Special Hi-Fi Features

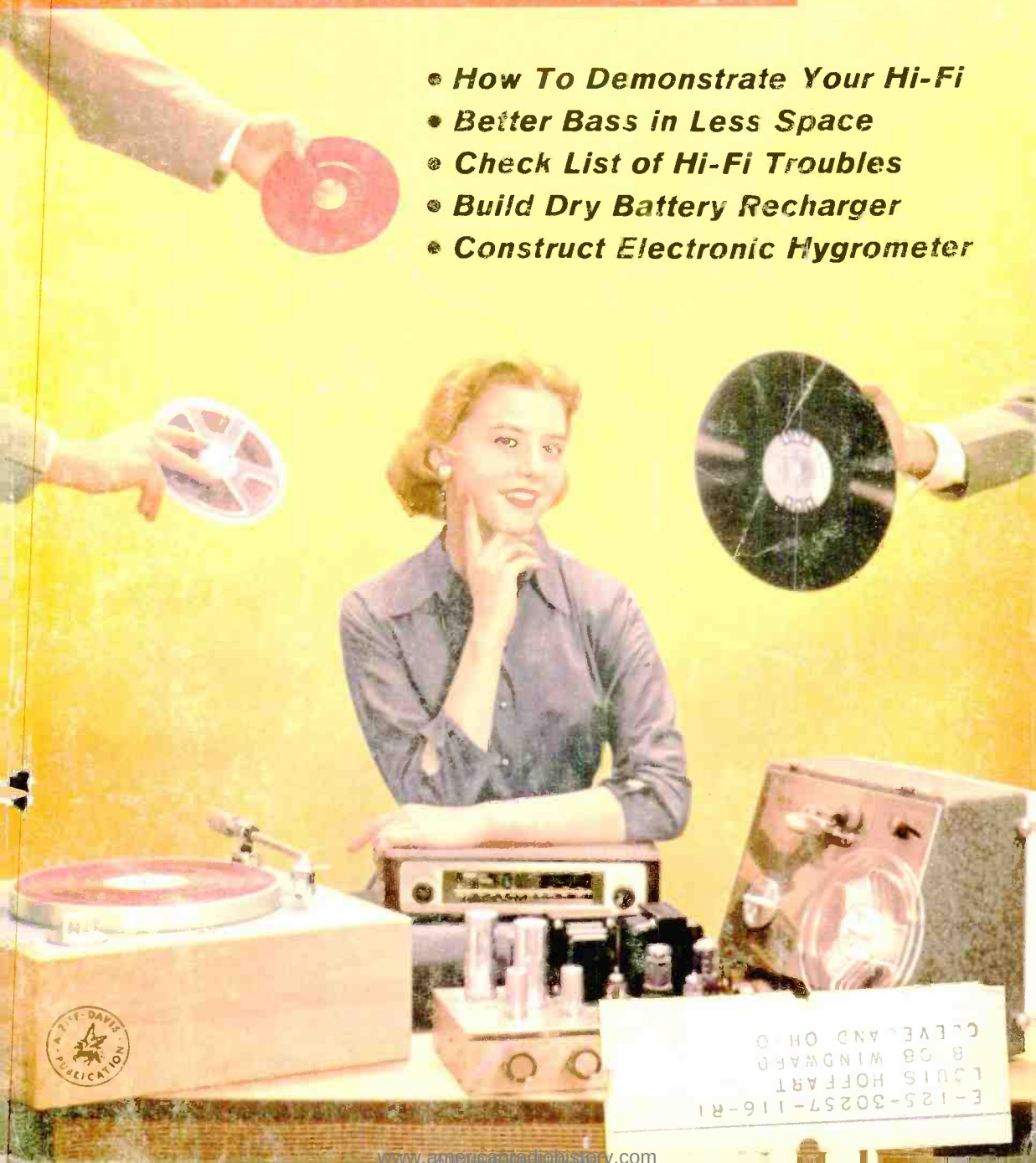
POPULAR ELECTRONICS

OCTOBER 1956

25 CENTS

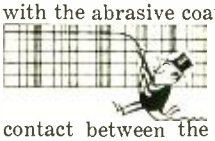
in U. S. and Canada

- How To Demonstrate Your Hi-Fi
- Better Bass in Less Space
- Check List of Hi-Fi Troubles
- Build Dry Battery Recharger
- Construct Electronic Hygrometer

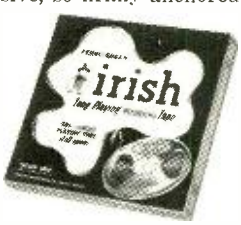


The 7 Old-Fashioned Villains of Tape Recording

...and How irish BRAND FERRO-SHEEN Foiled Them All

Once upon a time, 7 Old-Fashioned Villains like this  were wreaking endless woe on Decent People with Tape Recorders. The 1st Villain was Oxenscheid the Oxide Shedder.  He scraped away at the crumbly oxide coating of old-fashioned tape and gummed up tape recorders with the shedding particles. The 2nd Villain was Wearhead the Head Wearer.  He filed down the magnetic heads with the abrasive coating of old-fashioned tape. The 3rd Villain was Frickenshaw the Frequency Discriminator.  He dragged down the high-frequency response of old-fashioned tape through inadequate contact between the "grainy" coating and the head. The 4th Villain was Noysenhiss the Noise Generator. He generated tape hiss and modulation noise  as a result of the random vibrations and irregular flux variations caused by the uneven magnetic coating of old-fashioned tape. The 5th and 6th Villains were Dropofsky the Drop-Out Artist and Pringlethorpe the Print-Through Bug.  They put nodules and agglomerates into the oxide emulsion of old-fashioned coated tape, causing "drop-outs" whenever these trouble spots lost contact with the record or playback head, and inducing "print-through" on the recorded tape when the extra flux at the trouble spots cut through adjacent layers on the reel. The 7th Villain was Brattleby the Embrittler. 

He dried out the plasticizers in old-fashioned coated tape and embrittled irreplaceable recordings. Then: OCTOBER, 1954! That's when a very un-old-fashioned little man by the name of F. R. O'Sheen  announced that he had developed the revolutionary new **irish FERRO-SHEEN** process of tape manufacture and presto!  the 7 Old-Fashioned Villains were sent a-scurrying with cries of "Confound it – Foiled again!" Yes, F. R. O'Sheen had made the new magnetic oxide lamination of **irish FERRO-SHEEN** tape so smooth-surfaced and non-abrasive, so firmly anchored and homogeneously bonded to the base, so free from nodules and agglomerates, that the 7 Villains were evicted – for good! **Moral:** Don't let Old-Fashioned Villains do you out of your hi-fi rights!  Just say "No, thanks" to ordinary coated tape and ask for F. R. O'Sheen **irish FERRO-SHEEN**, that is! ORRadio Industries, Inc., Opelika, Alabama.



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COMING NEXT MONTH (NOVEMBER)

POPULAR ELECTRONICS

(ON SALE OCTOBER 23)

Subjects featured in November will include: why peculiar radio waves are radiated by lightning; cathode-ray tubes that permit simultaneous display of events occurring at different times; electronic devices used in fishing research and management.

There will be "How-to-Build-It" material on: an instant-heating intercom for home use; a tricky gadget far spotting trouble in receivers or amplifiers; multiple R/C control with a single-channel receiver.

In the hi-fi field, we will discuss the theory and operation of important tone control circuits, and the value of mixers in preparing your own tape recordings. Also look for the the next edition of "Sound Impressions"—our newest monthly department.

IN THIS MONTH'S

RADIO & TELEVISION NEWS

(OCTOBER)

Why Do Loudspeakers Sound Different?
Room Acoustics for Hi-Fi Listening
Transistorized "Transmitter"
The "Corona Loudspeaker"
Realistic High Fidelity — Loudspeaker Baffles and Enclosures
A Special Purpose Transistor Preamp

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Harold Gimlen, Flint, Mich. 6/21/56

AIRCRAFT INSPECTOR

With RTTA training and through repairing radios and televisions for the right people at the right price, I was able to make the right contacts. I am now an Inspector for Douglas Aircraft at about $125 a week.

Hugh Maddox, Los Angeles, Calif. 6/30/56

ELECTRICAL TESTER

RTTA training has helped me understand TV and many variations of simple circuits. The course covers all subjects very clearly. I am now an Electrical Tester for Western Electric Co. at $83.42 a week.

Raymond Lapan, Burlington, N. C. 1/24/56

HAS OWN BUSINESS

I have a shop at home and have been working on radio and TV after working hours of my regular job. I average $50 a week for this part time work. RTTA training helped me in making extra money and giving me experience in the electronic field.

Richard Hennis, Little Rock, Ark. 6/30/56

SERVICE MANAGER

I manage two radio and television shops, one here and one in Pompano Beach. RTTA training increased my knowledge of TV circuits and showed me new, quicker methods of repairing. Lessons as presented are very concise and clear.

William Phillips, Fort Lauderdale, Fla. 6/21/56

REPAIRED EVERY SET

RTTA training helped me to understand TV more thoroughly. I have repaired every set that I was called on to repair.

Andrew Busi, Jr., Iselin, Pa. 6/21/56

L. C. Lane, B.S., M.A. President, Radio-Television Training Association. Executive Director, Pierce School of Radio & Television.

—ABOUT MY EQUIPMENT

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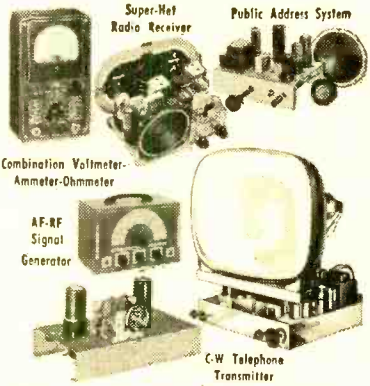

". . . a money making little gem."

I have completed kit #6 and was amazed at how it works. I showed it to a friend of mine and he asked me to set it up for one of the picnics his social club was having. That sure is a money making little gem.

John Fernandez, Fresno, Calif. 6/7/56

"We get excellent pictures . . ."

I would like to compliment you on an excellent and complete course. We get excellent pictures on my TV set from WSYR (Syracuse, N.Y.), approximately 110 air miles away. The set is working good and I have had to replace only three tubes since I assembled it two years ago.

Larry H. Stafford, Kingston, Ont., Canada 7/6/56

". . . very good reception . . ."

I have really enjoyed the course and have come a long way in TV servicing. I am getting very good reception on my TV station considering that the nearest VHF station is 120 miles.

J. W. Hanlon, Jr., Henderson, Texas 7/13/56

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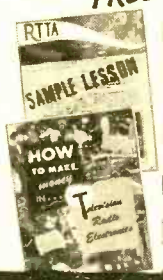

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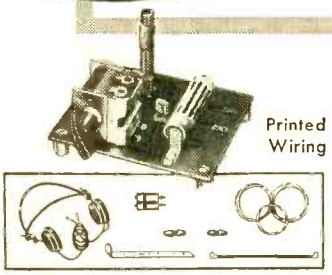

Fascinating knight-kit TRANSISTOR RADIO KIT

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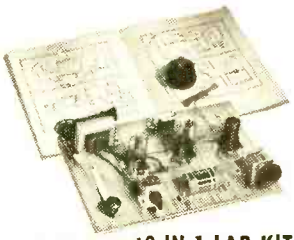
S-295. Net only **$14.75**



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Model S-265 only $12.65 Instructive, fascinating! Enables you to build any one of 10 circuits: Broadcast receiver for headphone reception; Phono Oscillator to play records through any radio; Phono Amplifier; Code Practice Oscillator; Signal Tracer; Electronic Timer; Relay, etc. Includes tubes, all parts, instructions (less photo-tube and socket, and headphone). Ready to build. For 110-120 v., 50-60 cy. AC. 10 lbs.

Model S-265. Net only **$12.65**

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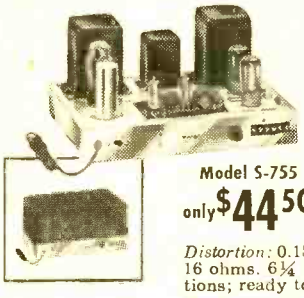

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Custom quality at very low cost. For use with any tuner or preamp with full set of controls. Deluxe features: Chrome-plated chassis; potted transformers and chokes; printed circuit wiring board; balance and damping controls. *Output:* 25 watts. *Response:* +0.5 db, 10 to 120,000 cps at 20 watts. *Distortion:* 0.15% at 25 watts. *Speaker Outputs:* 4, 8 and 16 ohms. 6¼ x 14 x 9". With all parts, tubes, instructions; ready to build. Shpg. wt., 27 lbs.

