the door.

NEIL CARBONE
Hollis, Queens, N. Y.

More Definition in Parts Lists

■ I have noticed that in almost every issue you publish construction articles containing pre-manufactured circuits. I often see printed circuits used in amplifiers (for example, in the December, 1956 issue, page 55).

As yet, these components are not available in England. For the benefit of your overseas readers, would it be possible to include in future issues complete interpretations of these special components?

L. WELLS
London, England

We admit that using such "specialized" components may be a hardship, but at the same time feel justified in doing so since the circuits in our articles make use of the parts called for. Substitution of components may upset operation to such an extent that a circuit might become inoperative —at least for the novice experimenter. Many American companies are willing to supply information on these components and we suggest that they be contacted directly for such information.

Helping Hams Obtain Licenses

■ I would like to report that since my name appeared under "Help Offered" in your November *Transmitting Tower*, two boys have passed their Novice exams and should have their licenses by the time this letter is printed.

NATHAN J. SCHULMAN
Brooklyn, N. Y.

Flattery—But We Love It!

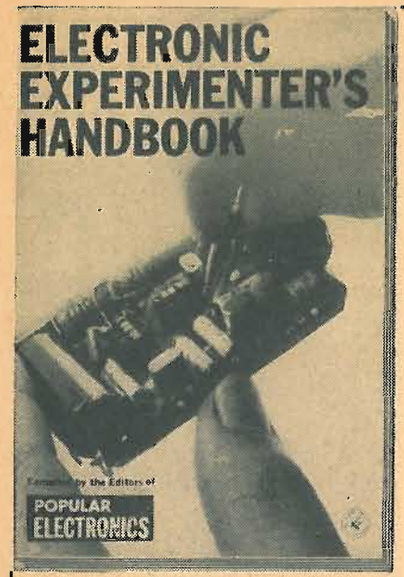
■ Enjoy your inexpensive and useful equipment for the workshop, lab, etc. Hope to see many more construction articles and other material that I would not ordinarily come into contact with. I regard your magazine as informative, enjoyable, and educational.

CLIFFORD L. THORNTON, JR.
Savannah, Ga.

■ I think a kit builder should be able to answer four questions before he starts building the kit. They include: (1) Is the kit sufficiently experimental so that he can have fun by changing parts? (2) When finished, is it going to be utilitarian? (3) Are the parts easily obtainable? (4) Can the builder understand how it works?

It is quite a job for you to cover every one

(*Continued on page 28*)



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Letters

(*Continued from page 24*)

of these points in your book, but of all the magazines that I have read POPULAR ELECTRONICS comes closer to it than any other. I hope you won't get tired of keeping it up.

EDWARD S. JANBAZIAN
Philadelphia, Pa.

■ Just finished reading your article on "More Solar Battery Experiments" in the January issue. It is one of the best articles I have yet read on putting solar energy to practical use. Let's have some more!

DICK MEDVED
Canton, Ohio

■ Just a line to let you know how much I appreciated Elbert Robberson's article on "Getting New Sound from Old Radios." My little Philco table model now has a new lease on life. Let's see more articles on this sort of thing.

ALAN TOMPKINS
New Haven, Conn.

■ Hats off to you and Gene Coriell for your swell article entitled "How to Fix Up Old Radios." I am always interested in more of the same.

Can we see diagrams on connecting a phono or preamp to these sets? Most of them have a fairly excellent tone.

M. O. SNYDER
Benton City, Wash.

■ On behalf of all the people who like to cut out and save specific articles, I want to thank you for completing many of the February, 1957, issue construction articles in the front of the magazine so that we did not need to cut up the back. I don't know if these articles were arranged this way on purpose, but I hope they were since I feel that an article should have page-to-page continuity if at all possible.

KEN GREENBERG
Chicago, Ill.

Thank you, gentlemen, for all of your kind remarks. We of the POP'tronics staff hope we will continue to merit such warm approval. Our long-range plans call for a bigger and better magazine which will be in a better position to serve more interests of the electronics experimenters, Novice hams, R/C fans, etc., among our audience.

The Rumble Is Coming!

■ As an avid reader of POP'tronics, I have found much reliable hi-fi information. I am now building the presence control detailed in your February, 1957 issue.

I am sure that many of your readers would like to add an efficient noise and rumble filter to their hi-fi systems.

ALAN F. STEIN
Forest Hills, L. I., N. Y.

Thanks, Alan, for the kind remarks. We put Len Feldman to work and he has designed a scratch and rumble filter which is scheduled to appear in our May issue. —30—

POP'tronics BOOKSHELF

"ELECTRONIC METAL LOCATORS" by Harold S. Renne. Published by Howard W. Sams & Co., Inc., 2201 E. 46 St., Indianapolis 5, Ind. Soft cover. 117 pages. $2.50.

You may not "strike it rich" but you can have a lot of fun prospecting with a metal locator. Beyond this use, such a device has many important industrial and commercial applications which are explained in the book along with the theory and construction of basic locator types, including details on units that can be built at home.

A chapter on mine detectors deals with locators used by the military. Other units treated include underwater metal locators, and a very unusual device that serves as either Geiger counter or metal locator. The highly informative text is rounded out with an abundance of photos and drawings, an extensive bibliography, and a list of locator manufacturers for quick, easy reference.

Recommended: as an excellent introduction to the field as well as an up-to-date summary.

Free Literature Roundup

Long-play records made by the microfusion process developed by Emory Cook include special sound, test, jazz, symphonic, binaural, and Calypso material. Write to Cook Laboratories, Inc., 101 Second St., Stamford, Conn., for a catalog.

A six-page bulletin (No. 2057) on panel meters is available from Simpson Electric Co., 5200 West Kinzie St., Chicago 44, Ill.

A specially prepared "Test Card" is being offered by the Duotone Corp., Keyport, N. J. You make impressions on it with your phono stylus, return the card to the company, and receive an analysis of the condition of the stylus. Cards are available at dealers or by writing to Duotone.

In a catalog listing Scott components, there is a non-technical explanation of hi-fi. For your copy, write to H. H. Scott, Inc., Dept. NR 12, 385 Putnam Ave., Cambridge, Mass.

And don't forget our own "Hi-Fi Guide and Yearbook"—see page 34 for details. —30—

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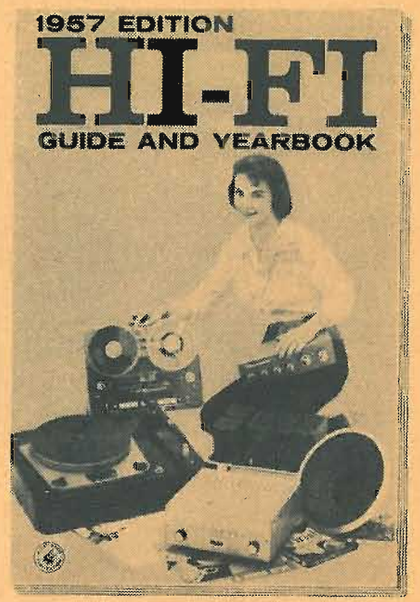

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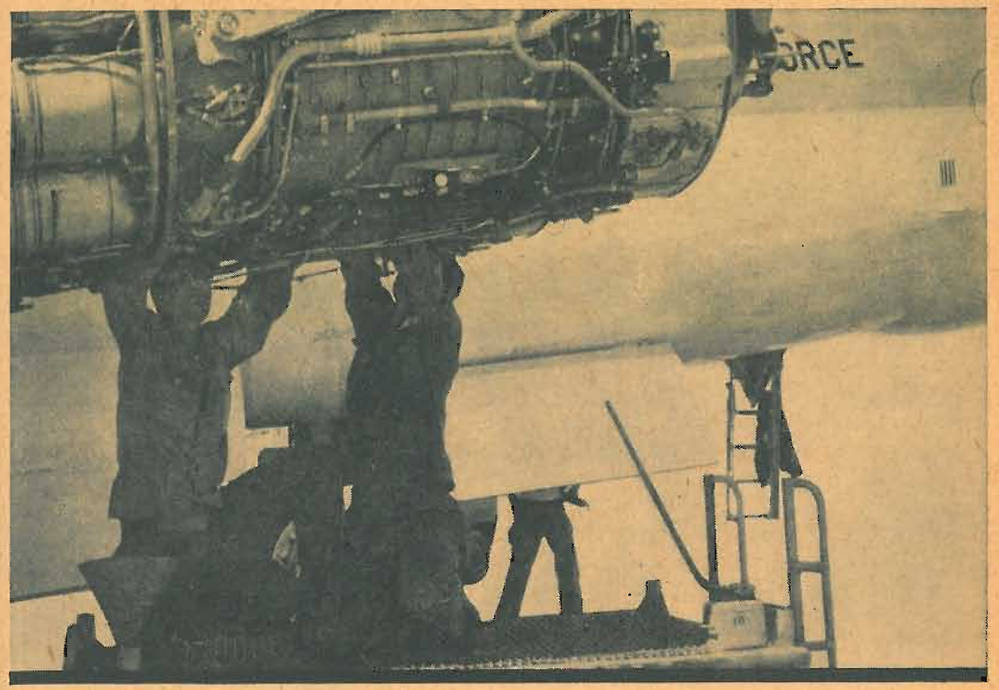

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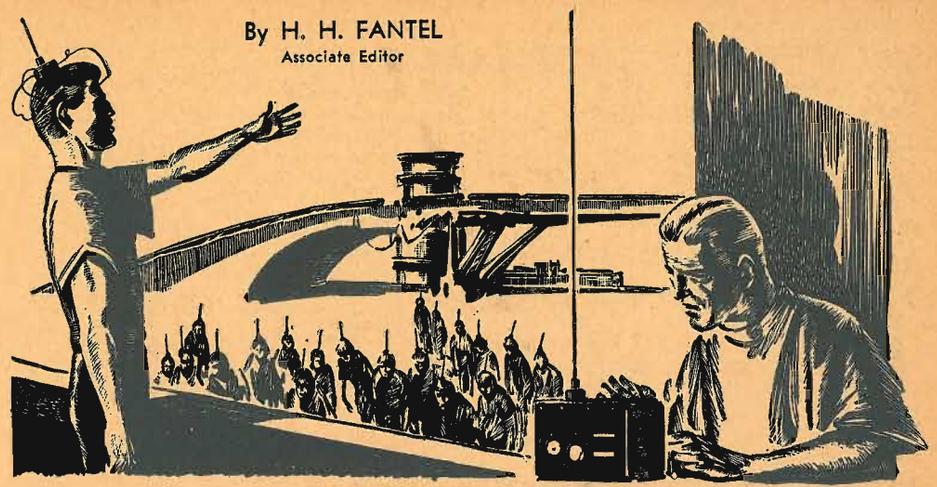


By H. H. FANTEL
Associate Editor

ELECTRONIC HYPNOSIS

Weapon of Tomorrow's Tyrant

"DO AS I SAY—*or else!*" That's the message of every aggressive weapon. A gun aimed at a man says: "Change your mind, or I'll change it for you."

Yet armed force may soon be obsolete as a method of "persuasion." Electronics now forecasts new ways for literally "changing minds"—getting "cooperation" from people who don't agree.

Electronic pulses beamed into the brain may render human beings completely submissive. Commands for everything you do, for every thought, and even your feelings (if you are allowed to have any) would be piped into you through a small radio receiver fitted to your skull. A new science, called *biocontrol,* combining recent advances in medicine and electronics, now holds the prospect of turning men into radio-controlled zombies.

POPULAR ELECTRONICS is among the first to follow this development to its likely conclusion: the mass enslavement of entire nations.

Past Tyranny. From the sharpened stone to the hydrogen bomb, the means of ruling men against their will have been messy and inefficient.

Unwilling slaves, bitter and sullen, always waste too much energy resenting their masters. Occasionally, this energy boils up into rebellion. Such high friction in the gears of a social system wears down the mechanism of the state. Besides, the people most likely to rebel are those with spunk and imagination. Consequently, they are the ones who are killed or locked up. Government ruling without consent of the governed must therefore always murder its best human assets.

All this was recently demonstrated in Hungary. The history of despotism, from ancient Egypt to modern Russia, endlessly repeats this pattern. Death and hunger are the strong allies of dictators—often strong enough to squelch freedom. But for ruler and nation alike, the end result is always ruin.

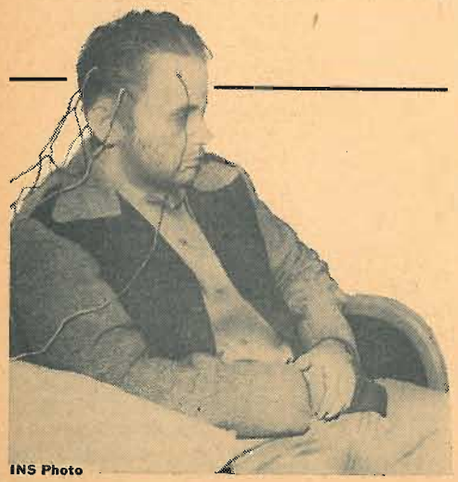
Future Tyranny. In electronic biocontrol, future tyrants may find a tool more efficient than brute force. The electronic skull device could simply cancel the wish for freedom. Bereft of the will to protest what is hap-

pening to him, a man turns into a robot. This makes him matchlessly efficient for routine work. Moreover, it simplifies all those problems of human organization involving persuasion and politics. Whole nations could become obedient herds. They could even be made to think they were happy.

Of course, individual thinking, imagination, knowledge, and love—in other words, "being human" in the usual sense—would then be restricted to a select minority. Perhaps the state would grant special permission to a favored few to have ideas and feelings of their own. This privileged group would probably act as "executives" and operate the transmitters controlling other people's brains. Unless these "executives" fight among themselves, a despotism based on such electronic thought control might work smoothly, efficiently, and without the danger of rebellion that troubles our present-day tyrants.

Brain Electronics. The roots of biocontrol reach back to the 18th century when the Italian experimenters Galvani and Volta first found that electricity could make a muscle twitch. About 100 years later, in 1871, a pair of German army doctors walked around the battlefield looking for "open-minded" fresh corpses whose skulls had been shot off. Applying electric currents to the exposed brains, they discovered that the dead men moved. They also found that a slight electric shock to certain brain areas produced corresponding predictable movements of the dead body. From this they concluded that the nervous system worked essentially through electric currents. Lacking ways to amplify weak currents, research was first confined to the stronger nerve impulses occurring in the muscles.

After the invention of the electronic amplifier and the oscilloscope, Hans Berger, a German psychiatrist, inserted silver wires under the scalps of his patients to tap the electric signals given off by their brains. Watching the amplified currents on the oscilloscope, he was the first to analyze the so-called brain waves of living persons.



INS Photo

Others soon joined Berger in this new field of research. Pooling their results, they pieced together a kind of electrical map of the human brain, which told roughly what kind of brain wave signified what kind of brain action. The wave patterns obtained were called "electroencephalograms" or just "EEG" for short. Such measurements are now a standard hospital routine in diagnosing brain tumors, epilepsy, or other nervous ailments.

The EEG and Us. Brain wave research took a sudden and ominous turn last year when Curtiss R. Shafer, an electronic engineer, made a simple suggestion: instead of analyzing the currents coming out of the brain, EEG specialists might feed certain wave patterns into the brain. Instead of observing human behavior, they might then be able to induce and control it. People presumably would think, feel and act as if in a kind of radio-controlled hypnosis.

"Elementary forms of biocontrol have already been demonstrated," reports Mr. Shafer. "Fluctuating direct current of the required waveform and intensity passed through a man's head . . . changes his sense of balance and he leans to one side because, like an unbalanced electronic autopilot, he feels that his vertical reference has shifted, and he is trying to compensate for his imaginary error. . . . Other experimenters have shown that rats and dogs may be made to feel hungry just after eating, or afraid when they have nothing to fear, simply by applying the corresponding neural currents into the central nervous system of the animal." The same principle holds true when an eyeless man is made to "see" light as an electric current is hooked up to his optic nerve.

The basic surgical technique that would be required for complete biocontrol has already been developed at Tulane University for the treatment of mental patients. In this operation, small holes are drilled through the skull, and silver electrodes are inserted into various sections of the skull. The electrodes cause no discomfort to the subject, no noticeable damage to brain tissue, and no interference with the functioning of the brain except when they are energized. They are normally left in place for several months, and presumably may be left there permanently.

"All of these techniques are crude," admits Mr. Shafer, "but so were the techniques of television only fifteen years ago," he adds confidently.

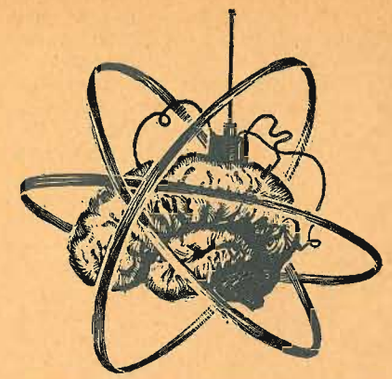
Tomorrow? Biocontrol may shape the future after World War III. Since bombs have become atomic, nobody can win a war outright. Whoever is left to pick up the pieces will probably grovel miserably amidst over-all devastation. Under such conditions, dictators are bound to rise, and biocontrol may be their method for enslaving the leftovers of nations. Unlike mere military conquest, which ultimately conquers nothing but the dead in battle, biocontrol would also make the conquest of the living complete and final, "for the controlled subjects would never be permitted to think as individuals."

Before the National Electronics Conference at Chicago, Shafer outlined life in a biocontrolled future: "A few months after birth, a surgeon would equip each child with a socket mounted under the scalp and electrodes reaching selected areas of brain tissue. A year or so later, a miniature radio receiver and antenna would be plugged into the socket. From that time on, the child's sensory perceptions and muscular activity could be either modified or completely controlled by bioelectric signals radiated from state-controlled transmitters."

Even without war, from a purely economic angle, biocontrol has its points: "The once-human being, thus controlled, would be the cheapest of machines to create and operate. The cost of building even a simple robot, like the Westinghouse mechanical man, is probably ten times that of bearing and raising a child to the age of sixteen."

Patterns of Power. Who will be the dictators of a biocontrolled future? Who will pick the "program" to be sluiced into people's heads?

Most likely, he will be a criminal madman of the Hitler type. Harvard's eminent Professor P. Sorokin noted that it is usually a weak person with criminal traits who feels the need to bully and dominate. Without a normal conscience to check him, such a man winds up either as an outlaw or a chief of state. Only in relatively few countries where the government is defined and limited by democratic law, and where people stand up for their rights, can ruthless men be kept out of power. Elsewhere they tend to run the show. Armed with biocontrol, such future authoritarians may try to wipe the very memory of freedom from men's minds.



Biocontrol poses Frankenstein's old question in new and terrible form: will man be destroyed by the machines he himself invented? To rule his machines rather than be ruled by them, man must first know his own mind and form a clear idea of his purpose as a person.

Depending on your personal beliefs, dictatorship by biocontrol may seem attractive or repugnant to you. It certainly clashes against any democratic notions about freedom of conscience and responsible, voting citizenship. Whatever your attitude, it should be clear in your own mind because, as Norman Corwin put it: "People who don't know what they want get what they don't want." —30—

Murderer's mind is probed. The killer of Ruby Ann Payne of Santa Ana, Calif., is shown on facing page as he submits in prison to brain wave recording on electroencephalograph (right) as part of sanity test. Signals are picked up by skull electrodes and then amplified.

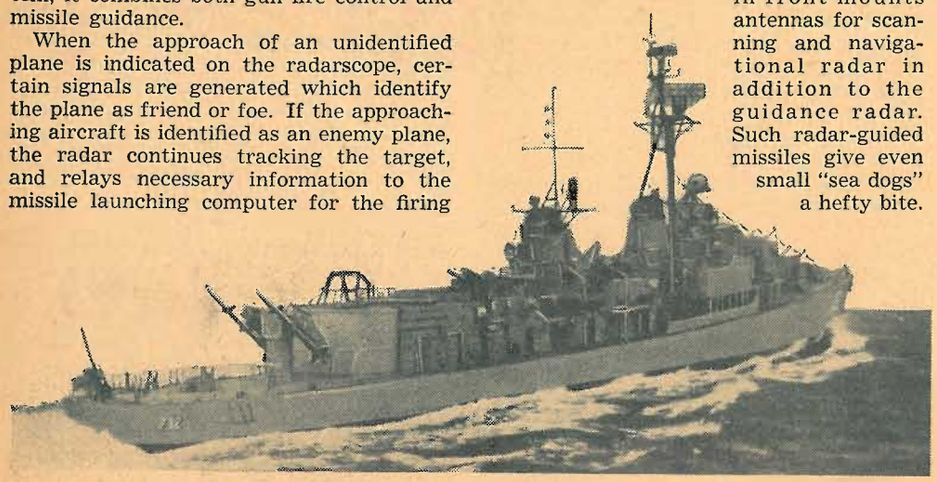
Navy's New Radar Doubles In Brass

War-born radar has in many applications become a peacetime boon. But as long as the rattling of national sabers echoes through the world, radar must remember and develop the military strain in its ancestry.

The latest seagoing radar, designed by Reeves Instrument Corp. for the U.S.S. Gyatt, the Navy's first guided missile destroyer, does double duty to hurl two-fold terror at the enemy. Within a single system, it combines both gun fire control and missile guidance.

When the approach of an unidentified plane is indicated on the radarscope, certain signals are generated which identify the plane as friend or foe. If the approaching aircraft is identified as an enemy plane, the radar continues tracking the target, and relays necessary information to the missile launching computer for the firing of the missile being used to shoot down enemy planes. A closely interrelated data system between the radar, the launcher and the missile itself then shoots the missile into the radar beam and the missile is guided by the radar to intercept and destroy its target.

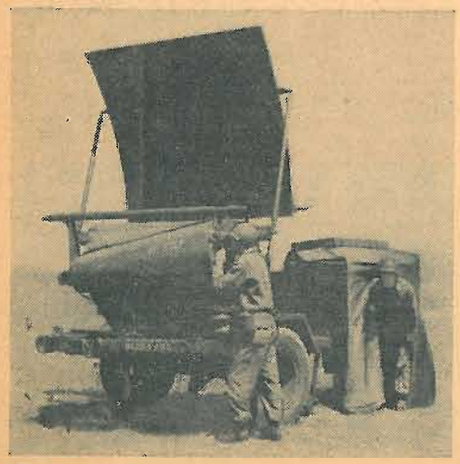
The official Navy photograph below shows the U.S.S. Gyatt with the missile launcher on the rear deck clearly visible. The radar mast in front mounts antennas for scanning and navigational radar in addition to the guidance radar. Such radar-guided missiles give even small "sea dogs" a hefty bite.

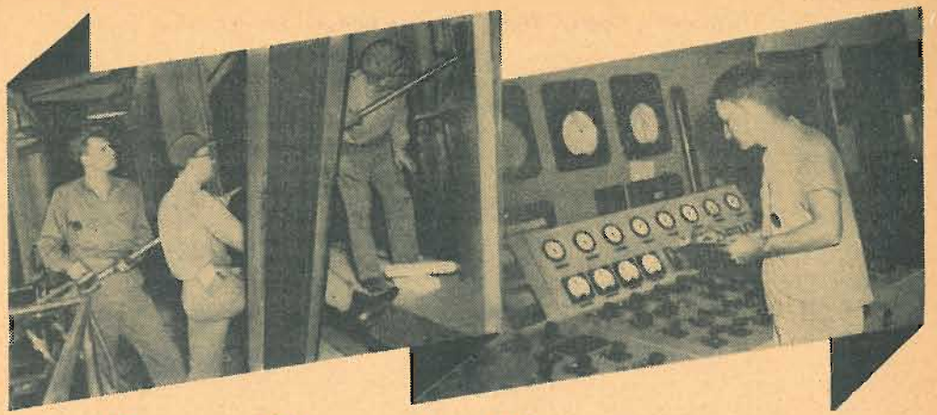


Army Radar Spots Mortal Mortars

While new shipboard radars sweep the sea, the infantry has also enlisted this versatile electronic fighter. The U.S. Army now has a special-purpose radar to spot the location of enemy mortars, which fire at a high angle to drop sudden death from an apparently empty sky. The upward-shooting mortars can aim over obstacles to reach positions protected from direct fire.

Counteracting this weapon, the Army's new compact, trailer-mounted radar (below, left) computes the location of the threatening mortar from the trajectory of its shells. The soldier shown at the instrument panel simply reads off range and azimuth of the enemy emplacement so that defense artillery can destroy it.





From Stem to Steam ... It's Electronic

By HERBERT REID

It takes "brains" to coax top performance from power systems

COMPUTERS, the hottest items in electronics, are literally getting up steam these days. To analyze the operation of giant steam generating plants, an electronic system has been designed that will do the job in a few hours. Before, it took several weeks and a team of specialists snooping into every nook and cranny of an interlaced system of boilers and pipes.

Now control engineers no longer need to crawl along steam pipes in dark catwalks, fitting their gages onto the hot and hissing valves. They just press a button in a cool, comfortable office and a new type of electronic "scanner" brings in reports on temperature, pressure, and gas composition from all the critical check points. Up to 500 measurements are picked off different locations and fed into electronic processing channels. The data are automatically punched out on tape and the tape readings are then transmitted by teletype to New York City, where the Babcock & Wilcox steam company maintains a large electronic computer. This computer puts the information through an intricate mathematical "mill" which extracts the real meaning of the data. This is flashed back by teletype to the boiler plant for application by engineers and technicians. Steam plants as far flung as Ohio and Pennsylvania latch on to the New York computer for long-distance brainwork.

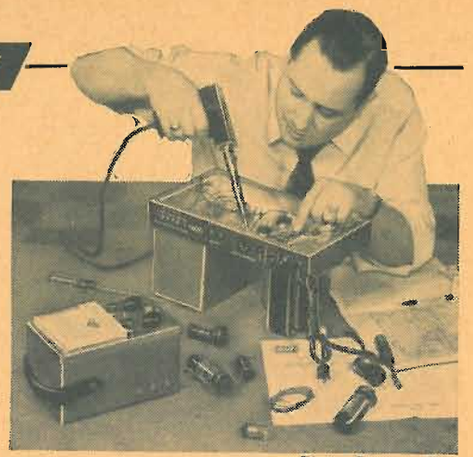
Encouraged by these results, power plants are going "full steam ahead" with their computer programs, not only for boiler operation, but also for distributing their final product: electric power. The Goodyear Aircraft Corp. has just designed an "Economic Power Dispatch Computer" which instantly figures out the most economical way to feed a network of power

(*Continued on page* 106)

Officials of Goodyear Aircraft Corp. (directly above) are proudly watching their "brain child," a new Power Dispatch Computer, as it goes to work at a generator plant, sluicing thousands of kilowatts to various parts of Ohio according to shifting power demands. At top left, three "hot" engineers are checking combustion in a steam boiler the old-fashioned way by poking at the flames. The new system (at top right) permits instant remote reading of automatically computed results in cool comfort.

A POP'TRONICS SURVEY

Hi-Fi AMPLIFIER KITS



Photo, Courtesy Eico

Wire your own and save money without sacrificing performance—a rundown of 35 kits now available

By NORMAN EISENBERG
Feature Editor

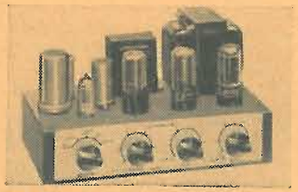
IF SOMEONE SUGGESTED that you could cruise in a late model Cadillac at about half the cost of a factory-assembled vehicle, you'd think he'd been hitting the bottle. When he further insisted that you could build your deluxe auto with minimum skill and common hand tools, you'd probably reach for the phone to call the men in white suits.

Yet, in hi-fi, an analogous situation exists: you *can* construct equipment in the "Cadillac" class by building it from a kit that contains all parts, and whose instructions are so clear that you would have to try hard to go wrong. And building from a kit results in a unit that may cost anywhere from 25 to 100% more in factory-built form.

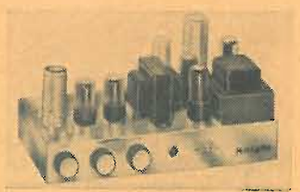
As things stand now, amplifier kits are the most numerous and varied. There are kits for preamplifiers, basic amplifiers, and complete amplifiers. The term "preamplifier" implies, of course, "preamplifier-equalizer-audio control unit," sometimes called the "front end." A "basic amplifier" or "power amplifier" accepts low voltage sig-

Heathkit A7-E, 7 watts

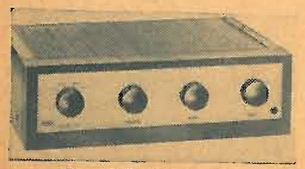
Arkay A-12, 10 watts



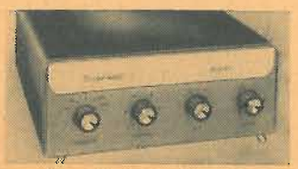
Grommes LJK, 10 watts



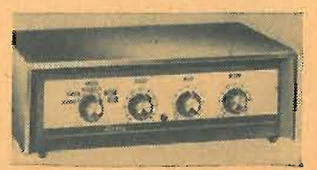
Knight S-753, 10 watts



Eico HF-12, 12 watts



Qual-Kit 2000, 12 watts



Arkay FL-10, 12 watts

KITS FOR COMPLETE AMPLIFIERS

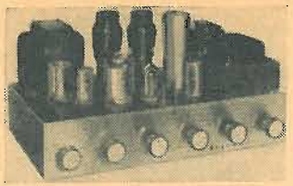
Rated Power (watts)	Model	Manufacturer and Address	Net Price	Est. Constr. Time (hours)	Size (inches)	Weight (lbs.)	Record Eqlzn. Settings	Loudness Compensation	Inputs		Tape Feed Jack	Aux. A.C. Outlets	Remarks
									Low	High			
7	Heathkit A7-E	Heath Co. Benton Harbor; Mich.	$19.95	6-8	11x6⅝x5¾	8½	RIAA curve built into preamp	No	1	1	No	0	Available also without built-in preamp as Model A-7D ($17.95)
10	Arkay A-12	Radio Kits, Inc. 120 Cedar St. New York 6, N.Y.	$22.95	7-8	11¼x6¼x 5⅝	15	Built in	No	1	2	No	1	
	Grommes LJK	Precision Electronics, Inc. 9101 King Ave. Franklin Park, Ill.	$24.95	7-8	10x6x6	11	3	No	2	2	No	1	
	Knight S-753	Allied Radio Corp. 100 N. Western Ave. Chicago 80, Ill.	$23.50	7-8	13x7x6	14	See remarks	No	See re-m'ks	1	No	0	Equalized preamp; separate kit for $3.10
12	Arkay FL-10	See above	$28.95	7-9	12½x8½x4	14	3	No	1	3	Yes	2	
	Eico HF-12	Electronic Instr. Co., Inc. 84 Withers St. Brooklyn 11; N. Y.	$34.95	7-9	12x8¼x3⅝	13	RIAA curve built in	No	2	2	Yes	1	Has direct tape head input; NARTB equalized
	Qual-Kit 2000	Quality Electronics, Inc., 319 Church St. New York 13, N. Y.	$28.50	7-9	12½x3½x 7⅜	13	3	No	1	2	Yes	1	
18	Lafayette KT-114	Lafayette Radio 165-08 Liberty Ave. Jamaica 33, N. Y.	$49.50	8-10	12½x9¾x 4⅛	23	24 (4 turnover; 6 roll-off)	Yes	1	4	Yes	2	Includes rumble filter and output meter
20	Bogen KDB-20DF	David Bogen Co.; Inc. P.O. Box 500 Paramus, N. J.	$69.50	9-11	15x9¼x8	28	7	Yes	2	3	Yes	2	Variable damping from plus 2X to minus 1½X speaker impedance
	Eico HF-20	See above	$49.95	9-11	15x10x8½	24	5	Yes	2	4	Yes	2	
	Elmat WAK	Electromatic Mfg. Corp. 88 University Place New York 3; N. Y.	$53.50	10-12	15x10x8½	25	5	Yes	2	4	Yes	2	
	Grommes 61 PGK	See above	$59.50	9-11	12x10x4¾	20	24 (4 turnover; 6 roll-off)	Yes	3	2	Yes	2	
	Heath A-9B	See above	$35.50	10-12	14x8⅞x7⅜	23	2	No	1	3	No	0	Includes 500-ohm spkr. terminal for p.a. applications
	Knight S-750	See above	$35.75	9-11	13x8¾x7	23	2	No	1	3	No	0	
30	Arkay FL-30	See above	$49.95	8-10	16x9x5	26	3	Yes	1	3	Yes	2	Transistorized phono preamp
35	Lafayette KT-115	See above	$59.50	8-10	12½x9¾x 4⅛	25	24 (4 turnover; 6 roll-off)	Yes	1	4	Yes	2	Includes rumble filter and output meter
50	Eico HF 52	See above	$69.95	10-12	15x10x8½	30	5	Yes	2	4	Yes	2	Special in and out jacks between preamp and power amp to accommodate electronic crossover
60	Techmaster 19K	Techmaster Corp. 75 Front Street Brooklyn; N. Y.	$79.95	9-10	14¼x10¾ x5¼	28	5	No (See remarks)	1	4	Yes	2	Mfr. believes not necessary in this amp; tone controls may be used for aural compensation