Model S-755. Net only..... **$44.50**
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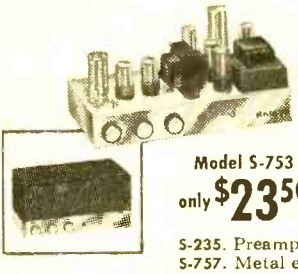

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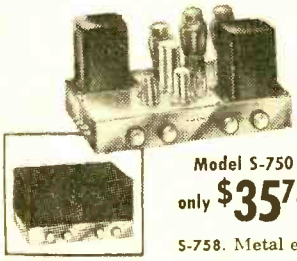
True Hi-Fi at lowest cost. Only 0.5 volt drives amplifier to full 10 watts output! *Response:* +1 db, 30 to 20,000 cps at 10 watts. *Distortion:* less than 0.5% at 10 watts. Chrome-plated chassis is punched for preamp kit listed below. Matches 8-ohm speakers. With tubes, all parts, easy instructions. 7 x 13 x 6" Shpg. wt., 14 lbs.

Model S-753. Net only..... **$23.50**
S-235. Preamp kit (for magnetic cartridges)..... **$3.10**
S-757. Metal enclosure for above; black finish.... **$3.95**



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Model S-750
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Delivers deluxe Hi-Fi sound. Includes built-in preamp; inputs for magnetic cartridges, etc.; record compensator; bass and treble controls, etc. *Response:* +1 db, 20-20,000 cps at 20 watts. *Speaker Outputs:* 4, 8, 16 and 500 ohms. Chrome-plated chassis, 7½ x 13 x 8¾". With all parts, tubes and easy instructions. 23 lbs.

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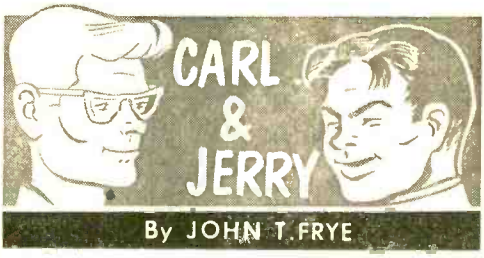

By JOHN T. FRYE

Abetting or Not?

CARL AND JERRY were preparing to go on one of their electronic safaris. Equipment to be taken along was spread out on the workbench of their basement laboratory, and Jerry was carefully dividing it into two piles.

First he placed a 75-meter transceiver in each pile. These were followed by identical small dish-type reflector antennas and small collapsing tripod mounts to support them. Then he placed a small power supply in the pile next to him and a larger and much heavier combination power supply and modulator in the pile Carl was to carry.

Finally, two small chassis, each carrying what seemed to be a weird-shaped bit of brass plumbing clamped around the top of a metal tube, were divided among the growing stacks of equipment. The two chassis were not exactly alike for, in addition to the unusual appearing tubes, one of them also had a conventional miniature glass tube mounted on it.

"THESE THINGS look like they'd suck eggs." was Carl's disparaging remark as he examined the unusual pieces of equipment. "I've seen some odd-ball transmitters and receivers in my day, but these things are ridiculous."

"At 2400 megacycles, you can't expect conventional-looking transmitters and receivers." Jerry pointed out. "A wavelength at that frequency is only 12.5 centimeters long—or approximately 4.92 inches. Compare that with about 260 feet for a wavelength on 80 meters."

"What are these things that look like tubes crossed with bathroom fixtures?"

"Those are special ultra-high-frequency 'light-house' tubes with a cavity resonator clamped on top of them. The one-tube job is the transmitter, while the other is the receiver—a superregenerative type with a separately quenched oscillator. The transmitter only puts out a maximum of a quarter of a watt, but these reflector-type antennas should give us enough gain to cover that quarter mile between Uncle Walt's and his neighbor up the highway."

"Why have we got to lug all this stuff

Carl & Jerry (*Continued from page* 10)

clear out there? Why can't we just test it around here?"

"Because that's the closest place I know of where we can get a clear shot across that distance with absolutely nothing in the way, and where we can have power for our rigs at both ends. Uncle Walt lives right on a curve in the highway, and you can look from his front porch straight up the pavement to Mr. Arthur's porch. I'll operate the transmitter at Uncle Walt's, and you can work the receiver at Mr. Arthur's."

"What do we need the transceivers for, anyway?"

"We'll probably have to do a lot of adjusting of antenna direction, frequency, etc., to get maximum signal strength. Since we'll only have one transmitter and one receiver on the ultra-high frequency, we can only talk one way after we establish contact. Being able to talk back and forth on seventy-five while making adjustments will help a lot."

"Okay; so let's get going," Carl said; and he quickly exchanged the heavy power supply in his pile for the light one in Jerry's while the latter's back was turned.

THE TWO BOYS loaded the equipment into the handlebar baskets they strapped on their bicycles *only* for occasions like this. (Ordinarily such accessories were considered "too sissy.") Carried along by their youthful enthusiasm, it required but a few minutes for them to pedal out to the farm of Jerry's Uncle Walter Bishop. Carl helped Jerry set up the transmitter and connect it to the power supply and modulator. The little dish-type antenna and reflector was perched on its tripod, and a short coaxial line ran down to the output fitting on the side of the cavity resonator.

Next, both boys rode on down the narrow path from the highway to Mr. Arthur's and set up the receiver on his porch. When Jerry was sure the receiver was working correctly, he took off the earphones and reached over and let them snap shut on Carl's head with a resounding "plop."

"Guess we're ready," he announced. "Use a single phone over one ear and leave the other free for use with the transceiver. The instant you hear my voice on the u.h.f. receiver, yell at me on the hand-held unit, for it will mean that I have the transmitting antenna pointed nearly at you. That beam will be very narrow, and we'll have to aim it right on the nose. Once we make contact, we can go ahead and align both transmitter and

When the other kids ask...

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Carl & Jerry (*Continued from page* 12)

receiver antennas perfectly, checking back and forth with the transceivers; and then you can carefully tune the receiver to the exact transmitter frequency."

"I *can*?" Carl questioned sarcastically. "With what? I see nothing that looks like a tuning knob on this plumber's nightmare."

"You tune the receiver by turning this little screw right here on top of the cavity resonator with this long fiber screwdriver," Jerry explained; "and move it only a fraction of a turn at a time."

Having delivered this bit of advice, he hopped back on his bicycle and was soon at his uncle's place. After switching on the high-frequency transmitter, he pulled out the telescoping antenna of the war-surplus transceiver, which automatically turned it on. Holding the case so that the earphone was at his ear and the microphone in front of his lips, he pushed the transmit-receive switch covered with a waterproof rubber pouch on the side of the case.

"How do you read, W9EGV? This is W9CFI," he said.

"Loud and clear, W9CFI, from W9EGV," was the prompt answer.

"Okay; I'm going to start shooting at you. If you hear me, yell plenty loud, for I'll have to set the handie-talkie down on the floor while I'm fiddling with the antenna."

"Roger. Let's see if you can spray me with some of that u.h.f."

JERRY BEGAN carefully aiming the reflector at the porch of the white house up the road. For several seconds nothing happened, and then he heard a faint cry from the earphone of the handie-talkie sitting beside him. "Hold it!" Carl said; you're knocking down the hiss in the receiver."

"Can you hear me?" Jerry asked into the microphone connected to the modulator of the u.h.f. transmitter.

"Sure can," came the answer; "Wups! You cut out for a minute, but it's okay again now."

As Carl said this, Jerry noticed a large black car with two men in it pull off the highway onto the path just next to his uncle's house. It was when this car had passed through the u.h.f. beam that Carl said the signal cut out momentarily. Jerry concluded the men had stopped to examine a map or something, and he and Carl went ahead with their experimenting.

It was not until two more cars pulled up opposite the first one that Jerry took more

(*Continued on page* 18)

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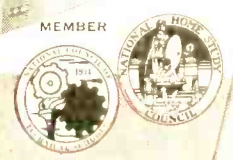

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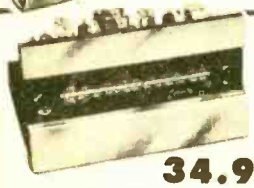

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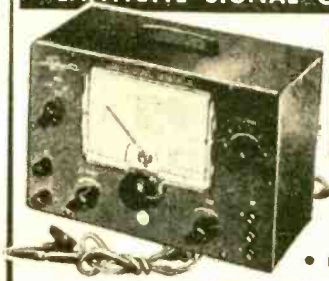

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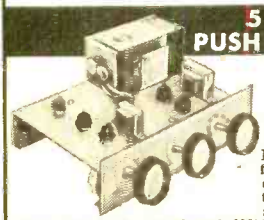

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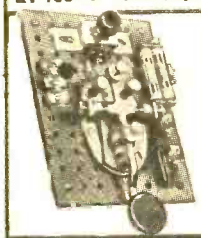

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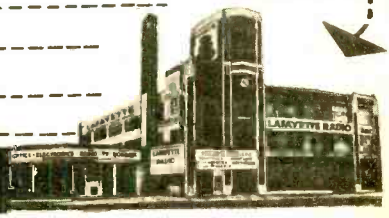

CUT OUT AND MAIL TODAY!

Carl & Jerry

(*Continued from page* 14)

careful notice. One of the cars that just stopped was an ancient Model A Ford truck loaded with late-in-the-season watermelons. The driver was a little weazened man with a sharply-pointed white goatee; and from the way he popped from the cab and began waving his arms about, he was obviously quite excited about something. The unmistakable appearance of the other car, a state police patrol, gave a possible clue to the cause of his agitation.

"Hey, Carl," Jerry said into the mike, "you'd better come on down here and see what gives. Looks like it may get interesting."

Collapsing the antenna of the handie-talkie to shut it off, Jerry hurriedly left without thinking to shut off the u.h.f. transmitter. He had barely reached the parked cars before Carl came pumping up on his bicycle.

"I tell you," the little man was shouting, "that you and your fancy radar gadget are all wrong. You can't possibly drive that bucket-of-bolts sixty-five."

"Take it easy, Pop," the big state trooper behind the wheel of the black car said good-humoredly. "This thing doesn't make mistakes. It said you were hitting sixty-five when you passed, and that's what you were doing. So we radioed ahead for Jim to stop you."

"Tell you what I'm gonna do," the man with the goatee offered. "If any one of the three of you can drive that Model A a mile over forty-five miles per hour, I'll

"You and your fancy radar gadget are all wrong," the man with the goatee was shouting. "You can't possibly drive that bucket-of-bolts sixty-five."

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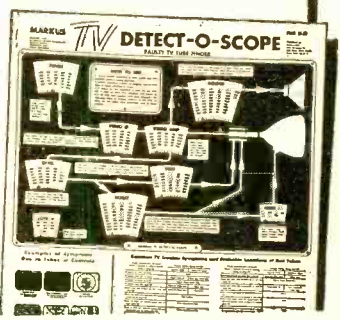

60% to 75% of all TV failures are caused by *faulty tubes*. This amazing new giant-sized "Detect-O-Scope" tells you, *at a glance*, exactly how to spot bad tubes in any TV set. Saves time, money — makes you an "expert" TV trouble-shooter! Gives identification numbers of tubes that may be causing trouble; shows you how to locate, check and replace them safely. 16 x 21 inches; copyrighted. Sells for $1.00 but yours absolutely *FREE* on this offer!

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Carl & Jerry (*Continued from page* 18)

give it to you and throw in the load of watermelons to boot!"

"Old Timer, you've got yourself a deal," the youthful trooper named Jim said, as he slid out of his patrol car. "I always did want to drive one of those old cars my old man still insists is 'the best car Henry ever built.' If you got sixty-five out of that iron, so can I. I'll go back up the road a piece and come on by with the thing wide open so you boys can get a reading on me."

He got into the truck, and went off up the highway with the motor spluttering.

"DO YOU KNOW how that radar thing works?" Carl whispered to Jerry.

"Sure. So would you if you had read the article about it in the May, 1956, issue of POPULAR ELECTRONICS. It depends on the Doppler effect."

"I remember that from physics. It's an apparent change in frequency of a signal emanating from a moving source as observed from a fixed position."

"Fine," said Jerry. "That's exactly right. The most common example is the apparent change in the pitch of a train whistle as it passes. When it's coming toward you, the pitch seems to increase; but as the train moves away, the pitch lowers. When the train is moving rapidly toward you, the sound waves are sort of bunched together and the pitch of the signal striking the ear is increased. When the whistle is moving away, the sound waves are stretched out, and the pitch seems lower. The radar gadget sends out a beam of u.h.f. signal that strikes the moving car and is reflected back to a receiver housed in the same unit with the transmitter.

"This reflected signal is mixed with the signal direct from the transmitter," Jerry continued, "and the difference between their frequencies is read by an audio frequency meter. The difference in frequency between the transmitted signal and the reflected signal depends directly on how fast the car reflecting the signal is moving. The faster it moves, the greater is the difference. At 100 miles per hour, the reflected signal will be shifted 731 cycles from the transmitter frequency of 2455 megacycles. Speeds below 100 miles per hour produce less shift. The audio frequency meter is calibrated in miles per hour for direct reading of speed."

"But where is the radar gadget?"

"Probably in the trunk of the black car. You can see the meter there on top of the dash. The signal is sent out and received back through a camouflaged hole in the

(*Continued on page* 24)

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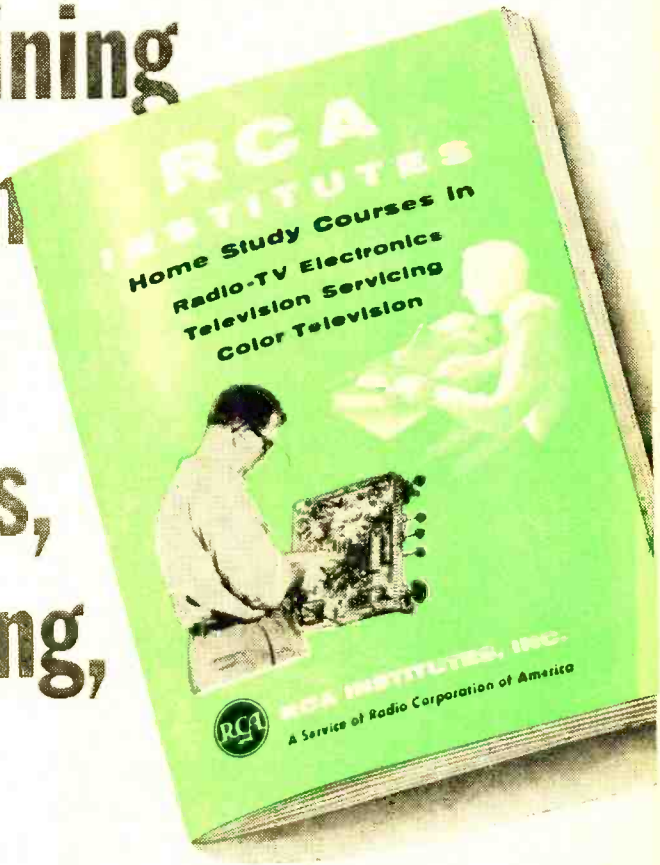

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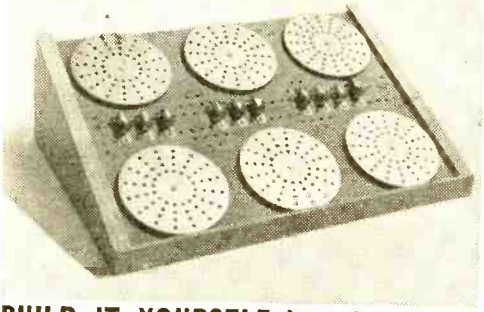

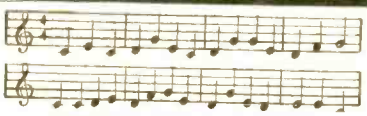

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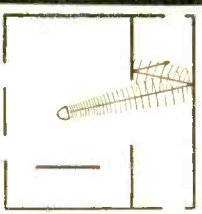

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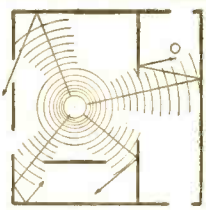

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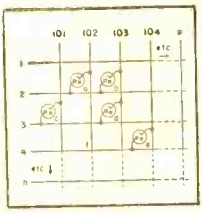

SECTION OF MATRIX Diagram of a Neon Tube Digital Storage Unit.

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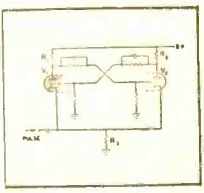
A modulo 2 counter. More commonly a flip-flop arrangement of 2 triodes. This is the main elementary component from which counters and accumulators are assembled.

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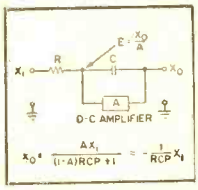

Block diagram for a simple integrating circuit.

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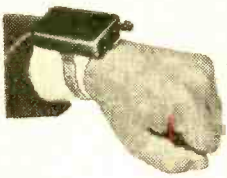

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Carl & Jerry (*Continued from page 20*)

metal lid of the trunk. All this car has to do is park along the highway and take speed readings. When a 'live prospect' shoots past, the radar car radios to a patrol car waiting about a mile down the highway, and he picks up the speeder. Well, here comes the truck; let's go over and see what kind of a reading it gives."

The boys moved over to the black car and watched the meter on the dash as the truck went spluttering by. The pointer rose sluggishly to a reading of thirty-five miles per hour.

"That's all that crate will do," Jim announced, as he drove back and parked the truck. "I had my foot clear down in the fan. My old man must have rocks in his head if he thinks that's a good car."

"I don't get it," the radar operator behind the wheel said to the other. "This thing never was wrong before. I still say we give the old gentleman a ticket—hey!" he broke off, "look at the meter."

SURE ENOUGH, the meter on the dash was jumping crazily about. Jerry's glance went from it to his Aunt Enid busily sweeping the immaculate front porch. (As every woman knows, a broom is a wonderful excuse for staying within earshot and eyesight of any interesting event!) As her broom nudged the coaxial cable, the dish antenna wobbled back and forth.

"Watch that meter a moment while I do something up on the porch," Jerry suggested to the men in the car. Running to the u.h.f. transmitter, he swept the invisable beam from the antenna back and forth across the trunk of the black car.

"That's what's doing it!" one of the men called. "What you got up there anyway?"

Carl and Jerry explained that the transmitter they were using was supposed to be in the 2300-2450 mc. ham band, but that since they had no extremely accurate frequency-measuring equipment at this frequency, the transmitter had drifted down very close to the 2455-mc. frequency of the radar transmitter. The difference in frequency was just enough to give a good reading on the speed indicator.

"Well, that's one for the book," the man behind the wheel said, tearing up the speeding ticket he had started to write. "Of all the places we had to set up our operation, we had to pick this one directly in the path of your beam. Pop, I'm sorry for all the hard time we've given you."

"That's all right, young man; we're all wrong at one time or another," the little man with the goatee said pleasantly; "but

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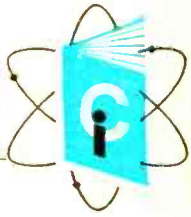

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Carl & Jerry *(Continued from page 24)*

I feel I owe these boys a favor. How about giving you a lift back to town if you're ready to go? You can put your bikes in back."

The boys promptly took him up on the offer, and soon they were chugging down the road. After they had gone about a mile, the little old man took a cautious look in his rear-view mirror, then reached over to the right side of the dash and gave a shiny knob there a practiced turn counterclockwise. Instantly the popping motor smoothed out and the truck plunged forward on the road.

"These young whipper-snappers don't savvy a combination choke and carburetor control any more than a redskin used to savvy the hindsight on a rifle," the old fellow said with a cackling laugh. "Fact is, most of the young ones don't know what a hand-choke is, let alone a dash-mounted carburetor control. When I saw that patrol car take out after me, I just leaned over and cut Betsy's gas down until she would barely run. That's why the officer could only get thirty-five out of her. Shucks, with her Fronty head and special camshaft, she'll hit seventy-five without a bit of trouble."

CARL AND JERRY made no comment. When the old man let them out at their homes, he insisted that each accept a large watermelon. As he drove off, Carl turned to his pal and said slowly:

"Jer, I feel kind of funny. I'm not at all sure but that we helped defeat 'due process of law' today."

"Neither am I. On the other hand, maybe our transmitter did get into the act. We'll never know. Let's go in and eat watermelon while we brood about it!" —30—

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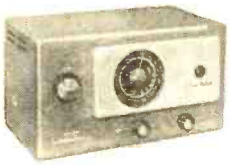

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COVERAGE: S-94: 30-50 Mc—S-95: 152-173 Mc

For the thrill of emergency radio—Police, Fire . . . Two new high performance receivers replacing the popular Hallicrafters S-81 and S-82. Compact, easy-to-operate and covers police, fire, taxicab, bus, railroad, private telephone mobile, forestry and other industrial and emergency-service communications operating within models' frequencies. Newly engineered FM chassis provides low frequency drift and high signal-to-noise ratio.

for hams • novices • short wave listeners...

MODEL S-53A
$89.95

COVERAGE: Standard Broadcast from 540-1630 kc plus four Short-Wave bands over 2.5—31 and 48—54.5 Mc.

FEATURES: Large easy-to-read overseas dial with international stations clearly marked. Electrical bandspread and logging scale. Five inch built-in PM speaker, jacks for headphones plus phonograph jack. Temperature compensated to reduce fading due to frequency shift. Two stages of i.f.

MODEL S-85 or S-86
$119.95

COVERAGE: Broadcast band 540-1680 kc plus three S/W bands 1680 kc—34 Mc.

This newly engineered Hallicrafters receiver has the 10, 11, 15, 20, 40 and 80 meter amateur bands calibrated on large easy-to-read dial. Over 1000° of calibrated bandspread for better selectivity on ham bands. Husky, full sized unit features separate bandspread tuning condenser and built-in PM 5" speaker.

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MODEL SX-96
$249.95
Matching R-46B Speaker $17.95

COVERAGE: Standard Broadcast; 538-1580 kc; Three S/W Bands, 1720 kc-34 Mc. Band 1: 538 kc-1580 kc—Band 2: 1720 kc-4.9 Mc—Band 3: 4.6 Mc-13 Mc—Band 4: 12 Mc-34 Mc.

TYPE OF SIGNALS: AM-CW-SSB

FEATURES: Precision gear drives are used on both main tuning and band spread dials.

Most talked about receiver on the air . . . This Hallicrafters double conversion selectable side band receiver offers major improvements in stability by the addition of temperature compensation in the high frequency oscillator circuits and the use of crystal controlled second conversion oscillators. Hallicrafters highly selectable 50 kc i-f system is used in this new precision-built receiver.

MODEL SX-99
$149.95
Matching R-46B Speaker $17.95

COVERAGE: Broadcast Band 540-1680 kc plus three Short-Wave Bands covers 1680 kc-34 Mc. Packed with all the features most in demand by the DX enthusiast, this model is a real stand-out in its price range. The large, very easy to read dial features over 1000 degrees of calibrated bandspread through the 10, 11, 15, 20, 40 and 80 meter amateur bands. Incorporated in the advanced design are such much-wanted components as an "S" meter, a separate bandspread tuning condenser, a crystal filter and an antenna trimmer. Grey-black steel and brushed chrome cabinet is perfectly styled for appearance and function.

LETTERS FROM OUR READERS

Reply to Plastic Request

■ In response to the helping hand requested by J. Jecmen (June, 1956, issue, p. 28) on how to seal documents in plastics via electronics, I would suggest staying away from such methods. It takes too much r.f. power to seal small lines, let alone a large flat area. Also it is hard to do as the "target area" is always varying size.

Just plain heat is sufficient. I have found that I can operate very economically with a 10" x 12" press and a 30-hp. boiler.

PLASTICS BY CHAPMAN
Berkeley, Cal.

Use for Proximity Detector

■ There are times when truck drivers and people in automobiles find it impossible to see objects when they are backing their cars or trucks into tight places. Why not develop a capacity-operated relay using transistors so that when you are close to an object a bell will ring or light will blink?

MAURICE L. LAROSE
Los Angeles, Calif.

Whether or not the exact device you propose can be built is open to question. It would seem as though it might be feasible if the "sensitive" areas could be restricted to the bumpers. Readers might like to try their hands at this project using a circuit similar to the Proximity Detector described in our April, 1956 issue on page 65.

Transistorized FM Receiver

■ Did you ever print a circuit for a transistorized FM receiver? Are there any transistorized FM receivers marketed, such as kits or pocket receivers?

E. L. DOERRER
Tinley Park, Ill.

This question is frequently asked and can only be answered in the negative. There are no FM transistorized receivers on the market at this writing. There is, however, a possibility of such equipment within the near future. Undoubtedly a step in that direction took place with the development of the new Regency short-wave converter featured on our September cover. This converter uses the Philco surface barrier transistor.

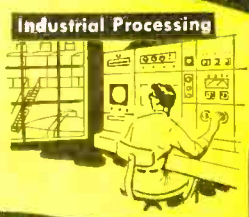
Phone Patching

■ I wonder if you might publish some material on phone patches. I would like to build one of my own.

THOMAS LITTY, KN6RAD
Los Angeles, Calif.

Well, Tom, there is a lot to be said for and against phone patches. Incidentally, for those

ATTENTION: MEN 17 to 55



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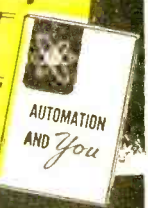

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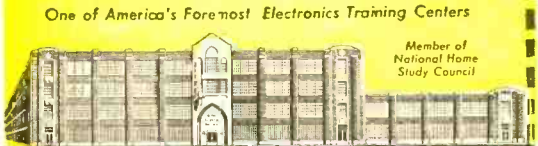

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readers who might misunderstand the term, it refers to methods of electronically intercepting phone messages without direct connections to the phone. We feel that there are a lot of potential misuses for phone patches and would rather not publish plans on constructing them.

Radiotelephone Mix-Up

■ We read with interest the article by Elbert Robberson in your August issue called "You Can Phone From Your Boat." However, I would like to point out that the equipment shown on

page 93 and described as being produced by the Raytheon Co. is actually RCA Radiomarine's ET-8059 "Golden Sentry."

K. V. Hayes
New York, N.Y.

Help for Mr. Grenier

■ In answer to "How to Make the Invisible Visible," I would suggest rubbing the tube envelope in one's hair. Sometimes a very light coat of oil and dust will make the numbers on the tube legible when held up to the light.