BASIC OR POWER AMPLIFIERS

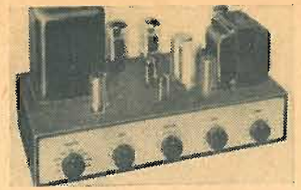
Rated Power (watts)	Model	Manufacturer and Address	Net Price	Est. Constr. Time (hours)	Size (inches)	Weight (lbs.)	Damping Factor	Input Signal for Rated Output	Output Tubes	Speaker Terminals	Remarks
20	Approved A-890	Approved Electronic Instr. Corp. 51 Vesey St. New York 7, N.Y.	$47.50	8-10	15x9x7	28	25	0.5 v. for 5 watts	5881's	4, 8, 16	Has gain control; 1 aux. a.c. outlet
	Heathkit W-3M	Heath Co. Benton Harbor, Mich.	49.75	8-10	11x5½ x7 (two units)	29	28.5	0.75 v. for 5 watts	5881's	4, 8, 16	Built on two chassis; one for power supply
	Heathkit W4-AM	(See above)	39.75	8-10	15¼x 8⅞x7	28	28.5	2 v.	5881's	4, 8, 16	1 aux. a.c. outlet
	Techmaster TM-15A	Techmaster Corp. 75 Front St.; Brooklyn 1, N.Y.	49.95	8-10	12x9x 6½	27	10	1.1 v.	5881's	4, 8, 16	
25	Heathkit W-5M	(See above)	59.75	8-10	13⅜x 8½x8¼	31	40	2.2 v.	KT-66's	4, 8, 16	2 aux. a.c. outlets
	Knight S-755	Allied Radio 100 N. Western Ave. Chicago 80, Ill.	44.50	8-10	14x9x 6¼	27	variable; —4 to +35		5881's	4, 8, 16	Printed-circuit board for input stages to be assembled
50	Dynakit Mark II	Dyna Co. 5142 Master St.; Phila. 31, Pa.	69.75	4-5	9x9x 6¾	27	15	1.5 v.	EL-34's	8, 16 (4 optional; kit cost $75)	Pre-assembled printed circuit board for input stages; simplified bias adj. for output tubes
	Regency HF-50K	Regency Div.; I.D.E.A.; Inc.; 7900 Pendleton Pike Indianapolis 26, Ind.	74.50	8-10	10¼x10¼ x7¼	35	15	1.5 v.	EL-34's	8, 16	
	Eico HF-50	Electronic Instr. Co.; Inc. 84 Withers St. Brooklyn 11; N.Y.	57.95	8-10	14x8x7	25	12+	0.5 v	EL-34's	4, 8, 16	2 aux. a.c. outlets Note: Eico HF-60 has same circuit as HF-50, but uses Acro TO-330 output transformer
60	Eico HF-60	(See above)	72.95	8-10	14x8x7	25	12+	0.55 v.	EL-34's	4, 8, 16	
	Lafayette KT-120	Lafayette Radio 165-08 Liberty Ave. Jamaica 33, N.Y.	59.95	8-10	14x6⅞ x7 15/16	25	17	0.55 v.	EL-34's	4, 8, 16	Input level control

PREAMPLIFIERS (Audio Control Units)

Model	Manufacturer and Address	How Powered	Net Price	Est. Constr. Time (hours)	Size (inches)	Weight (lbs.)	Record Eqlzn. Settings	Loudness Compensation	Inputs Low	Inputs High	Tape Feed Jack	Remarks
Approved A-800	Approved Electronic Instrument Corp. 51 Vesey St. New York 7, N. Y.	amp.	17.95	8-9	12x4x2	6	6	no	1	2	no	1 aux. a.c. outlet
Eico HF-61	Electronic Instrument Co., Inc. 84 Withers St. Brooklyn 11, N.Y.	self	29.95	9-10	12⅜x 4⅞x 4⅞	8	5	yes	3	4	yes	4 aux. a.c. outlets; phono load selector; separate rumble and scratch filters
HF-61A		amp.	24.95									
Heathkit WA-P2	Heath Co. Benton Harbor, Mich.	amp.	19.75	9-10	12⅜x 3⅝x 4⅞	7	16 (4 turnover; 4 roll-off)	no	2	3	yes	Input level adj. above jacks
Precise UPA-1N	Precise Development Corp. 2 Neil Court Oceanside, Long Island, N. Y.	amp.	19.95	8-9	12x4x4	4	5	optional, extra cost	1	3	no	1 aux. a.c. outlet
UPA-1P		self	25.95									
Techmaster TM-16SP	Techmaster Corp. 75 Front St. Brooklyn 1, N. Y.	self	24.50	8-9	9⅞x3⅜ x4½	4	5	yes	1	3	no	1 aux. a.c. outlet
TM-17P		amp.	19.95				3	no				

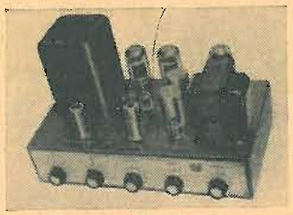


Bogen KDB-20DF, 20 watts



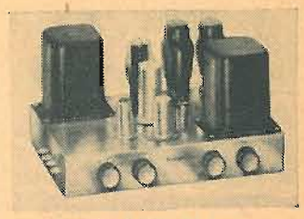
Eico HF-20, 20 watts

Grommes 61PGK, 20 watts



Elmat WAK, 20 watts

Heathkit A9-B, 20 watts

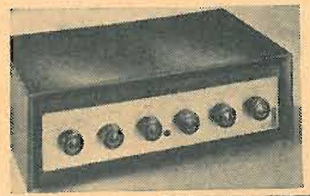


Knight S-750, 20 watts

nals from the preamp and builds them up to powers of sufficient wattage to drive a loudspeaker. When both preamp and basic amp are combined on one chassis, the unit is termed a "complete amplifier."

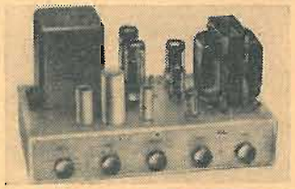
Each of these categories contains a miscellaneous assortment in terms of capabilities, flexibility of use, number of inputs and outputs and controls, and power ratings. Once you decide what your hi-fi requirements are, it's up to you to choose your kit and start building. The audiophile whose needs are modest and who plans to use a fairly high efficiency speaker might do well to build a complete amplifier kit in the 10- to 20-watt class. For the all-out enthusiast, with multiple speakers and several program sources and a leaning toward tape recording and stereophonics, the more powerful units—either complete amplifiers or separate preamp and basic amplifier combinations—will probably be the best choice.

As is the case with factory-built amplifiers, the selection depends on hi-fi requirements and budget. A 10-watt amplifier is not necessarily inferior to a 50-watt unit; it is designed to do a different kind of job. A hi-fi'er need not apologize for using a low-powered amplifier; the "prestige" lies not in how big your system is but in how well it serves your listening needs. Remember too—the most modest component on today's



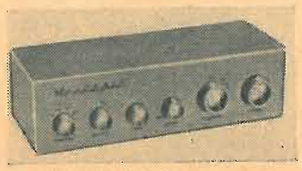
Arkay FL-30, 30 watts

Lafayette KT-115, 35 watts (KT-114, 18 watts)

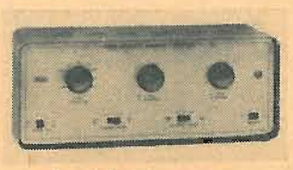


Eico HF-52, 50 watts

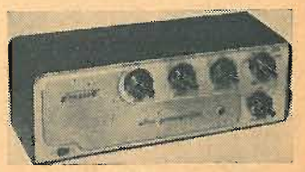
Techmaster 19K, 60 watts



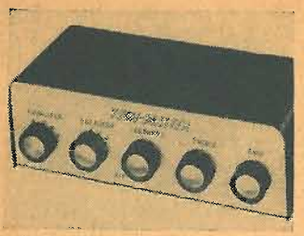
Heathkit WA-P2, preamp



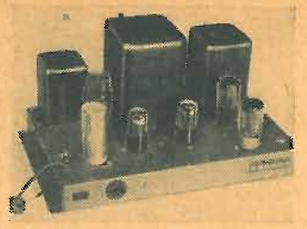
Eico HF-61A, preamp



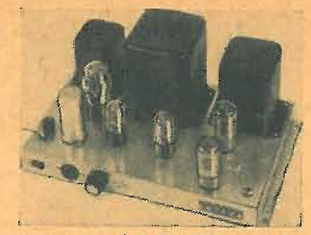
Precise UPA, preamp



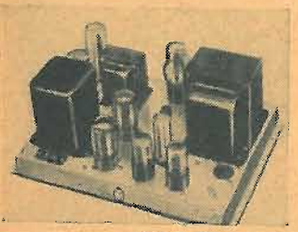
Techmaster TM-16SP, preamp



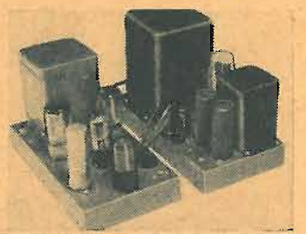
Heathkit W4-AM, 20 watts



Approved A-890, 20 watts



Techmaster TM15A, 20 watts

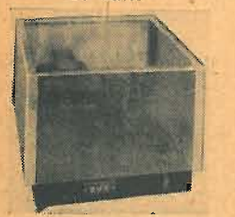


Heathkit W-3M, 20 watts

Heathkit W-5M 25 watts

Knight S-755, 25 watts

Regency HF-50K 50 watts



Dynakit Mark II 50 watts

hi-fi market is still vastly superior to its counterpart in the package radio-phono of yesteryear.

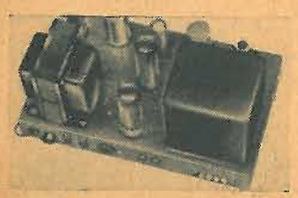
Kit Design. Many people fear that kits may be designed by the expediency of compromising circuitry and physical construction for the sake of ease of home-assembly. This is not so.

To be sure, some kits are more difficult and/or more time-consuming to assemble. This, in itself, is a factor which may determine the builder's choice. It works both ways. The challenge of a complex circuit and the certainty of mastering its construction is, in itself, an appeal for many hi-fi'ers. On the other hand, the simplicity and relative ease of construction of more modest circuits is sure to find favor with budget-minded listeners of less technical bent.

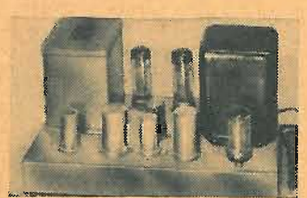
In any event, the circuitry is planned first by top engineers. Then, the unit as a whole is planned for production-line assembly as in a plant. But instead of training personnel to do each phase of the work, the kit people spell it out for *you*. You use your time, your labor and skill, your space, your tools, your light and heat, etc., to assemble the finished product. The saving of the kit manufacturer on all these factors is reflected in the price of the kit.

For several reasons, not the least of which is the innate design and construction of amplifier circuitry, this process has

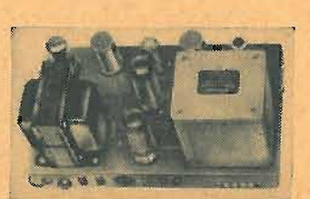
(*Continued on page* 101)



Eico HF-50, 50 watts



Lafayette KT-120, 60 watts



Eico HF-60, 60 watts

Crank-Up Tape Recorders Go Exploring

THE MOVIE CAMERA has peered into many far corners and strange places of the world. But, until recently, many of the most adventurous films were utterly mute. No recording equipment accompanied the camera on its wilder explorations, for sound could go no farther than the nearest electrical outlet. There was no way of powering microphones in off-the-road places inaccessible to the jeeps carrying the power generators. The film-makers had to fake in sound later, relying on tricks and imitation.

All this changed when the Amplifier Corporation of America pioneered the development of a battery-powered tape recorder, no bigger and hardly heavier than a briefcase. With a crank-up spring motor, the Magnemite recorder is completely self-contained and can follow the camera anywhere.

Lacking an a.c. supply for synchronizing the tape drive, this recorder controls tape speed by means of a precision flyball governor. With a range up to 15,000 cps, fidelity is not sacrificed to portability, and the sonic result is on a par with larger recording machines. —30—

In a village 13,000 feet high in the mountains of Tibet, where customs of the middle ages still survive, Swiss mountaineer Norman Dyhrenfurth (top), checks a sound take for his documentary films. Few white men ever visit here and machinery is as strange to the inhabitants as their music is to us. Note the heavy flywheel of the recorder between the tape reels.

From chilling heights to steaming tropics, the Magnemite takes every adventurous change in its stride. Camera and sound equipment (center) eavesdrop on the mating song and dance of Paradise Birds. Below left, a local combo obliges the recordist with previously "unheard of" sound samples of their crude instruments that should delight anthropologists as well as just plain folk-music fans.

Safari with camera and mike for science or entertainment is a specialty of Armand and Michaela Dennis (right). Before gaining fame as explorer, Armand worked as an electronic research scientist. Michaela quit her London fashion design salon, donning dungarees to follow her husband literally to the ends of the earth.

Saga of the Edison Award

Fifth Annual G.E. Award recognizes value of ham radio to general public

Mary "Mae" Burke, W3CUL, 1956 Edison Award winner.

RADIO AMATEURS have performed innumerable acts on behalf of their fellow citizens. Many of these are called "acts of public service." They are not in any way duties which the radio ham is obligated to perform; they are, rather, proof of his concern for the welfare and safety of his country.

The General Electric Company realized in 1951 that many such acts were far beyond the call of a private citizen. To honor the one ham whose public service stood out above all others, they established the annual Edison Radio Amateur Award. With it went national recognition, a handsome trophy, and a check for $500. The judges of the Award include national figures such as: E. Roland Harrison, President of the Red Cross; Under Secretary of State Herbert Hoover, Jr., (a ham himself); Rosel H. Hyde, Chairman of the Federal Communications Commission; and Goodwin L. Dosland, President of the American Radio Relay League (ARRL).

In 1952, the Edison Award was given to Don L. Mullican, W5PHP, for providing emergency communications to an area devastated by a tornado. The 1953 award went to Stan Surber, W9NZZ, who handled hundreds of free messages from isolated Arctic outposts. Benjamin Hamilton, W6VFT, won the 1954 award for activities related to civil defense; and in 1955 it was awarded to Bob Gunderson, W2J10, a blind radio ham.

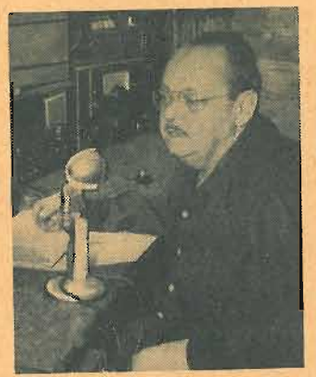
The 1956 award has gone to Mae Burke, W3CUL, Morton, Pa. More than any other radio ham in the United States, she exemplifies the almost unbelievable ability of ham operators to "pass traffic." Message-handling, or "traffic" as it is known to hams, means providing a line of communication between servicemen and their families (Mae handles as many as 3000 messages a month), or for anyone else who doesn't have the money to use a commercial circuit. At W3CUL, as many as 10,000 messages may be handled each month; the total since 1949 is over 300,000. Working as a radio relay station, Mae must meet schedules (at 6:30 a.m., 7:00 a.m., 11:00 a.m., 2:00 p.m., 6:00 p.m., and finally at 8:00 p.m., *daily*), type or copy the many messages, and tune her receiver and transmitters . . . certainly a "man-size" job for anyone.

While declaring W3CUL the 1956 Edison Award winner, the judging committee also issued eight other special citations. One of these went to Julius M. J. Madey, K2KGJ, a 16-year-old high-school honor student who rearranged his living habits (to bed at 4:30 p.m., up at 9:30 p.m., to bed again at 5:00 a.m., and finally off to school at 8:30 a.m.) so that he might be able to relay traffic from the Navy personnel working in Antarctica with "Operation Deepfreeze."

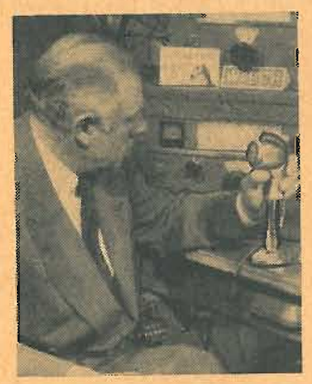
A citation went to Harry Fendt, W2PFL, who was instrumental in saving two lives in 1956 through quick message-handling to doctors. One of these events concerned a special drug needed in the Belgian Congo and was dramatized on Dave Garroway's morning show.

Natural disasters played a big part in two other citation awards. One of them was issued to Sam Baker, W3FIQ, for setting up and maintaining an emergency communications link with Erie, Pa., during the heavy Thanksgiving snowstorm. Another woman, Martha Shirley, WØZWL, Black Hawk, S. D., twice operated her ham station from totally isolated and snowbound communities; in doing so, she provided the only means of communication available over periods of up to four days.

People from all walks of life are nominated for the Edison Award–students, housewives, police officers and craftsmen as well as those working in radio factories or broadcasting stations. If there is an outstanding characteristic, it can only be that four of this year's nominees are bedridden! Unbelievable as it may sound, these people perform public services of such magnitude that friends and neighbors believe they merit Edison Award consideration. Need more be said in behalf of the morale-building and deeply rewarding aspects of ham radio? -30-



Citation winners discussed in text; Martha Shirley, WØZWL (above, left); Harry Fendt, W2PFL (above, center); Julius Madey, K2KGJ (above, right). Additional citations were awarded to: Newton Kraus, W1BCR (below, left) for message handling from "Operation Deepfreeze"; James Born, W4ZD (below, center) for his numerous civic and ham radio activities; and Sam Baker, W3FIQ (below, right) for emergency communications during a severe Erie, Pa., snowstorm.



Unpainted Chest Saves $$$ as Hi-Fi Housing

YOU CAN GIVE your hi-fi gear a home—without mortgaging your own, or letting the chassis and wires drive you right out of it. As illustrated in the photos, an unpainted chest—priced at $15.75—can be harnessed to serve as an equipment console. All it takes is a little additional hardware, some finishing materials, and basic skills with common hand tools.

There's practically no end to the variety of designs possible, depending on the dimensions and quantity of your own equipment. In the chest shown here, the top three drawers were adapted to house tuner and amplifier (first drawer), record player (second drawer), and small loudspeaker (third drawer). The fourth drawer serves as storage area and may be left alone or partitioned into sections.

How It's Done. First, remove the top three drawers. Disassemble them carefully as some of their wood must be used later. In most cabinets of this type, the front of a drawer is grooved for holding the bottom in place. To remove the bottom, plane the underside of the groove till it is level with the other three edges of the drawer. This planing serves two purposes: it permits you to slip out the drawer bottom quite readily, and it also permits the use of a hinge on the front panel. The brass "piano hinges" used on the model were chosen for their appearance and strength.

Components are then "panel-mounted"—not on the drawer front, but on a new front which is fashioned from the drawer's bottom, and which is set into the drawer area at a slight recess. The drawer front itself is hinged to the front of the chest. When closed, the cabinet looks like any ordinary chest of drawers. With the hinged drawer front open, the hi-fi components are revealed in a very neat and efficient setting. What's more, the open front can serve as a small drop-leaf working surface.

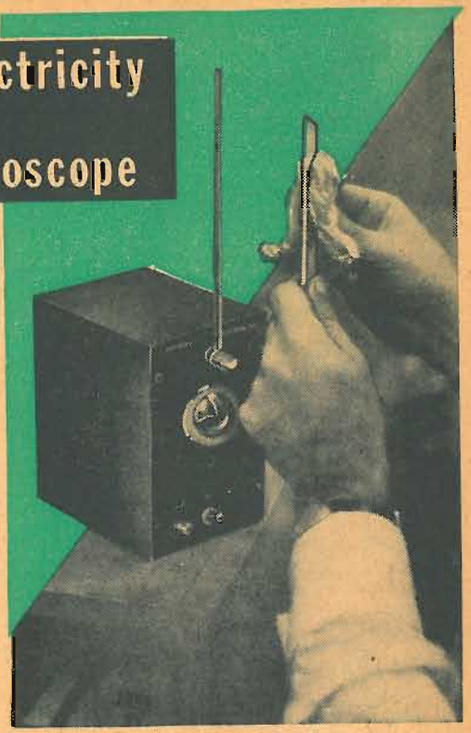
To secure the recessed mounting panel in place, fasten it to a frame that can be made from the sides of the disassembled drawer. The frame is fastened to the four inside panels of the chest itself, and the mounting panel in turn fastened to the frame. Cutouts for the control knobs and tuning dial of the equipment are made with hand drill and keyhole saw, after measuring carefully for their location.

The small speaker mounted in the third drawer is not the main speaker in this system. A larger, separately housed speaker is actually located in another room of the house. The smaller unit is used for monitoring when tuning in a station or adjusting controls for record playing. In a large room, both small and large speakers can be used together to achieve a wide, full sound distribution pattern.

Finishing. Naturally, you can paint or stain the cabinet to suit your taste. This cabinet was given a coat of cherry stain. If you use stain, remember that the sooner it is wiped off, the lighter will be the finished wood. When the stain has dried, apply two or three coats of clear varnish. Between each coat of varnish, rub with very fine sandpaper. Finally, apply a coat of wax for protection and a really smooth, professional-looking surface. —*Donald A. Smith*

Detecting Static Electricity with an All-Electronic Electroscope

By HARVEY POLLACK



Rubbing an insulator with soft cloth and bringing it near the feeler antenna of the electroscope will close its "eye." This unit can take a 100,000-volt discharge safely. The chassis is welded to front panel of case, shown below.

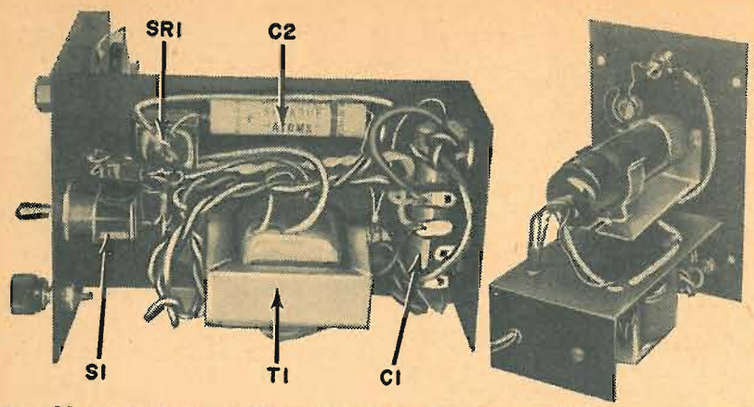
AN ELECTROSCOPE is an instrument for detecting the presence and polarity of static electrical charges. As a constructional project for science fairs, high school or college physics demonstrations, or home experimentation, the electronic electroscope to be described here is a real dream! Its reaction is easily visible to a large group, it is unaffected by high humidity, it provides positive discrimination between plus and minus charges, and—possibly best of all—it costs less than six dollars to build!

The standard gold or aluminum-foil type of electroscope is subject to humidity effects and is very difficult to present to a group of onlookers. Moreover, an uncharged foil-leaf instrument does not differentiate between positive and negative charges since it reacts the same way to both: its leaves diverge for either type of charge. Finally, the leaf electroscope must be handled with great care to avoid tearing the delicate foil by applying too intense a charge; this electronic model has taken a 100,000-volt discharge right into its feeler antenna from a static electricity machine with absolutely no ill effects.

Construction. Most projecteers discover sooner or later that there is a real thrill to be had from the businesslike appearance of a finished job. The case used in this model is crackle-finished steel with the chassis welded to the front panel. If you plan to use a similar unit, be sure to purchase one that has the chassis parallel to the 4" and 6" dimensions (over-all dimensions 4" x 5" x 6").

The placement of parts as shown in the photographs may be varied as long as care is taken in shielding the sensitive tuning-eye grid lead from surrounding a.c. fields. If you mount the isolation transformer and all the other small parts except *C3* and *R3* *under* the chassis, and the 6E5 tube and assembly above it, you should have no trouble with hum due to incorrect orientation of parts. All that is left to do to insure hum-free operation is to shield the 6E5 grid wire carefully from the back of the tube socket to isolating resistor *R3*.

Slip a length of shield braid taken from



Major parts are identified in the under-chassis view at far left. Use of full length transformer leads gives chassis a somewhat crowded appearance but makes for better soldering. Top view directly at left shows overall placement of the various parts.

an old microphone cable (or buy an 8" length of the braid material) over the yellow wire of the tuning-eye assembly, and carefully bond it to the chassis by soldering it to lugs fitted under the heads of the screws that secure the isolation transformer. Cut the leads of *R3* as short as possible, and make certain that neither one grounds out against the shield braid or the panel. Use a good, heavy feedthrough binding post for the feeler rod to avoid reducing the input resistance of the electroscope and spoiling its sensitivity.

All holes through which wires pass must be grommeted. *Be very sure that neither wire of the a.c. line cord touches any chassis ground points.* This instrument has been designed with an isolation transformer for *your* protection. Careless wiring might very well void its usefulness and give you a false sense of security.

Testing. No pre-completion tests are necessary. If the electroscope fails to perform as described (p. 55) when it is first plugged in, disconnect it immediately and check for the following common errors:

(1) Wire leads having the wrong code color, as compared with the diagrams, connected together or to common lugs.

(2) Polarity of the selenium rectifier reversed.

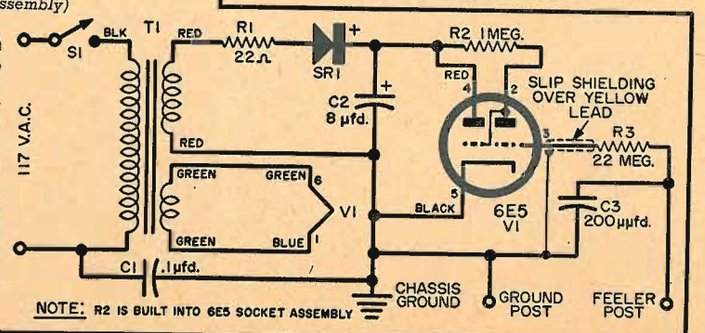
(3) Polarity of the electrolytic capacitor, *C2*, reversed.

(4) Grid circuit inadvertently grounded to shield braid or other ground point.

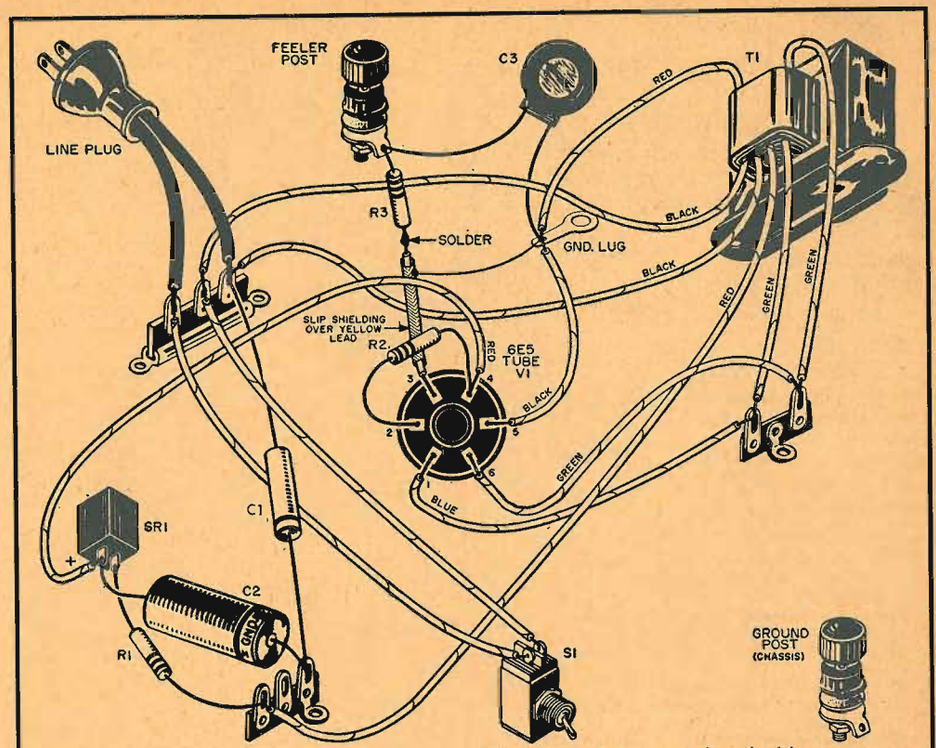
(5) Open or short-circuited connections.

Correct performance is indicated when the following steps are taken and the instrument performs as stated. Plug the line cord into a suitable 117-volt a.c. receptacle and trip the toggle switch to the "ON" position. After a 15-second warm-up, the face of the tuning eye should exhibit its characteristic green glow with a shadow angle of about 25°. The edges of the shadow should be quite sharp and clear. If they are fuzzy or if the angle is smaller than 25°, reverse the line plug. This will clear up the trouble.

C1—0.1-μfd., 600-volt, w.v. paper tubular capacitor
C2—8-μfd., 150-volt tubular capacitor, small cross-section (Sprague Type TVA-1405)
C3—200-μμfd., 600-volt molded disc-type capacitor
R1—22-ohm, ½-watt resistor
R2—1-megohm resistor (built into tuning-eye assembly)
R3—22.0-megohm, ½-watt resistor
S1—S.p.s.t. toggle switch, bat-handle, 3 amp. at 120 volts
SR1—50-ma., 120-volt selenium rectifier, molded Bakelite encapsulation (Sarkes-Tarzian #50)
T1—Isolation transformer, primary to secondary equals 1:1, 30-ma. secondary rating with 6.3-volt winding (Olsen Radio Warehouse, Type T-103 or equivalent)
V1—6E5 electron-ray tuning indicator
1—Eye socket assembly (socket and leads with 1-megohm resistor built in, Amphenol 58-MEA6)
1—4" x 5" x 6" black crackle-finish steel cabinet with chassis welded to panel
1—Line cord and plug
1—Terminal post for feeler antenna, 5-way feedthrough type with positive insulation against panel contact
1—Small non-insulating terminal post for ground
1—Length of shield braid (approx. 8" to fit over yellow lead of 6E5 assembly)



Schematic diagram and parts list for the electronic electroscope. Note capacitor C1; it permits small hum voltages present on the chassis to go to ground through the a.c. line cord. C3 helps store any charges present and prolongs reaction of the eye. R3 protects the tube from surges.



Follow this pictorial diagram to build the electronic electroscope described here.

Using the Electroscope. This unit is so sensitive that almost any good insulator rubbed briskly with a soft cloth will give positive action and cause the eye to react. Among the best materials are hard rubber, as used in good combs, strips or rods of polystyrene, Lucite, glass, and nylon. Rub each of these in turn with fabrics such as flannel, silk, nylon, and dacron, and with animal products such as wool, fur, etc.

Upon *approaching* the feeler rod with a *negatively* charged object, the 6E5 shadow closes. When a *positively* charged body is brought up to the feeler, very little action will be seen; but when it is *withdrawn*, the eye closes. Even with the charged object in activating position, the eye restores itself to the normal angle within a few seconds—due to unavoidable leakage in and around the tube elements. —30—

HOW IT WORKS

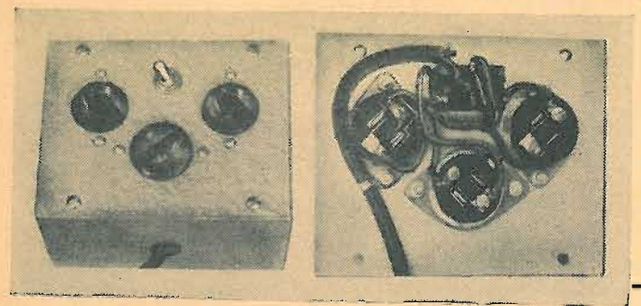
Contained in the 6E5 tuning-eye tube is a triode voltage amplifier and an electron-ray indicator. The electron-ray indicator portion has a control electrode directly connected to the triode plate inside the tube, the cathode, and a target electrode coated with a fluorescent material that glows when bombarded by electrons. The control electrode projects a short distance up inside the bowl-shaped target electrode and is placed between this element and the cathode in such a position that it can cast an electronic "shadow." As the control electrode becomes more negative than the target, the shadow widens. Reverse action occurs when the control electrode becomes more positive and, finally, when it takes on the same potential as the target, the shadow disappears altogether and the eye is said to be closed.

When a negative charge is applied to the grid of the *triode* via the feeler terminal, the triode plate current drops, the voltage across *R2* diminishes, the triode plate and control electrode become more positive, and the eye closes.

On the other hand, when a positive electrostatic charge is brought near the feeler, electrons are drawn away from the grid of the triode into the feeler rod, leaving the grid positive for an instant; the grid now attracts electrons to its own structure until the positive charge is neutralized, thus re-establishing the original "floating" potential. Hence, the eye neither opens appreciably nor closes upon positive approach, but the grid system now contains more electrons than it did before. When the body is taken away, the excess electrons are free to spread out due to mutual repulsion and return to the grid structure. This places a negative potential on the grid, causing the eye to close.

Dimmer Control for Photofloods

Amateur and professional photographers alike make extensive use of #2 reflector photofloods. If you do any portrait work, you will bless this little dimmer control a thousand times. It enables you to adjust your lights while they are generating only one-tenth of the heat that they produce at full brilliance. You can compose and focus without giving your subject a broiling infrared treatment.

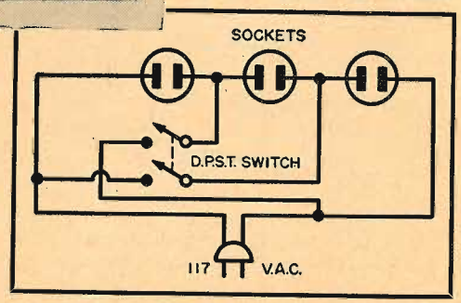


Dimming the bulbs will extend the life of your photofloods because the filaments are not allowed to go cold during a sitting. When cold, the resistance of a bulb is low, and the initial surge of current through this low resistance causes early burn-out.

Most photographers prefer three photofloods for portrait composition. Three receptacles are provided on the control box, one for each of the floods. With the toggle switch in one position, the lamps are all in parallel to produce full brilliance; in the other position of the switch, the circuit is converted to series connection. In this condition, only one-third of the normal current flows through each lamp.

For a truly professional-looking unit, build the dimmer in a grey hammertone aluminum Minibox. The model is a 3" x 4" x 5" type with removable front and back panels, available at all electronic distributors.

All parts—the three Amphenol tube socket type a.c. receptacles and the d.p.s.t. toggle switch—are mounted on the front panel, shown removed from the box in right-hand photo. The line cord emerges from the long side wall of the box. This arrangement is convenient for wiring and permits the box to lie flat on the floor or be strapped to one leg of a tripod. The components should be grouped quite close together so that they will be well clear of the lip of the control box when the front panel is secured to it.

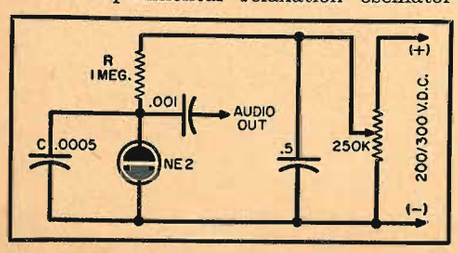


Interconnecting wires between receptacles and switch must not be smaller than #18 gauge and should be tinned for easy soldering. The line cord carries the full load—almost 15 amperes in the parallel connection—and so must not be smaller than #14 gauge. The toggle switch must be capable of carrying 10 amperes. —*Harvey Pollack*

Light-Sensitive Relaxation Oscillator

Neon bulbs are light-sensitive although they do not possess the properties associated with true photoelectric cells. Light merely assists the neon bulb to ionize and do its job more easily.

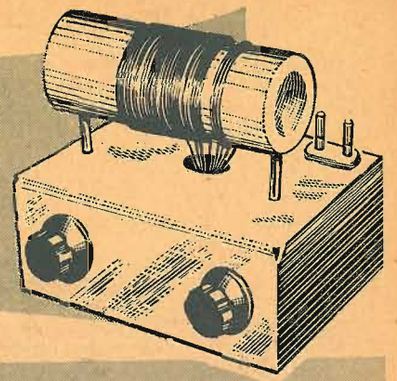
The experimental relaxation oscillator shown in the diagram will work to approximately 3000 cycles before oscillation ceases. At this "drop-out" point, the NE-2 will glow brightly, indicating that it is completely ionized.



If the B+ is readjusted (by the 250,000-ohm potentiometer) to where oscillation will start again, and is gingerly increased to a point near drop-out, a bright beam of sunlight will push the NE-2 across its threshold into complete ionization. With sunlight on the neon bulb, and the oscillator circuit again adjusted to produce its highest frequency, a beam of interrupted light will vary this frequency around a full half-tone.

—*Norman V. Becker*

Getting More from the "Peaker"



THERE ARE SEVERAL METHODS of connecting a receiver to the antenna "Peaker" described in a recent issue of POPULAR ELECTRONICS.* One of the three methods to be discussed here will give better performance than either of the others, depending upon the particular receiver.

Link Coupling. The circuit of the "Peaker" as originally published is reproduced in Fig. 1. This circuit uses what is known as link coupling, i.e., a relatively small coil, *L2*, magnetically coupled to the resonating coil, *L1*, is linked to the antenna coil in the receiver. This is done by connecting the *A* and *G* terminals of the "Peaker's" link coil, *L2*, to the antenna and ground terminals, respectively, of the receiver.

If your receiver has two input terminals, use the method shown in Fig. 2(A); if it has three, use the method of Fig. 2(B). Make certain that you include the jumper wire if you use Fig. 2(B).

In any instance where good results are not obtainable by this means, it may be better to go to one of the other coupling methods. When either of the following methods are used, the link coil may be deleted from the "Peaker."

Series Coupling. Figure 3 (p. 114) depicts series coupling between "Peaker" and receiver. It places the receiver's antenna coil in series with the "Peaker's" resonating coil. When this connection is used, the receiver's antenna coil becomes part of the "Peaker's" tuned circuit; thus, maximum signal energy is developed in the receiver when the "Peaker" is tuned to resonance.

We can also make use of an additional terminal (*X*) on the tap switch, *S1*, to short out resonating coil *L1* entirely. This is sometimes a helpful dodge when you are using a long antenna and tuning to frequencies around 15 mc.

(*Continued on page* 114)

* See "The SWL's Friend—An Antenna 'Peaker,'" by Frank H. Tooker, June, 1956, page 79.

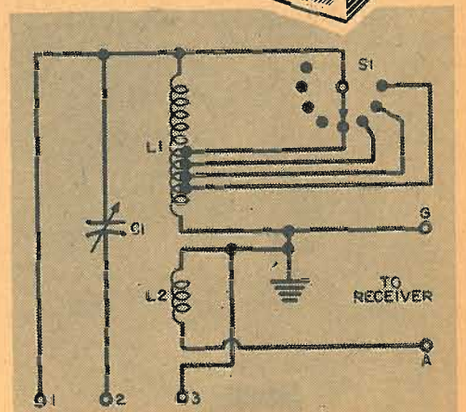


Fig. 1. Circuit of the "Peaker," which uses link coupling. Parts values are given below.
C1—365-μμfd. broadcast-type variable capacitor
L1—32 turns No. 20 solid tinned copper wire spaced to occupy 2" on 2"-diameter form, tapped at 4, 8, 12, 16, 20, 24, 28 and 32 turns from ground end
L2—4 turns, average, No. 20 solid tinned copper wire spaced to occupy ¼" and separated ¼" from L1
S1—1-pole, 8-pos. rotary switch with ceramic insulation (Centralab Type PA-2001 or equal)

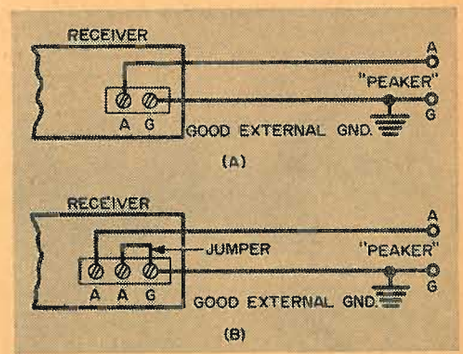


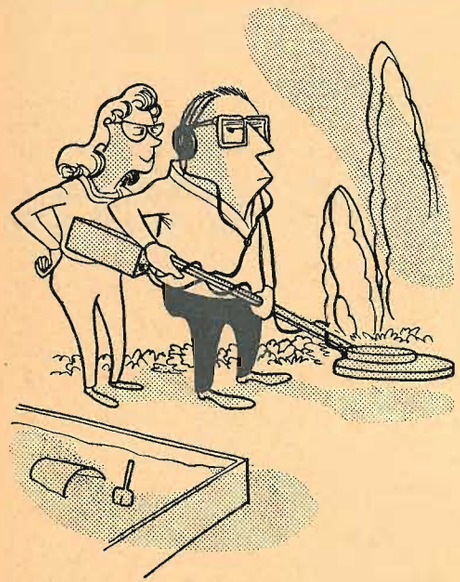
Fig. 2. Connecting A and G terminals of link coil L2 to antenna and ground terminals of receiver with (A) two input and (B) three input terminals.

THE METTLE LOCATOR

By Carl Kohler

SHAMBLING through the garden—completely absorbed with seeking fresh test-areas for my new metal locator, I failed to see the Girl Kibitzer until she was breathing down my neck. Since there's just no ignoring her once that happens, I removed the headphones and threw the first punch.

"This skillfully constructed instrument



. . . Absorbed with seeking fresh test-areas for my new metal locator, I failed to see the Girl Kibitzer until she was breathing down my neck . . .

could be an electronic gardening-device," I said.

"!" She exclaimed, her narrowed eyes unnarrowing.

"But it's not," I added.

"?" She asked, articulately.

"Well, it *might* also be a high-voltage beam-sprayer with which to send insects to whatever buggy Valhalla may exist for insects."

"!!!" She gasped, admiration beginning to tinge her face.

"But," I amended, mysteriously, "it's not!"

" ? ? ? ? ? " She demanded excitedly.

"Well, I'll give you a hint," I said, generously. "On pages 86-87-88, of the June, 1956, issue of POPULAR ELECTRONICS lie the facts, the figures and the entire story of this versatile instrument." I chuckled indulgently and pointed toward my workshack. "Seek and ye shall most likely find out all about it, my dear!"

She took off like a super-charged missile.

BY GOSH, I thought, returning to my tests, *I've been telling that girl too much. Have to let her do her own ferreting after this. That's the ticket! Keep her so busy, hunting up information, she'll be too occupied to . . .*

She was back, breathing stentoriously.

"Okay, chum," she rasped caustically, "so . . . you built a . . . metal locator . . . and . . . what does . . . that . . . do for the . . . state of . . . electrical . . . disrepair around this . . . lashup?"

"I'll *show* you! It's utterly *fabulous!*" I said enthusiastically.

"I bet!" She sneered.

"Now, *watch!*"

"I'm looking."

"*Get* this, now!"

"I'm LOOKING!"

"Don't *miss* this—it'll shake you, at first!"

"I'm braced—GO AHEAD!"

Carefully, I lowered the housing containing the search-coil to the ground and slowly swung the locator back and forth, listening intently to the beat-note singing in the headphones.

"I ain't shook much, yet . . ." she observed evenly.

"Just a min—*wait,* now . . . no . . . wait, I think . . . *yes, there it is!*" I rejoiced. "We've got it now! Boy, that's *performance!*"

"Still unshook, chum," she mentioned acidly.

I removed the headphones, put the locator carefully down on the ground, scratched an X into the soil with my finger and lit a cigarette.

"Something happened?" she inquired.

"It's down there," I said, my features (I hoped) a bland combination of inscrutable confidence. "Right . . . down . . . there."

"It *is,* hey?" She bent over and studied the X with a sour expression. "Imagine *that!* It's right down there! Why, you could walk over it a dozen times and never know it was there." She stood up and folded her arms across her chest.

"Well, WHAT IS IT?" she demanded, scorching me with her eyes.

I handed her the spade.

"Now, *I* did *my* job—you do yours."

She began digging.

"WHILE you're engrossed with the excavation process, I'll brief you on the general characteristics of this marvelous instrument," I said, settling myself comfortably in a nearby lawnchair. "Its possibilities will stun you with avarice or you aren't the same girl who haunts department stores searching for a 10¢ difference in bargains!" I chuckled, softly, at my small jest and hoisted my feet a bit higher.

"Of the two major types of locators," I continued, rather wishing I'd had her bring some coffee with her, "the field-distortion and the beat-frequency, I chose the latter because it was simpler. Also, while not quite as effective, performance-wise, as the more complicated type, it'll serve very nicely since I checked out the variables connected with—"

"Hey," she called, "I'm down three feet and haven't found a single thing . . . unless this gismo of yours locates earthworms, potato-bugs and the remains of what looks like an *old coffee-pot.*"

"Excelsior! Eureka!" I cried, dragging myself painfully to my feet. "You've *done* it!"

"I did good?" She appeared uncertain.

"Of course!" I assured her, warmly

. . . For awhile, I watched and she dug. Then, for change of pace, she dug and I kept an eye open . . .

. . . "Now see what your crazy old ideas have done!" she screeched in anguish-laden tones . . .

pumping her hand. "You've just proven that the locator *can operate very swiftly if the buried metal*—in this instance, what seems to be an aged and semi-disintegrated pot—has attained *any degree* of association with the surrounding mantle rock, due to chemical—"

"I did something real jazzy, eh?"

"Mais oui!" I exclaimed, kissing her on both cheeks.

"Stop slobbering all over me," she snapped, peevishly, "and tell me exactly what's so wonderful! Doesn't seem like any big deal to me. I just dug up a lousy old pot. What's the alleged importance, chum?"

"I was afraid you'd ask that," I said, somewhat flattened.

"Is that *all* this gimmick's good for—finding pots?"

"Ho, foolish girl!" I laughed. "Use your imagination! *Think!* Think of all the wonderful, long-buried treasures that are just *waiting*—waiting for you and I to discover their ancient places of concealment and unearth them, I might add, to our personal profit and delight! Think of it! All the gold and silver objects, coins, items worth thousands! Nay, *millions,* or I'm a monkey's brother-in-law! All safely tucked away in Mother Nature's own vault and waiting for us to dig them out!"

"Around *this* joint?" She looked dubiously around the tract-housing neighborhood. "Treasure?"

"Don't forget." I lowered my voice to a harsh whisper, glancing about to be sure the bushes hadn't ears. "Don't forget, girl, this once was Spanish territory! The

(*Continued on page* 112)

Electronic "Maid" Cleans House

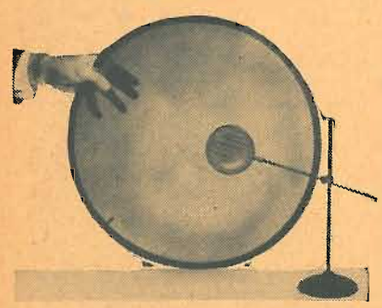
The girl in the picture at left is suitably attired to show that she is spared the discomforts of "housemaid's knee" since the gadget in the foreground has taken over her house-cleaning chores. The Trion Electronic Air Cleaner seems to be a machine of philosophical disposition since it tackles a problem by going after its first cause: it cleans house by eliminating the need for cleaning house. With electronically filtered air, the house doesn't get dirty in the first place. The girl is now out of work, but looks happy because she won't get fired. Efficiency experts say she will be "freed for more creative activities."

Keeping "X" Planes on Leash

The giant radar at right, built by Reeves Instrument Corp., is trucked about the Mojave desert to keep the Air Force's new "X" (experimental) craft on an invisible leash during their flight tests.

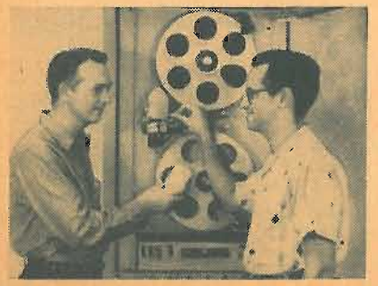
The new radar range, built for the Air Research and Development Command, will extend from Edwards Air Force Base on the western "shore" of Rogers Dry Lake in California out over 400 miles of desolate and virtually uninhabited territory into Nevada.

Of the same type as the radar systems built by Reeves for the Guided Missile Test Range off the Florida coast, this installation is designed to track, record, and monitor the performance of the U. S. Air Force's most advanced aircraft. It is part of a $40,000,000 expansion program for Edwards AF Base.



Color TV Wears Shadow Mask

A shadow mask consisting of a paper-thin metal sheet with 400,000 perfectly round holes guides electron beams to the phosphor-coated face-plate on color television tubes. Each hole in the mask is 1/100th of an inch in diameter. It focuses the tube's three electron beams on the right phosphor dot (red, blue or green) on the color screen. Made by Superior Tube Company, the mask, shown at left with part of it enlarged by a magnifying lens, assures that the right beam hits the right dot to produce a correct blend of the primary colors.

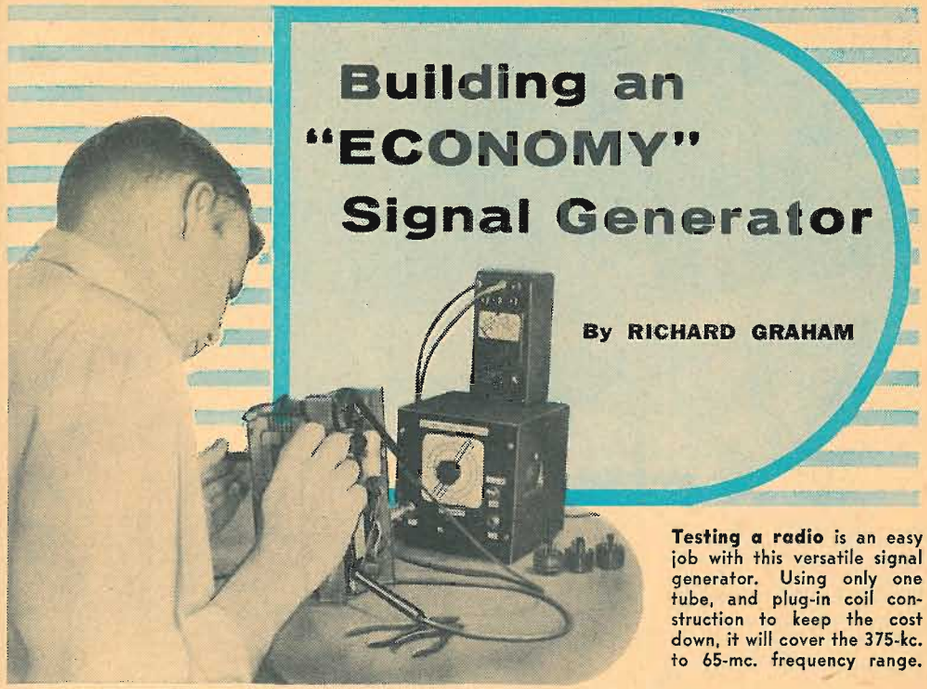


Mark Missile Track on Tape

The Air Force Missile Test Center's tracking stations of the 5000-mile Florida Missile Test Range will now be able to receive 1890 separate items of information from any missile being tested on the range. This is made possible by an amazing new telemetry recorder which was developed for the Air Research and Development Command by the Consolidated Electrodynamics Corporation of California in a phenomenal period of 90 days. The new recorder monitors seven radio data links.

Building an "ECONOMY" Signal Generator

By RICHARD GRAHAM



Testing a radio is an easy job with this versatile signal generator. Using only one tube, and plug-in coil construction to keep the cost down, it will cover the 375-kc. to 65-mc. frequency range.

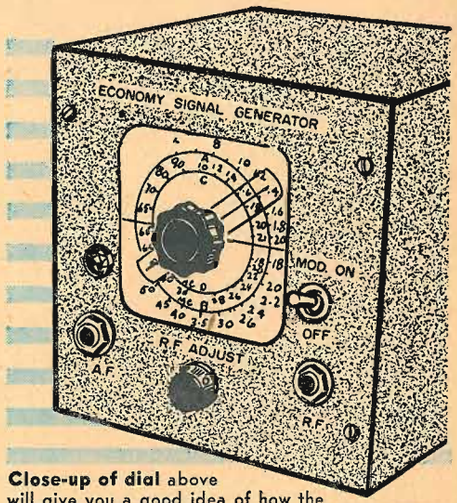
A SIGNAL GENERATOR means as much to the electronics experimenter and serviceman as a hammer does to the carpenter. It is considered an essential tool of the trade. This particular signal generator is tailored for the experimenter with "good tool" taste but without the financial resources to back it up.

The "Economy" signal generator is fairly straightforward in electrical design. Although it uses only one tube, it offers a frequency range that can be spread or tailored to one's individual requirements. This is achieved by the use of plug-in coils. It also results in a general cost reduction . . . particularly since the coil forms are free!

Four plug-in coils cover the range of 375 kc. to 65 mc. The generator incorporates an internal 400-cycle audio modulation. The audio tone is made available through the front panel to check audio systems, amplifiers, etc.

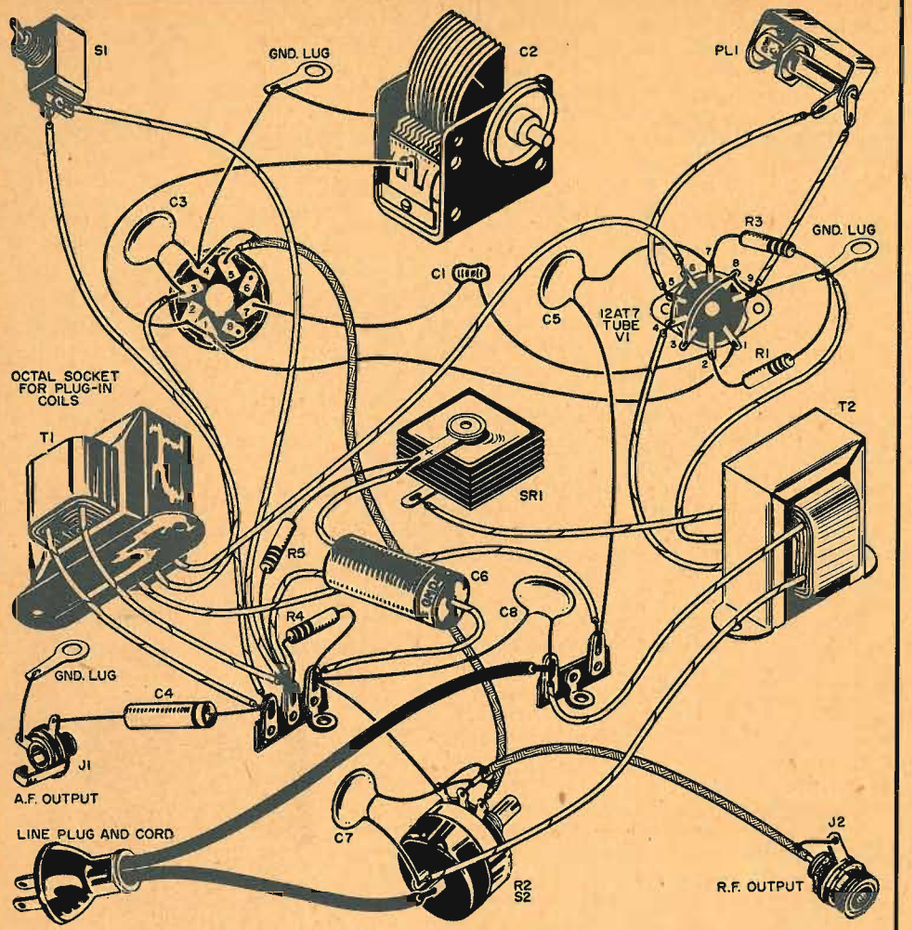
Mechanical considerations involved in building a signal generator are as important as the electrical design. Ever try to lift a high-quality laboratory unit? It often takes two men to transport it across a room. Mechanically rugged and rigid construction is a primary aim in these generators.

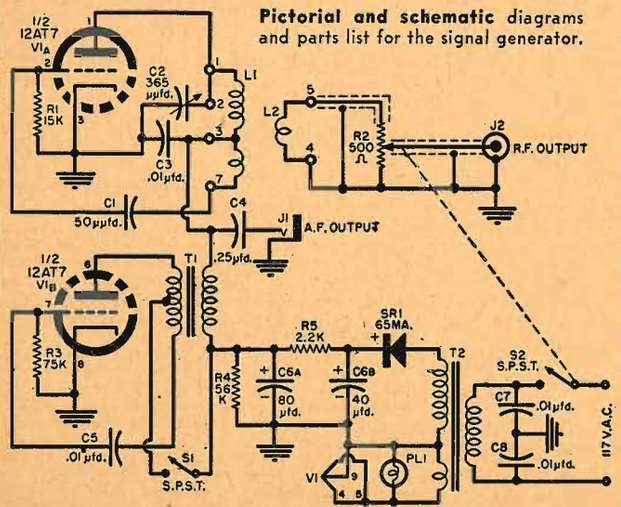
While the "Economy" generator can certainly be lifted by a very small boy, it has this same mechanical philosophy in its layout. A steel chassis and box are used purely for mechanical rigidity. The rear edge of the chassis has a metal post standoff and the plug-in coil bracket has a special metal post to hold it to the cabinet. These precautions make a fairly rugged unit in which the frequency output is reasonably immune to pounding and vibration.



Close-up of dial above will give you a good idea of how the generator can be calibrated. See text for details.

Construction. The unit is housed in a black crackle 6" x 6" x 6" steel utility box





Pictorial and schematic diagrams and parts list for the signal generator.

C1—50-μμfd. ceramic capacitor
C2—365-μμfd. variable capacitor
C3, C5, C7, C8—0.01-μfd., 600-volt disc ceramic capacitor
C4—0.25-μfd., 400-volt paper capacitor
C6—80-40 μfd., 150-volt electrolytic capacitor
J1—Open-circuit jack
J2—Coaxial jack
PL1—Pilot light
R1—15,000-ohm, ½-watt resistor
R2—500-ohm carbon potentiometer
R3—75,000-ohm, ½-watt resistor
R4—56,000-ohm, 1-watt resistor
R5—2200-ohm, 2-watt resistor
S1—S.p.s.t. switch
S2—S.p.s.t switch on R2
SR1—65-ma. selenium rectifier
T1—Modulation transformer, 4000-ohm secondary, 10,000-ohm center-tapped primary (Stancor A3812)
T2—Power transformer, 125 volt @ 15 ma., 6.3 volt @ 0.6 amp. (Stancor PS8415)
V1—Type 12AT7 tube

with a 4¾" x 5½" steel shelf. The 12AT7 is mounted vertically under the chassis, and the coil socket is mounted on a right-angle bracket formed from a 1¾" x 2½" piece of steel. If short leads are maintained in the coil (*L1*) and variable capacitor (*C2*) circuitry, you will find that there is nothing critical in the wiring.

The coil forms can be salvaged from defective octal tubes. Just make sure that the coil is wound on the diameter base specified. Break a tube in a paper bag with a sharp hammer blow. The base can then be cleaned out with a pair of cutters. A screwdriver will pick or scrape out the cement. Remove wires from the pins by heating the pins with a soldering iron. After the solder has melted, give the base a sharp rap and the hole in the pin will be clear of both wire and solder.

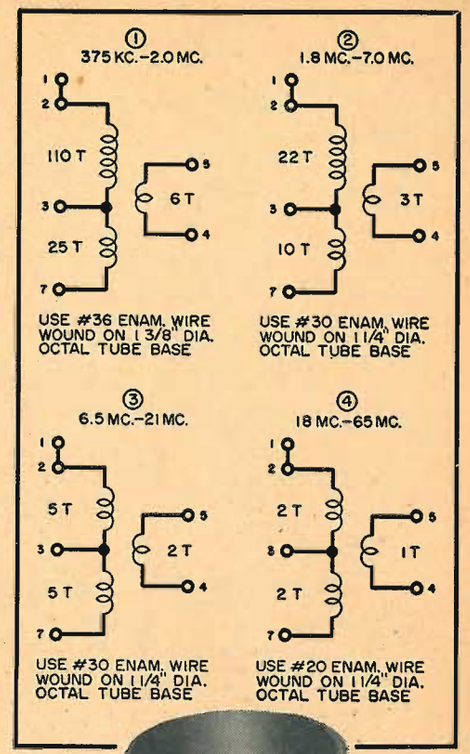
The post providing support between the rear chassis edge and cabinet and the post between the coil socket and cabinet are made up of standard 1" threaded metal spacers. They are fastened together by cutting the head off a screw and using the threaded portion to hold the two posts together.

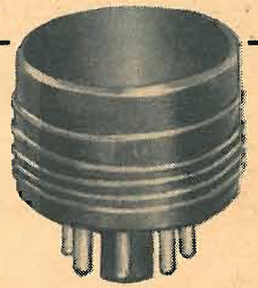
Calibration. This poses a more interesting challenge than building the generator, but an accurate and reliable calibration can be worked out with a good communications receiver. An "all-wave" receiver of undetermined accuracy can be used if it has a short-wave coverage up to approximately 22 mc.

The calibration method to be described uses broadcast-band stations of known frequencies. These are made to beat against the generator fundamental and harmonics up through the highest frequency received by the receiver. The lowest frequency of the generator is around 375 kc.

Let's assume that there is a broadcasting station at 800 kc. in your locality, and that the receiver is tuned in to this station. Place the receiver antenna close to the generator output lead. If the low-frequency coil is plugged in the unit, and the generator is set to the lowest frequency (i.e., the variable plates of *C2* are all in), as the generator is slowly rotated toward the higher frequencies a beat note or whistle will be heard.

As the dial is rotated, the beat note will first be noticed as a high-pitched whistle which decreases in frequency as the dial is rotated further. This continues until zero frequency difference is reached, known as "zero beat." As the dial is rotated still further, the frequency will again increase until it is inaudible. However, when we were "zero beat" with the broadcast station at 800 kc., it really meant that the generator





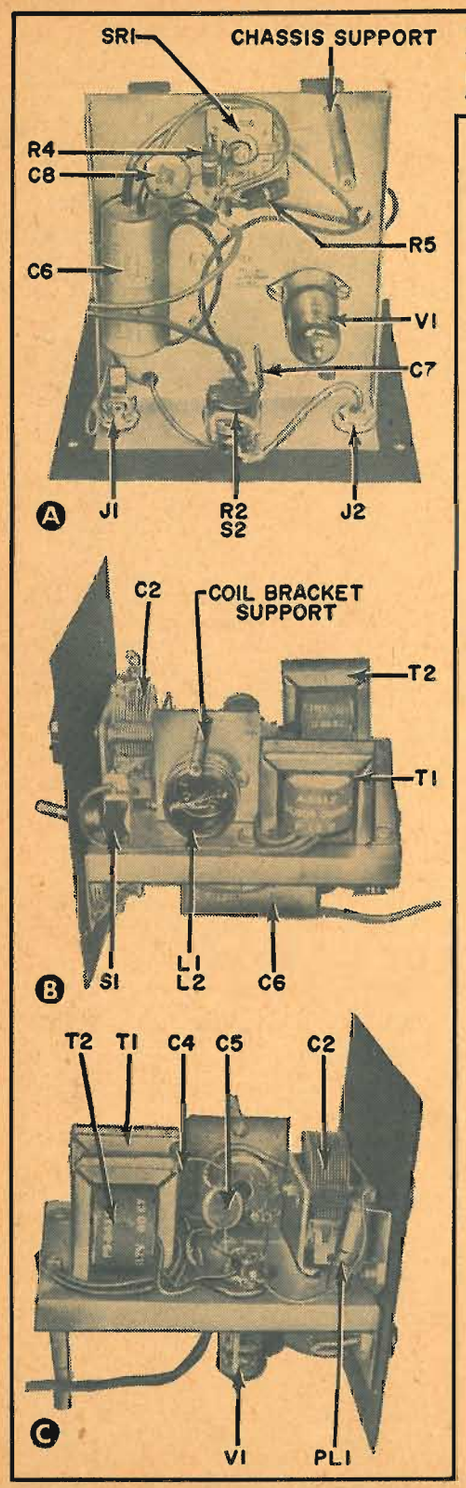
Four plug-in coils, such as the one shown here, cover the basic frequency range. Data for each coil is given in the box above. You can salvage the coil forms from defective octal tubes as described in the text.

HOW IT WORKS

This signal generator utilizes a series-fed Hartley circuit, with stability being achieved through rigid mechanical construction. Oscillation occurs through feeding the signal appearing in the plate circuit back into the grid with the proper phase change.

The generator is plate-modulated through a small Stancor modulation transformer. This method is unusual in signal generator design but is capable of rendering a higher percentage of modulation, and so has the effect of giving a louder audio signal output when used during receiver alignment.

The primary of transformer *T1* is connected as an audio oscillator in the same type of Hartley oscillator circuit as the r.f. oscillator. Audio output for test purposes is coupled from the secondary of *T1* through capacitor *C4* to block d.c. from the output test lead.



Three views of the "Economy" signal generator chassis show placement of the major components: Ⓐ bottom view; Ⓑ right side view; and Ⓒ left side view. Layout is very critical.

was exactly set to 400 kc. Thus, the first calibration point has been obtained.

The generator frequency is increased until a carrier is heard, indicating that the generator is set at 800 kc. That point is then calibrated on the generator. Now, with the generator set at 400 kc., previously calibrated, the third and fourth harmonics of the generator can be picked up on the receiver at 1200 kc. and 1600 kc. They will be considerably weaker.

With these frequency points calibrated on the receiver, more calibrated points on the generator can be determined as follows: Set the receiver to the newly calibrated frequency of 1200 kc. on the dial. Continue increasing the generator frequency until a strong carrier (no whistle) is heard. This frequency will be 1200 kc. and is so calibrated on the generator dial. The receiver is then set to 1600 kc. and the generator adjusted until the new carrier is heard, which would be at 1600 kc. Thus, we have determined four frequencies with good accuracy.

With the generator at 1600 kc., scan the receiver frequencies starting at 1600 kc. for generator harmonic points. The first should be heard at 3.2 mc., then 4.8 mc., and a weaker one at 6.4 mc. Now set the receiver at the 6.4-mc. spot and double-check the lower generator frequencies. For example, as the generator frequency is increased, the next signal heard in the receiver will be when the generator is set at 3.2 mc. This point is calibrated on the generator dial, then the carrier at 6.4 mc. Such a boot-strap process can be repeated to the highest frequency covered by the receiver.*

The generator frequencies beyond the highest frequency received by the short-wave receiver can be calibrated by means of an FM tuner. As generator harmonics will lie in the FM and TV band, the procedure described above can also be used to extend the calibration of the generator. —30—

*Something to watch in calibrating by this method is that, since each calibration point is based on the previous calibration, extreme care must be used.

Also, feed as little signal from the generator into the receiver as possible to avoid the false responses that would result if the generator signal were too strong. Such responses are always weaker than the desired response and spaced twice the intermediate frequency away. For example, if a receiver has a 455-kc. i.f., the image response might appear 910 kc. higher or lower (only one or the other) than the stronger desired frequency.