Chris Bednarek, K2RAG
Cambrice Heights, N.Y.

■ If you use the old method of breathing on the tube, I suggest that it be put into a freezer or refrigerator beforehand. This cooling of the tube will make the numbers legible if the process is repeated several times.

Ian McMillan
Orangeville, Ont.

■ Almost without exception, it is possible to make tube numbers legible by simply dying the tube in common iodine. On extraordinarily bad tubes, good results can be obtained by heating iodine crystals in a test tube and letting the fumes bathe the tube in question.

Meron R. Stanley
Nokomis, Ill.

The methods mentioned above seem to be agreed upon by a large number of our readers. Our thanks to the many who did write in and whose letters or cards we were unable to mention due to space limitations.

Instructions Wanted

■ I have an old Model 501 Supreme tube tester and have lost the instruction papers. The manufacturers have been unable to replace them since

this model is no longer in production. Can anyone lend me a set of instructions so that I can copy them?

RICHARD MATZNER
Rt.#1, Box 599Z
Ft. Worth, Texas

Pen Pals

■ Can you put my name down for some pen pals interested in SWL'ing?

ARNOLD GREENFIELD
New York, N.Y.

Arnold, you'll find the newest member of the Ziff-Davis publishing family your answer. It is called "PEN PALS" and will appear on the newsstands throughout the country on October 11th. It will contain 1500 names of people interested in ham radio, tape correspondence, photography, etc. Each name and address represents someone who enjoys getting and writing letters. Suggest you stop and pick up a copy. You'll also see some very interesting feature articles by famous personalities. —30—

OCTOBER IS ABC MONTH

IN ALL PROBABILITY, most of our readers will have noticed the "ABC" insigne which appears on page 3 of each issue. As some may know, it means that POPULAR ELECTRONICS is numbered among those magazines which have qualified as members of the Audit Bureau of Circulations. To a few others, "ABC" and "Audit Bureau of Circulations" may be meaningless technical terms. Actually, they are very far from that, and since October is "ABC Month," we have allocated space to tell you about this insigne.

The ABC insigne is a measure of service and a mark of integrity to both buyers and sellers of advertising space, for it means fairness and honorable dealing with advertisers and readers alike. Through the Audit Bureau of Circulations, the advertiser gains accurate information as to who reads POPULAR ELECTRONICS. This information is in the form of a net paid circulation figure (an average over a short period or small number of consecutive issues).

To gain circulation that will meet the standards established by the unique nonprofit ABC, we must consistently publish a magazine that is steadily bettering its articles and features for the benefit of our readers. Reader acceptance means more newsstand buyers, more subscribers and more renewals. If we are doing a thorough and capable job, the ABC audit reports will reflect our efforts with an increased paid circulation figure.

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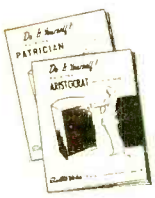

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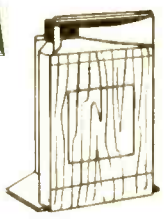


THE PATRICIAN IV KIT. An interior assembly kit for those desiring the finest. This augmented design of the Klipsch corner folded-horn bass section delivers an added full octave of bass. Designed for use with E-V Model 103C Patrician IV four-way driver components. For built-in installations or to be decorated as you choose. Finished size: 57½ in. high, 34½ in. wide, 26⅞ in. deep. Shpg. wt. 150 lb.

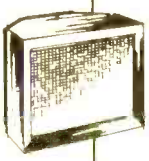
Model KD1 Net, $99.00

THE BARONET KIT. Phenomenal reproducer for such small size. This folded-horn corner enclosure is designed for use with E-V Model SP8B 8-in. Radax speaker. E-V T35 or T35B Super Sonax UHF driver can be added for a separate two-way system. Finished size: 23 in. high, 14 in. wide, 13 in. deep. Shpg. wt. 24 lb.

Model KD7 Net, $24.00

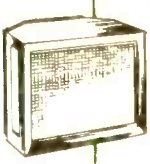
THE ARISTOCRAT KIT. Folded-horn corner enclosure designed for 12-in. speakers and separate 2 and 3-way systems. For use with Electro-Voice SP12 or SP12B coaxial speakers, 12TRX or 12TRXB triaxial reproducers, and 108, 111 2-way and 108A, 111A 3-way systems. Smooth reproduction down to 35 cps, with remarkable purity and efficiency. Finished size: 29⅝ in. high, 19 in. wide, 15¾ in. deep. Shpg. wt. 37 lb.

Model KD6 Net, $36.00



THE EMPIRE KIT. Economical, folded-horn enclosure for use in a corner or flat against one wall. Designed for 15-in. speakers and separate 2 and 3-way systems. Particularly effective when used with SP15B coaxial speaker, 15TRXB triaxial reproducer, or 116 2-way or 116A 3-way system. Recommended components for Regency kit may also be employed. Finished size: 29⅝ in. high, 32 in. wide, 16 in. deep. Shpg. wt. 45 lb.

Model KD5 Net, $48.00



THE REGENCY KIT. Most popular low-boy style folded-horn enclosure that can be used in corner or flat against one wall. Improves the bass range and response of any 15-in. speaker. Makes an outstandingly efficient reproducer when used with E-V SP15 coaxial speaker, 15TRX triaxial reproducer or 114A 2-way or 114B 3-way system. Finished size: 29⅝ in. high, 33½ in. wide, 19 in. deep. Shpg. wt. 70 lb.

Model KD4 Net, $69.00

THE CENTURION KIT. Four-way system folded-horn, corner enclosure. Uses exclusive E-V "W" type single-path indirect radiator for propagation of extended bass. Sealed cavity behind 15 in. low-frequency driver cone promotes superlative transient response, subdues cone excursions, lowers distortion. For use with E-V Model 105 or Model 117 package of driver components. Finished size: 42⅛ in. high, 29 in. wide, 22½ in. deep. Shpg. wt. 75 lb.

Model KD3 Net, $79.00

THE GEORGIAN KIT. An interior assembly kit that creates authentic Klipsch indirect radiator type corner folded-horn bass section for 15 in. 4-way speaker system. Exceeded in range only by the Patrician IV. For use with E-V Model 105 or Model 117 package of 4-way driver components. For built-in installations or to be decorated as you choose. Finished size: 38½ in. high, 26¾ in. wide, 22½ in. deep. Shpg. wt. 88 lb.

Model KD2 Net, $58.00

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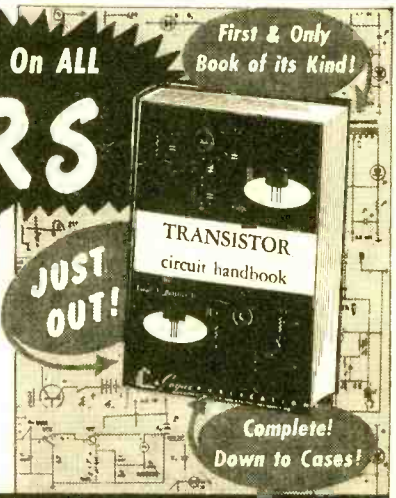

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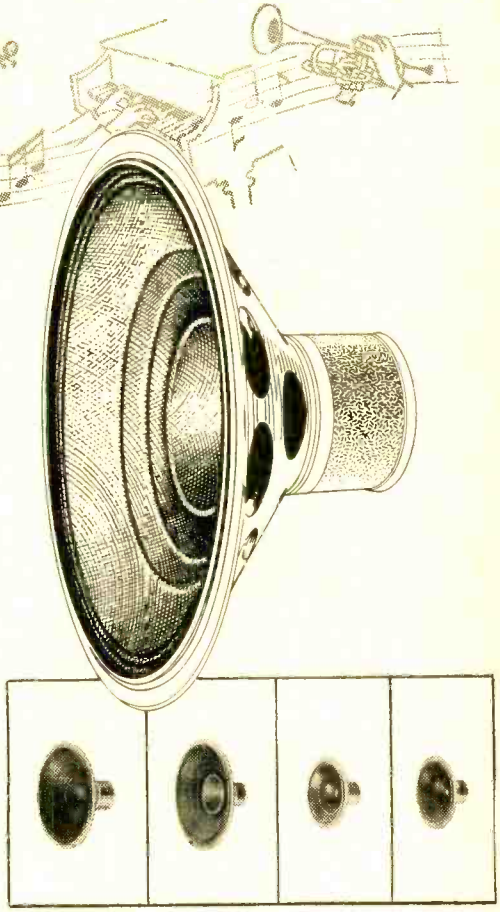

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"SIMPLIFIED RADIO SERVICING BY COMPARISON METHOD" by M. N. Beitman. Published by Supreme Publications, 1760 Balsam Rd., Highland Park, Ill. 92 pages. Paper bound. Price, $1.50.

The author's "comparison method" for servicing receivers is a "quickie" technique based on an acquaintance with basic circuit types. This manual outlines the procedures and presents schematics, tube diagrams, and related data on a number of representative circuits. The approach is "practical" with little mention of theory or mathematics.

Recommended: as an aid to beginning service technicians.

"AMPLITUDE MODULATION" by Alexander Schure. Published by John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y. 64 pages. Paper bound. Price, $1.25.

Basic principles and circuitry for transmitting amplitude-modulated radio signals are explained in this book, another in the publisher's "Electronic Technology Series." Topics covered include plate, grid and cathode modulation, and AM checking and monitoring.

Recommended: for technicians and students as a handy reference guide.

"HI-FI SPEAKER SYSTEMS" published by Jensen Manufacturing Co., 6601 South Laramie Ave., Chicago 38, Ill. 36 pages. Paper bound. Price, 50 cents.

Plans and descriptions for 18 Jensen speaker systems, including enclosures, are presented in this manual. Suggestions for specific uses of one type or another are given to help the audiophile chose a system that meets his own needs. More than a mere listing of Jensen components and kits, this manual contains much "do-it-yourself" data.

Recommended: for hi-fi'ers who want to build their own speaker systems.

"APPLIED AUTOMATION" edited by James R. Custer. Published by Chilton Co. Publishers, Chestnut & 56 Sts., Philadelphia

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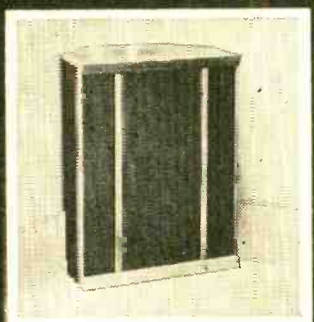

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Model KR-4/12, factory-assembled and finished version of same ..... $69.00 net
PFK-15C, for 15" woofer drivers:
Shipping Weight 48 lbs. ..... $58.00 net
Model K-15, unfinished kit ..... $42.00 net
Model KR-4/15, factory-assembled and finished version of same ..... $87.00 net

Model PFK-300
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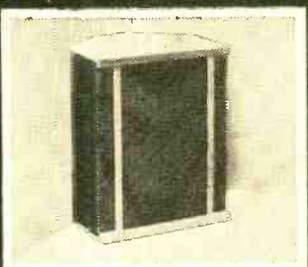
Model K-3, unfinished kit version of same ..... $49.50 net
Model KR-3, factory-assembled and finished version of same ..... $99.00 net



Model PFK-500
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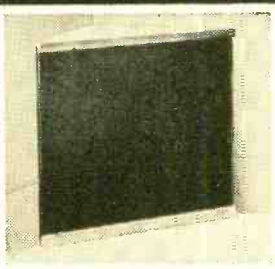
Pre-finished kit version of the REBEL 5, the extra-compact CABINART corner horn designed by Paul Klipsch for 8" and 12" speaker systems.
Shipping Weigh 34 lbs. $36.00 net
Model KR-5, factory-assembled and finished version of same ..... $48.00 net
Model K-5 unfinished kit version of same ..... $24.00 net



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Pre-finished versions of the CABINART Model 61/63 kits (folded corner horns) for 12" and 15" speakers, respectively.
PFK-610, for 12" speakers:
Shipping Wt. 39 lbs. $29.95 net
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39, Pa. 268 pages. Cloth bound. Price, $7.50.

This book is a collection of articles originally published in the magazine *Automotive Industries*. Dealing with various phases of automation as applied to the manufacture of cars, the book addresses itself chiefly to the industrial engineer and describes in detail equipment used to make and automatically assemble parts. Electronic controls are also discussed.

Recommended: as a treatise on specialized aspects of automation.

"AUDEL'S TELEVISION SERVICE MANUAL" by Edwin P. Anderson. Published by Theo. Audel & Co., 49 West 23 St., New York 10, N. Y. 434 pages. Cloth bound. Price, $2.00.

A publisher known for guidebooks and manuals covering various technical and industrial fields, Audel has brought out an excellent volume on TV sets. The approach is generally from the point of view of the practicing technician, but a goodly amount of theory is included in the form of discussions and schematic diagrams.