The above statements are not meant to confuse but rather to serve as words of caution to enable the successful calibration of the generator. After the method is understood, calibration can be completed quite rapidly.

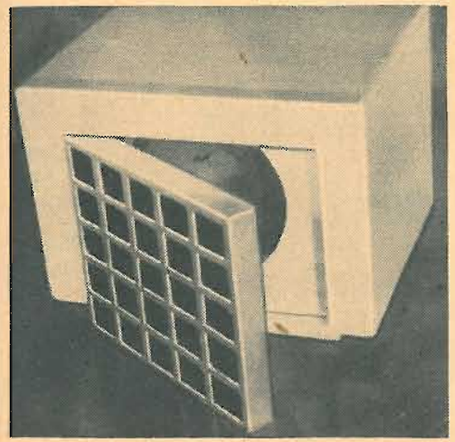
Speaker Cabinet for Communications Receivers

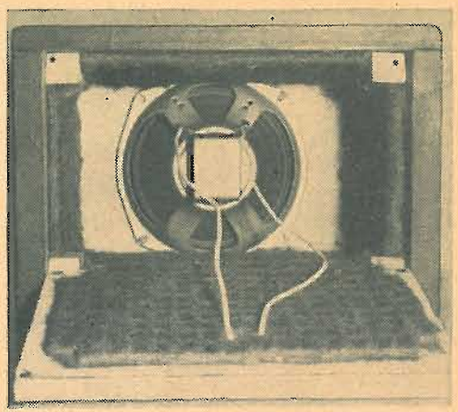
You can make your own speaker cabinet if you have a communications receiver that does not have the speaker built in. In many cases there is some gain in performance if we borrow a page from the book of the hi-fi enthusiast.

Treat the speaker case as an infinite baffle. This will result in a marked reduction in the "boominess" of commercially built receivers. It is, of course, suited only for voice communications, not for music.

The cabinet is constructed of heavy wood fastened with glue and countersunk nails. The grill is constructed from 3/16" x 3/4" wood strips. Dimensions of the cabinet are not critical and may be adjusted to suit the space available and the speaker you desire to use. The author's model uses a 6-inch speaker. The padding is rug cushion and should be added or removed until the optimum sound quality is achieved.

—Charles Welch





Inside view of speaker cabinet above shows use of rug cushion padding. At left is completed cabinet with grill constructed of small wood strips.

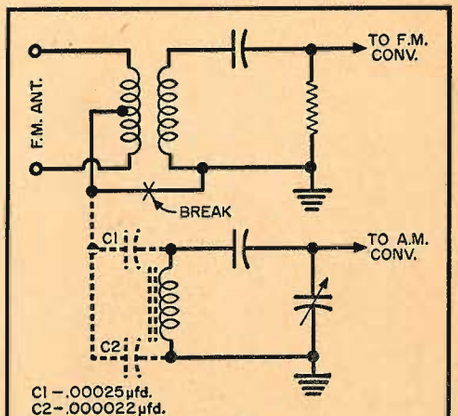
Improving AM-FM Tuner Performance

Many AM-FM tuners employ a ferrite Loopstick antenna for reception of the AM broadcast band, and an external folded-dipole antenna for the FM band. It is often difficult to obtain satisfactory reception with these tuners on the AM band due to the large amount of signal voltage required to drive the broadband AM stages. More often than not, an external antenna proves to be the only remedy.

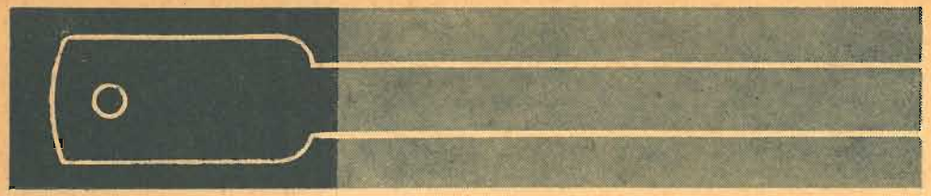
The simplest method of adding an external antenna to this section of the tuner is to couple the AM and FM antenna input circuits together—making the FM dipole a common antenna. Shown in the schematic diagram is the antenna circuit most often used in AM-FM tuners. The dotted lines indicate the necessary modifications.

To make the change-over, remove the lead between the center-tap of the FM antenna coil primary and the ground side of the coil secondary. Connect one lead from each of the new capacitors (*C1* and *C2* in diagram) to the FM coil center tap. Connect the other side of each capacitor across the AM Loopstick as indicated.

These modifications will add considerably to your tuner's AM reception, and no change in FM performance will result as long as you adhere to the optimum values given in the diagram. *—Warren J. Smith*



Schematic diagram of antenna input circuit most commonly used in AM-FM tuners. Dotted lines indicate changes around C1 and C2.



Should You Have Your Head Examined?

By SHANE SMITH

DEFINITELY YES—and regularly, too! We're not jumping to conclusions about your personal noggin. But your phono pickup head can go crazy, too. Rough experience may have warped it. It may then refuse to adjust to its groove "environment" and noisily insist on having its own way. A firm hand (yours) can usually get it back in line. Here's some practical first aid for such "headaches."

In fuzzy phonographs, you can usually trace trouble right to the source: the record or the stylus. Nothing can be done about worn and noisy records, except to expound what an ounce of prevention is worth where care is the only cure. But for the stylus there are several handy remedies. Styli can suffer five kinds of infirmity: (1) old age; (2) disorientation; (3) overweight; (4) arthritis and (5) plain dirt.

Old age simply shows up as wear around the edges. Hard work in the groove gradually grinds down the youthful smoothness of your stylus until its face falls into sharp crags. The old stylus then takes savage revenge on the records that led it such a strenuous life by biting into them whenever they go for a spin and try to get another wiggle out the old jewel.

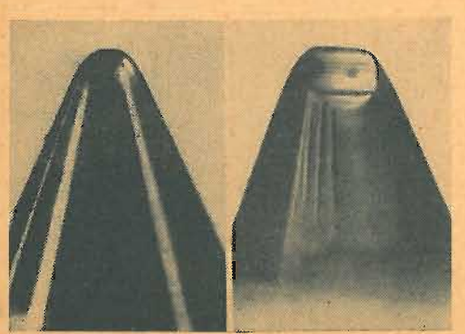
Of course, old age is always a fatal ailment. In this case, it is best diagnosed under the microscope, where the sharp lines in the formerly round stylus face show up clearly under sideways light. If you haven't got a microscope, your hi-fi dealer has, and he'll gladly let you see for yourself (and without charge) the ravages of time.

Such inspection tells you when to replace the worn stylus. As a rule, sapphires last 40-50 playing hours. Diamonds keep up the whirl for about 1-2 years.

Yet if you have friends, relatives, children or dogs within reach of your phonograph, it's a good idea to check more often. Any one of them might have dropped the pickup on the turntable when you weren't looking, splitting a chunk right out of that precious point. You may never suspect this catastrophe until you look at your needle in the microscope and see something like an utterly abandoned quarry. Meanwhile, your records are reamed by a chisel edge. For this reason alone, a periodic peek is a good idea.

Disorientation in styli is a simple case of being off center and out of line. For instance, in the popular G.E. magnetic cartridge, the stylus must nestle exactly halfway between the two magnet poles so that equal swings to either side produce equivalent signals. Otherwise, one half of the sound wave "outshouts" the other—and your ears lose the argument.

Sometimes the metal piece holding the stylus is bent so far out of shape that the stylus hits the pole piece on a wide swing. The weird acoustic results of such miniature "crashes" occurring at the rate of thousands per second can give you a real—not at all metaphoric—headache. Plastic surgery quickly sets things aright: a gentle nudge on the delicate stylus suspension usually brings the stylus back into the center of the gap, where it belongs. It's always



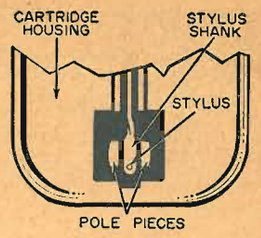
Most hi-fi shops use a microscope to distinguish smooth stylus (left) from battle-scarred ruin (right). Check your stylus to protect your favorite records.

every few months ... gauge will let you keep the tone arm weight near its optimum. For most popular hi-fi cartridges, it should be 4-7 grams, while 2-3 grams suffice for professional pickups.

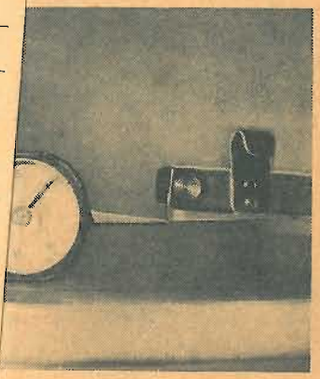
Arthritis, manifest in a certain stiffness of joints, comes naturally to aged pickups. After years of strenuous ups and downs and musical hi-jinx at every turn, the pickup loses its youthful springiness and can no longer follow the rapid dance of life in a record groove. The little plastic or rubber damping blocks that make stylus movement so easy and supple have hardened with time. No longer able to join the merriment of the fast musical vibrations, the old stylus leaves the accustomed furrow—and as it jumps out of the groove, you jump out of your chair. "Loss of compliance," says the expert after sage consultation.

Fortunately, the disease is rare. In most cases, the stylus itself will wear out before its moorings start to stiffen. And every time you replace the stylus, you automatically get a brand-new set of damping blocks. But if your record player jumps grooves and

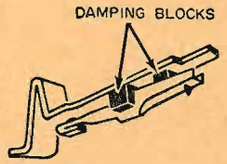
(Continued on page 94)

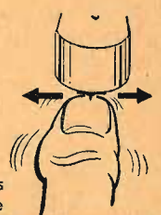


No slant on fidelity. Stylus must sit straight in groove. Check vertical axis.



...ylus pressure, the Scherr precision ...s exact readings on clearly legible dial. An extra hand marks the maximum weight and keeps its position on the dial after the measurement is completed. An automatic record of the stylus pressure is thus retained.

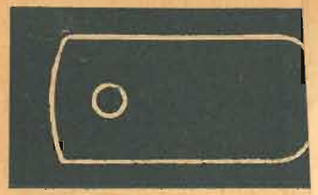




Compliance of damping blocks in stylus assembly (left) can be roughly checked by thumb-nail test shown at right.

STYLUS REPLACEMENT CHART

Stylus	Playing Time	Replacement
Diamond	as many hours per day as desired	must inspect after 1 year; may not be worn
Sapphire	1 hour per day	after 40 days
Osmium	1 hour per day	after 18 days



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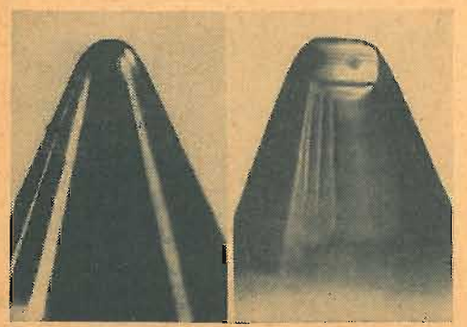


Most hi-fi shops use a microscope to distinguish smooth stylus (left) from battle-scarred ruin (right). Check your stylus to protect your favorite records.

a period alone, a periodic peek is a good idea.

Disorientation in styli is a simple case of being off center and out of line. For instance, in the popular G.E. magnetic cartridge, the stylus must nestle exactly halfway between the two magnet poles so that equal swings to either side produce equivalent signals. Otherwise, one half of the sound wave "outshouts" the other—and your ears lose the argument.

Sometimes the metal piece holding the stylus is bent so far out of shape that the stylus hits the pole piece on a wide swing. The weird acoustic results of such miniature "crashes" occurring at the rate of thousands per second can give you a real—not at all metaphoric—headache. Plastic surgery quickly sets things aright: a gentle nudge on the delicate stylus suspension usually brings the stylus back into the center of the gap, where it belongs. It's always a good idea to remove the stylus assembly before this operation.

Just as important as lateral centering of the stylus in a G.E. type cartridge is its vertical alignment. By this we simply mean that the stylus must come straight down on the record; its center axis must be downright plumb. If it leans over to one side, it will wear that side of the groove faster than the other and pick up an unsymmetrical signal. The fault of such vertical slanting may be in the tone arm or in the stylus suspension itself. In the latter case, remove the stylus, and gently correct the bend in the metal strip holding the jewel point. If the stylus is non-removable, this adjustment must be made at the factory. *Never* twist a stylus permanently attached to the pickup mechanism (e.g., in a moving coil pickup). This would certainly ruin the entire delicate assembly.

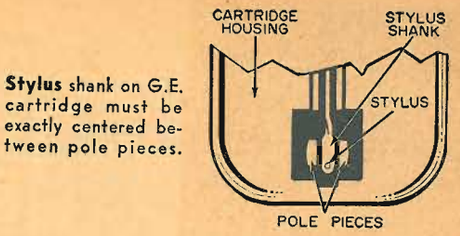
Overweight is a real killer. The time of life runs out fast on stylus and record alike if excess weight bears down on them. Of course, if you have a professional-type counterbalanced tone arm, you can quit worrying. Once adjusted, the pressure stays put.

Yet in spring-loaded tone arms, the spring gradually tires and pulls less strongly against the weight of the arm. The arm then rests more heavily on the stylus. But fortunately, most of these arms have a spring tension adjustment where a few turns of the screw make up for the gradual weakening of the spring. A quick check every few months with a stylus pressure gauge will let you keep the tone arm weight near its optimum. For most popular hi-fi cartridges, it should be 4-7 grams, while 2-3 grams suffice for professional pickups.

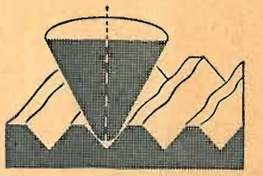
Arthritis, manifest in a certain stiffness of joints, comes naturally to aged pickups. After years of strenuous ups and downs and musical hi-jinx at every turn, the pickup loses its youthful springiness and can no longer follow the rapid dance of life in a record groove. The little plastic or rubber damping blocks that make stylus movement so easy and supple have hardened with time. No longer able to join the merriment of the fast musical vibrations, the old stylus leaves the accustomed furrow—and as it jumps out of the groove, you jump out of your chair. "Loss of compliance," says the expert after sage consultation.

Fortunately, the disease is rare. In most cases, the stylus itself will wear out before its moorings start to stiffen. And every time you replace the stylus, you automatically get a brand-new set of damping blocks. But if your record player jumps grooves and

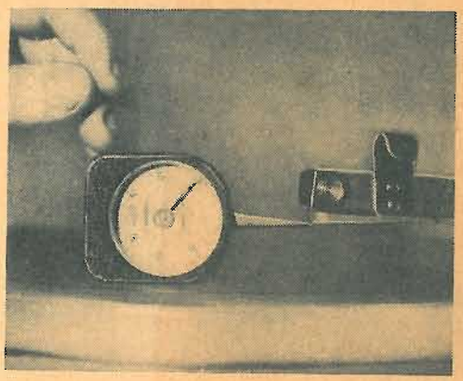
(*Continued on page* 94)



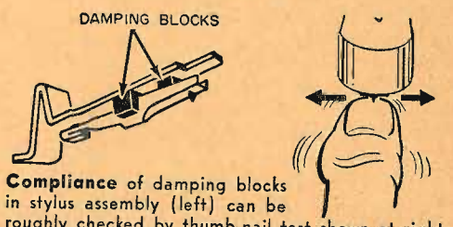
Stylus shank on G.E. cartridge must be exactly centered between pole pieces.



No slant on fidelity. Stylus must sit straight in groove. Check vertical axis.



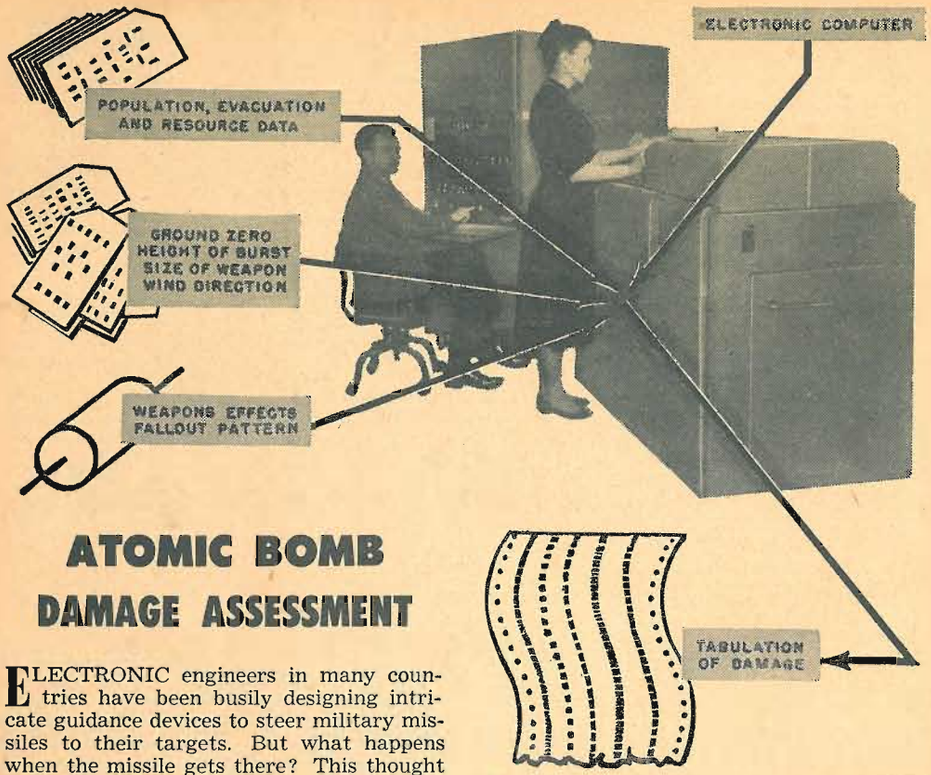
Checking stylus pressure, the Scherr precision gage indicates exact readings on clearly legible dial. An extra hand marks the maximum weight and keeps its position on the dial after the measurement is completed. An automatic record of the stylus pressure is thus retained.



Compliance of damping blocks in stylus assembly (left) can be roughly checked by thumb-nail test shown at right.

STYLUS REPLACEMENT CHART

Stylus	Playing Time	Replacement
Diamond	as many hours per day as desired	must inspect after 1 year; may not be worn
Sapphire	1 hour per day	after 40 days
Osmium	1 hour per day	after 18 days



ATOMIC BOMB DAMAGE ASSESSMENT

ELECTRONIC engineers in many countries have been busily designing intricate guidance devices to steer military missiles to their targets. But what happens when the missile gets there? This thought is far less pleasant than the idea of electronically guided flight. Yet it is now electronics' bitter task to measure the dreadful possibilities of atomic war—possibilities which electronics itself helped to create.

The Civil Defense Administration asked the Stanford Research Institute to design a computer able to tell quickly what would be left after an attack. This is necessary since nearly total devastation will hamper communication with stricken areas.

Stored in advance in the computer is punched-card information about: population numbers in major areas of the country; population densities; evacuation facilities; available doctors, hospitals, medical supplies, water, etc.; vulnerability factors, taking into account the terrain (hilly or flat) and the predominant type of housing structure; and similar information.

After the attack, the machine will receive magnetically recorded data as to whether the weapons were ground or air bursts, their location, size and type of detonated bombs and prior warning time for evacuation purposes. Wind velocity and direction are also noted so that casualties and damage from radioactive fallout can be assessed.

Let's assume that in an attack on San Francisco, two big megaton bombs and four "small" bombs of 20 kilotons each are dropped. Let's assume also that they all miss the main target and, instead, fall on the surrounding towns of Piedmont, Alameda, Richmond, Presidio, Palo Alto, and the San Francisco airport. The computer could then quickly tell us that 231,000 people would die. This includes immediate casualties as well as slow deaths over a 60-day period.

To arrive at these figures, the computer would take into account that the FCDA station in San Jose with its supply of blood and antibiotics would remain relatively undamaged, and that enough doctors would survive to allow at least one physician for every 85 wounded. It would also tell that the Southern Pacific Railroad Yards in San Francisco were largely intact, but so radioactive that no one could go near them. The San Francisco International Airport would be a crater, the Oakland Airport under a layer of radioactive dust—but usable again after a few weeks.

In the event of war, this type of detailed damage assessment can be rapidly computed at a central station for every point of attack throughout the country, enabling our generals to plan the next move. —30—

IF YOU WANT an "electronic brain" around the house, the lamp control circuit described in this article may be for you. It can do a wide variety of things and is pretty foolproof in operation. Rather than attempt to dress it up, I have described it here in its most elementary form. Undoubtedly, better-looking arrangements can be perfected, or even different combinations tried out to achieve similar effects. But, at least, this is a starting place.

Pressing the push buttons during the day has no effect because in daylight *RL1* is pulled in and the control circuit is de-energized. Thus, the unit "knows" the lamp should not be turned on when the room is illuminated with daylight.

The "electronic brain" serves as a power failure indicator. Any failure of the power line during darkness will unlatch the control circuit, and the lamp will turn on when the power comes on again. If you get up before daybreak and find the lamp turned on, your electric clocks may not be telling the truth—and you will do well to consult your radio to determine whether or not you will be late for work or school.

Bright flashes of lightning during the night may also trigger the latching circuit. This turns out to be quite an advantage. It's nice to find the living room illuminated when you have to go there half asleep to close the windows against an impending storm!

Build This "Electronic Brain" To Control Living-Room Lights

By FRANK H. TOOKER

Construction. The "electronic brain" lamp control is built in a 3" x 4" x 5" aluminum box. The assembly is compact but not crowded, thanks to the use of three subassemblies.

Start with the subassembly of the flanged U-section of the box. Drill the holes for the two switches and the indicator lamp socket. Mount these parts temporarily in the box. Then make a little L-bracket to hold the socket for thermal delay relay *RL4*, and mount the socket on the bracket. Orient the socket so that the heater element (mica strip with wire wound on it) will be toward the front of the box. With the relay plugged into the socket, position the bracket on the inside of the box and locate the bracket

"WHY I BUILT THE LAMP CONTROL . . ."

(1) It knows I want the lamp turned on when evening comes or if I close the window blinds.

(2) When the lamp is on, it knows that I will want it turned off when I retire—but not immediately, for I will need the light to find my way out of the living room. When I tell it to turn the lamp off, it stores this information, waits about 15 seconds, then extinguishes the light.

(3) It knows I may want to get up in the night and have the lamp on. If I do, I can convey this information to the "brain" and it will turn the lamp on for me.

(4) It knows I cannot see in the dark. Consequently, when it turns the lamp off, it turns on an indicator to tell me exactly where it is located in the room.

(5) It knows I can find it when daylight comes, so it turns the indicator off at daybreak.

(6) It also knows I can find it when the lamp is turned on, so it does not turn on the indicator at any time except at night when the lamp is off.

(7) When it has turned the lamp on as a result of a storm coming up, it remembers to turn the lamp off again when the storm has passed.

(8) It knows that daylight follows darkness, that darkness follows daylight, and that there is no need for the lamp to be turned on when the room is illuminated with daylight. It also knows that some people like to "diddle" with the controls of things like electronic brains—no matter how anyone may try to fool it by giving it commands to turn on the light at such times, it knows that these commands are not seriously meant, and it keeps the lamp turned off except when it is really needed.

HOW IT WORKS

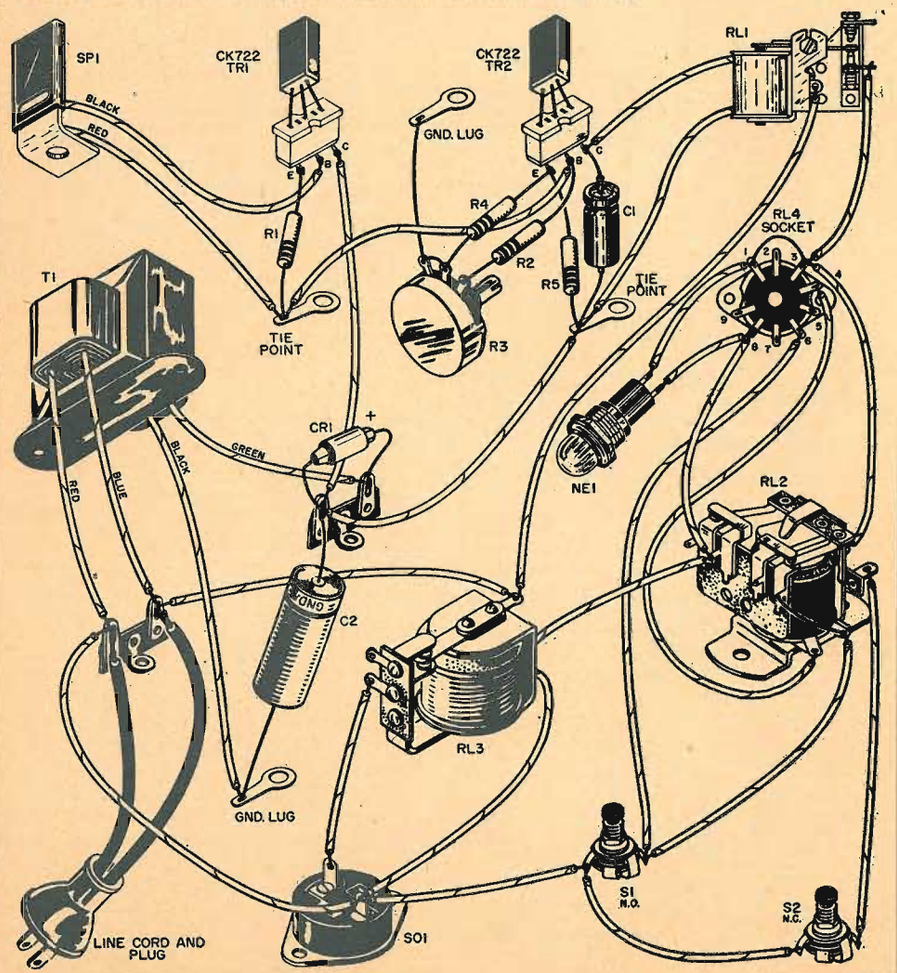
The daylight-or-darkness detector is the selenium photocell, *SP1*. When daylight falls on *SP1*, a small direct current is generated and transistor *TR1* is biased in the forward or conducting direction. *TR1* and *TR2* are directly coupled, so that as long as sufficient daylight falls on *SP1*, relay *RL1* remains pulled in and the lamp control circuit is de-energized. When darkness approaches, the armature of *RL1* drops out and *RL3* closes to apply power to the receptacle, *SO1*. The living-room lamp is plugged into *SO1*.

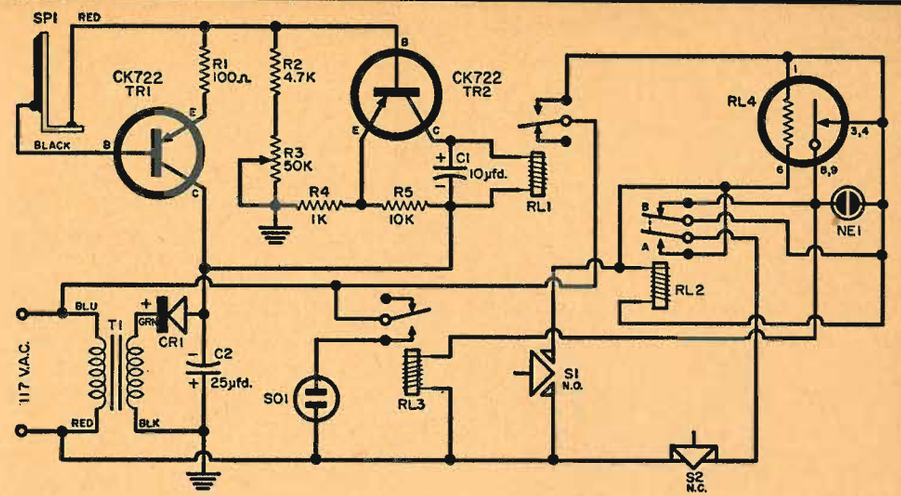
To turn the lamp off, press *S1*. This applies power to the coil of *RL2* and the heater of *RL4*. *RL2* pulls in immediately and latches closed through its contact (*a*). The operation of *RL2* opens contact *b*, but current continues to flow to the coil of *RL3* through the normally closed contacts of *RL4*, and the lamp remains on for 15 seconds. At the end of this interval, *RL4* opens, *RL3* is de-energized, and the lamp is extinguished.

When *RL4* opens, a small current is applied to the neon lamp, *NE1*, through the coil of *RL3*. This current is sufficient to fire the neon bulb but much too small to operate *RL3*. To turn the lamp on again, press *S2* to unlatch *RL2* and *RL4*, and apply current to the coil of *RL3*. The indicator, *NE1*, is simultaneously extinguished because the closing of contact *b* short-circuits the neon lamp.

When daylight comes, *SP1* begins to generate and operates *RL1*. This de-energizes the lamp-control circuit and unlatches *RL2* and *RL4*. Thus, at daybreak, the unit readies itself to turn on the lamp automatically again when darkness follows. If the room is temporarily darkened, *RL1* drops out and turns on lamp. When sky becomes brighter, *RL1* pulls in, *RL3* is de-energized, and the lamp is extinguished.

The diagrams below and at right show you how to wire together the lamp control's components. As the filament transformer shown in the pictorial and in the photo of the underside of the chassis plate (on page 72) is quite bulky and can supply considerably more current than the transistor amplifier requires, the miniaturized unit listed in the parts list is recommended for use instead, and the transformer leads in both of the diagrams have been color-coded accordingly.





C1—10-μfd., 15-volt miniature electrolytic capacitor
C2—25-μfd., 25-volt electrolytic capacitor
CR1—Type 1N66 or 1N34 diode
NE1—Type NE-51 neon lamp in Dialco 937 socket assembly (built-in 56,000-ohm resistor)
R1—100-ohm, ½-watt resistor
R2—4700-ohm, ½-watt resistor
R3—50,000-ohm potentiometer
R4—1000-ohm, ½-watt resistor
R5—10,000-ohm, ½-watt resistor
RL1—Sensitive relay, 8000-ohm coil (Sigma 4F-8000-S/SIL)
RL2—117-volt a.c. relay, d.p.d.t. contacts (Advance MG/2C/115VA)
RL3—117-volt a.c. relay, s.p.d.t. contacts (Advance MG/1C/115VA)
RL4—Miniature thermal delay relay, 15-second delay, normally closed contacts, and 117-volt a.c. heater element (Amperite 115C15T)
S1—S.p.s.t. push-button switch, normally open contacts, black button (Switchcraft 201)
S2—S.p.s.t. push-button switch, normally closed contacts, red button (Switchcraft 102)
SO1—Chassis-type outlet receptacle
SP1—Selenium photocell (International Rectifier B2M)
T1—Step-down transformer (Argonne AR-100 transistor transformer)
TR1, TR2—Type CK722 transistor (Raytheon)
1—3" x 4" x 5" aluminum box
2—Transistor sockets
1—9-pin miniature tube socket (for RL4)
1—Power cord and plug
Misc. hardware, tie points, rubber grommets, flat and extruded fiber washers, scrap aluminum sheet for chassis plate and thermal relay bracket, wire, solder, etc.

mounting-screw holes on the front panel.

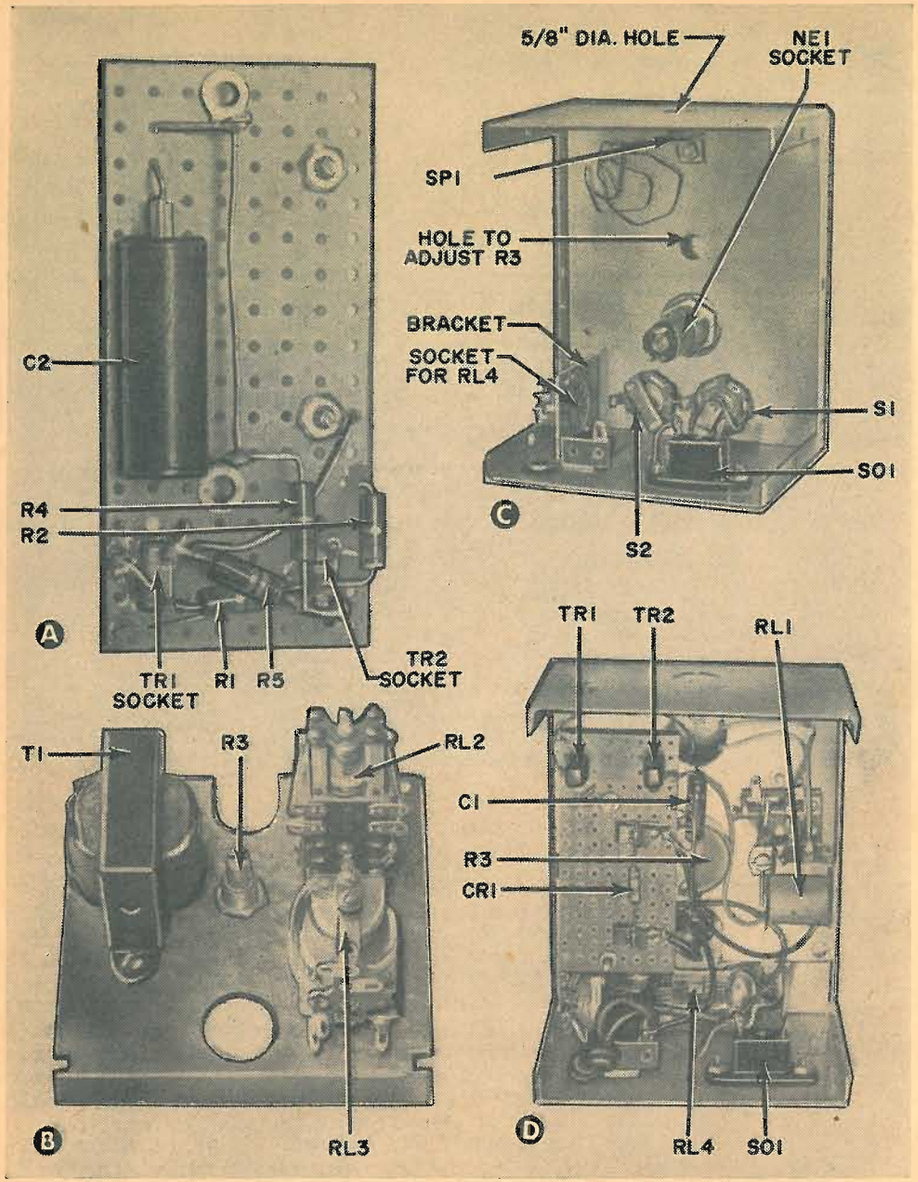
On the front of the box, locate holes for the outlet receptacle *SO1* and the power cord grommet. Locate and drill the mounting screw hole for the photocell, *SP1*, at the rear center of the top of the box. This hole should space the sensitive surface of the cell about 5/16" away from the back of the box. The bracket on the cell is internally connected to the red lead and must be insulated from the metal box. Then drill a 5/8"-diameter hole in the back of the box where it will be directly in front of the sensitive surface of the photocell. The purpose of this opening is to admit light to the photocell.

The chassis plate holds the remainder of the parts. Make it to the approximate size and shape shown in (B), p. 72. Two holes drilled through a ½" lip and mating holes in the back of the box pass a pair of *6-32* screws to mount this chassis plate.

Relays *RL2* and *RL3* mount on the transformer side of the chassis plate. Relay *RL1*, control potentiometer *R3*, and the little subchassis holding the transistor amplifier mount on the available side of the plate. After *R3* has been mounted, drill a 3/8"-diameter hole in the top of the box where it will be directly opposite the slotted shaft of *R3*. A screwdriver will be inserted through this opening to perform the sensitivity adjustment. Wire each subassembly separately, insofar as is possible. Then assemble the unit and complete the wiring.

Adjustment. Locate the unit on a table near the lamp it is to control, with the hole in front of the photocell pointed toward a window. Make sure the light from the lamp will not shine on or toward the photocell opening. Now place your hand over the opening to shut out the light from the window, and rotate the slotted shaft of *R3* until the lamp lights. Remove your hand from the opening, and the lamp should go off.

Leave the unit set until the time of evening when the room is darkened to the point where you would want the lamp on. If the lamp does not go on of its own accord at this time, adjust *R3*, very slowly and



Use of subassemblies in the "electronic brain" lamp control makes for a compact but uncrowded unit. Shown above are: (A) underside of subchassis holding transistor amplifier; (B) underside of chassis plate; (C) box subassembly; and (D) underside of completed device.

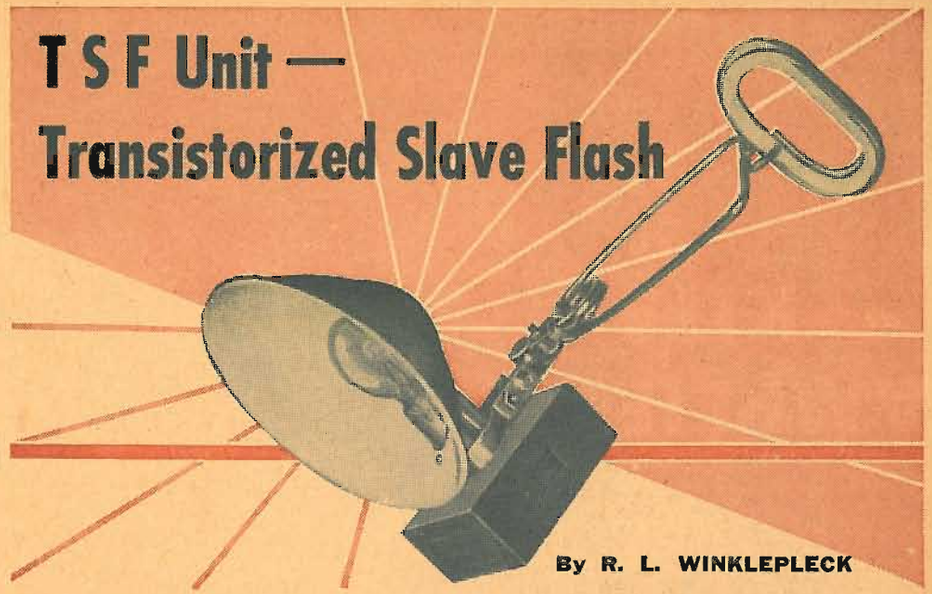
carefully, until it does. Then press the black push button; a light click should be heard, followed about 15 seconds later by another click and the extinguishing of the lamp. Simultaneously, the neon indicator should come on. When you press the red button, the indicator should go off and the lamp should come on.

It is unnecessary to locate the lamp control close to a window. The author's unit is located three feet away and never fails to operate.

Possible Troubles. *RL1* should pull in and drop out smoothly, no matter how slowly the light intensity changes. If the relay

(*Continued on page* 108)

TSF Unit — Transistorized Slave Flash

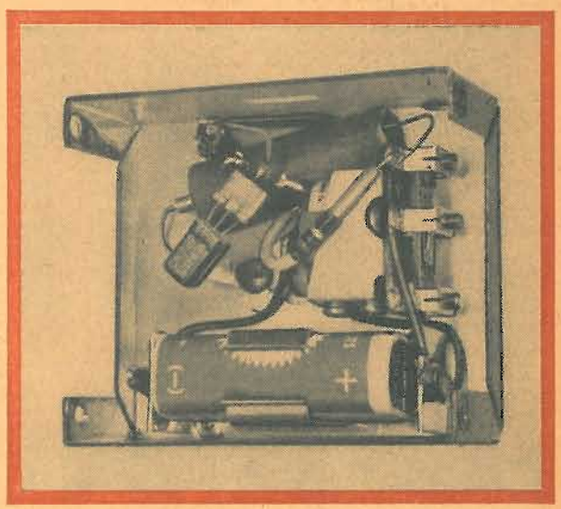


By R. L. WINKLEPLECK

Improve your flash photos with this compact, low-cost, easy-to-handle unit

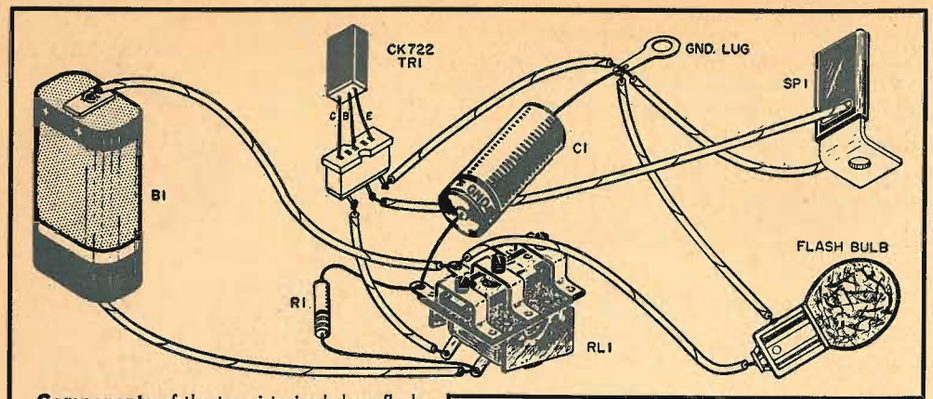
"MULTIPLE FLASH" is a challenging expression to most amateur photographers. Every serious amateur knows that 99 $\frac{44}{100}$ % of the flash pictures he takes would be improved by using two or more flash bulbs for illumination. Books have been written expounding the theme of providing fill-in light. Nevertheless, most of us go right ahead using one bulb and getting the harsh, unflattering effect that is associated with flash.

It's a little hard to explain why multiple flash is generally ignored. Probably it's a case of following the course of least resistance. Extension flash is a nuisance with the long, trailing cords from the camera to each light. The "slave flash" is the answer to this entire problem, but most commercial slave units generally consist of a photoelectric cell, a vacuum-tube amplifier and relay to flash the remote bulb. They do eliminate the long cord from the camera to the remote flash, but the outfits are somewhat bulky and expensive.

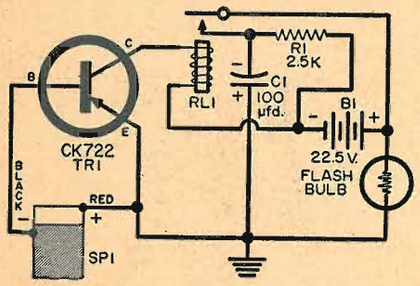


Inside the slave unit. Sun Battery is mounted behind opening in box, and special miniaturized relay is at the right.

Inexpensive transistors open up interesting possibilities in this field. The tiny transistor can do the amplifying job which formerly required a vacuum tube. Even more important, it can be operated from a small hearing-aid battery. The long extension cords are eliminated entirely. Couple the transistor with an equally small, self-generating, selenium Sun Battery and a miniature relay, and you have a very small, light, highly portable unit with no trailing cords. Clip it to or hang it on anything handy at the spot where you want the sup-



Components of the transistorized slave flash should be physically interconnected as shown in the pictorial diagram above; schematic diagram and parts list are given below.



B1—22½-volt hearing-aid battery
C1—100-µfd., 25-volt electrolytic capacitor
R1—2500-ohm, ½-watt resistor
RL1—Relay (Advance Type SO with 10,000-ohm coil)
SP1—Sun Battery (International Rectifier Corp. Type B2M)
TR1—Type CK722 transistor

plementary light to originate, and you're ready to shoot.

Assembly. This very simple transistorized BC slave flash circuit is cheap and easy to assemble. The photocell can be salvaged from an old exposure meter or it can be the inexpensive Sun Battery now on the market. The relay may be purchased cheaply from surplus stocks or it may be a new unit especially selected for small size. All new parts can be used for a total cost of $8, exclusive of flash socket and reflector.

If the components are carefully selected for small size, everything can be easily assembled in a small aluminum box. The unit shown was built into a 5¼" x 3" x 2⅛" Minibox cut down to 2½" x 3" x 1¼". The Sun Battery is mounted inside the box behind an opening the size and shape of the sensitive surface. The socket-reflector assembly is rigidly mounted; although the Sun Battery must face the camera flash, you can clip the slave unit in place either right side up or inverted, depending upon whether it's to the right or left of the camera.

The transistor can be soldered directly into the circuit using a pair of thin-nose pliers between the transistor body and the soldering gun to drain away the heat. Hearing-aid battery (*B1*) can also be soldered in place, but a mounting clip is inexpensive and permits quick, easy replacement. Be sure to mark the clip with the correct battery polarity.

Relay Adjustment. Some relay adjustment is required. When construction is completed, short the flash socket with a wire and connect a voltmeter across the relay contacts. With the contacts open, a voltage reading will be noted. Adjust the gap between relay contacts to the minimum which will remain open when the unit is shaken.

Now expose the Sun Battery to the maximum light intensity it will encounter under normal operating conditions. If the relay contacts are still open, gradually reduce armature spring tension until the contacts close as shown by disappearance of a reading on the voltmeter. Tighten the spring very slightly until the contacts open.

At this setting, ordinary room lights should never flash a bulb accidentally, but

(*Continued on page* 110)

HOW IT WORKS

This circuit is designed so that the flash bulb is, in effect, the switch which turns the unit off and on. Until a live flash bulb is placed in the socket, the battery is completely isolated from both the amplifying and flashing portions of the circuit. Placing the flash bulb in its socket charges *C1* with current flowing from the battery through the bulb and resistor, but the rate of current flow is insufficient to flash the bulb. When light from the flash on the camera strikes *SP1*, it generates a small d.c. voltage which permits current to flow through the base-emitter circuit of transistor *TR1*. This current flow, in turn, permits a collector current flow, amplified 10 to 12 times, which is sufficient to operate relay *RL1* dependably. When the relay contacts are closed, the capacitor is discharged instantaneously into the bulb, causing it to flash.

Install Your Own LOUDNESS CONTROL

By LEONARD FELDMAN

Low-cost unit lets amplifier sound "hi-fi" at low volume

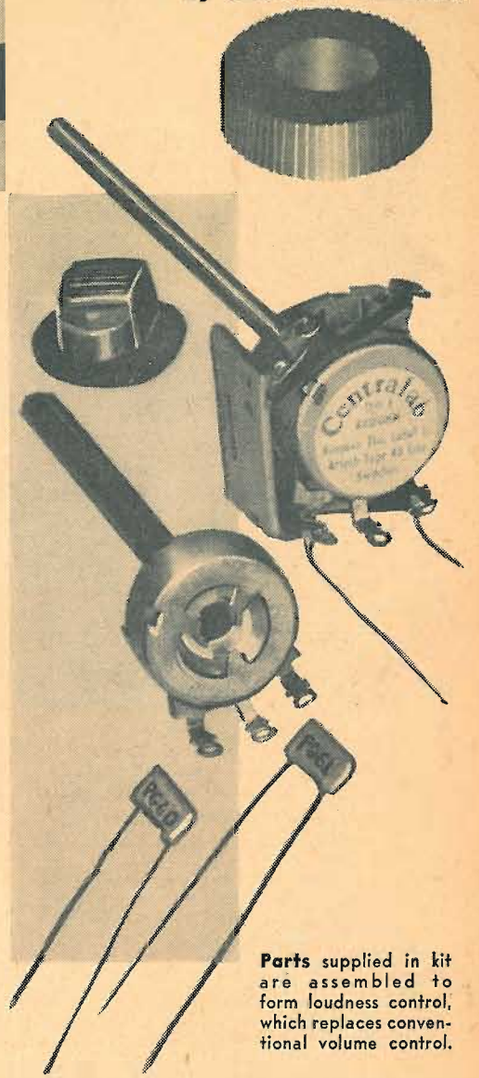
OUR EARS often play tricks with frequency response—particularly at low listening levels. They seem to hear middle frequencies better than they do bass tones or—to a lesser extent—very high pitched tones. Therefore, some tonal compensation is needed to restore an over-all balance to music reproduced by a sound system. As was pointed out in our December, 1956, issue, a loudness control provides this compensation automatically, and makes it possible to enjoy wide-range reproduction at relatively low listening levels.

Amplifiers not equipped with such a control can be fitted with one quite readily. A loudness control in kit form—Model 02-200 "Compentrol"—is made by the Centralab Company of Milwaukee, Wisconsin. Included in the kit are all the parts needed for assembling one's own loudness control (see photo at right). This kit costs $4.75 and is carried by most electronic parts dealers.

The loudness control replaces the regular volume control. Before making the change, however, determine whether or not the regular volume control also serves as the power "on-off" switch. If it does, you will need one more part—Centralab "Fastatch" switch, Model KB-1, which costs an additional 50 cents. If your power "on-off" switch is separate and not part of your volume control, KB-1 will not be required.

Making the Change. Exact wiring and assembly instructions are furnished with the kit. Here are a few hints for assuring best results. For example, when you disconnect the old volume control, the leads wired to it should be left in their same relative positions, or labeled to facilitate reconnecting them to their proper terminals on the Compentrol.

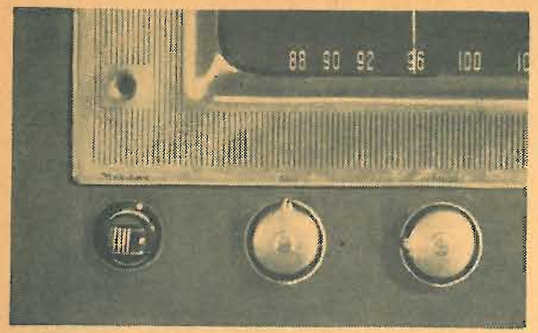
Note also that three printed-circuit plates are supplied. One provides bass compensation and is the mainstay of the loudness control. The other two (PC-60 and PC-61) provide varying amounts of treble boost and



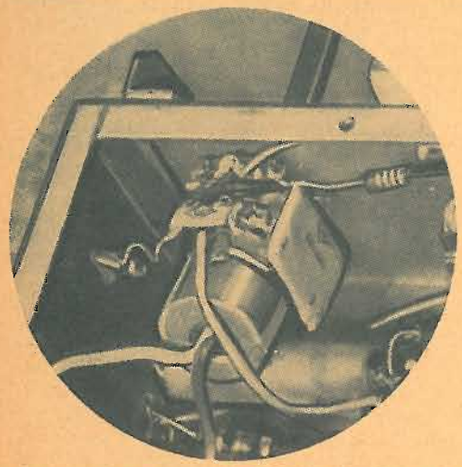
Parts supplied in kit are assembled to form loudness control, which replaces conventional volume control.

you should use the one that best suits your tastes and needs. If your system has always been somewhat deficient in highs, try PC-61; this unit provides more treble boost than PC-60 does. On the other hand, if you have a multiple speaker system with separate tweeter, you're more apt to find that PC-60 is just right for your system (less treble correction). Another thing—you can always clip one of these two printed-circuit plates out and substitute the other—or a simple direct wire if you feel you need no treble correction.

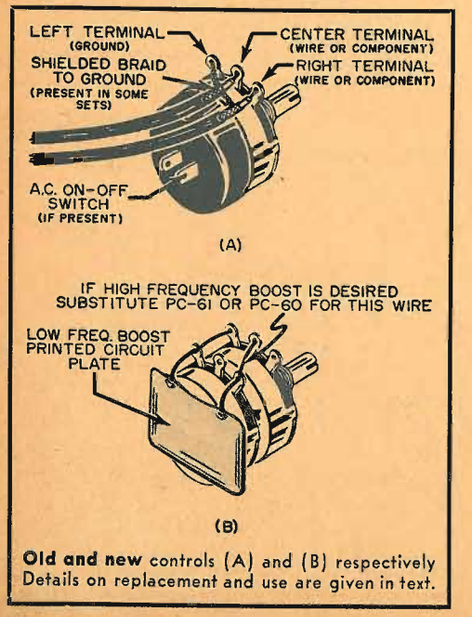
The shafts supplied with the kit are oversized, to permit trimming them down to any



Dual concentric knobs at far left symbolize newly installed loudness control. White dots on knobs help recall positions.



Mounting the control behind the front panel takes little time and effort. Control shafts may be cut to any desired length for neat, correct fit.



Old and new controls (A) and (B) respectively Details on replacement and use are given in text.

required length for neat and proper mounting. A simple hacksaw will cut these shafts effectively.

Control Knobs. The Compentrol is a dual control and requires two concentrically fitted knobs. These are supplied with the kit. If you find that their appearance conflicts with other knobs on your equipment, you may be able to get a set of dual knobs that match the other knobs. Another alternative is to get an entirely new set of knobs for all controls on your set. Most parts jobbers stock a wide variety of control knobs for you to choose from. In any case, the audible improvement in the system's sound will far outweigh any "knob problems."

Using the Control. Probably the nicest thing about the loudness control is that you can set it up to suit your own personal listening tastes. As a rule, once set up, it needs no further adjustment and can then be used as if it were a volume control. It is important, therefore, to make the following adjustments exactly as outlined.

Turn the small knob fully clockwise. With music (preferably full orchestra) as the program source, gradually turn the rear (larger) knob clockwise until what you hear is as loud as you would ever want it to be. Now, to lower the volume to more reasonable "living-room" proportions, use only the forward (small) knob which—from now on—is the only knob with which you need be concerned.

If, for some reason, you should want to cancel the compensating effects of the loudness control even at low volume settings (as, for example, when listening to a speaking voice or a normally soft solo instrument), simply turn the forward knob fully clockwise and work with the rear knob as your level control. When this is done, no compensation is afforded, and conventional volume control action is restored.

It will probably take you a while to get ideal settings of the two knobs to suit all listening conditions. The dots on the knobs are for convenience in noting what optimum settings you finally arrive at for different types of program material. You may want to make a list of these settings, as for example: "Symphony Orchestra, rear knob 3 o'clock, forward knob 12 o'clock," etc. With a little patience, this new control can provide a flexible means of bringing you closer to the hi-fi goal of lifelike reproduction of music in your home. —30—

By LOU GARNER

WITH NO FILAMENT to burn out or elements to shake loose, the transistor is one of the most reliable of components. As *reliability* must be the key word in the design of military equipment, the U. S. Armed Forces have been extremely interested in the possibilities of this semiconductor amplifier since it was first announced by Bell Telephone Laboratories. Latest news is the adoption of a new policy by the Army . . . to use transistors wherever possible in all receivers and low-power transmitters operating up to 70 mc. and designed for combat areas.

And now this important word, *reliability,* is entering into the design of commercial equipment. From Philco comes word that its all-transistor radio will carry a *five-year guarantee.* During this period, the radio can be returned for free factory repairs. What's more, the guarantee applies to *the battery as well for the first year!* This unusually long guarantee is made feasible by the life expectancy of transistors, as well as by the use of high-quality components and rugged printed-circuit wiring panels.

Readers' Circuit. We have been receiving a number of cards and letters which say . . . in essence . . . "don't forget us—the hi-fi and audio fans." So this month we are featuring a circuit for a transistorized audio preamplifier and mixer. Submitted by reader Frank W. Schrader of 18 Carey Ave., Butler, N. J., this circuit uses three Raytheon transistors as resistance-capacity-coupled audio amplifiers.

As shown in the diagram (Fig. 1), two separate channels are provided. The high-gain channel (*tape input*) uses a two-stage amplifier; the low-gain channel (*mike input*) uses a single stage. Separate gain controls are provided for each channel (*R1* and *R2*), and the amplified output signals are combined through isolating resistors *R12* and *R13*.

In operation, base bias current for *TR1* is supplied through *R3*, with *R5* serving as the collector load. An unbypassed emitter resistor, *R4*, introduces degeneration to stabilize circuit operation. The second stage in the high-gain channel is essentially a duplicate of the first, with base bias supplied through *R6*, and *R11* acting as the collector load; *R7* provides the degeneration. The low-gain channel amplifier, *TR3*, is similar to the other stages.

Large-value electrolytic capacitors, *C1*, *C2*, and *C3*, are used to insure adequate

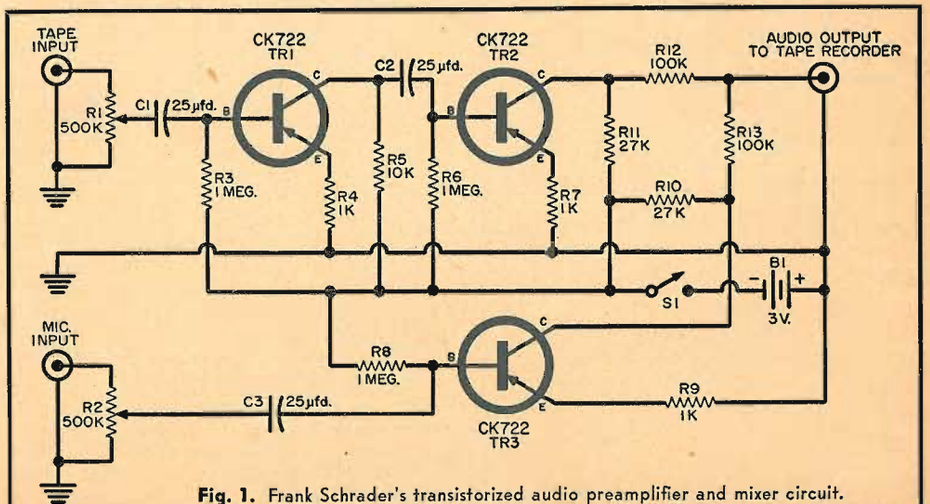


Fig. 1. Frank Schrader's transistorized audio preamplifier and mixer circuit.

low-frequency response. Operating power is supplied by a 3-volt battery, *B1*, made up by connecting two penlite cells in series. Frank used miniature controls (Lafayette No. VC-18) for *R1* and *R2* in his model, but standard volume controls having an audio taper may be employed if space is not a problem.

You may want to make a few experimental circuit modifications. Frank suggests experimenting with the final values of base bias resistors *R3, R6* and *R8* to obtain the best compromise between over-all gain and signal distortion. While the values specified should be adequate in most cases, best results will be obtained if these resistors are chosen to match the individual transistors used. The final values should fall between 100,000 ohms and 2 megohms.

Finally, if the tape recorder, p.a. system, audio amplifier, or other instrument you use with the preamp does *not* have a d.c. blocking capacitor in its input circuit, you may want to provide one. Simply connect a 0.5-μfd., 200-volt tubular capacitor between the juncture of *R12* and *R13* and the "hot" terminal of the output jack, in place of the direct connection shown.

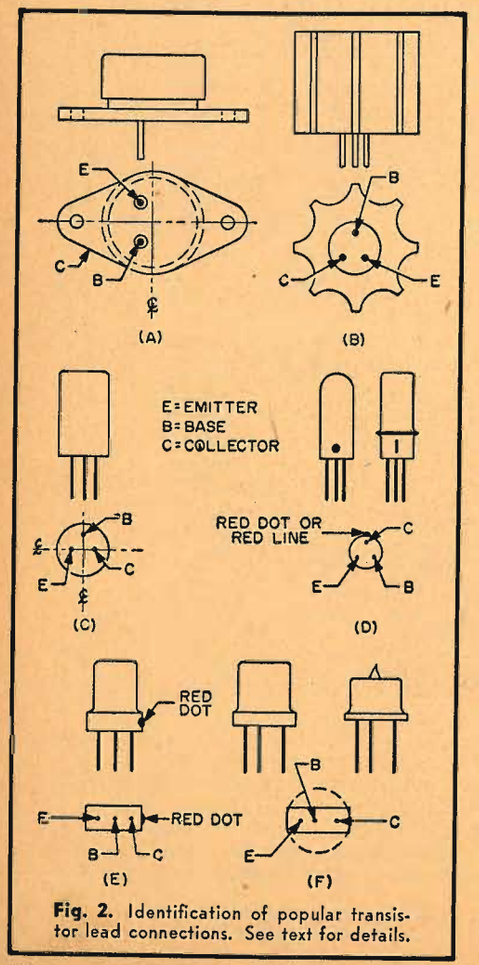


Fig. 2. Identification of popular transistor lead connections. See text for details.

Frank is a tape recording enthusiast. He has mounted an extra recording head on his tape recorder just in front of the existing head. He uses this as a pickup, feeding the signal into the "high-gain" (*tape input*) channel of the preamp. Here it is combined with a signal from a microphone fed into the "low-gain" (*mike input*) channel. The combined output signal is then fed into the input jack of the tape recorder itself, where it is re-recorded by the regular recording head.

This technique enables him to make multiple recordings with a single tape recorder. According to Frank, it's a cinch to sing a quartet with yourself if you re-record the tape an appropriate number of times, adding a new "voice" each time.

But you'll find many applications for the preamp-mixer even if tape recording is not your pet passion . . . you can use it to combine signals from two musical instruments, from a microphone and an instrument, from a radio tuner and a microphone, or from phonograph pickup and microphone . . . in fact, wherever there are two audio signals you would like to combine.

Transistor Lead Connections. A popular and often-asked question concerns the identification of transistor lead connections. The connections for most common types are shown in Fig. 2, together with typical transistor body outlines. This sketch is *not to scale*. All lead connections are shown from the bottom of the transistor.

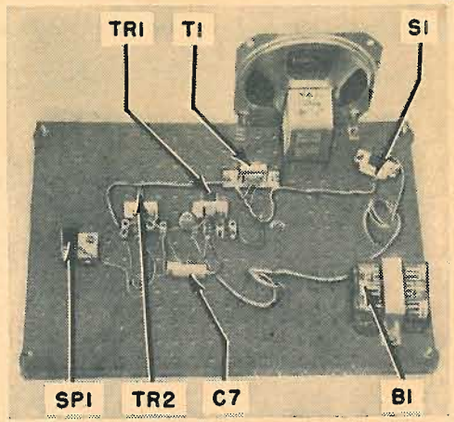
"High power" transistor connections are shown in Figs. 2(A) and 2(B). The arrangement used for CBS-Hytron's Types 2N155, 2N156, 2N255 and 2N256, as well as many similar types of other manufacturers, is given in Fig. 2(A). Note that the metal body or shell of the transistor serves as the collector terminal. A separate lead is provided for the collector electrode in power transistors with the pin arrangement shown in Fig. 2(B), but the collector is still connected internally to the metal shell. Typical units using this arrangement are Sylvania Types 2N68, 2N95, 2N101, and 2N143. *Note that two of the pins are closer together*; this provides the necessary "clue" to lead identification.

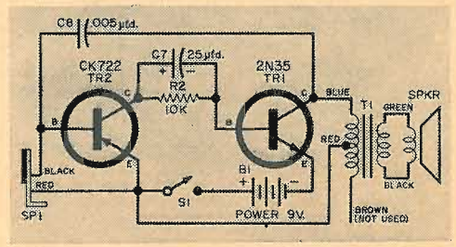
The arrangement shown in Fig. 2(C) is used in RCA Types 2N215, 2N217 and 2N269, among others. Leads are arranged

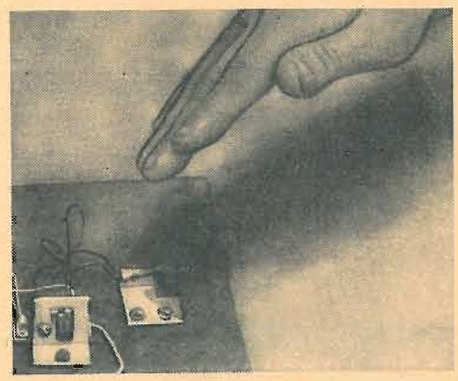
(*Continued on page* 115)

Transtopic Experiment No. 17

"Musical Light" Magic Toy







THIS is another in the series of transistor experiments that started in the March, 1956, issue. Reprints of the earlier experiments are available from Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y. The last published experiment appeared in the March, 1957, issue on page 83.

As you move your hands over the "musical light" toy, making "magical passes," various tones and sounds emanate from the loudspeaker, changing with each movement of your hands. These movements are for stage effect only . . . for the actual position of the hands has little or no effect on the operation of the device. It is the shadow cast by the hands on a photocell that varies the tones.

The circuit is a standard two-transistor direct-coupled audio oscillator. The B2M Sun Battery (*SP1*) is substituted for the base resistor of transistor *TR2*. As the light intensity falling on *SP1* is changed, the base resistance and the base bias current both change, shifting the operating frequency of the circuit.

With the wiring completed and checked, and the transistors installed, close switch *S1* and allow a moderate amount of light to fall on *SP1*. Pass your hand over *SP1* so that more or less shadow falls on the sensitive surface of this unit, and listen for the changes in audio tone. With practice, you may even be able to play tunes!

One precaution: *too much or too little* light may result in improper operation. Don't try to use the instrument in a completely darkened room . . . nor in bright sunlight. For the most mysterious effects, you can assemble the circuit in a closed box, with the photocell mounted in the top and more or less hidden from view.

Have fun! And don't tell the "secret" of operation to your friends. Let them marvel at your ingenuity.

—*Louis E. Garner, Jr.*

THE TRANSMITTING TOWER

Herb S. Brier, W9EGQ

APPEARANCE of a new transmitter or transmitter kit on the market always interests Novices and Generals alike. The most recent one is the Heathkit DX-20, which replaces the famous Heathkit AT1. The DX-20 has been assembled and tested for a report to the readers of the *Transmitting Tower*. You will get a good idea of what it looks like when assembled from the photographs below.

Technically speaking, the DX-20 is a crystal-controlled, 50-watt, bandswitching transmitter covering the amateur bands between 3.5 and 29.7. (This coverage includes the Novice 3.7-, 7.15-, and 21.15-mc. assignments.) It is housed in a handsome 13½" x 8½" x 7" grey cabinet and weighs 16 pounds.

Circuitwise, the DX-20 employs a 6CL6 crystal oscillator/frequency multiplier to drive a 6DQ6A, capable of feeding power into many different antennas via a *pi*-network output circuit. Band changing is automatic through a rotary switch which selects appropriate taps on the air-wound oscillator and amplifier coils. A built-in milliammeter measures the 6DQ6A plate and grid currents to facilitate tuning. An internal power supply, utilizing a 5U4GB rectifier and choke-input filter, delivers 500 volts, d.c., at 125 ma.

Eighty-meter crystals are normally used for 80-meter output from the DX-20 and may be used for 40- and 20-meter output. Forty-meter crystals are used for output on 40 through 10 meters. Access to the crystal socket, which is mounted inside the transmitter, is through an opening in the left side of the cabinet. A knob serves as the handle to the cover of this opening—the function of which has puzzled many who have seen pictures of the unit.