Plenty of "solid" information is packed into this lean volume. Basically a manual to aid in the diagnosis and correcting of TV receiver faults, it includes valuable data on many closely related fields, such as master antenna systems, broadcasting, and color television. The text is clearly written; illustrations are abundant; the glossary at the end is highly useful; and the price is right!

Recommended: to technicians working with—or interested in—television.

"ALLIED'S ELECTRONICS DATA HANDBOOK" published by Allied Radio Corp., 100 North Western Ave., Chicago 80, Ill. 64 pages. Paper bound. Price, 35 cents.

This book is a collection of the most-often needed formulas and data used in radio and industrial electronics. Material is arranged for maximum convenience as a reference guide. Diagrams, tables, charts, and an index add to the book's usefulness.

Recommended: for experimenters and technicians at all levels.

Out of Tune

Economy Vacuum-Tube Voltmeter (*June*, 1956, *page* 47): In the wiring and pictorial schematics, the "Ohms Test Lead" is connected to the wrong side of the battery *B1*. In both instances, this lead should be connected directly to the plus side of the battery and disconnected from the negative side. —30—

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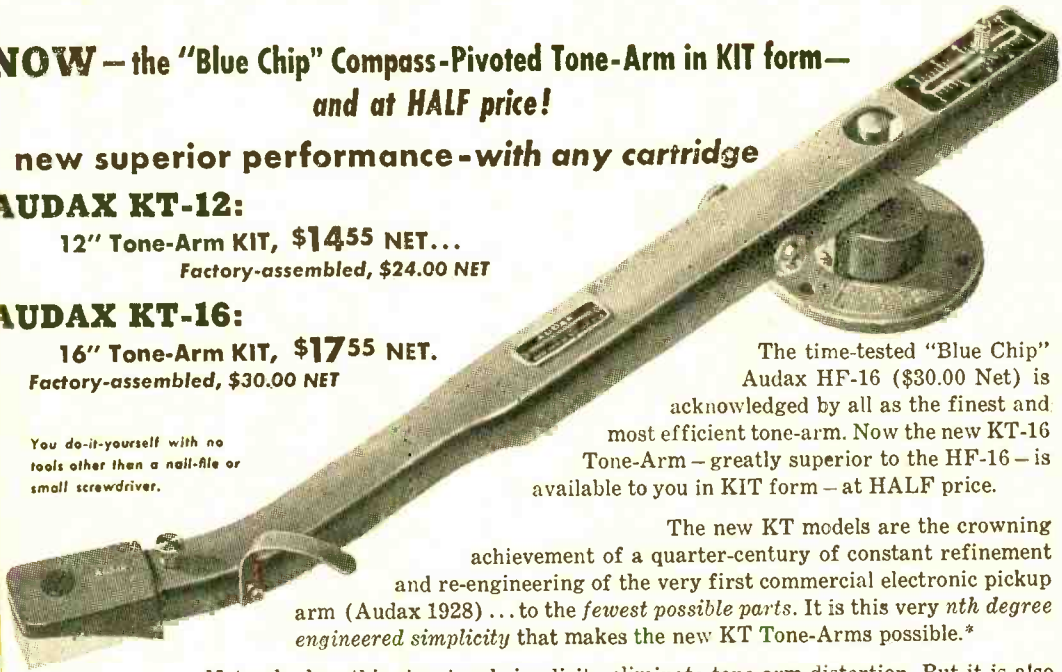

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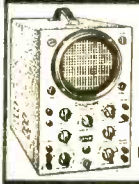

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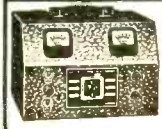

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Use these specially made records to show off your sound system

By
NORMAN EISENBERG
Feature Editor

How To Demonstrate Your Hi-Fi

Cover photo by Maynard Frank Wolfe; equipment courtesy Harvey Radio Co.

IN THE FIRST PART of our story on hi-fi "specialty" records, we discussed several test records.* The non-musical or "pure" sounds recorded on these discs raise a pointed question for the hi-fi listener: "Isn't there some way of testing and/or demonstrating my hi-fi system without resorting to sound for its own sake? I like music!"

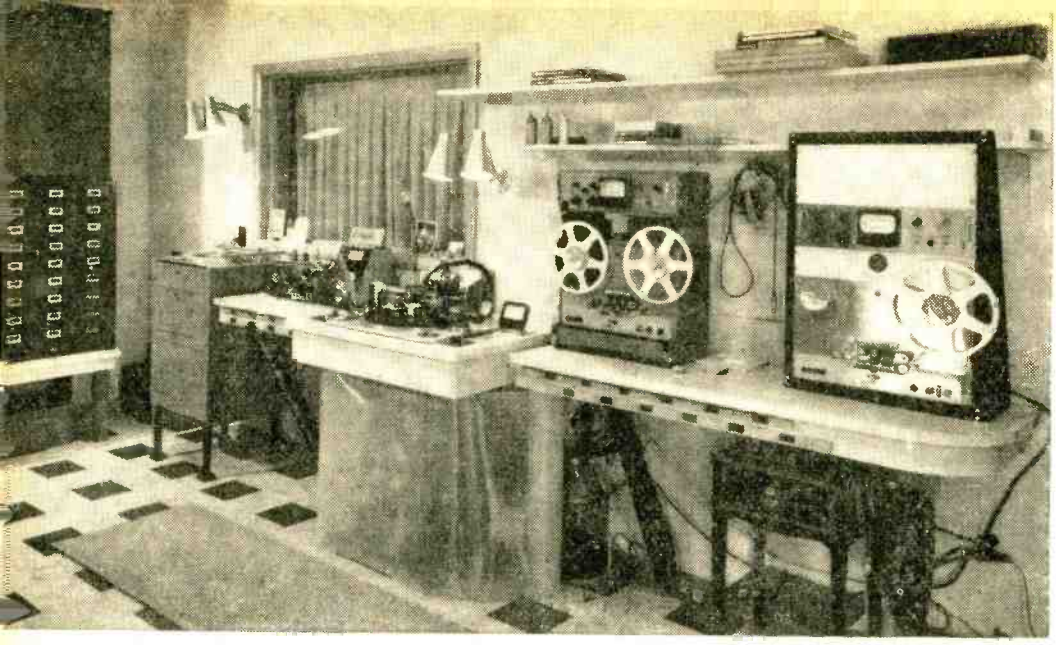
Music and Audiology. The answer, rising like an echo from the sonic context of audio laboratories, is good news for record collectors of all bents and tastes. The recording industry, for some time now, has demonstrated its ability to record music with the same range and accuracy that characterizes the test records.

This is best illustrated by a number of recent releases. Both the recorded material and the accompanying program notes deal with sound in terms of good music. These records also let you in on some of the "trade secrets" of recording, such as reverberation time, microphoning, and frequency skewing. Musical selections tell their own stories, abetted by carefully worded comments — spoken, written, or sometimes both.

One of the most ambitious, and successful, of this type of record is Vox's *This Is High Fidelity* (VOX DL-130). Practically a short course in audio, this disc strikes a neat balance between technical data and musical performances. Tones from 15,000 cycles down to 30 cycles are included, as well as examples of intermodulation distortion, resonances, etc. But, mostly, the record lets its musical examples do the job, with a "now-and-then" commentary by a well-informed narrator to help guide you through the grooves. If hi-fi enthusiasts find learning audio technology somewhat like taking a pill, this record will certainly provide the sugar-coating for it. The most uninformed listener should get something out of it with no pain and a good deal of pleasure.

New Program Notes. Something of this idea—with an added new twist—is

* One which arrived too late for inclusion last month is London's *Microgroove Frequency Test Record (LL-758)*. This is a recording of frequency tones from 40 to 15,000 cycles. The step-by-step tone gradations can provide an accurate listening check on how well a hi-fi system reproduces those tones. They can also be used for detecting resonant points in the system's response, making adjustments on amplifier controls, checking speaker crossover points, taking meter readings, etc.



Behind the scenes at Audiophile Records. Technician's lab is as much a part of hi-fi recording as is the musician's studio. Performances are taped. After editing, tape is used to cut master disc.

used in two of Westminster's productions: *High Fidelity Demonstration* record (DRB), and *Check and Double Check* (TRC). In these records, the practice of "indicated listening" is brought to the level of an art itself, with very careful explanations for the musical selections. These printed notes help you judge whether or not your phono system is doing the job it should. And while making this judgment, you really enjoy yourself, for both DRB and TRC contain samples of some of the best of Westminster's superb repertoire of recorded music.

In addition to uninterrupted musical selections, DRB contains announced frequency tones from 40 to 15,000 cycles, demonstrations of controlled ranges, of definition, and of instrumental color.

TRC, more elaborate, contains frequency tones with instructions on how to listen to them to check for wow, correct equalization, peaks, stylus adjustment, and correct control settings. The music is chosen to demonstrate—and simultaneously check—your system's handling of such items as dynamic range, transient response, tonal balance, hall acoustics, etc. In each case, the printed information makes listening easy and edifying.

War Horses and Adventures. Another contribution to the music-audiology type of record is the *High Fidelity Demonstration Record* issued by Urania (URLP-7084). This disc is short on test tones, long on music—mostly Wagner. A few old, familiar "war horses" like Ponchielli's *Dance of the Hours* are carefully groomed and raced in good form around the microgrooves for some clean, pleasant listening.

A little bit of everything is included in RCA Victor's *An Adventure in High Fidelity* (LM-1802). Main feature of this record is an original composition by Robert Russell Bennett. Performed by the NBC Symphony Orchestra with the composer conducting, this piece does a lot of sonic exploring, with excursions to the very lowest and highest reaches of the orchestra. Other features of this pressing include a unique demonstration of the sound of each instrument, and a varied program of classical and popular selections, with a printed guide telling what to listen for in each section.

Tidbits and Specials. Enough of a variety is included on Capitol's *Further Studies in High Fidelity* (SAL-9027) to please hi-fi fans of any musical bent. One side contains popular selections including representative works by some of the best artists currently in vogue, such as Les Paul, Yma Sumac, and Billy May. The other side includes choice tidbits from six composers, covering the range from a Brahms chamber work to the full-bodied contrapuntal vigor of a dance from Stravinsky's *Rite of Spring*. Every piece is superbly played and recorded. Again, printed program notes provide perceptive remarks on the recording techniques used and correct listening techniques—from a musical as well as hi-fi standpoint.

As a tribute to Mozart, Vanguard has issued—for this year of the composer's bicentennial—a special pressing of two of his best-known works, the *Symphony No. 40 in G Minor*, and the serenade *Eine kleine Nachtmusik*. There is no technical data supplied with this release, but Vanguard lists it as a "demonstration record." Justly so: it is a combination hi-fi showpiece as

well as a splendid reading (Felix Prohaska and the Vienna State Orchestra). Characterized by its "transparent" string work, this record may well serve as an introduction to the charm, grace, wit, and power of Mozart's music.

The full, clean sound of the small jazz combo has long been recognized as a recordist's dream: easy to record well, and nicely suited for playback in average-size rooms. Audiophile Records, Inc. has done a good deal in this area, in addition to their classical releases. Typical is *Dixieland Jazz* (AP-1) and *Traditional Jazz* (AP-34). AP-1 is strictly for the connoisseur both in recording technique (78-rpm microgroove; look out for tracking troubles on the ordinary record player!) and in the off-beat numbers. The music is played with vigor and enthusiasm by six artists headed by Harry Blons.

AP-34 contains more familiar Dixieland on a more familiar kind of disc (long-playing microgroove). Here, Doc Evans and his band, with Knocky Parker on piano, produce a real foot-beating session. Included is a performance of what is probably the most sensational rendition on vinylite of *When the Saints Go Marching In*. No tests are included on these records, other then the implied one of your rig's ability to play them.

Drumming Up Trade. Percussion instruments have proven a wonderful source of test and show-off sounds for recording. Aside from the interest that most people have in these fascinating instruments, the dozens of assorted bang-gadgets in a full orchestra can provide a field day of examples of frequency range, transient response, tracking, and other qualities sought after by the audiophile.

Two new releases attest to this interest. Angel's *Bell, Drum and Cymbal* (ANG-35269) features Saul Goodman, first tympanist and head of the percussion section of the N.Y. Philharmonic-Symphony in what is virtually a short course in drum sounds and their uses. Everything on this disc is clean and brilliant; the triangles will tinkle about your head, the bass drum will rock your floor; the gong will rattle your windows. (Of course, you can turn the volume down and save the house.) The flip side contains, among other things, a special arrangement for percussion of Saint-Saens' *Danse Macabre* in which Goodman plays 14 instruments. Multiple track recording did the trick here, and very neatly too.

Vox's *Spotlight on Percussion* (DL 180) is sensational in its sound, encyclopedic in its scope, and luxurious in its presentation. Most of the heavy swinging is handled by

Tympani technique is demonstrated by Saul Goodman, Angel Records star. His "Bell, Drum, and Cymbal" and Arnold Goldberg's "Spotlight on Percussion" (Vox) mix music with audiology.

Arnold Goldberg, chief percussionist with the New York City Ballet Orchestra and the Little Orchestra Society. No less than 61 instruments are hit, rattled, scraped, hammered, shaken, or otherwise vibrated by Mr. Goldberg, including some rarely heard—or heard of—such as the "crotales," a set of ancient cymbals. There are some multiple track recording tricks on this pressing too, which emphasize the versatility of percussion instruments as full-fledged music makers in their own right.