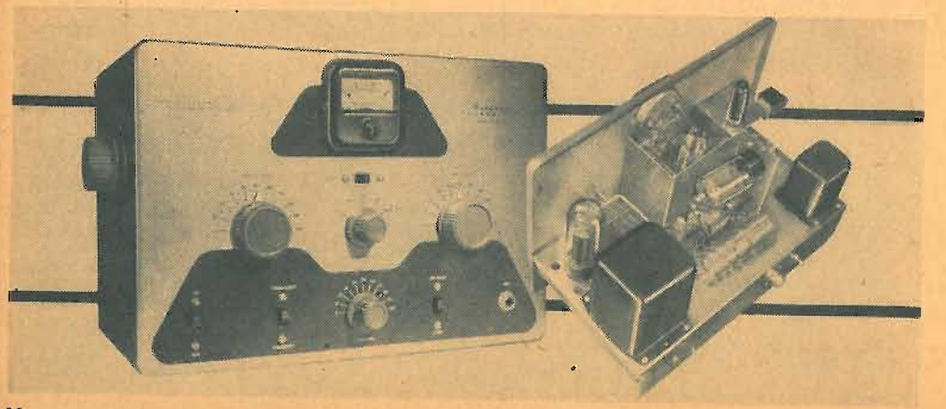
For the information of General Class operators, the output of any standard VFO tuning 160 meters or 80 meters and 40 meters, and equipped with its own power supply, can be plugged into the crystal socket of the DX-20 for VFO control. Crystal control is mandatory for Novice operators.

Assembling the DX-20. Putting the DX-20 together should not be difficult for anyone who will carefully follow the step-by-step assembly instructions in the complete instruction manual furnished with the kit. All parts, except key, crystals, and antenna are furnished, and all holes are drilled. This reduces essential tools to pliers, two screwdrivers, a knife for removing insulation from wire, small-tipped soldering iron or soldering gun, and a small quantity of rosin-core solder.

Ten days of spare-time work is not too

(*Continued on page* 119)

External and internal views of the Heathkit DX-20 which was assembled by the author.



HELP US OBTAIN OUR HAM LICENSES

In this section of the Transmitting Tower, the names of prospective amateurs requesting help and encouragement in obtaining their licenses are listed. To have your name listed, write to Herb S. Brier, W9EGQ, c/o POPULAR ELECTRONICS, 366 Madison Ave., New York 17, N. Y. Please print your name and address clearly. Names are grouped geographically by amateur call areas.

K1/W1 CALL AREA

Russell Studer, 82 Wainwright Circle W., So. Portland, Maine. (Code and theory)

John Krzewicki (15), 1028 Walnut St., Newton Highlands 61, Mass. Phone: BI 4-6762. (Code and theory)

James Falcon, 50 Jay St., Rumford, R.I. Phone: GE 4-2238. (Theory)

Ray Archambault (13), Ingleside Ave., Worcester 4, Mass. (Code)

K2/W2 CALL AREA

Ernest Tischetti (14), 208-12 St., Brooklyn 15, N. Y. Phone: ST 8-6351. (Code)

Russell Walker (14), 35 Sleepy Hollow Dr., Packanack Lake, N. J. Phone: MOuntain View 8-3317M.

Ronald Stanczyk (13), 264 Forest Rd., Palisade, N. J. Phone: WH 3-6152. (Code and theory)

William Jewtraw Jr. (16), 51-53 71st St., Woodside 77, N. Y.

Richard L. Abbott, 952 Downing Rd., Valley Stream, N. Y. (Code and theory)

Bobby Weinfeld, 1013 Bryant Ave., Bronx 59, N. Y. (Code and theory)

Michael S. Zak, 9 Brighton 10 Path, Brooklyn 35, N. Y.

John Lewis, 24 Caroline Ave., Elmont, N. Y. (Theory and selection of equipment)

Jimmy Volinsky, 1210 Elder Ave., Bronx 72, N. Y. Phone: TI 2-2874. (Code and theory)

K3/W3 CALL AREA

Jackie Foote, 329 Massasoit St., Lester 13, Pa. (Code and theory)

Thomas F. Nolan (14), 360 Lakeside Dr., Levittown, Pa. Phone: WIndsor 6-4651. (Code and theory)

Ed Price, 710 Grant Rd., Folcroft, Pa. (Code and theory)

Thomas Howell, Petersburg, Pa. (Code and theory)

Henry A. Tumpa, 30 Richard St., Coraopolis, Pa. (Code and theory)

K4/W4 CALL AREA

Larry Segrest, 1258 Pine Hills Rd., Orlando, Fla. (Theory)

Bobby Mills, 1261 Pine Hills Rd., Orlando, Fla. (Theory)

John Daniels, 325 Shepherd St., Raleigh, N. C. (Code and theory)

Donald Murray, 1780 N.E. 146th St., North Miami, Fla. Phone: 6-7725.

John Abramson, 7005 Fairfax Dr., Arlington 13, Va. Phone: JE 2-1145.

Roy L. Eger, Route 1, Box 291-M, Leesburg, Fla.

Edsel Williams (13), 4 Maryland Ave., Greenville, S. C. Phone: 3-1553. (Code and theory)

K5/W5 CALL AREA

Edward Mikulencak, Box 304, Moulton, Texas. (Code)

Richie Hoff, 2828 N.W. 44th St., Oklahoma City, Okla.

William N. Thomas, Star Rt. 2, Box 31, Anahuac, Texas. (Code and theory)

Sanford Hutson (14), 2004 South Prairie, Stuttgart, Ark. Phone: WA 2-6293. (Code and selection of equipment)

James McWain, 517 W. Prairie St., Arlington, Texas.

Andrew L. Phillips, Star Route, Morton, Miss. (Code and theory)

K6/W6 CALL AREA

Samuel Martin Bledsoe, P.O. Box 261, Dinuba, Calif.

Steven Holzman (11½), 503 N. Arden Blvd., Los Angeles 4, Calif. (Code and theory)

Jerry Ziliak (15), 5506 W. 115 St., Los Angeles 45, Calif. (Code)

Lew Christy, 1336 Poplar St., San Bernardino, Calif. (Code, theory and selection of equipment)

Gary Andersen (14), 936 Anza Dr., Pedro Valley, Calif. (Code and theory)

K7/W7 CALL AREA

Stephen Owen, 2405 E. Lincoln Way, Cheyenne, Wyo. (Code and theory)

E. L. Wilson, 505 N. 41st St., Phoenix, Arizona. (Code and General theory)

Bob Schmieder, 6012 N. Second Ave., Phoenix, Arizona. Phone: CR 7-0357.

Mike Irwin, 312 Park St., Grangeville, Idaho. (Code and theory)

Jon Haterius, 200 Beacon Dr., Eugene, Ore.

K8/W8 CALL AREA

Lyle Rogers (14), 1115 Hawk St., Toledo, Ohio. Phone: LA 2972.

Ralph Wittman Jr. (14), 1044 Hawk St., Toledo, Ohio. Phone: KI-4377. (Code and theory)

Prof. Lloyd C. Rudy, 12113 Woodward Ave., Highland Park, Mich. Phone: TO 8-1387.

Dick Goodman, R.D. #1, Vienna, Ohio. Phone: WArren 8-2032.

Jack R. DiBlasi, 16660 Stansbury, Detroit 35, Mich. (Code and theory)

William Schuster, 72 Birckhead Pl., Toledo 8, Ohio. Phone: CH 2-8680.

Trevert Blackburn, Box #148, Clyde, Ohio. (Would like to trade SWL cards)

Wm. C. Thiele, 2555 Lakewood Ave., Detroit 15, Mich. (Code and theory)

Jerry Seelhoff (15), 625 N. Hickory St., Owosso, Mich. (Theory)

Russell Schroeder II, 11 Southlawn Ct., Saginaw, Mich. Phone: PL 5-1020. (Code and theory)

Robert W. Kocsis, 1920 Merl Ave., Cleveland 9, Ohio.

E. J. Camaglia, 13301 Littleton Rd., Garfield Hts. 25, Ohio. (Help in obtaining General Class license)

Rudge Kosteeka, 464 E. 272 St., Euclid 32, Ohio. Phone: REdwood 1-3872. (Code and theory)

K9/W9 CALL AREA

Daryl L. Waite (17), R.R. #1, Ursa, Ill. (Code)

Dan Bednar, 7347 So. Mozart St., Chicago 29, Ill. Phone: GR 6-6711. (Code)

Gilbert Grom (15), 525 So. Tenth St., DeKalb, Ill.

Stephen Cook (16), 3538 N. DeQuincy St., Indianapolis 18, Ind. (Code and theory)

KØ/WØ CALL AREA

Neil Dresbach, Groton, S. D. (Code)

James Donna, 2351 Harding St. N.E., Minneapolis 18, Minn.

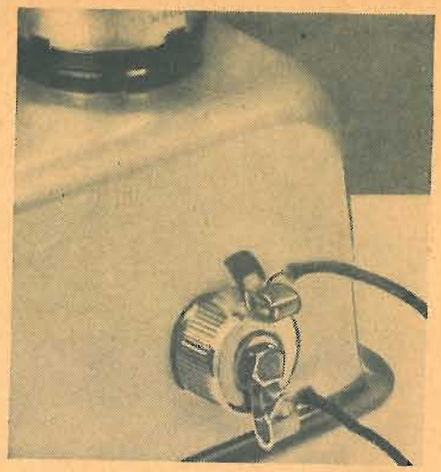
Paul Haefner (15), 4401 N. Second St., St. Louis 7, Mo. (Code and theory)

To help prospective amateurs obtain their Novice licenses, the Radio-Electronics-Television Manufacturers Association offers a set of code records (recorded at a speed of 33⅓ rpm) and a Novice Theory Course for $10.00, postpaid. The complete course or more information on it is available from RETMA, 1721 DeSales St., N.W., Washington 6, D. C.

Mike Connection Adapter

In experimental work, it is sometimes necessary to make quick wire connections to a male mike chassis connector. The easily made adapter shown at right solves this problem at little cost.

Obtain an Amphenol Type 75-CCC1 dust cover and chain (about 25 cents net). Clip off the chain and drill a 7/32" hole through the center of the flat side. Then place a small fiber extruded washer on each side of the hole, pass a ½"-long round-head *6-32* screw through washers (with the head on the inside), and fasten a size-15 Fahnestock clip under hexagon nut on the outside. This will insulate screw and clip from dust cover and provide a round-head contact on the inside. Now solder a size-15 Fahnestock clip onto side of dust cover as shown. *—Art Trauffer*



Permissible Operating Range for Radio Control

R/C systems are widely used in such applications as model control, garage door opening, remote tuning of radio and TV receivers, switching lights, remote transmitter tuning, sounding of alarms, and telemetering. Flea-powered transmitters are also used in phono oscillators, wireless microphones, and metal locators. Experimenters find all of these applications useful, educational and — of course — entertaining.

When such a system is NOT operated in the Citizens band or on an assigned control frequency, such as 27.255 mc., its distance coverage must be restricted; otherwise, it becomes an unlawfully operating radio transmitter.

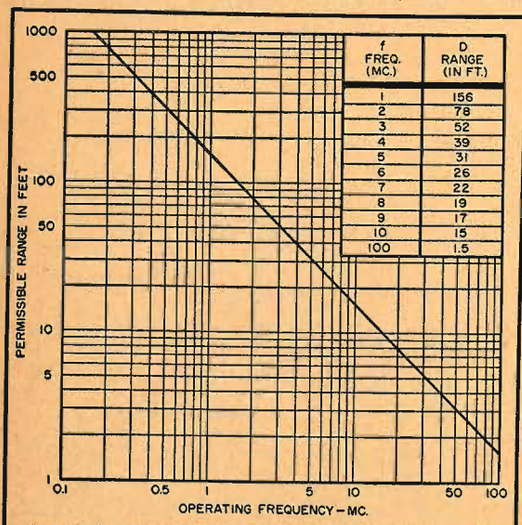
The Federal Communications Commission defines operation of a transmitting device in this category as permissible when the signal strength of its transmissions does not exceed 15 microvolts-per-meter at a distance from the transmitter equal to operating wavelength (λ) divided by 2π.

Curiosity naturally arises in the mind of the prospective user of radio control as to the maximum distance which may be covered under these conditions at various operating frequencies. But many get bogged down in the calculations. Frequency must be changed to wavelength (in meters) and the result divided by 2π, which is 6.28. Then this answer must be converted into feet, since it comes out in meters. To save steps, the author has worked out a simplified equation: $D=156.46/f$, where D is permissible distance in feet and f is frequency in megacycles.

As an illustration of the use of this equation, consider the problem of a phono oscillator to operate at 1200 kc. (1.2 mc.), this point having been found to be clear on the receiver dial. Permissible distance is:

$$D=156.46/1.2=130.38 \text{ feet}$$

To save the labor of making even this calculation, use table and graph at left. *—Rufus P. Turner, K6AI*



f FREQ. (MC.)	D RANGE (IN FT.)
1	156
2	78
3	52
4	39
5	31
6	26
7	22
8	19
9	17
10	15
100	1.5

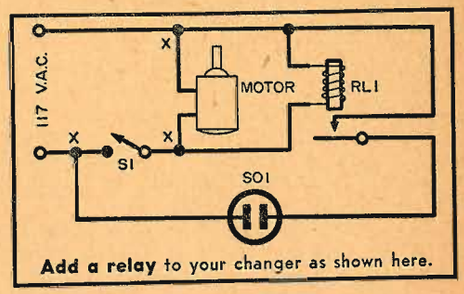
Graph for determining permissible operating range, with range table for common operating frequencies at upper right. For operating frequencies equal to 1/10 f, multiply D values by 10; for operating frequencies equal to 10f, multiply D values by 0.1. Not all frequencies are entirely satisfactory for control purposes. At 50 to 100 kc., antennas must be very long. Above the broadcast band, care is necessary to prevent long-distance radiation. At very high frequencies, operating distance becomes too short for practical interest.

Record-Player Changer Will Shut Off Amplifier

Does your record player selfishly turn itself off but leave you to take care of the amplifier? My changer used to do that, until I took hold and shook it up a little. Just $3.00 and about one hour of effort will easily take care of your changer, too.

All changers have a light duty switch to turn the motor off. This switch might be used to handle auxiliary equipment, but the amplifier load is much greater than the motor load, and the switch will not safely handle the additional current. Hence, a 117-volt a.c. relay is called for.

The relay should be mounted as far from the tone arm as possible in order to prevent hum from being induced in the magnetic cartridge by the relay field magnet. The a.c. socket may be located anywhere that is convenient. *—Russell D. Shattuck*

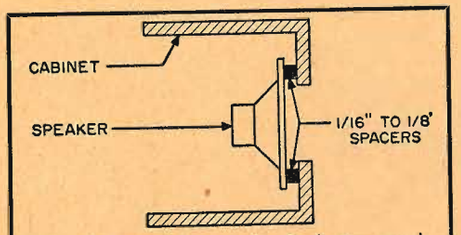


Add a relay to your changer as shown here.

Improve Your Table Radio Speaker

When a small PM speaker is mounted in a small cabinet, the sound will sometimes tend to have a hollow cracker-box quality. Eliminate this objectionable condition by locating the speaker slightly behind the front panel of the cabinet to provide a small air space between the panel and the speaker.

If the speaker is mounted on the receiver chassis, moving the whole chassis back slightly will do the trick. In the event that the speaker is mounted on the panel of the cabinet, small spacers 1/16" to ⅛" thick may be inserted between the speaker and panel, as shown in the diagram at left. The width of spacing depends on the size of the speaker and cabinet. Try various spacings until optimum results are obtained.—*F. H. Tooker.*



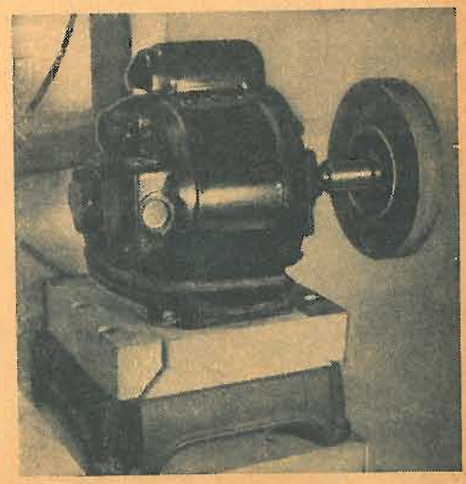
How to mount PM speaker for better sound.

Space-Saving Idea for Electronics Workbench

One of the advantages of electronics as a hobby is that a large workshop is not necessary. Sufficient space for a workbench can usually be found even in a small house. The principal drawback to a small bench lies in the reduction of working space if a vise is permanently mounted to the bench.

On my bench, which measures only four feet long, I have solved this problem through the use of an interchangeable tool mount. Only the indispensable drill press is permanently attached to the bench. As shown in the photograph, wooden guides are bolted to the base of the drill press. Tools, such as a vise and grinder, are mounted on wooden bases which fit snugly within the guides.

As the need for it arises, each tool may easily be slipped into the mounting. This mounting permits the use of a number of tools which require a rigid mounting, and yet does not reduce the available working space. Incidentally, the drill press table makes a convenient place to set a test instrument so that it will be close to the work but not in the way. Naturally, the guides can be mounted directly to the bench top at the most convenient location. *—Wm. B. Rasmussen*



Tuning the Short-Wave Bands

=with Hank Bennett=

SHORT-WAVE LISTENING is a hobby attractive to people of all ages. Many of the steady contributors to this SWL column prove that statement. Some of them are well along in years, while at the other end of the scale several of the most active SWL's are teenagers. A good example is Silas Dunn, 712 South Cedar St., Little Rock, Ark. Silas will be thirteen years old on the date that this issue is released nationally. He is a seventh-grader in the Little Rock Junior High School.

Silas has found that equipment is not a big stumbling block to getting started in SWL'ing. He has used a standard broadcast receiver and, as shown in the accompanying photo, he is now DX'ing with a five-tube, four-band Silvertone Portable. He has this attached to a 59-foot inverted "L" antenna. During his first year of DX'ing, Silas heard over 70 countries. He has just started to receive QSL cards from such DX favorites as *Radio Pakistan, Radio Ankara* (Turkey), *Radio New Zealand,* and *Radio Omroep Nieuw Guinea* (Dutch New Guinea). Silas reports that his favorite station is *Radio Australia* because of its many fine programs that seem to be especially directed to short-wave listeners. He prefers the 20-meter band for reception of amateur stations, and likes the 19-, 25-, 31-, 49-, and 60-meter tropical bands for s.w. reception.

Silas Dunn (on the left), and his brother, at the controls of his Silvertone portable receiver.

Station Listings. Your Editor would like to remind you that, although the times and frequencies in each month's station reports are correct at the time of writing, he cannot guarantee that they will be correct at time of publication. Many s.w. stations find it necessary to change their schedules and/or frequencies without notice. In most cases, however, the listing will prove to be correct.

In an attempt to serve the interests of the Novice SWL as well as the experienced DX'er, we list stations that are received with little difficulty. Most of the larger European transmitters can be heard throughout the United States. On the other hand, stations in Africa require dexterity and patience in tuning. Although they have been heard in the Eastern United States, they present a formidable challenge to DX'ers in the Middle and Far West. You will find these stations listed under Angola, French Equatorial Africa, French West Africa, and Nigeria; they are best received during middle and late afternoons (EST) in the 60- to 80-meter tropical band (3300 to 5000 kc.).

> If you hear a call that you cannot identify, send a self-addressed and stamped card or envelope to Wade H. Williams, 2327 Wheeling St., El Paso, Texas. Mr. Williams has excellent reference material on U. S. Ships and Yachts, Radio and Air Navigation Aids, and other data that are helpful to SWL's. This service, which is free of charge, covers most phases of s.w. radio with the exception of short-wave broadcast stations and amateur radio stations.

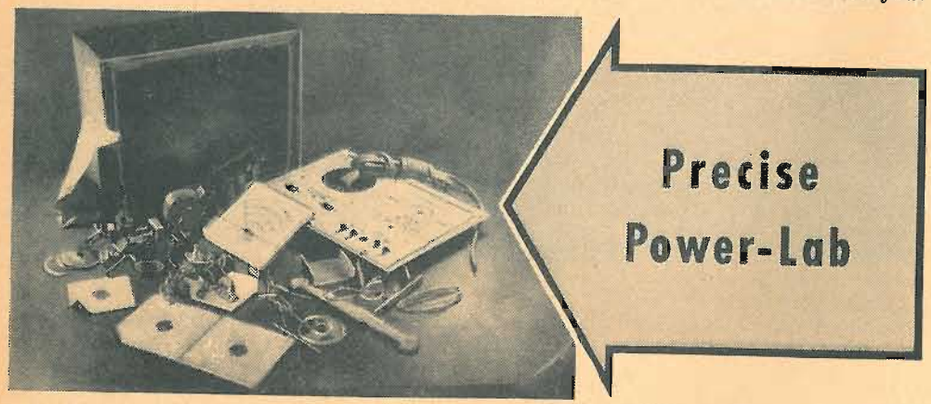
Club Notes. The two Swedish Clubs, The Universal Radio Club and the Swedish Amateur Radio Club, have joined to become one club. It is now known as SARC, The Swedish Allround Radio Club. The address is Box 440, Hoor, Sweden.

(*Continued on page* 123)

KIT BUILDER'S KORNER

ALTHOUGH it was our first intention to omit "Kit Builder's Korner" in this issue (to test reader reaction), we ran across such a hot item that it seemed imperative to do an about-face. The item in question is the "Power-Lab" Model 711 or 713 manufactured by Precise Development Corp., Oceanside, N. Y.

We were particularly attracted to the "Power-Lab" because here at long last is



an instrument that permits operating 6- or 12-volt automobile radios from the lab or workshop bench. It loafs along at a 10- to 15-ampere output that would have jerry-built low-voltage rectifiers gasping for breath.

If you need an a.c. line ammeter, the "Power-Lab" becomes one at the throw of a switch. It can also measure wattage taken from the line, isolate the 117-volt a.c. line whenever necessary (a big factor when working on a.c.-d.c. radios or TV sets), or even act as a variable voltage supply. In fact, the "Power-Lab" can be used to charge batteries.

Putting It Together. The method of showing inter-component connections is unusual (color is used extensively) and should help those who have doubts of their kit wiring ability. About the only word of caution that your editors can provide concerning the "Power-Lab" is that you should wire it up carefully—and, if you're a rank novice, preferably do it under competent supervision. The "Power-Lab" is designed particularly for the fellow who knows his way around electronics.

Special Features. There are several unusual components employed in the "Power-Lab." The square selenium plates seen in the foreground of photo at left must be assembled by the kit builder. Protection of the "Power-Lab" is provided by a miniature circuit breaker; this unit should not be tampered with—so don't let your curiosity run away with you. The giant-size capacitor, exceeding 1000 μfd., is required in the low-voltage filtering circuit to insure smooth d.c. output.

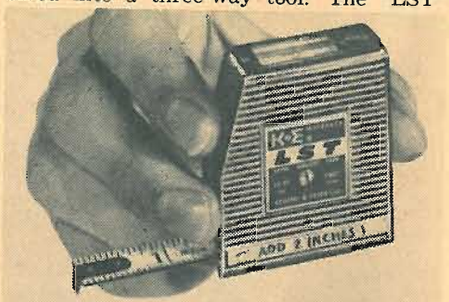
Comment. The "Power-Lab" is an instrument for the lab or service shop, and can be employed particularly well in TV servicing and car radio servicing. —30—

The "Power-Lab" is conveniently portable.

TOOLS and GADGETS

LEVEL TAPE SQUARE

An accurate and unbreakable level, a square at the lower right corner, and a 10′ replaceable Wyteface tape have been combined into a three-way tool. The "LST"



level tape square is appropriate for home, workshop or professional use, and is available at hardware stores for $1.98. Accurate inside and outside measurements are assured by the tape's sliding end-hook, and the rugged, die-cast case is chrome-plated. (*Keuffel & Esser Co.*, Hoboken, N. J.)

CAPACITOR-RESISTOR ANALYZER

Model CRA-2 helps remove the guesswork from circuit trouble-shooting. When making leakage current measurements, the values are read directly from the meter while the rated operating voltage is applied to the capacitor. In addition, the

vacuum-tube ohmmeter scale reads accurate insulation resistance of capacitors.

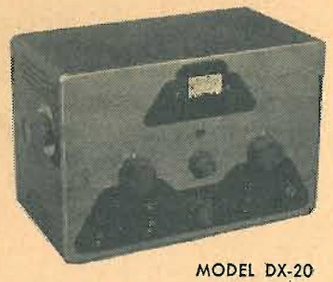
The extended-range calibrated power factor control permits power factor measurements of electrolytic capacitors rated as low as 6 w.v.d.c. and as high as 600 w.v.d.c. Rapid "in circuit" tests for short,

(*Continued on page* 98)

BRAND NEW MODEL

HEATHKIT

CW TRANSMITTER KIT



MODEL DX-20

$35.95

Shpg. Wt. 18 lbs.

$3.60 DWN., $3.02 MO.

Here is a straight-CW transmitter that is one of the most efficient rigs available today. It is ideal for the novice, and even for the advanced-class CW operator. This 50 watt transmitter employs a 6DQ6A final amplifier, a 6CL6 oscillator, and a 5U4GB rectifier. It features one-knob band switching to cover 80, 40, 20, 15, 11 and 10 meters. It is designed for crystal excitation, but may be excited by an external VFO. A pi network output circuit is employed to match antenna impedances between 50 and 1000 ohms. If you appreciate a good signal on the CW bands, this is the transmitter for you!

MODEL SG-8

$19.50

Shpg. Wt. 8 lbs.

$1.95 DWN., $1.64 MO.

POPULAR WITH SERVICEMEN

HEATHKIT

RF SIGNAL GENERATOR KIT

Produces RF signals from 160 KC to 110 MC on fundamentals on 5 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. Prealigned coils eliminate the need for calibration after completion.

MODEL AR-3

$29.95

incl. Fed. Excise Tax (less cabinet)

Shpg. Wt. 12 lbs.

$3.00 DWN., $2.52 MO.

HAM BANDS CLEARLY MARKED

HEATHKIT COMMUNICATIONS-TYPE

ALL BAND RECEIVER KIT

This receiver covers 550 KC to 30 MC in 4 bands, and is ideal for the short wave listener or beginning amateur. It provides good sensitivity and selectivity, combined with good image rejection. Amateur bands clearly marked on illuminated dial scale. Employs transformer-type power supply — electrical bandspread — antenna trimmer — separate RF and AF gain controls — noise limiter — headphone jack — and automatic gain control. Built in BFO for CW reception.

CABINET: Fabric-covered cabinet with aluminum panel as shown. Part 91-15A. Shipping wt. 5 lbs., $4.95 incl. Fed. Ex. Tax, $.50 dn., $.42 mo.

FULL SET OF COILS INCLUDED WITH KIT

HEATHKIT GRID DIP METER KIT

MODEL GD-1B

$19.95

Shpg. Wt. 4 lbs.

$2.00 DWN., $1.68 MO.

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

HEATH COMPANY • BENTON HARBOR 10, MICH.

A Subsidiary of Daystrom, Incorporated

EASY TO BUILD

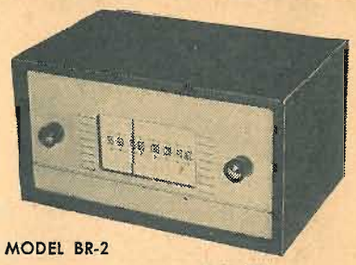
. . . A "LEARN-BY-DOING" EXPERIENCE

HEATHKIT BROADCAST BAND

RECEIVER KIT

You need no previous experience to build this table-model radio. It covers 550 KC to 1620 KC and features good sensitivity and selectivity. A 5½" speaker is employed, along with high-gain miniature tubes and a new rod-type antenna. The power supply is transformer-operated. The kind of a set you will want to show off to your family and friends. Construction is simple. You "learn by doing" as the project moves along.

CABINET: Fabric-covered plywood cabinet as shown. Shipping Wt. 5 lbs., .50 dwn., .42 mo., part No. 91-9A. $4.95 incl. Fed. Excise Tax.



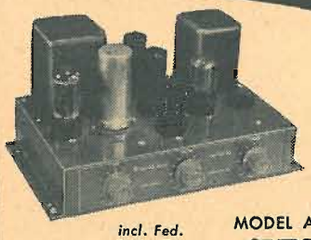
MODEL BR-2

$18.95

incl. Fed. Excise Tax (less cabinet)

$1.90 DWN., $1.59 MO.

Shpg. Wt. 10 lbs.



incl. Fed. Excise Tax

$1.80 DWN., $1.51 MO.

MODEL A-7D

$17.95

Shpg. Wt. 10 lbs.

REAL HI-FI PERFORMANCE AT MINIMUM COST

HEATHKIT 7-WATT

AMPLIFIER KIT

This 7-watt amplifier is more limited in power than other Heathkit models, but still qualifies for high fidelity, and its capabilities exceed those of many so called "high fidelity" phonograph amplifiers. Using a tapped-screen output transformer, the model A-7D provides a frequency response of ± 1½ DB from 20 to 20,000 CPS. Total distortion is held to surprisingly low level. The output stage is push-pull, and separate bass and treble tone controls are provided.

Model A-7E: Similar to the A-7D except that a 12SL7 tube has been added for preamplification. Features two inputs, RIAA compensation, and extra gain. $20.35, incl. Fed. Excise Tax, $2.04 dwn., $1.71 mo.

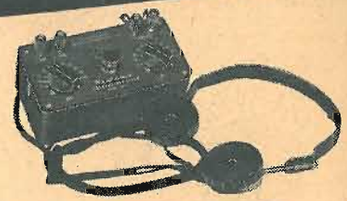
MODEL CR-1

$7.95

incl. Fed. Excise Tax

Shpg. Wt. 3 lbs.

$.80 DWN., $.67 MO.



. . . INTERESTING PROJECT FOR ALL AGES

HEATHKIT

CRYSTAL RECEIVER KIT

The crystal radio of dad's day is back again, but with big improvements! Sealed diode eliminates "cats whisker." Uses two high-Q tank circuits to tune 540 to 1600 KC. No external power required. Easy to build.

FOR AMATEUR OR PROFESSIONAL PHOTOGRAPHERS

HEATHKIT

ENLARGER TIMER KIT

MODEL ET-1

$11.50

Shpg. Wt. 3 lbs.

$1.15 DWN., $.97 MO.

This is an easy-to-build device for use by photographers in controlling their enlarger. It covers the range of 0 to 1 minute with a continuously variable control. Handles up to 350 watts. Timing cycle controlled electronically for maximum accuracy.

HEATH COMPANY • BENTON HARBOR 10, MICH.

A Subsidiary of Daystrom, Incorporated

NEW EDGE-LIGHTED TUNING DIAL FOR IMPROVED READABILITY

HEATHKIT HIGH FIDELITY

FM TUNER KIT

This FM tuner can provide real hi-fi performance at an unbelievably low price level. Covering 88 to 108 MC, the modern circuit features a stabilized, temperature compensated oscillator, AGC, broad-banded IF circuits, and better than 10 UV sensitivity for 20 DB of quieting. A ratio detector is employed for high efficiency, and all transformers are prealigned, as is the front end tuning unit. A new feature is the edge-lighted dial for improved readability, and a new dial cord arrangement for easier tuning. Matches the models WA-P2 and BC-1. Easy to build.

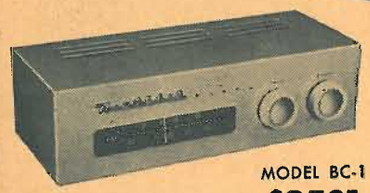
MODEL FM-3A

$25.95

incl. Fed. Excise Tax (with cabinet)

Shpg. Wt. 7 lbs.

$2.60 DWN., $2.18 MO.



MODEL BC-1

$25.95

incl. Fed. Excise Tax (with cabinet)

Shpg. Wt. 8 lbs.

$2.60 DWN., $2.18 MO.

NEW EDGE-LIGHTED TUNING DIAL. MATCHES MODEL FM-3A

HEATHKIT BROADBAND

AM TUNER KIT

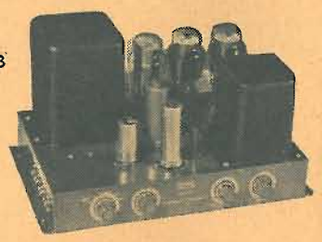
The BC-1 was designed especially for high fidelity applications. It features a low-distortion detector, broad band IF's, and other characteristics essential to usefulness in hi-fi. Sensitivity and selectivity are excellent, and audio response is within ± 1 DB from 20 CPS to 2 KC, with 5 DB of pre-emphasis at 10 KC to compensate for station rolloff. 6 DB signal to noise ratio at 2.5 UV. Covers 550 to 1600 KC. RF and IF coils are prealigned, and the power supply is built in. Features AVC, 2 outputs, and 2 antenna inputs. Tuning dial is edge-lighted for high readability.

MODEL A-9B

$35.50

Shpg. Wt. 23 lbs.

$3.55 DWN., $2.98 MO.



FULL 20 WATTS FOR PA OR HOME APPLICATIONS

HEATHKIT 20-WATT

AMPLIFIER KIT

This high-fidelity amplifier features full 20-watt output using push pull 6L6 tubes. Built-in preamplifier provides 4 separate inputs, selected by a panel-mounted switch. It has separate bass and treble tone controls, each offering 15 DB boost and cut. Output transformer is tapped at 4, 8, 16, and 500 ohms. Designed primarily for home installation, but used extensively for public address applications. True high-fidelity performance with frequency response of ± 1 DB from 20 CPS to 20,000 CPS. Total harmonic distortion only 1% (at 3 DB below rated output).

HEATH COMPANY • BENTON HARBOR 10, MICH.

A Subsidiary of Daystrom, Incorporated

FEATURES GOOD LOOKS AND HIGH PERFORMANCE

HEATHKIT HIGH FIDELITY

SPEAKER SYSTEM KIT

The model SS-1 covers 50 to 12,000 CPS within ± 5 DB, and can fulfill your present needs, and still provide for the future. It uses two Jensen speakers and has a cross-over frequency of 1600 CPS. The speaker system is rated at 25 watts, and the impedance is 16 ohms. The enclosure is a ducted-port bass reflex type and is most attractively styled. It is easy to build and can be finished in light or dark stain to suit your taste.