The jazz section of this release was recorded at a one-man jam session in which Kenny Clarke put his tom-toms, cymbals, and assorted drums through the paces of a wild first run which no one, including Clarke, had heard before. The results are exciting to hear and will provide a good workout for any hi-fi system.

The Pipes That Please. Long the acme of attainment among audiophiles, the organ has the widest range and the most awe-inspiring dynamics of all the instruments. What's more, some of the world's most beautiful music has been written for the organ. New organ recordings attract hi-fi enthusiasts like new highways draw motorists—they're at once a challenge and a source of deep enjoyment.

Two excellent examples of the "big

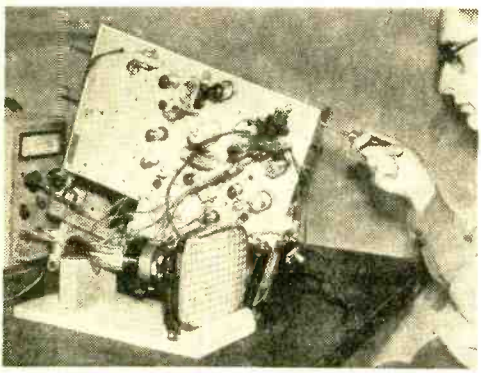
(*Continued on page* 131)

Radio in Helmet

BUILT INTO the soldier's helmet is a transistorized, two-way voice radio. The complete set (shown in the photo inset) weighs only a pound, yet has a range up to one mile. When not in use, the microphone slips easily out of sight. Developed to facilitate communication between squad members, the device also has civilian applications; it can be used by policemen, fire fighters, or construction workers.

"Check Tube" Simplifies Servicing of TV Receivers

A TELEVISION receiver "check tube" which can be used to test virtually any TV receiver or 10" to 27" picture tube has been announced by Sylvania Electric Products Inc. Designated as the 8XP4, the tube is an 8½" rectangular picture tube featuring automatic self-focusing. Its parallel-mounted electron gun eliminates the need for an ion trap. Shown at the left in a rack for servicing a chassis, the 8XP4 may be employed in receivers designed for either magnetic or electrostatic-focus tubes. Its deflection angle of 90° makes it suitable for testing nearly all types and sizes of picture tubes, including portable types. No external conductive coating is used, thus eliminating the need for "discharging" the tube before handling.

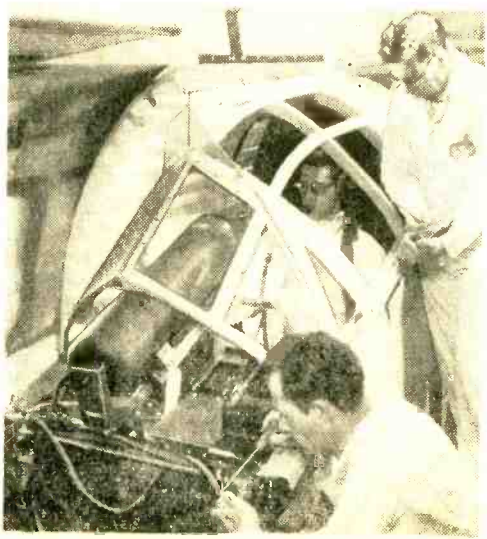


Back-Seat Flying

THE COCKPIT below is "a plane within a plane." Installed in main cabin of T-29 airliner, controls enable second pilot to take over once regular pilot has aircraft aloft. Developed at Hughes Aircraft, this electronic system enables test pilots to fly as if they were actually in an F-102 jet.

80-Foot Tube?

"BIGGEST little tube" is General Electric's description of the 80-foot water tower built at the company's new tube factory under construction at Owensboro, Ky. The 200,000-gallon water tower was built to the proportions of a 6BK7, a v.h.f. tube used in TV sets. This miniature tube is about two inches long.



TV IN THE TALL TIMBER

By Rafe Gibbs

SEVENTY SCIENTISTS, federal and state forestry officials sat recently in the Borah Little Theatre at the University of Idaho, and gazed at an ordinary television set. They had come to watch a demonstration of the "eyes" of television on forest fires—a development destined to revolutionize both fire spotting and fighting in the nation's forests.

The scene on the TV screen showed the great expanse of timber on the Thatuna Range of Northern Idaho. Just timber . . . then smoke . . . a gray ribbon spiraling above the pine and tamarack.

"Fire sighted . . ." boomed a voice over a loudspeaker in the theatre. The voice did not come through an ordinary television speaker. Originating at a Forest Service lookout tower high on Moscow Mountain, it came via a microwave radio link.

A man in the theatre spoke into a hand microphone: "Give us a close-up look."

And promptly the TV camera in the distant lookout station zoomed down with a probing view of the fire—a fire that had been set for purposes of the demonstration.

The experts were intrigued. Leaving the theatre, they wound up the mountain side in a car caravan to see the TV and microwave equipment at the lookout station.

What they saw in the theatre and on the

Lookout stations have beckoned to many a youth as summer homes (top). Now scientists are considering them as homes for TV equipment to fight forest fires. High in a lookout station, the camera's long-range "eyes" can observe such dangerous factors as wind shift, and give added protection to the man on the fire line (left).

U. S. Forest Service Photo

Portable antennas like the one at left can be easily and quickly set up in different mountain locations for fire spotting.

mountain top, however, was only the beginning. In the demonstration, the equipment in the tower was operated manually . . . but it can be operated electronically. In the not-too-distant future, hundreds of forest lookout stations may have no human watcher . . . only TV cameras would be on duty, panning back and forth over the terrain.

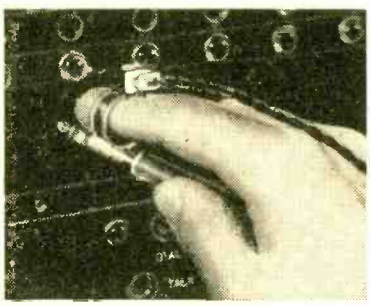
Forest rangers would spend their days and nights watching the battery of TV screens—but no "Hopalong" or "Howdy-Doody." If a fire were spotted on one of the screens, the particular roving camera would be electronically halted or reversed for pinpoint study of location and scope. Then crews would be dispatched to fight the fire.

"In the actual fighting of forest fires, the television camera can do a better job than the human lookout aided by binoculars or telescope," said Professor Lloyd Craine of the University of Idaho. "The camera, with a powerful 12-inch lens, brings out good detail at 15 miles. Wind shifts can be easily spotted, giving added protection to fire fighters in danger of being overrun by a blaze."

Richard G. Cunningham, field engineer for Kay Lab, San Diego, Calif., pointed out that TV "eyes" are sensitive to infrared rays, which would make the detection system practical for night operations. —30—

Electronic Eye for Blind PBX Operators

A TINY, light-sensitive phototransistor fitted like a thimble enables a blind person to earn a living as a switchboard operator. At the usual PBX switchboard, a buzz is heard and a lamp lights up along the rows of jacks when a call comes in. The blind operator, hearing the buzz, runs a hand along the row of lamps. On reaching the lighted lamp, she hears a signal through this new Bell Laboratories device, telling her that she has found the place for plugging in the patch cord. From then on she completes the connection by her trained sense of touch. This new development may open up many jobs for the blind.



TV Cameras Probe Watery Depths

AMERICAN TV viewers recently explored 50 feet under the surface into the mouth of a subterranean river in Silver Springs, Florida, courtesy NBC's live telecast on its Sunday afternoon "Wide, Wide World" show. Photo at left is a typical view from the dramatic sequence filmed under water and transmitted to the nation.

The special underwater TV camera equipment was built by Pye Ltd. of Cambridge, England. According to Douglas Allanson, Pye engineer, underwater TV can be used in spots where a diver might be imperiled, and is proving an invaluable aid to all underwater operations, including salvage and scientific research.

By
PAUL HARVEY

How to Build a Dry Battery Rejuvenator

This unit recharges anything from a tiny penlite cell up to large portable radio batteries

IN THIS DAY of transistorized equipment, portable radios, Geiger counters, metal locators, and radio control, reclamation of dry cells and dry batteries has become an economic necessity. Since the life of either a single cell or a battery of cells may be substantially extended by using carefully controlled equipment and judicious charging techniques, the initial investment in the components required to make the charger described here is well worth while.

Designed to cover a range of from 1.5 volts to 90 volts, this little unit will handle anything from a penlite cell or a tiny hearing aid battery up to the large combinations found in portable radios.

Special Features. The worst mistake one can make in using a dry battery charger is to exceed the maximum safe charging rate for the battery in question. In this circuit, a milliammeter is connected permanently in series with the battery to insure the proper charging rate.

Positive automatic protection against overloads and short circuits is incorporated in this rejuvenator. The application of excessive voltage endangers both the battery and the meter unless such protection is included. Any charging current above approximately 6.5 ma., in this circuit, pulls in an overload relay having an electrical latch-in feature which kills the circuit until it is manually reset. Overload is instantly signaled by a red pilot light.

Also built into the circuit is an isolation transformer to prevent possible shocks, and a series crystal diode (*CR1*) that prevents reverse current flow—or the battery discharging through the charger.

Construction. A 4" x 5" x 6" case will house the whole works. The additional help of a small open-end aluminum chassis (measuring 3¾" x 4" x 1½") makes the finished product compact and professional-looking. Once you are certain that all the parts you are going to use will fit the chassis, the panel holes should be drilled or cut to size.

When the panel is finished, plan the parts layout on the chassis. Mount the enclosed relay *RL1* and the isolation transformer *T1* on the top surface. This particular relay was selected because it makes the wiring considerably easier. The dust-proof cover insures long, trouble-free operation.

After all parts are mounted, wire the chassis components before securing the chassis to the panel. Finish as much of this wiring as possible before you finally mount the chassis in the cabinet. Soldering is more difficult once chassis is in place.

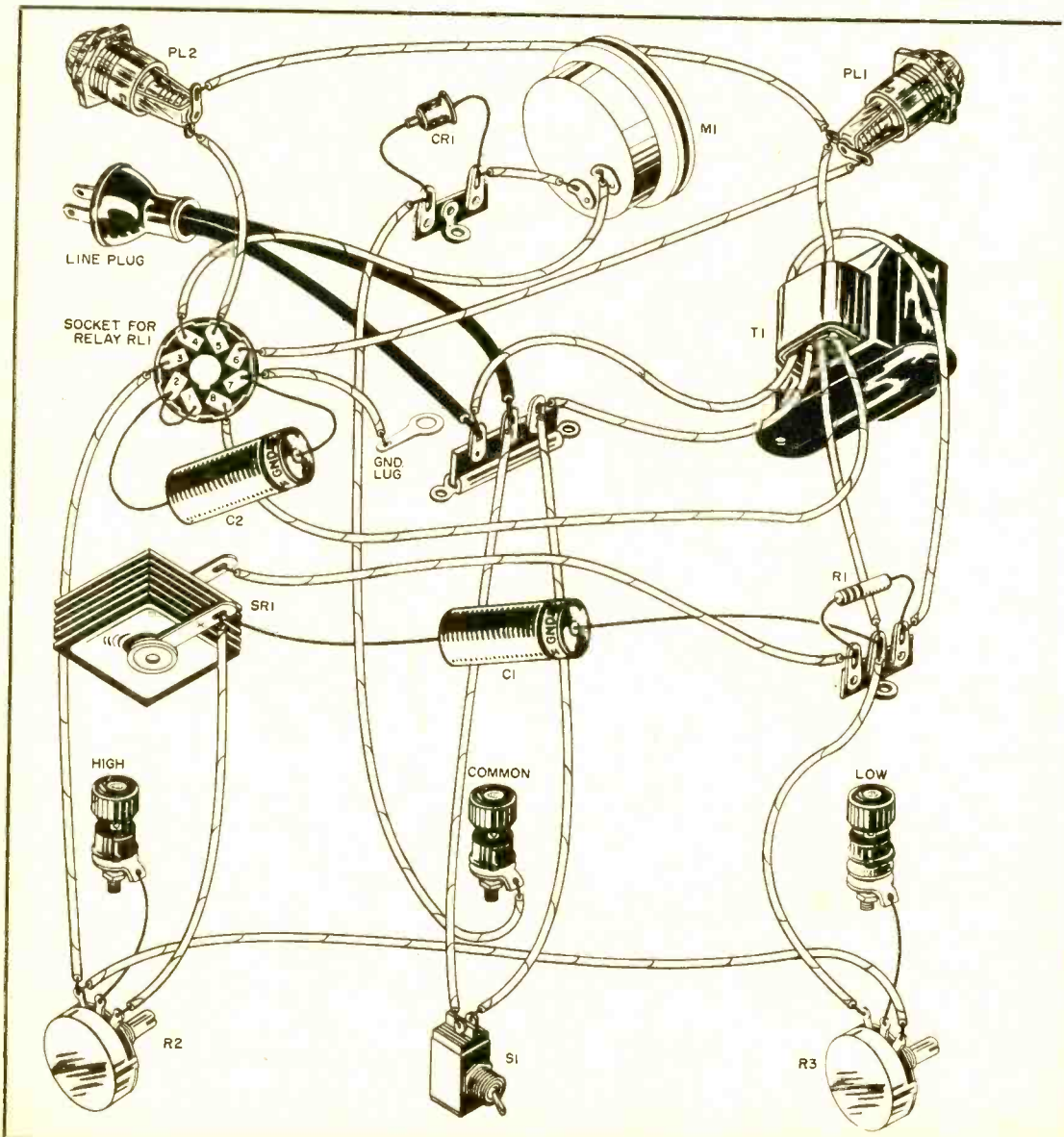
Testing. Before applying power, use your ohmmeter to locate possible short circuits. For instance, be sure that the a.c. line goes only to the switch *S1* and the primary winding of the isolation transformer, check the resistance across *C1* to find possible shorts, and re-examine the polarity of *C1* and *C2* to see that they follow the instructions in the schematic diagram.