MODEL SS-1

$39.95

Shpg. Wt. 30 lbs.

$4.00 DWN., $3.36 MO.

MODEL SS-1B

$99.95

$10.00 DWN., $8.40 MO.

Shpg. Wt. 80 lbs.

ATTRACTIVE STYLING MATCHES MODEL SS-1

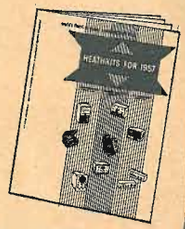
HEATHKIT HIGH FIDELITY

RANGE EXTENDING SPEAKER SYSTEM KIT

The SS-1B is designed especially for use with the model SS-1. It consists of a 15" woofer and a compression-type super tweeter to add additional frequency coverage at both ends of the spectrum. Cross-over frequencies are 600, 1600, and 4,000 CPS. Together, the two speaker systems provide output from 35 to 16,000 CPS within ± 5 DB. The kit is easy to assemble with precut and predrilled wood parts. Power rating is 35 watts, and impedance is 16 ohms.

Free 1957 CATALOG

Our new 56-page 1957 catalog describes more than 75 different kit models for experimenters, hams, students, engineers, industrial laboratories, etc. Send for your free copy now!



HOW TO ORDER

It's simple — just identify the kit you desire by its model number and send your order to the address listed below. Or, if you would rather budget your purchase, send for details of the Heath Time Payment Plan!

ORDER BLANK

HEATH COMPANY • BENTON HARBOR 10, MICH.

A Subsidiary of Daystrom, Incorporated

Name_____

Address_____

City_____ Zone_____ State_____

SHIP VIA

- ☐ Parcel Post
- ☐ Express
- ☐ Freight
- ☐ Best Way

Quantity	Item	Model No.	Price
		POSTAGE	
		TOTAL	

Enclosed find ☐ check ☐ money order for $_____. Please ship C.O.D. ☐ postage enclosed for_____lbs. On express orders do not include transportation charges — they will be collected by the express agency at time of delivery. On parcel post orders include postage for weight shown. Orders from Canada and APO's must include full remittance. *NOTE: All prices subject to change without notice.*

Have Your Head Examined?

(*Continued from page 67*)

you know for sure that everything else is all right (your turntable level and your stylus pressure are correct), you may have reason to suspect lack of compliance.

No accurate, sensitive test for compliance is available for home use. To measure such small forces as effect the sideways motion of a phono pickup takes rather fancy machinery. But you might try this rough "rule of the thumb." Let the stylus rest on the crest of your thumb nail. Then gently wiggle your thumb back and forth a small fraction of an inch—no further than the width of a record groove. If the stylus follows this short motion, chances are that its compliance is all right. It will then follow the undulations of the record groove with equal ease. But if the stylus remains ramrod while your thumb slides under it, ask your dealer about it. He may advise you to replace the stylus assembly or, if you use a moving coil pickup, to send it to the factory for fitting a new stylus.

Dirt, plain or otherwise, is as natural to a stylus as to a pig. They just dig it up. Yet while pork is none the worse for it, music is. During the play of a single 12-inch LP side, the stylus literally sweeps up

about 2½ miles of groove—the curviest, nookiest dust-catcher you ever saw. Mounting in miniature heaps and forming pinhead balls around the stylus shank, the caked dirt clogs the free motion of the stylus. Besides, the magnet poles always seem to find some metal filings to clasp to their bosoms. Result: distortion and muffling of the highs.

Again the home remedy is simple and effective. During your regular "head examination," just pry loose these little pads of dirt. Do it gently with a pin, and don't bend the stylus shank. Don't use alcohol, carbon tetrachloride or similar solvents. These might attack the small rubber damping blocks of the stylus suspension and bring about premature arthritis (see p. 67). In that case, the cure may be worse than the disease. So keep it dry.

A more or less regular "head check" along these lines is a fine prophylactic for audio complaints. When there's trouble in the head, it won't help you to drag out your signal tracers, oscilloscopes, and what-have-you. They'll give you no clue. A defective phono pickup head poisons your music at the source, where no signal tracer can catch it. In a high percentage of hi-fi ailments, you will save yourself a futile run-around by going right to the head! —30—

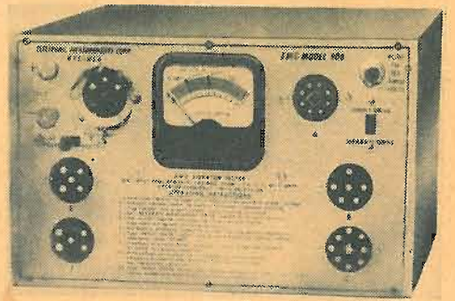
Tools

(*Continued from page* 88)

open, intermittent, high r.f. impedance and high power factor can be performed. (*Pyramid Electric Company*, 1445 Hudson Blvd., North Bergen, N. J.)

VIBRATOR CHECKER

The Model 906 will check both 6-volt and 12-volt vibrators, reading their condition on a "Bad-Good" scale. It will check both



interrupter and self-rectifier type vibrators for proper starting point as well as for quality of operation. Supplied with a new-style plastic front meter, this instrument is priced at $28.90, wired and tested, and at $15.50 when furnished in kit form. (*Electronic Measurements Corporation*, 280 Lafayette St., New York, N. Y.) –30–

Amplifier Kits

(*Continued from page 48*)

reached its greatest development in terms of amplifier kits. Working quite independently of each other, kit engineers have almost universally agreed—as evidenced by the number and variety of kits now available—that amplifiers are the most likely components to be considered workable as home construction projects.

The prospective kit buyer invariably wants to know how simple or difficult it is to put together the unit. Many enthusiasts who have never looked inside a kit package, or leafed through the accompanying instruction booklet, have a kind of awe and fearful reluctance about getting themselves involved in the apparently complex wiring that is evident from a quick glance under the chassis or at a conventional schematic diagram.

It is true that to start "cold" and build an amplifier merely from a schematic and parts list does take some experience and training. You must, of course, identify parts and relate their symbolic and functional location on the schematic to their actual location and layout on the chassis. This is not always easy, and involves such things as length and dressing of leads, tube pin connections, mounting and orientation of parts, use of terminal lugs, etc.

Happily, such considerations do not apply to the kits listed here. The modern amplifier kit is conceived of as an exercise in horizontal procedure in which layer after layer of circuitry is added only after the foundation is secure. Rather than wire "stage by stage," you wire those things common to all stages at the same time, such as the filament circuits of the tubes. You don't have to know a resistor from a capacitor when you start—but you will know by the time you're finished.

Kit instructions—prepared, by the way, by skilled technical writers and illustrators—are based on the assumption that you know nothing about wiring or schematics. Every conceivable possibility of inexperience, and every chance for error is carefully taken into account. Illustrations provide you with views of the unit in various stages of construction, including detailed close-ups of important and/or relatively complex sections. Hook-up procedures are arranged to facilitate the steps that follow.

For example, there are instructions as to when to solder and when not to solder. The unguided novice might be tempted to solder a connection as soon as the lead has been hooked around its connecting point. This could create trouble and waste time when another connection must be

made to the same point later. Kit directions take care of this and everything else. If followed carefully, they insure perfect units.

Advantages of Kits. If you have a yearning to "build it yourself," the kit idea is an excellent one. Regardless of which you choose, you know the circuit has been designed, built, tested, and revamped if necessary, by top flight engineers. It represents a standard, substantial, and thoroughly reliable piece of engineering which, while not factory-built, has been factory-tested and is factory-guaranteed.

There's no shopping around for parts or the possibility of last-minute substitutions that may or may not work in place of what was originally and rightfully planned. All the parts you need are conveniently selected, packaged, and labeled. You are even instructed as to what tools you'll need.

Finally, there is the educational value of assembling a kit. From one standpoint, kit assembly can be regarded as a virtual beginner's course in practical electronics. You can't help working with parts and circuits —even if only by rote—without absorbing some technical understanding. What's more, working with your hands and with such simple tools as a screwdriver and a soldering gun can add to your total mental and emotional capital. As a relaxing hobby, as sheer fun, and even as an occupational therapy aid, kit building has rewards that can't be measured in terms of decibels or cycles-per-second.

Available Kits. The tables on pages 45 and 46 list amplifier kits now available, arranged by basic types: complete amplifiers, preamplifier-control kits, and basic or power amplifiers. Details on any kit may be obtained from your local hi-fi dealer or by writing directly to the company at the address listed.

Of all the specifications that should have some meaning, "frequency response" and "intermodulation distortion" are the most widely used (and abused). Without thorough and explicit technical data, neither term has much meaning to the hi-fi user. They sound imposing and impressive, but that is little excuse to include them in this survey. Thus, we have made no attempt to rate the amplifiers in terms of their comparative technical specifications.

Each manufacturer attempts in his own fashion to maintain a standard of quality control. All of the amplifiers listed "can reproduce" the desired hi-fi range of 40 to 16,000 cps. Some of them do it the hard way, but they all do it. Some of them can undoubtedly work well within the entire range of, say, 20 to 20,000 cps without a second thought. Price may serve as a guide to

(*Continued on page* 106)

Lafayette's

4 AND 6 TRANSISTOR SUPERHET KITS POCKET AND HOME RADIOS FOR SPEAKER AND EARPHONE OPERATION

FIRST BUILD THIS

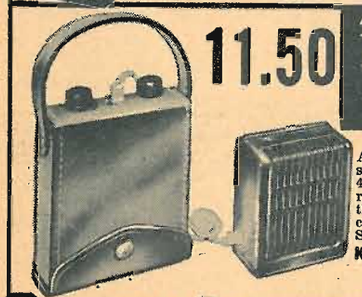
THEN BUILD THIS **19.95**

POCKET SIZE: 4"L x 3-5/16"W x 1"D BUILT-IN ANTENNA! REQUIRES NO EXTERNAL ANTENNA OR GROUND!

Lafayette engineers have designed this fascinating 4-transistor superhet receiver kit in a unique and interesting form. It is, by itself, a completely self-contained, pocket sized personal portable set which operates a miniature earpiece so only you can hear; by plugging into the KT-96 kit listed below, it is instantly converted to a full 6-transistor home radio, complete with speaker for the entire family to enjoy. The set is completely subminiaturized and utilizes the new, radically different Argonne "Poly-Vari-Con" ultra miniature 2-gang variable condenser. You will be delighted with the truly subminiature parts, from the variable which measures only 1-1/16" square x 3/8" deep, to the tiny I.F.'s and electrolytics. The chassis measures only 4" L x 3-5/16" W x 1" D. You'll be amazed at its performance. Circuit features use of 4 transistors (2 high frequency and 2 audio type) plus a germanium diode, 2 I.F. stages and built-in high gain ferrite core and antenna. The result is a sensitive, stable and selective set covering the entire broadcast band. Requires no outside antenna or ground connection. The kit is furnished complete with transistors and all parts, including battery and chassis already drilled and punched. The earpiece and carrying case are accessory items, not supplied. All necessary pictorial and circuit diagrams are furnished with simple, easy-to-follow instructions. Shpg. wt., 2 lbs.

KT-94 Kit ..... Net **19.95**

MS-311 LEATHER CARRYING CASE ..... Net **1.95**
MS-260 Super power dynamic earpiece ..... Net **3.95**
MS-278 Economy earpiece ..... Net **1.95**



11.50

2-TRANSISTOR CLASS B PUSH PULL OUTPUT STAGE KIT WITH SPEAKER SELF-CONTAINED IN BEAUTIFUL PLASTIC CASE.

• CONVERTS 4-TRANSISTOR KIT INTO A 6-TRANSISTOR HOME RADIO WITH SPEAKER

Add a completely transistorized push-pull audio stage to your 4 transistor receiver. Complete stage including speaker and case measures only 3" H x 2¾" W x 1⅝" D. Plugs right into 4 transistor kit above. Converts your 4 transistor set to a 6 transistor plus diodes superhet receiver. Performance equal or superior to commercially wired sets selling at more than twice the price. Kit includes 2 transistors, 2 transformers, 2½" PM speaker, pre-punched chassis, speaker case to hold entire stage, battery, hardware, instructions and diagrams. Shpg. wt., 1 lb.

KT-96 ..... Net **11.50**

FM-AM TUNER KIT

Basic FM-AM Tuner having outstanding specifications and delivering astonishing performance — all at a budget price in easily assembled kit form.

34.95

- **AFC DEFEAT CIRCUIT WITH FRONT PANEL CONTROL**
- **FOSTER-SEELEY DISCRIMINATOR CIRCUIT**
- **GROUNDED GRID TRIODE AMPLIFIER**
- **20-20,000 CPS RESPONSE**

Choose this 7 tube compact high-fidelity FM-AM tuner whose characteristic features are found in units costing many times as much, and whose performance is unheard of at this low price. There are two front panel controls, a function control for AM, FM, PHONO, TV and a tuning/AFC defeat control. Features Armstrong FM circuit with limiter and Foster-Seeley discriminator. Simplified tuning with slide-rule dial and flywheel counter-weighted mechanism, high impedance phono input and high impedance audio output.

SPECIFICATIONS

FREQUENCY RANGE: FM 88-108MC, AM, 530-1650 KC. **ANTENNA INPUT:** FM, 300 ohms, AM Ferrite loopstick and high impedance external antenna. **DISTORTION:** Less than 1% at rated output. **FREQUENCY RESPONSE:** FM, ± .5 db 20 to 20,000 cps, AM ± 3 db 20 to 5000 cps. **SENSITIVITY:** FM, 5 UV for 30 db quieting, AM, Loop sensitivity 80 UV/meter. **SELECTIVITY:** FM, 200 KC bandwidth, 6 db down; 375 KC FM discriminator peak to peak separation, AM, 8 KC bandwith, 6 db down. **IMAGE REJECTION:** 30 db minimum. **HUM LEVEL:** 60 db below 100% modulation. **TUBE COMPLEMENT:** 2-12AT7, 1-6BE6, 1-BA6, 2-6AU6, 1-6AL5 plus selenium rectifier. **SIZE:** 5¼" high x 9⅝" wide x 9½" deep (excluding knobs). **CONSUMPTION:** 30 watts. For 110-120V 60 cycles AC. Attractive etched copper-plated and lacquered finish. Less metal case. Shpg. wt., 9 lbs.

KT-100 ..... NET **34.95**
ML-100....Metal cage for above, Shpg. wt., 3 lbs. **5.00**

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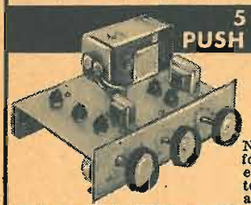

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New 5 transistor audio amplifier for phonos—microphones—tuners—etc. Excellent for the experimenter—student—or any one desiring a good transistorized amplifier. Uses new G.E. 2N189 and 2N186A transistor. Inverse feed back for reduction of distortion. Transformer coupled driver and output stages. Complete with punched chassis, knobs, transistors, all parts and detailed instructions and diagrams.

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For those interested in mastering the international code, an audio tone oscillator is essential. The circuit of this transistorized feedback oscillator has the simplicity of the neon glow, the signal strength of the vacuum tube, and requires only two penlite cells for weeks of service. It may be used for solo practice, or two may send and receive with the same unit. Kit comes complete with Transistor, Telegraph Key, Resistors, Condensers, Masonite Board, etc., and Schematic Diagram.

KT-72 ..... Net **2.99**
Cannon ECI—Single Headset ..... Net **1.13**

2 TRANSISTOR POCKET RADIO KIT

Packed into a 2½"x3½"x1¼" plastic case. This Two Transistor plus crystal diode radio kit offers many surprises, utilizing a regenerative detector circuit with transformer coupled audio stage, gives you high gain and excellent selectivity. Pulls in distant stations with ease with more than ample earphone volume. Kit comes complete with two transistors, crystal diode, loopstick, Argonne transistor audio transformer, resistors, condensers, plastic case, etc. Including schematic and instructions.

KT-68A Complete Kit less earphones. Net **10.95**
MS-260 New Super Power Dynamic Earphone, Ideal for Transistor Circuit Imp. 8000 ohm, D.C. 2000 ohm **3.95**

NEW POCKET AC-DC VOM MULTITESTER
2,000 ohm per Volt on AC & DC

- **Completely wired — Not a kit**

Accurate VOM with a sensitivity of 2000 ohms per volt on both AC and DC. Single selector switch. 3" 160 amp. meter. Scales: DC Volts: 0-10-50-500-1000; AC Volts: 0-10-50-500-1000; Ohms: 0-10K, 0-1 Meg; DC Current: 500 ua and 500 ma; Decibel: —20 to +22, +20 to 36; Capacity: 250 mmf to .2 mfd and .005 to 1 mfd. Heavy plastic panel, metal bottom. 4¼" x 3½" x 1⅝". With batteries and test leads. Shpg. wt. 4 lbs.

RW-27A **8.95**

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3 TRANSISTOR SUPERHET POCKET RADIO KIT

- A TRUE POCKET SUPERHET RECEIVER-NO EXTERNAL ANTENNA!
- NO EXTERNAL GROUND!

A remarkable sensitive, super-selective pocket superhet receiver with astonishing performance over the complete broadcast 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. The receiver's appearance enhanced by attractive maroon and silver station dial. Sensitive 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. 4⅛"x2⅝"x1-1/16". Shpg. wt., 1 lb.

KT-116 —Complete Kit, less earphone..... Net **16.95**
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1 AND 2 TRANSISTOR POCKET RADIO KITS

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- **IDEAL FOR STUDENTS, HOBBYISTS AND EXPERIMENTERS**
- **PRE-PUNCHED CHASSIS FOR ADVANCEMENT TO 2 TRANSISTOR KIT**

Ideal, low-cost transistor pocket radio kit. Super-selective ferrite loop antenna permits good reception up to 50 mile radius with approx. 50 ft. antenna and good ground. Provisions for advancement to 2 transistor receiver. Complete Kit with simple detailed instructions. 3⅝" x 2⅝" x 1". Shpg. wt., 1 lb.

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TWO TRANSISTOR POCKET RADIO KIT—KT-98

Contains all KT-97 components plus additional R-C coupled transistor stage for increased sensitivity and output. Complete with instructions. Shpg. wt., 1 lb.

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MS-111—Crystal earphone for KT-97 and KT-98..... Net **1.49**
MS-260—Super power dynamic earphone..... Net **3.95**

20,000 OHM PER VOLT MULTITESTER SEMI KIT

A new kind of kit—the difficult work is already done—you wire in only a few multipliers and mount the battery holder to complete the unit. A fine high sensitivity (20,000 ohms per volt DC —5000 ohms per volt AC) instrument employing a 3" 40 microamp movement. Has 4 DC voltage, 4 AC voltage, 2 DC current, 3 resistance and 2 db ranges. Complete with test leads and detailed instructions. Size 3⅜" x 4⅜" x 1⅝". Shpg. wt., 3 lbs.

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Kits

(Continued from page 102)

this point since obviously only the more expensive amplifiers can afford to use the optimum output transformers as well as other fine parts that make for high quality.

As far as the mysterious "Intermodulation Distortion" (IM) is concerned, tests reveal that all of the amplifiers operate well within tolerable limits when operated at "reasonable" volume levels. Leading authorities agree that even with 3% IM distortion (which seems a whopping amount in the light of present-day amplifier design), a critical person can listen intently without really hearing any distortion and without suffering fatigue. There is virtually no question that the IM of the amplifiers listed here fall below that amount.

The bulk of the information selected for inclusion in these tables is of prime importance to the hi-fi *user* of the equipment and is frankly slanted toward an *operational* approach.

We are no longer sorting out amplifiers as "good" or "bad" or "hi-fi" or "not hi-fi." For the same reason, no attempt has been made to advise readers which kits to buy. Properly constructed, any of these kits can provide years of service. The one to choose is the one that meets your individual needs in terms of power requirements, space requirements, flexibility of installation, matching to other components, anticipated expansions or changes in the system, individual styling, and—of course—your budget. —30—

From Stem to Steam . . .

(Continued from page 43)

lines—digesting a long list of variables, such as coal consumption and prices, transmission losses, generator output, turbine efficiency, load distribution and peak demands.

A power company, consisting of many widely scattered substations and generating plants, has varied demands for power output. The demand changes from minute-to-minute, hour-to-hour and day-to-day, depending upon when Mrs. Homemaker decides to use her vacuum cleaner, toaster, range or sewing machine.

Add to these varying demands the differing efficiency of each substation and generating plant, and a knotty problem results. Substation efficiency (the ability to distribute power) varies with each station and can only be accurately determined by knowing such variables as the age of the various boilers (often several per station), the turbine output and generator output.

When all the variables are computed by

human beings using mechanical equipment, a time lag results, causing some equipment to overload while a neighboring substation remains below its operating capacity.

With the new computer, variables from the entire system are digested electronically, computed automatically and the necessary adjustments made instantaneously.

Similar techniques for gathering and analyzing data from distant and inaccessible places have been developed for the U. S. Air Force Missile Test Center at Cocoa Beach, Florida, a rocket range which has become a kind of "main stem" traveled by the awesome harbingers of future forms of flight.

A ground-based computer, generously dubbed "Mr. Genius" by the scientists who spent their own genius and five years on its design, effectively becomes part of the instrumentation of the missile. It digests large quantities of missile flight data, producing answers to problems in a small fraction of the time formerly required for solution of these complex equations.

To give engineers a chance to correct possible mistakes, data recorded during the firing of each missile should be computed, correlated, and analyzed before the next missile is launched. In the past, there was no way to complete this tremendous mathematical task in the short time between launchings. Now the computer with its fast answers makes it possible for each missile to "learn" from the one just ahead. Tying in this computer with the many research problems of the Air Force missile program, Air Force scientists are making "Mr. Genius" very much at home on the range.

Computers thus keep a controlling grip on our prime sources of power, from the time-honored steam engine to the latest rocket motor. These electronic units whip up the raw energies of fuel combustion to the limits of efficiency and at the same time keep these forces from getting out of hand by becoming dangerously explosive. —30—

Build This "Electronic Brain"

(*Continued from page* 72)

chatters, check both transistors and also the polarity of *C1* and *C2*. Check both of these capacitors for a possible defective unit. Make sure no light from the controlled lamp is getting into the photocell. And check the adjustment of *RL1*. If one of the other relays chatters, make sure all relay contacts are clean.

If the lamp turns on and off about twice

a second, light from the controlled lamp is getting into photocell *SP1*. Move the position of the lamp, or the control unit, until the condition ceases.

If the lamp goes off when another lamp is turned on, light from the second lamp is getting into the photocell. Relocate the second lamp, the control unit, or both.

Regardless of the setting of *R3*, if the light remains on when daylight is falling on the photocell, check *SP1* and its connections. The black lead must go to the base of *TR1*, the red lead to the base of *TR2*. Make sure that the bracket of *SP1* is insulated from the box, and that resistors *R4* and *R5* have not been accidentally interchanged. Check the sensitive relay adjustments and the continuity of the coil.

With the photocell in total darkness, if the light remains off regardless of the setting of *R3*, check *TR1* and *TR2*. Make sure *CR1* has been connected in the circuit with the proper polarity. If it has been accidentally reversed, check the condition of both transistors for possible damage due to the wrong connection. Check the sensitive relay adjustments, and check the continuity of the coil of *RL3*. Finally, make sure all relay contacts are clean. —30—

Transistorized Slave Flash

(*Continued from page 74*)

the unit should be very responsive to the bright burst of light from the camera-mounted flash. (When placing a bulb in the socket, however, it's a good idea to keep your thumb over the photocell to prevent accidental discharge.) Disconnect the meter and remove the short. You're ready to go.

ADDITIONAL NOTES TO CAMERA FANS

When similar flash bulbs are used in both the camera gun and the slave, they cannot, of course, reach peak brilliance at exactly the same time. Using Class M bulbs, for instance, which reach their peak light output 20 milliseconds (ms.) after the circuit is closed, the bulbs might peak 20 ms. apart plus the 2 to 4 ms. required for the slave circuit to respond.

Actually, with the relay carefully adjusted and the slave 10 or 15 feet from the camera, the two bulbs peak only 10 or 15 ms. apart, since the slave is generally actuated long before the camera bulb reaches peak output. This small difference is relatively unimportant since at 1/50 second the camera shutter is open for 20 ms., adequate to catch both flashes if the shutter is properly synchronized. However, if you are operating the slave at some distance from the camera and find you are missing the light from the slave, you might try a slower shutter speed.

In practice, it has been found very satisfactory to use a Class M bulb (20-ms. delay), such as a Press 25 or No. 5, on the camera and a Class F bulb (5-ms. delay), such as SF or SM, on the slave. This combination pulls the two flashes 15 ms. closer together and they peak almost simultaneously. —30—

The Mettle Locator

(*Continued from page* 59)

wealth of the Dons was carried through here—huge hordes of it *mysteriously* disappearing, *murderously* thefted and buried . . . its owners then dying violently and the secret of its location *lying silently within the breast of the sullen earth for, lo, these—"*

"Let's not make a *production* out of it, chum," she said. "If what you say is true—let's just keep our mouths shut and start making with the locator."

"Muy bien!" I agreed, still caught up with my own rhetoric.

ARMED with spade, locator and greed, we spent the following hours testing portions of the yard and, when the instrument indicated buried metal, digging furiously. For awhile I watched and she dug. Then, for change of pace, she dug while I kept an eye open, leaning alertly against a tree, for treasure-jumpers . . . a fine, cooperative system which worked smoothly—allowing us to cover (and uncover) a considerable amount of ground.

The only flaw in the entire operation: we found no gold or silver objects. True, we found other aged and interesting things like tire-irons, skillets, ancient bottle-caps, rusted bed-springs, a ceremonial sword (later identified as belonging to a neighbor who returned, unsteadily, from a lodge meeting), several unknown chunks of steel that didn't appear to be much of anything, two pipe-wrenches (in excellent condition), a wheel (circa Whippet '30) and, lastly, assorted lengths of round-rod.

"Nuts!" snorted Friend Wife, casting the spade into the hole she had just neatly dug. "No treasure around here! You read the wrong books—those Spaniards must've lugged that stuff all the way home with them!"

"B-But I tell you, this locator—"

She glared stonily at the locator.

"That thing's a *fake!"* she announced in the cold tones of hate. "That thing couldn't find gold in Fort Knox! And I've got the broken back to *prove* it, chum!"

"Listen!" I protested. "According to the instructions—"

"I say it's a phoney!"

This was pretty strong talk. And strong talk calls for strong measures. I mentioned her to follow me. Stalking indignantly over to Junior's sandbox, I turned and eyed her belligerently.

TAKE off your watch!" I commanded.

"My—" She hesitated. "Why *mine?"*

"Because I unselfishly bought you a good, gold one, *that's* why. Mine's a five-buck, nickel-plated job—and I want something goldy to prove, once and for all, that this locator *works!"*

Unwillingly, she removed the wristwatch and handed it over. I promptly buried it in the sandbox, making certain it was well covered. Then, I rose and put the headphones on her head. Holding the locator over the buried watch, I demanded: "Hear that difference in tone? That lower quality to the beat-note?"

She nodded.

"That's the locator's way of saying *GOLD!"*

"That doesn't prove much," she complained, removing the headphones. "I *already* knew there was gold there."

"B-But . . .b-but . . ." I stammered.

"Where's my watch?" She pawed intently in the white sand. *"Hey! Where's my watch?* HEY, I DON'T SEE MY WATCH!"

"In the sand," I replied, factually.

"Yeh, but where?" Now she scrabbled frantically in the sand, digging with the intensity of a demented gopher. "I can't find it!" she wailed, miserably. *"I can't find the little watch I've had ever since my twenty-eighth birthday!"*

Quickly, I brought the locator into play again. In a moment the beat-note indicated gold . . . the pitch changing noticeably. "Here—right here!" I told her, pointing to a spot. "The locator says it's right . . . *here!"*

Swiftly, she dug right . . . there. No watch.

"Now *see* what your crazy old ideas have done!" she screeched in anguish-laden tones. "That improbable locator-thing has lost my watch! I want my watch!" And she returned to methodless excavation with the fury of a pursued mole.

SEVERAL DAYS have passed, now, and the situation is still fraught with unsolved mystery and inexplicable circumstances. Friend Wife is removing a ton and a half of sand from the sandbox, by the admirable (if tedious) process of a bucketful at a time—screening each load with more scrutiny and care than a riverside miner expecting nuggets.

My personal disgrace has been compounded by another failure. The locator seems to be living up to her heated description of being "improbable" . . . in fact, so improbable that I'm seriously thinking of mailing it to the FCC—and letting experts tussle with this fantastic instrument.

Although I followed directions to the

last conventional shielded-coil, oscillator and audio-amplifier—that crazy locator's picking up *ham calls* now!

And *I'm* going batty with frustration since I can't seem to figure out a way to answer them.

Hi-fi was never like this. —30—

Getting More from the "Peaker"

(*Continued from page* 57)

Series coupling of the "Peaker" is most useful when the receiver's input impedance is relatively low. If you obtain poor or no results from link coupling, and if you find it impossible to tune the "Peaker" to resonance with series coupling, the chances are your receiver has a high input impedance. In this case, you'll probably find that parallel coupling works out best for you.

Parallel Coupling. In the circuit of Fig. 4, the antenna coil of the receiver is placed in parallel with the resonating coil in the "Peaker," making the receiver's antenna coil a part of the "Peaker's" tuned circuit. Some receivers intended primarily for short-wave broadcast listening may have a relatively high input impedance and perform best with parallel coupling. With any receiver, it is best to try all three methods of coupling, experimentally, and select the one which gives optimum results.

The circuits in Fig. 3 and Fig. 4 both achieve their effective performance through very tight coupling between the "Peaker" and the receiver. If the receiver has no r.f. stage to provide isolation, severe pulling of the receiver's oscillator may occur with the tuning of the "Peaker" at the higher frequencies. Such pulling is indicated when no stations can be received and the receiver howls at certain settings of the "Peaker." As this is primarily a receiver fault, the best solution is a better receiver. In cases where pulling is not too bad, it is helpful to use variable coupling between the link coil and the resonating coil in the "Peaker."

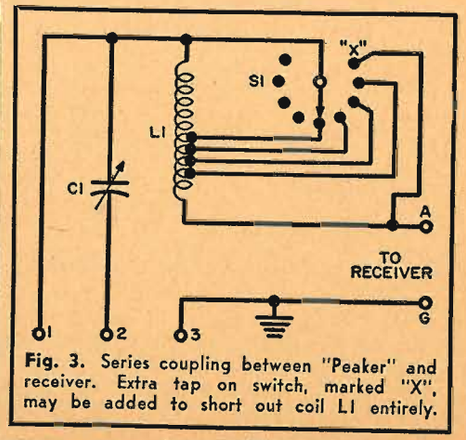


Fig. 3. Series coupling between "Peaker" and receiver. Extra tap on switch, marked "X", may be added to short out coil L1 entirely.

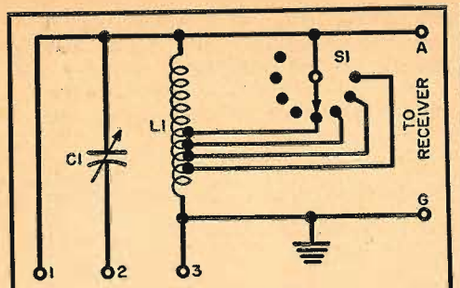


Fig. 4. Parallel coupling, primarily useful with receivers having high input impedance.

Regardless of whether link, series, or parallel coupling to the receiver is employed, connecting the "Peaker" to antenna and ground, as well as the method of tuning it, is exactly as described in the earlier article. —*Frank H. Tooker*

Transistor Topics

(*Continued from page* 78)

in a simple triangle. The clue to proper identification is that two of the leads are on an imaginary "center line" drawn across the face of the transistor.

A slightly different triangular arrangement of leads is shown in Fig. 2(D). This is employed by Amperex, CBS-Hytron, and Philco. The leads are identified by a colored dot or line (often *red*) placed on the body of the transistor next to the *collector* lead. Reading in a clockwise direction from this point, the leads are collector, base, and emitter.

Raytheon Types CK722, CK721, 2N132, 2N133 and 2N138, as well as some Tung-Sol types, are provided with three *equally spaced* leads arranged in a straight line. While the shape and size of the transistor's body, as well as the actual spacing of the leads, will vary with the type of transistor, all have the same "clue" to identify the collector electrode—a colored dot (often red) on the side of the transistor next to this electrode connection. The center terminal is the base lead. See Fig. 2(E).

Finally, the RETMA "standard" in-line pin arrangement is shown in Fig. 2(F). The leads, while in a straight line, are unequally spaced, with the base and emitter leads close together and the collector lead further out. The base is the center lead. This arrangement is used with most of the

transistors manufactured by General Transistor, with "low power" transistors manufactured by Sylvania such as Types 2N34 and 2N35, with many RCA types including the popular 2N109, with most popular G.E. types including the 2N107 and 2N170, with many of Raytheon's types—the CK768, CK760 (2N112) and CK761 (2N113), etc., and by most other manufacturers. While the lead spacing and arrangement remain the same, the actual shape and size of the transistor's "body" will vary considerably from one type to another; two typical body outlines are shown in Fig. 2(F).

Superhet Receiver Kits. While there are many, many, one- and two-transistor receiver kits on the market, relatively few superheterodyne construction kits are offered to home builders. Yet the superhet is generally considered to be "tops" as far as receiver circuitry goes, and most commercially available receivers employ this circuit arrangement. Recently, your columnist obtained and tried all the currently available superhet kits. Here's a quick rundown.

The KT-116 is a *three-transistor* kit offered by Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y. One transistor serves as a converter (mixer-oscillator), another as an i.f. amplifier, and the last one as an audio amplifier. A diode detector is used. The kit assembles into a small plastic case, has a self-contained antenna, is powered by a self-contained 9-volt battery, and is designed for earphone operation only.

KT-94 is a *four-transistor kit* offered by Lafayette Radio. Two r.f. transistors serve as converter and i.f. amplifier. Two audio transistors are used in a capacity-coupled two-stage audio amplifier. A diode detector is employed. The kit assembles on a small metal chassis, has a self-contained ferrite antenna coil, and is powered by a self-contained 9-volt battery. A leather carrying case is an optional accessory. Although the basic receiver is designed for earphone operation only, a power amplifier-loudspeaker kit is available as an accessory item.

The TK-104 is a *four-transistor* kit manufactured by Tran-Kit Electronics Co., Inc., 467 So. 5th Ave., Mt. Vernon, N. Y. This kit is available through a number of local distributors. Two r.f. transistors are used as converter and i.f. amplifier. A diode detector is employed. Two audio transistors are used in a two-stage transformer-coupled amplifier, with the final stage driving a self-contained PM loudspeaker. The kit assembles on an etched

circuit board and has a self-contained antenna coil, with the circuit powered by a 9-volt battery. It is supplied complete with a leather-like plastic carrying case. A jack is provided for earphone operation.

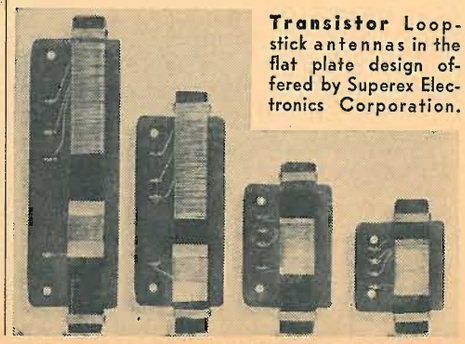
KT-119 is a *six-transistor* kit offered by Lafayette Radio. The r.f. transistors are used in the converter stage and in a two-stage i.f. amplifier. Audio transistors are used in a two-stage transformer-coupled amplifier, with the output stage consisting of two transistors in Class B push-pull driving a built-in PM loudspeaker. A diode detector is used, with an a.g.c. (automatic gain control) circuit incorporated in the receiver's design. The receiver operates from a self-contained ferrite antenna coil and 9-volt battery. An earphone jack is provided. The receiver assembles on a metal chassis, with a leather carrying case available as an accessory.

In addition to the complete receiver kits, one manufacturer offers a "basic" kit of i.f. transformers and local oscillator coil. The manufacturer, Vokar, 7300 Huron River Drive, Dexter, Mich., supplies these kits through regular radio parts distributors.

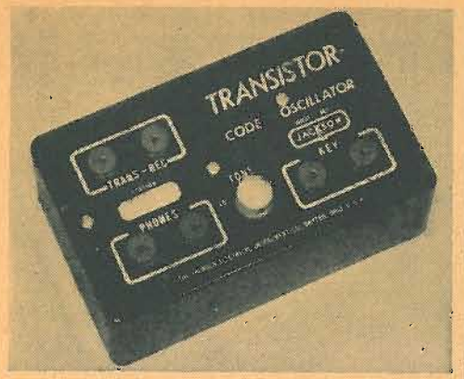
Product News. Superex Electronics Corporation, 4-6 Radford Place, Yonkers, N. Y., is offering eleven different transistor Loopsticks to experimenters and to home builders. Both conventional solenoid coils and the new "flat" design coils are available.

Cadillac's new Eldorado Brougham comes equipped with a transistor receiver as standard equipment. Other autos offering transistor receivers either as standard equipment or as optional accessories include Chrysler's Imperial, Chevrolet's Corvette and some Ford models. Motorola manufactures a number of "hybrid" transistorized receivers for standard automobiles.

But auto transistor applications are not limited to radio receivers. American Motors' Rambler Rebel models can be had equipped with an electronically controlled



Transistor Loopstick antennas in the flat plate design offered by Superex Electronics Corporation.



This transistorized code practice oscillator introduced by Jackson Electrical Instrument Company was discussed in the March Transistor Topics.

fuel injection system. Designed and manufactured by Bendix, the fuel injector uses power transistors in the control circuit.

John Ould, USA Ltd., Mount Vernon, N. Y., has introduced a fully transistorized portable public address system. The amplifier is rated at 10 watts and operates on self-contained batteries.

That's all for now . . . see you next month.

Lou

The Transmitting Tower

(*Continued from page* 80)

much for the average person to allot to the task. Probably the unit can be assembled over a weekend, but I must admit that I often hear about how fast someone has put together an electronic kit while I have that very kit before me correcting "Speedy's" mistakes. Actually, taking a bit more time to do the job right is usually a lot faster than having to go back and do it over again. It's a lot more fun, too.

Testing the DX-20. As many Novices do not have a very clear picture of what happens when they tune a transmitter, I shall describe the method of testing the DX-20, because a similar tuning process is used with most two-stage Novice transmitters.

Plug an 80-meter xtal into its sockets and connect a 40-watt, 117-volt light bulb to the transmitter output connector. Set the three tuning knobs to "0," and the bandswitch to "80," the meter switch to "grid," the *on-off* switch to "off," the *transmit-standby* switch to "standby," and the *tune-operate* switch to "tune." Then plug in the key and power plug.

Allow the tubes to warm up, turn the *transmit-standby* switch to "transmit," and

press the key. Tune the *oscillator* knob for maximum meter deflection, which will probably "pin the meter." Then, detune the *oscillator* for an indication of approximately 2.5 ma. on the meter.

Release the key and return the *transmit-standby* switch to the "standby" position. Shift the meter switch to "plate" and the *tune-operate* switch to "operate." Again, put the *transmit-standby* switch to "transmit," and press the key. The meter should immediately "hit the pin." Quickly tune the *amplifier* dial for minimum plate current, which will be in the neighborhood of 20 ma. The output light bulb will probably glow dimly at this time.

Turn the *loading* control to about "10." This will cause the amplifier plate current to increase sharply. Retune the *amplifier* dial for minimum plate current. Its minimum value will be higher than before, but the light bulb will also be glowing more brightly, proving that increased input energy is being converted into useful power output.

Repeat the *loading* and *amplifier* adjustments until the 6DQ6A plate current reaches its rated value of 100 ma. when the *amplifier* dial is "dipped" for minimum plate current. Then, carefully readjust the *oscillator* control slightly for maximum brightness of the 40-watt bulb, which will be very nearly its normal brightness. If this last adjustment changes the amplifier plate current from 100 ma., readjust the *amplifier* and *loading* controls, as described above, for 100 ma. of current. Upon switching the meter switch back to read grid current, you will discover it to be around 2 ma. This is the optimum value of "loaded" grid current.

Repeat these operations on each band in turn. On 10 meters, where the 6DQ6A operates as a frequency doubler, output will be noticeably less than on the other bands, and maximum transmitter output will occur with the *oscillator* control adjusted for maximum amplifier grid current. Both conditions are normal.

To test the DX-20 on the air, I tuned it up to a multimatch antenna* on each band, following the same procedure as with the dummy antenna, although final settings for the *amplifier* and *loading* controls were different. I made about ten contacts on the different bands in an afternoon of operation, getting very good reports.

Conclusions. The design of the DX-20 leaves little to be desired, either mechanically or electrically. Compared to the Heathkit AT1, it has about 50% greater power input rating. And because its output tube works as a straight amplifier instead of a frequency multiplier on 40, 20 and 15 meters, its output is over three times as great on these bands. On 10 meters, its output is about double that of the AT1.

Worth special mention is the *tune-operate* switch on the DX-20. In the "tune" position, only the oscillator functions, permitting the operator to tune it or to spot his exact frequency on his own receiver without overloading ("blocking") the receiver and without putting a signal on the air to interfere with other amateurs.

If assembled and operated according to instructions, it is hard to see how anyone could go wrong with a DX-20 at its price of $35.95, plus postage. It is available by mail from the Heath Company, Benton Harbor, Mich.

*See *Transmitting Tower*, January, 1957.

News and Views

Al, KN2TNV, is 19, was born in Italy, lived eight years in Ecuador before coming to the USA nine years ago, and has lived in or visited about 25 different countries. He became interested in amateur radio through the *Transmitting Tower*. In four months on the air, he has made 375 contacts in 47 states and 15 countries in four continents. His equipment includes a DX-35 transmitter, an NC-98 receiver, and a 40-meter doublet antenna, with most of his work being on 40 and 15 meters. . . . Of special interest to Technicians is the report of **Bob, K6PHE.** Between March and January, he worked Argentina (LU) and all the U.S. call areas, with the exception of WØ on the 6-meter band. He reports that many of the west-coast boys have been working Japan and Hawaii as well as the east coast regularly. Bob predicts that 6 meters will be wide open in April and invites more stations to join the fun. He uses a Gonset Communicator with a 100-watt amplifier and a 4-element beam.

Lance, KN8CDE, is one of those who has been prevented from putting up an outside antenna. So he tacked up a 15-meter folded dipole to the ceiling of his bedroom. As the room is not 22' long, he had to bend the ends of the antenna to fit it in. In four months on the air, he has worked 26 states, Alaska and Puerto Rico with it on 15 and 40 meters, using a DX-35 transmitter and an RME-45 receiver. . . . **Chuck, WN3HSW,** uses an AT1 transmitter and an S-38D receiver, on which he uses a Q-Multiplier powered by the power supply described in POPULAR ELECTRONICS last May. His states-worked total is 20, best DX being California, all on 40 meters. He would like to work Grand Junction, Colorado. Chuck also reports that the Etna Radio Club (W3EXW), 3 Vine Street, Etna, Pa., a suburb of Pittsburgh, helps prospective amateurs obtain their Novice licenses and then their General Class ones.

Joe, KØIAN, (father) and **Jim, KNØHJW,** (son) are putting Nebraska on the air. They use a Globe Scout transmitter and an NC-98 receiver. In three months on the air, Jim has worked 32 states, Alaska, and Hawaii. Joe has been doing a lot of listening on 6 meters, hearing amateurs from all over the country

on the band—no transmitter, yet. . . . **Buddy, KN4LNC,** has worked 16 states in six weeks on the air with his AT1 transmitter and S-40B on the 80- 40-, and 15-meter Novice bands. His only complaint is that his 15-meter crystal puts him up with the foreign phone stations, making it hard to work DX.

Ray, KN9DWI, uses an AT1 transmitter into an antenna he "dreamed up" on 40 meters. It must have been some dream, because in five months he has worked 43 states, Hawaii, Alaska, Panama Canal Zone, Puerto Rico, and three Canadian provinces. He feels that he could have worked the other five states but he prefers to chase DX. . . . **Irv, KN2VGU,** has been on the air for three months, but he has made only nine contacts in three states, all on 80 meters. Apparently the trouble is in the antenna—a 125′, off-center-fed Hertz—although a local noise generator of some sort doesn't help matters. For the information of the Brooklyn gang who might be able to help, Irv's sister Bunny is about ready to take her amateur examination, and his father is **Joe, KN2VGV.**

Dick, KN2UTC, uses a Johnson Adventurer transmitter to feed a "Windom" antenna, 132′ long, through a "match box," and does his receiving on an NC-300. He started on 80 meters, moved up to 40, and then to 15 meters, where he now spends most of his time. In a couple of months on the air, he has worked 38 states and 13 foreign countries, including the Azores, Algeria, Sweden, Belgium, Poland, England many times, and Brazil. He has also called several Australians without success—so far. . . . **Jerry, KNØHYA,** has really been getting some use out of his Novice license. In two weeks on the air he has worked 23 states in all call areas except the second. All work has been on 40 meters with a DX-35 and an S-85 receiver. His goal is WAS as a Novice, even if it means losing a little sleep.

Usually space limitations prevent listing requests for pen pals in the *Transmitting Tower,* but, because so many of our readers are interested in foreign pen pals, I attempt to squeeze in a foreign request from time to time. This one is from Karlheinz Kranz (18) 1 Berlin-Tempelholf, Siegertweg 13, Germany. He is an SWL and hopes to get his amateur license soon. He promises to answer all letters received.

Offer of Help. **Bob, KN2TWK** (14), has had so much fun on the air since getting his Novice license last July that he is now offering to help some "poor SWL" get started in ham radio. When you contact him, he will undoubtedly tell you about the 15-meter beam and tower he is building from W6SAI's article in POPULAR ELECTRONICS, November, 1956. Bob's address is: Robert E. Lee, 40 E. Palisade Blvd., Palisades Park, N.J.

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Keep your letters and pictures coming. Until next month, 73,

Herb, W9EGQ

Tuning the Short-Wave Bands

(*Continued from page* 84)

The following is a resume of the latest reports received. All times shown are Eastern Standard Time, using the 24-hour clock system.

Albania—*Radio Tirana* broadcasts in Albanian at 1930-2000 daily on 9700 kc. It follows *Radio Moscow* on that channel and is in turn followed by *Radio Sofia. (JS)*

Angola—CR6RI, Dondo, 9340 kc., is excellent at 1400-1430 with a program of classical music; fades in around 1330; identifies in Portuguese at 1430 with chimes and anthem to denote close/down. *(166)*

Australia—The new Melbourne Overseas Service schedule including the new 50-kw. VLD is as follows: on 7220 kc. at 0430-1230 to South Asia; on 9580 kc. at 0714-1230 (VLD) to South Asia; on 11,740 kc. at 2330-0415 to Europe and the Pacific; on 11,760 kc. at 0230-0445 to the Mid-Pacific; on 11,770 kc. at 0714-0845 to Eastern N.A., 0900-1000 to South Asia, and 1014-1115 to Western N.A.; on 15,160 kc. at 1500-1700 to the South Pacific, 1715-1930 and 0100-1230 to South Asia; on 15,200 kc. at 0500-0845 to the Northeast Asia sector; on 17,790 kc. at 1600-1930 and 0100-0700 to Northeast Asia; on 17,840 kc. at 1500-1700 (VLD) to the Mid-Pacific, 1714-0700 (VLD) to South Asia; on 21,540 kc. at 1714-0045 to South Asia; and on 21,590 kc. at 2330-0045 to Africa. Use of 15,320 kc. and 21,600 kc. has evidently been dropped. *(100)*

Belgian Congo—OTM, Leopoldville, 4758 kc., is heard on this new channel from 1548 with a program in Flemish. This station is parallel with the 9380-kc. outlet, closes at 1600. *(166)*

Belgium—*Radio Brussels* resumed an experimental English program heard Saturdays at 1815-1900 over ORU3, 9705 kc., ORU4, 11,850 kc., ORU5, 9745 kc., and relayed by OTC, Leopoldville, Belgian Congo, on 9655 kc. *(WW, 39, 87, 171, 173, 177)*

Ceylon—The Commercial Service of *Radio Ceylon,* Colombo, is heard on 9520 kc. daily with strong signals in English at 0600-0730. The programs are mostly musical, with some commercials. *(133)*

China—*Radio Peking* has been noted on a new frequency of 7297 kc. at 1720 with an oriental language program. This runs dual to 11,835 kc. Another new outlet is 9705 kc., tuned at 1100 with a march, English ID, and news. This one was lost by 1120. *(166)*

Colombia—Two stations often heard but not often reported are HJLB, *La Voz del Tolima,* Ibaque, 6040 kc., and HJGF, *Radio Bucaramanga,* Bucaramanga, 4845 kc. Both

stations are noted late evenings with L.A. music and Spanish announcements. (*52*)

Cook Islands—One of the more elusive stations in the Pacific is ZL1ZA, *Radio Rarotonga,* Rarotonga, 5050 kc. It has been noted on Thursdays only at 0500-0600. This station is anxious to receive reports and issues a nice card. (*GA*)

Cuba—Havana has a new xmtr on 5085 kc. Heard well at 1900-2300, it relays CMC, *Reloj de Cuba,* and CMW. No s.w. call has been announced; it may be COCW, listed for 5045 kc. but not active on that frequency. (*7,100*)

Czechoslovakia — *Radio Prague* is being widely reported on 9585, 6055, 6105, and 6170 kc. at 1930-2000, 2200-2300, and 0000-0030 to N.A. in English. They have "Answers to Listeners" at 0000 on Mondays and at 2200 on Sundays. (*WF, CB, 73, 85, and many others*)

Dominican Republic—*La Voz Dominicana,* HI7T, Ciudad Trujillo, is heard on 3285 kc. around 2200 with music. This 1000-watt station is relatively easy to find. They will verify reports in English with a very nice QSL Card. Also widely heard on HI2T, 9735 kc. (*JS*)

Egypt—Cairo has several new frequencies in use. They include: 9490 kc., heard with French news at 1300; 9773 kc., tuned at 1530 with ID in English, followed by news; and 7090 kc., excellent at 1635 with Arabic chanting, parallel with 9490 kc. (*166*)

The *Voice of Free Egypt,* an Arabic-language Clandestine station, is heard well on 17,787 kc. at 0900-1045, dual to 15,136 kc. (formerly 15,129 kc.), and at 1230-1245 with 15,160 kc. This is not Djaddah, Saudi Arabia, as previously reported. (*100*)

Ethiopia—*Radio Addis Ababa,* 15,010 kc., has been noted around 1315 with an English news session to Europe. This station is 7500 watts. (*BB*)

Finland—*Radio Finland,* OIX4, 15,190 kc., is fair to good at 0700-0745 and fair at 0745-0900. English news is noted at 0700-0715. (*104*)

French West Africa—Dakar, 3336 kc., was noted at good level from 1630 with variety music; ID is *Ici Dakar* at 1715, then French news. The s/off was at 1730, no anthem. (*166*)

Guatemala—*Radio Central Musical,* TGXB, 6200 kc. (listed 6050 kc.), Guatemala City, is heard at 1800-1930 and 0000-0058 s/off with all Spanish language and American popular and L.A. music. Music is excellent; frequent ID as *Radio Central Musical en Guatemala.* (*61*)

Haiti—The *Evangelistic Voice of the West Indies* is good at 0800-0930 (except Thursdays) on 15,415 kc. (4VE) and 9656 kc. (4VEH). On Saturdays this xmsn is extended to 1030. They have a "Listener's Post" (Mailbag program) on Saturdays at 0930-1015 and 1630-1715, also on Mondays at 2130-2215. These stations do not transmit evenings on Wednesdays and Thursdays. 4VEH is currently looking for monitors to send reports to them at least once a month. If you want to be a regular monitor, write to 4VEH, Box 1, Cap Haitien, Haiti. You will receive special reporting forms. (*104, 116*)

Honduras — HRN, *La Voz de Honduras,* Tegucigalpa, has moved to 5960 kc. where there is severe QRM from HJCF. Best reception is at 0700. HROW has moved from 5880 kc.; new frequency not yet located. (*100*)

India—*All India Radio,* Delhi, is being heard on 11,711 kc. at 1020 with Indian music; ID in English at 1030; English news after 1030. English news was also noted on 9765 kc. at 0730. The 9630-kc. outlet was noted in language at 0720-0745. (*28, 59, 166*)

Israel—The *Voice of Israel* is not to be confused with the *Voice of Zion* which just broadcasts its programs over the *Voice of Israel's* transmitters. The *Voice of Zion* is the most widely reported, but here is the schedule for the *Voice of Israel:* in Hebrew at 0000-0010 on 6740 kc., at 0400-0405 and 1630-1645 on 9008

Publications Available

The National Bureau of Standards publishes reports of the CRPL-D series, *Basic Radio Propagation Predictions,* which are issued monthly, three months in advance of prediction, and the NBS publication (Circular #465), *Instructions for Use of Basic Radio Propagation Predictions.* Both may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. The price is $1.00 per year (12 issues) or 30 cents per copy in the USA. Foreign prices are $1.25 and 40 cents, respectively. (*32*)

Radio Sweden now sends weekly program schedules to anyone desiring them. Write to *Radio Sweden,* International Service, Stockholm 7, Sweden. (*11*)

The British Broadcasting Corporation is now sending free quarterly folders to North American listeners who participate in their Audience Research. For details, write to BBC, North American Audience Research (Overseas), London. (*11*)

For an annual folder entitled "Lisbon Calling," write to *Emissora Nacional,* Servico de Intercombio, Rua Do Quelhas 2, Lisboa, Portugal. (*11*)

A log book specially designed for SWL's is available from the National Company, Malden, Mass., for 50 cents. You will find this log a good method of keeping a permanent record of your DX.

and 6740 kc., at 1300-1315, 1400-1415, and 1515-1530 on 9008 kc.; in English at 0410-0415, 0645-0700, and 1500-1515 on 9008 and 6740 kc.; in French at 0415-0420, 0700-0715 on 9008 and 6740 kc., and at 1430-1500 on 6740 kc. (*37*)

Japan—The Far East Network, Tokyo, 17,825 kc., is heard in Eastern N.A. at 1700-1730 dual to 15,225 kc. and at 1930-2000 on 11,705 and 15,225 kc. The 11,705-kc. outlet is tuned at 0100-0125 with English news and weather to 0105. Dictation-speed program reviews follow. (*JH, 61*)

A new standard frequency and time service noted on 15,000 kc. at 2200-2300 is probably JJY, Tokyo, usually QRM'ed by WWV/WWVH. (*23, 31, 149*)

Lebanon—Beirut, FXE, is being widely heard on 8022 kc. (varying to 8040 kc.) with music at 1250, time pips at 1300, then ID and Arabic news. It also has been noted closing at 1800. The 1400 news is in French rather than English as listed. English news is heard at 1010 but is hard to read. Another xmsn was noted at 2345-0100 with chanting, Arabic and French news, and western music. (*DK, 25, 27, 28, 51, 61, 166*)

Luxembourg—*Radio Luxembourg*, Junglinster, is heard on 6090 kc. from 1600 to 1900 s/off with all programs in English and consisting of commercial broadcasts to England. At times there may be heard QRM from *Radio Commerce*, Haiti, on 6091 kc. Tune for Rock-and-Roll music at 1830. (*JS, FS*)

Netherlands—*Radio Nederland* operates in the first N.A. xmsn at 1615-1655 on 15,365 and 11,950 kc. and the second xmsn at 2130-2210 on 11,950 and 9590 kc. (*104*)

Nigeria—The National Program of the Nigerian B/C Service at Lagos is now heard daily on 4990 kc. instead of 4800 kc. It is noted from 1600 to 1656/close with ID at 1600 and musical programs until s/off. (*37, 166*)

SHORT-WAVE ABBREVIATIONS

A—Approximate frequency
anmt—Announcement
BBC—British Broadcasting Corporation
ID—Identity, Identification
kc.—Kilocycle(s)
L.A.—Latin America(n)
N.A.—North America(n)
s/off—Sign off
xmsn—Transmission from station
xmtr—Transmitter used by station

Pakistan—Karachi can be tuned on 7138 kc. at strong level from 0700 to 0710 with English news, and on 15,355 kc. at 2000-2005 with another newscast. (*59, 166*)

Poland—*Radio Warsaw*, 6025 kc., has a "Mailbag" program on Mondays at 1930 and Tuesdays at 0745. English news can be heard at 2130-2140. This station verifies with a card. (*GJ, 127*)

Portugal—*Radio Lisboa* is noted on 21,700 kc. at 1200-1245 with news, talks, and classical music, in an English xmsn. They give frequent ID's. It is also heard at 1415-1430 in a Portuguese language session. Another Portuguese xmsn was tuned at 1330-1500 on 17,895 kc. (*39, 61*)

Sierra Leone—The Sierra Leone B/C Service at Freetown was noted on 3316 kc. with BBC features at 0210. After a short music and

news period, they went into language at 0224. They also ID as *This is Freetown Calling.* (27)

Surinam—PZC, Paramaribo, 15,406 kc., was noted around 1900-1935 with American pop tunes and Dutch language anmts. (128)

Sweden—*Radio Sweden* is heard well on 9620 kc. at 2000-2045 with an English program of music, news, weather, and press comments. The West Coast xmsn is noted at good level from 0000 to 0030. Swedish follows this xmsn until 0100 s/off. (*AF, GW, 61*)

Switzerland—The English xmsn to N.A. is heard at 2030-2215 on: 6165 kc., HER3; 9535 kc., HER4; and 11,865 kc., HER5. The DX program is broadcast on the first Thursday of each month at 2050. The last hour on Mondays, Wednesdays, and Fridays is in language for the Swiss abroad. (156)

Syria—Damascus is now using 15,165 kc. at 1430-1630 to Europe, replacing 17,865 kc. (100)

USSR—*Radio Moscow* is being widely reported in its "Pacific Service" at 2000 on 15,140 kc. and at 0000 on 17,870 kc. English news can be tuned at both times. (61, 98)

Yugoslavia—*Radio Belgrade,* 6100 kc., is heard with English news to Europe at 1330-1345 (dual to 7200 kc.) and at 1715-1730. On the Thursday evening program, they feature "Writers and Poets." (JS, 116) —30—

SHORT-WAVE CONTRIBUTORS

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CODE Courses, Novice to 8 WPM, $5.95. Advanced, 9 to 18 WPM, $4.95. Both, $9.95. Each—7" magnetic recording tape, dual track, 3¾ IPS. Rush Order today. Tapedcode, Box 31-B, Langhorne, Pa.

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DISGUSTED of "Hi" Hi-Fi Prices? Unusual discounts on all high fidelity requirements. Write now. Key Electronics Co., 120 Liberty, New York 6, N. Y.

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RECORDERS, Tape. Hi-Fi. Wholesale Prices. Catalogue. Kerstin, 215 E. 88 St., N. Y. C. 28.

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REPAIRS & SERVICING

PROFESSIONAL Wiring and Testing of Kits including all Ham Gear. McSwan, Box 1101, Culver City, Calif.

MISCELLANEOUS

SONGPOEMS and Lyrics Wanted! Mail to: Tin Pan Alley, Inc., 1650 Broadway, New York 19, N. Y.

1000 BUSINESS Cards $3.55 Postpaid. Free Samples. Astral, Box 141, Hempstead, N. Y.

ADVERTISER'S INDEX

Superior's new Model 670-A

SUPER-METER

A combination VOLT-OHM MILLIAMMETER *PLUS* Capacity Reactance, Inductance and Decibel Measurements.

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
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. (GOOD-BAD scale for checking quality of electrolytics)
REACTANCE: 50 to 2,500 Ohms 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
DECIBELS: −6 to +18 +14 to +38 +34 to +58

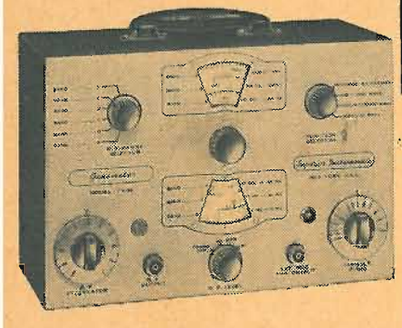
ADDED FEATURE: Built-in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

The Model 670-A comes housed in a rugged crackle-finished steel cabinet complete with test leads and operating instructions.

$28.40

The new Model TV-50

GENOMETER



A versatile all-inclusive GENERATOR which provides ALL the outputs for servicing:

A.M. Radio • F.M. Radio • Amplifiers Black and White TV • Color TV

7 Signal Generators in One!

- ✓ R. F. Signal Generator for A.M.
- ✓ R. F. Signal Generator for F.M.
- ✓ Audio Frequency Generator
- ✓ Bar Generator
- ✓ Cross Hatch Generator
- ✓ Color Dot Pattern Generator
- ✓ Marker Generator

R. F. SIGNAL GENERATOR: The Model TV-50 Genometer provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: In addition to a fixed 400 cycle sinewave audio, the Model TV-50 Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

CROSS HATCH GENERATOR: The Model TV-50 Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting, horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

DOT PATTERN GENERATOR (FOR COLOR TV): Although you will be able to use most of your regular standard equipment for servicing Color TV, the one addition which is a "must" is a Dot Pattern Generator. The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence.

MARKER GENERATOR: The Model TV-50 includes all the most frequently needed marker points. 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: The Model TV-50 projects an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars.

THE MODEL TV-50 comes absolutely complete with shielded leads and operating instructions.

$47.50

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SEE FOLLOWING PAGE FOR COMPLETE DETAILS

PRINTED IN U.S.A.

Superior's New Model TV-12

TRANS-CONDUCTANCE TUBE TESTER

ALSO TESTS TRANSISTORS!

TESTING TUBES

• **EMPLOYS IMPROVED TRANS-CONDUCTANCE CIRCUIT.** An in-phase signal is impressed on the input section of a tube and the resultant plate current change is measured. This provides the most suitable method of simulating the manner in which tubes actually operate in Radio & TV receivers, amplifiers and other circuits. Amplification factor, plate resistance and cathode emission are all correlated in one meter reading. • **NEW LINE VOLTAGE ADJUSTING SYSTEM.** A tapped transformer makes it possible to compensate for line voltage variations to a tolerance of better than 2%. • **SAFETY BUTTON** — protects both the tube under test and the instrument meter against damage due to overload or other form of improper switching. • **NEWLY DESIGNED FIVE POSITION LEVER SWITCH ASSEMBLY.** Permits application of separate voltages as required for both plate and grid of tube under test, resulting in improved Trans-Conductance circuit.

TESTING TRANSISTORS

A transistor can be safely and adequately tested only under dynamic conditions. The Model TV-12 will test all transistors in that approved manner, and quality is read directly on a special "transistor only" meter scale. The Model TV-12 will accommodate all transistors including NPN's, PNP's, Photo and Tetrodes, whether made of Germanium or Silicon, either point contact or junction contact types.

Model TV-12 housed in handsome rugged portable cabinet sells for only **$72.50**

Superior's new Model TW-11 STANDARD PROFESSIONAL

TUBE TESTER

- Tests all tubes, including 5, 6, 7, Octal, Lock-in, Hearing Aid, Thyratron, Miniatures, Sub-miniatures, Novals, Sub-minars, Proximity fuse types, etc.
- Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TW-11 as any of the pins may be placed in the neutral position when necessary.
- The Model TW-11 does not use any 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. All tube listings printed in large easy-to-read type.
- **NOISE TEST:** Phono-jack on front panel for plugging in either phones or external amplifier will detect 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.

The Model TW-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

$47.50

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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.

NO INTEREST OR FINANCE CHARGES ADDED!

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

SEE OTHER SIDE

CUT OUT AND MAIL TODAY!

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-331 3849 Tenth Avenue, New York 34, N. Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance or interest charges added. It is further understood that should I fail to make payments when due, the full unpaid balance shall become immediately due and payable.

☐ Model TW-11 . . . Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.

☐ Model 670-A . . . Total Price $28.40 $7.40 within 10 days. Balance $3.50 monthly for 6 months.

☐ Model TV-12 . . . Total Price $72.50 $22.50 within 10 days. Balance $10.00 monthly for 5 months.

☐ Model TV-50 . . . Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.

☐ Model 76 . . . Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.

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For the first time ever: ONE TEST PROVIDES ALL THE SERVICES LISTED BELOW!

Superior's New Model **76**

IT'S A
CONDENSER BRIDGE
with a range of .00001 Microfarad to 1000 Microfarads (Measures power factor and leakage too.)

IT'S A
RESISTANCE BRIDGE
with a range of 100 ohms to 5 megohms.

IT'S A
SIGNAL TRACER
which will enable you to trace the signal from antenna to speaker of all receivers and to finally pinpoint the exact cause of trouble whether it be a part or circuit defect.

IT'S A
TV ANTENNA TESTER
The TV Antenna Tester section is used first to determine if a "break" exists in the TV antenna and if a break does exist the specific point (in feet from set) where it is.

Specifications

✓CAPACITY BRIDGE SECTION
4 Ranges: .00001 Microrarad to .005 Microfarad; .001 Microfarad to .5 Microfarad; .1 Microfarad to 50 Microfarads; 20 Microfarads to 1000 Microfarads. This section will also locate shorts, and leakages up to 20 megohms. And finally, this section will measure the **power factor** of all condensers from .1 to 1000 Microfarads. (Power factor is the ability of a condenser to retain a charge and thereby filter efficiently.)

✓RESISTANCE BRIDGE SECTION
2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms. Resistance can be measured without disconnecting capacitor connected across it. (Except, of course, when the R C combination is part of an R C bank.)

As Design Engineers, we the undersigned would like to say that the Model 76 is in our opinion the best combination unit of its kind we have been privileged to design. Although it is comparatively a low-priced tester, it will, after you become acquainted with its multiple services, be your most frequently used instrument.
S. LITT
L. MELENKEVITZ

✓SIGNAL TRACER SECTION
A built-in high gain pentode voltage amplifier, plus a diode rectifier, plus a direct coupled triode amplifier are combined to provide this highly sensitive signal tracing service. With the use of the R.F. and A.F. Probes included with the Model 76, you can make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc. Provision has been made for use of phones and meter if desired.

✓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? The Model 76 will enable you to locate a break in any TV antenna and if a break does exist, the Model 76 will measure the location of the break in feet from the set terminals. 2 Ranges: 2' to 200' for 72 ohm coax and 2' to 250' for 300 ohm ribbon.

Model 76 comes complete with all accessories including R.F. and A.F. Probes; Test Leads and operating instructions. Nothing else to buy .....Only **$26.95**

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NO INTEREST OR FINANCE CHARGES ADDED!

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

SEE OTHER SIDE

CUT OUT AND MAIL TODAY!