With switch *S1* in the "off" position, plug the unit into a suitable 117-volt a.c. receptacle. Neither pilot light should glow

nor should the meter show a deflection. Now insert one test lead into the *common* jack (black) and one into the *low* terminal (red). Set both output voltage controls (*R2* and *R3*) at zero (fully counterclockwise) and switch *S1* to the "on" position. The green pilot light should glow but the meter should continue to read zero. Short-circuit the test leads to each other and gradually advance the *low* control potentiometer while observing the meter. You should be able to reach 5 ma. of current easily.

Return the *low* control to zero and turn *S1* off. Plug the red test lead into the *high* terminal, leaving the black lead in the *common* jack. Reset the *high* potentiometer to about half-scale. Now flip *S1* on. The meter needle should start to deflect, then you should hear a muted click—the overload relay pulling in—and the pilot lights should change over from green to red. At the same instant, the meter should at once drop to zero. When the switch is turned off momentarily, you should hear the relay open. If the switch is again turned on, the process should repeat itself. This shows that the overload circuit is functioning properly.

Finally, test the charger on any batteries you happen to have around. Cells or batteries between 1½ volts and 15 volts

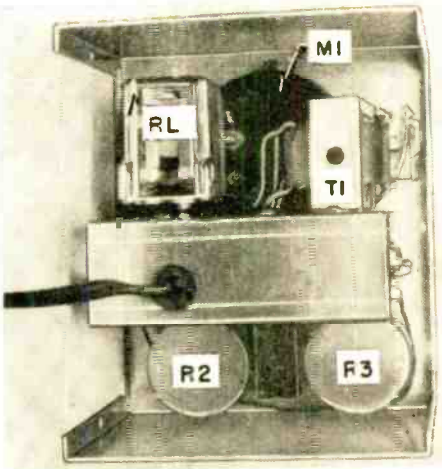


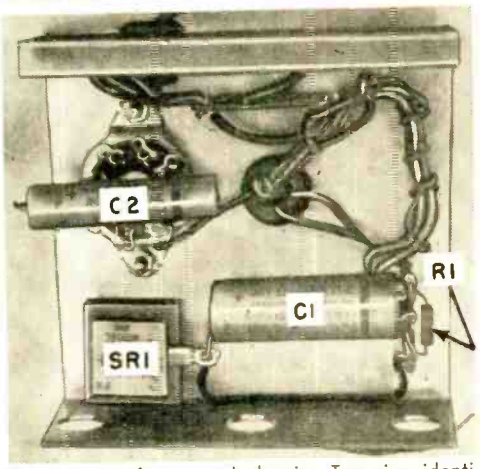
are connected between *low* (+) and *common* (−), those from 22½ volts to 90 volts between *high* (+) and *common* (−). You should be able to run the current from a small value to 5 milliamperes or more.

Using the Charger. The chemistry of dry batteries does not permit rapid recharging, nor can the life of this kind of power unit compare with lead-acid storage cells. Increased life is possible only when charging is carried on with reasonable care. The first thing to remember is that the absolute maximum charging rate is 5 ma., and even this should be confined to the larger types of low-voltage batteries.

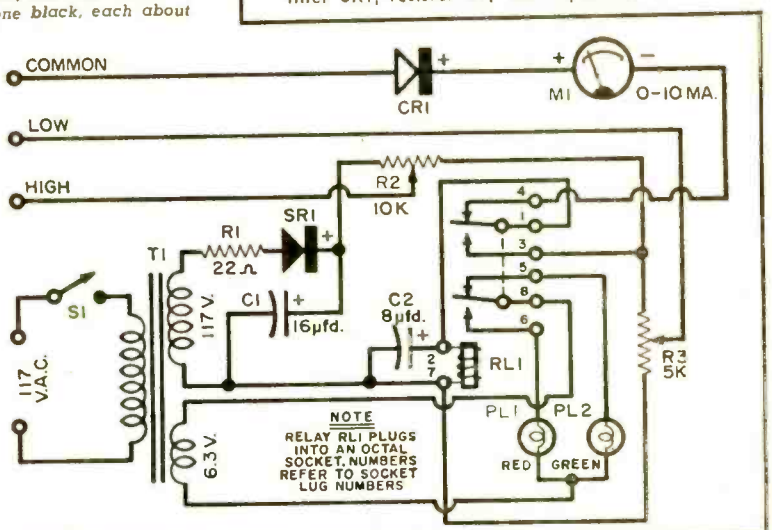
(*Continued on page* 126)

C1—16-μfd., 150-volt electrolytic capacitor
C2—8-μfd., 150-volt electrolytic capacitor
CR1—Germanium rectifier (G.E. 1N93)
M1—0-10 ma. d.c. meter, 2¼" round face
PL1, PL2—6.3-volt pilot light assembly, screw base, with 1 red and 1 green lamp (Drake #20S)
R1—22-ohm, ½-watt carbon resistor
R2—10,000-ohm, 4-watt wire-wound potentiometer
R3—5000-ohm, 4-watt wire-wound potentiometer
RL1—5000-ohm coil, enclosed-type, d.p.d.t. relay (Potter and Brumfield Type KCP-11)
S1—Standard s.p.s.t. "on-off" switch
SR1—65-ma. selenium rectifier
T1—Isolation transformer, 1:1 ratio, 30-ma. secondary, 6.3 volts @ .6 amp. (Stancor PA8412, Halldorson P9102, or Akrad T-103)
1—6" x 5" x 4" aluminum case with grey hammertone finish (similar to ICA Flexi-mount #29442)
1—3¾" x 4⅛" x 1½" aluminum, open-end chassis (similar to ICA miniature #29079)
3—Large 3-way output terminals, with insulating shoulders, to take banana plugs, spade lugs, or pin tips
2—1½" pointer-type black Bakelite knobs for ¼" shaft
1—Line cord and plug for 120-volt a.c. circuits
2—Insulated banana plugs, one red, one black
2—Insulated alligator clips, one red, one black
2—Test cords, one red, one black, each about 3' long

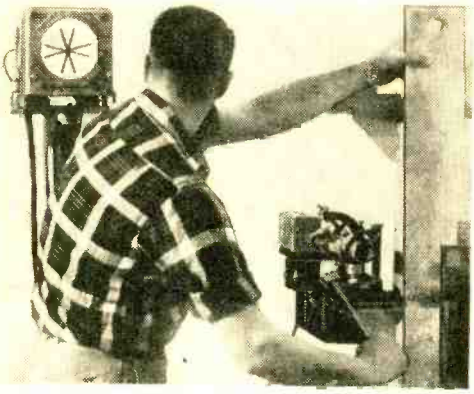




Two views of open-end chassis. Top view identifies enclosed-type relay RL1, isolation transformer T1, meter M1, and potentiometers R2 and R3. Underchassis view shows placement of selenium rectifier SR1, resistor R1, and capacitors C1 and C2.



Wiring details for the battery rejuvenator are shown in the schematic diagram at right. Complete parts list for the unit appears above. At left is the pictorial diagram which shows you how to hook up the various parts.

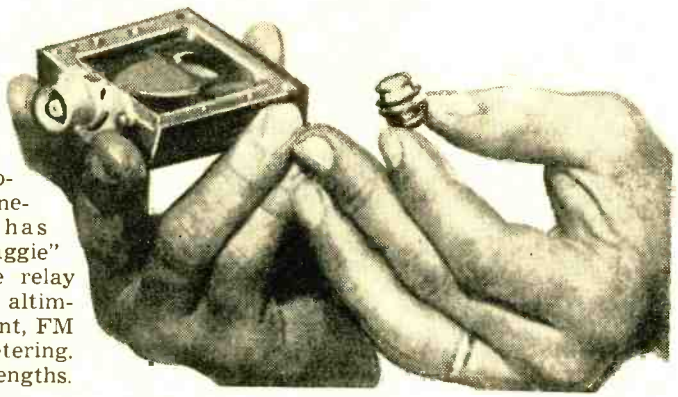


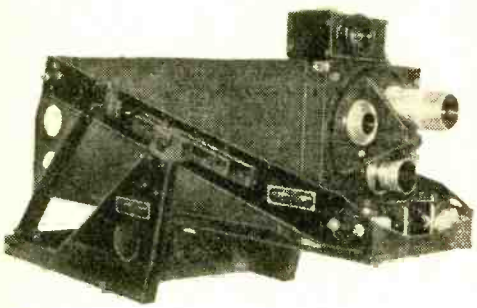
TV Helps Make Jets

ONE MAN does what formerly took two by using TV to line up a jig. The jig guides production workers at Republic Aviation in making identical copies of aircraft subassemblies. In this closed-circuit system, the TV camera automatically "looks" through the telescope while the operator positions the contour plate by lining up the cross-hair patterns as they appear on the screen. The system provides sharper images than most home TV sets. Yet the camera weighs only 5 pounds and the monitor 16 pounds. Both are portable. Money and time are expected to be saved.

New "Maggie"

NEW VERSATILITY for the magnetron—a vacuum tube famous for its use in wartime radar—has been announced by the General Electric Research Laboratory. Discovery of magnetron "voltage-tuning" has extended the use of the "maggie" in new types of microwave relay systems, counter measures, altimeters, electronic test equipment, FM communications, and telemetering. Tubes operate at u.h.f. wavelengths.



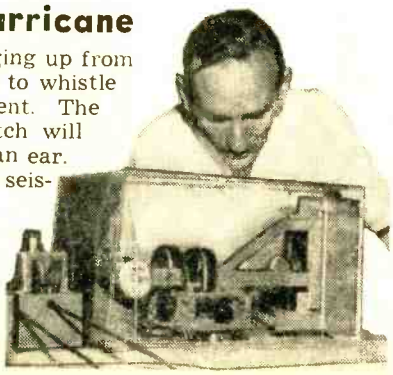


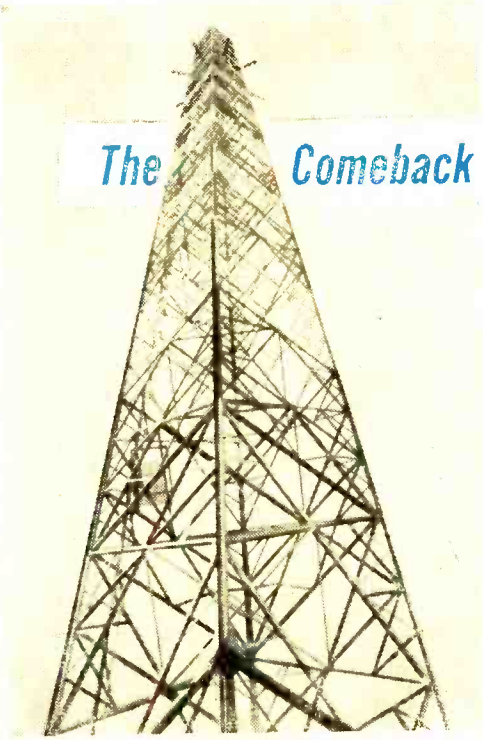
Stratospheric TV on Film

SMALL ENOUGH TO be taken aloft to the stratosphere in a jet aircraft is Philco's new TV camera shown at the left. Two unmanned cameras and transmitters may be used to relay TV pictures from extremely high altitudes to a ground control point. At the receiver, a special system photographs the TV picture onto 35-mm. film. This film can be processed in one minute and then used to project an aerial view on theater-size TV screens to aid in aerial reconnaissance.

Seismographs Adapted to Track Hurricane

WHEN FUTURE hurricanes come whirling and raging up from the Caribbean, the University of Florida is going to whistle at them with the aid of special electronic equipment. The closer they get to the University, the higher in pitch will be the whistle—until it becomes inaudible to the human ear. Source of the whistle is a novel arrangement of two seismographs. Normally used for detecting and recording earthquakes, these devices are being applied to detect and track hurricanes. A pair of the sensitive instruments will act as a team at a fixed station. Several such stations, using triangulation, will locate the hurricane. Shown at right is university professor William F. Fagen, who developed the system.





Antenna installation at the U. S. Naval Radio Station, Annapolis, Md., transmitting component of the U. S. Naval Communication Station in Washington, D.C. Station NSS provides ships at sea and other communications stations with accurate time signals.

The Comeback Trail for Long-Wave DX

By TOMMY KNEITEL

THERE has been an increasing interest shown in "long-wave" DX'ing during the past few months. Have you tried it yet? Perhaps, like many others, you feel that you don't have enough information regarding the activities of stations operating on long wave. It is the purpose of this article to tell the prospective "long-waver" about the various possibilities of this band for DX'ing.

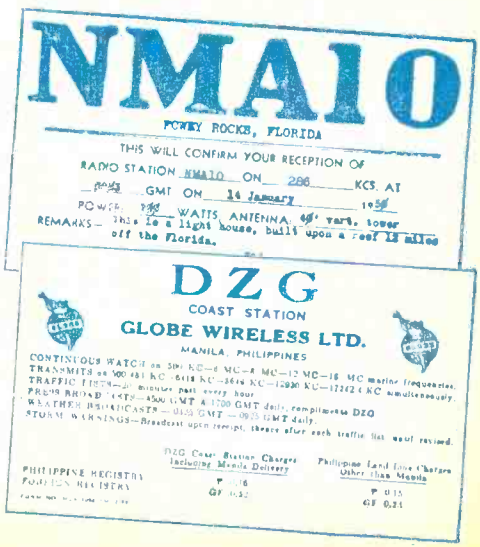
Another obstacle to long-wave DX'ing has been the difficulty in obtaining equipment suitable to the needs of the average DX'er. Construction details on a simple regenerative receiver and a simple converter are scheduled to appear in the November and December issues of POP'tronics. Watch for them!

What You Need to Know. "Long wave" is considered as ranging from 10 kc. to 535 kc. This over-all band is subdivided into segments, each containing stations operating in different communications services. The main divisions of the band are listed in Table 1. Interspaced between 150 kc. and 535 kc. are about eighty-five broadcasting stations located in Europe and Asia.

It must be remembered that most long-wave stations—except broadcasting, of course—use c.w. Even though you will probably be spending most of your long-wave listening hours on c.w. stations, you will be surprised to learn that knowing how to "read" c.w. is not too important. The reason for this is that the majority of stations operating on long wave are radiobeacons, and they are a cinch to copy—with or without a knowledge of c.w.

Radiobeacons are stations that are operated for the safety of ships and aircraft. They transmit a series of intermeshed "A's" (dit dah) and "N's" (dah dit) that sound like one steady tone when you are "on the beam," that is, in a direct line with the signal pattern of the station's transmitter. They identify themselves periodically (about every 30 seconds) with a three-letter "call sign." These letters are transmitted very slowly and can be copied down in the form of actual "dots" and "dashes" for translation from Morse later. Marine radiobeacons, on the other hand, do not transmit the "A-N" signals, but repeat their call sign continuously. A marine radiobeacon's call sign consists of anywhere from one to four letters and/or numbers.

For those DX'ers who are fortunate



Typical QSL cards received from long-wave stations. The top one was prepared by author, filled in and returned by the station he heard.

COMMUNICATIONS SERVICES	FREQUENCIES (kc.)
Radionavigation	10-14
Fixed Public, Coastal and Marine C.W.	14-200
Aeronautical Radiobeacons	200-285
Marine Radiobeacons	285-325
Aeronautical Communications (C.W.) and Beacons	325-405
Radio Direction Finding	410
Coastal and Marine C.W.	415-490
International Calling and Distress	500
Misc. Radiobeacons	510-535

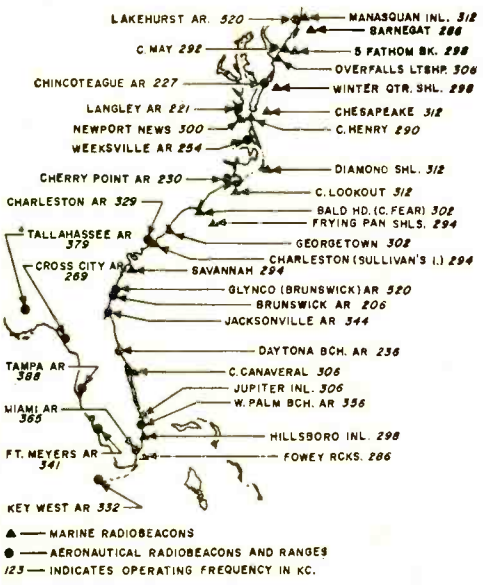
Table 1. Main divisions of the long-wave band.

STATION	FREQUENCY (kc.)	LOCATION
NHK	532	Patuxent River, Md.
NRJ	532	Sanford, Fla.
NSC	532	Brooklyn, N. Y.
NTD	532	Pt. Mugu, Calif.
WN	532	Seattle, Wash.
NSE	530	Milton, Fla.
KB	528	Bermuda
SRF	528	San Rafael, Calif.
WWA	528	Weeping Water, Nebr.
SSC	526	Sumter, S. C.

Table 2. Widely reported long-wave stations.

enough to be able to read c.w., the long-wave band offers unlimited horizons in DX. For example, the International Calling and Distress frequency (500 kc.) offers the possibility of hearing ocean-going vessels and hundreds of coastal stations located in all parts of the world.

One of the most reliable long-wave signals, as far as area covered is concerned, is Station NSS, operated by the U. S. Navy at the Naval Observatory in Washington, D. C. This station provides ships at sea and other communications stations with accurate time signals. NSS's frequency is 121.95 kc. (in addition to five short-wave frequencies). The signals consist of a series of dots transmitted for five minutes preceding each even hour, twenty-four hours a day.



Marine radiobeacons dot the U. S. coast line. Operated for the safety of ships and aircraft, they offer many opportunities to the long-wave DX'er.

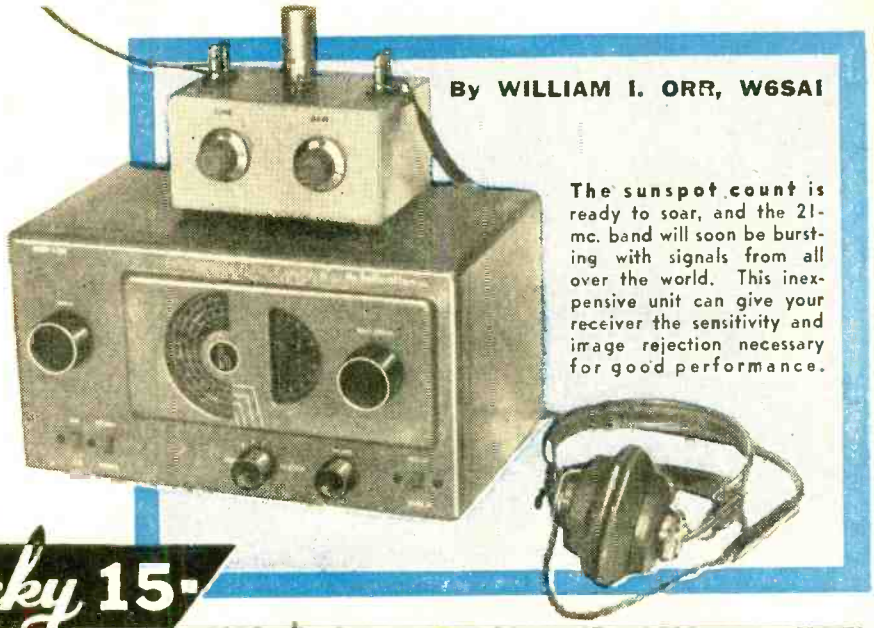
Stations You Can Hear. Information regarding the stations that you will hear on this band is plentiful, provided that you know what the best sources of information are. For those interested in long-wave broadcasting stations, a very accurate list is contained in *Broadcasting Stations of The World, Vol. II,* which may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for $1.25.

The really difficult stations to pin down, and the most fun to DX on, are the radiobeacons. For those intending to pursue this type of DX, there are three publications which are *musts.* The first is *The Airman's Guide,* a list of all U. S. aeronautical radiobeacons. This list is published bi-weekly by the Civil Aeronautics Administration, and is on sale at 25 cents a copy from the Superintendent of Documents. But it's not necessary to get a new edition every two weeks—for DX'ing purposes, any copy printed within six months is sufficient.

The second publication on radiobeacons is *Air Navigation Radio Aids,* a listing of all Canadian aeronautical radiobeacons which is printed every two months by the Department of Transport, Air Services Branch, Ottawa, Ontario, Canada. Finally, there is *Radio Navigational Aids,* issued yearly by The Hydrographic Office, U. S. Navy; this list of all marine radiobeacons throughout the world costs $5.00 and is well worth it.

If you would like to try your hand at DX'ing on the International Distress and Calling frequency, two handy books to keep around are: *List of Coast and Ship Stations,* and *Alphabetical List of Call Signs.* These are both distributed by the Secretary General, International Telecommunications

(*Continued on page* 122)



By WILLIAM I. ORR, W6SAI

The sunspot count is ready to soar, and the 21-mc. band will soon be bursting with signals from all over the world. This inexpensive unit can give your receiver the sensitivity and image rejection necessary for good performance.

Lucky 15-A Preselector for 21 Mc.

You will have more luck on the 15-meter Novice band if you add this simple preselector to your receiver

THE telephone at my elbow rang with a suddenness that made me jump. It was Tommy, the Novice amateur who lived just down the street. I pushed the earphones up over my forehead and said: *"Hi, Tommy! How's DX?"*

"Hi," said Tommy. He sounded as if he had lost his last friend. *"I'm trying to get on the 15-meter Novice band, but I just can't seem to hear any signals. Guess I need a new receiver."*

"Don't sell your receiver short," I replied. *"Those little a.c./d.c. all-band receivers are a lot of radio for the money. As you know, they have no r.f. stage, and the sensitivity of the receiver suffers at the higher frequencies."*

"Isn't there anything I can do?" asked Tommy. *"The sunspot cycle is going up, and 15 meters is going to be hot as a firecracker! Some of the fellows at the club have already worked Africans and Europeans on that band!"*

"Tell you what," I said. *"You hop on over here, and let's talk about this little problem of yours. I think a simple preselector will fix you up. A little radio-frequency amplifier placed ahead of your receiver will improve the sensitivity. In fact, if we're foxy, we can make the preselector work on the 10- and 20-meter bands as well."*

"Right!" shouted Tommy. *"Stand by! I'm on my way!"*

Tommy must have run all the way to my house. It was a brisk five-minute walk for the usual out-of-condition ham like myself. Tommy made it in two minutes flat. He came puffing into the garage workshop with his receiver under his arm. *"Here I am—ready—to—go—to work,"* he panted.

"O.K., Roger Bannister. You sit down and get your wind back, and I'll give you a little lecture about what we're going to do," I replied.

The 11-year sunspot cycle just starting will breathe new life into the higher frequency amateur bands. Dormant for several years, the 21-mc. Novice band is awakening as the sunspot count soars, and will be bursting with signals from all parts of the globe. Hundreds of Novice amateurs, tired of the interference encountered on the 80- and 40-meter bands, are migrating to this exciting portion of the radio spectrum.

Unfortunately, many of the less expensive superheterodyne receivers do not have the sensitivity and image rejection necessary for

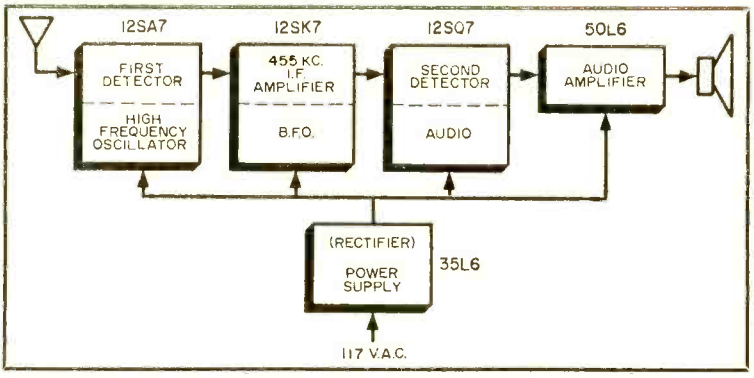


Fig. 1. Block diagram of basic communications receiver. A simple but efficient receiver may utilize only five tubes, three of them performing dual functions. An r.f. amplifier stage can easily be added ahead of the first detector tube.

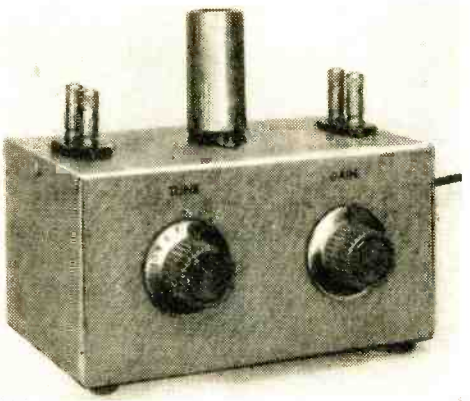
good performance on this band. The addition of a simple, inexpensive preselector will help the performance of such receivers to a great degree.

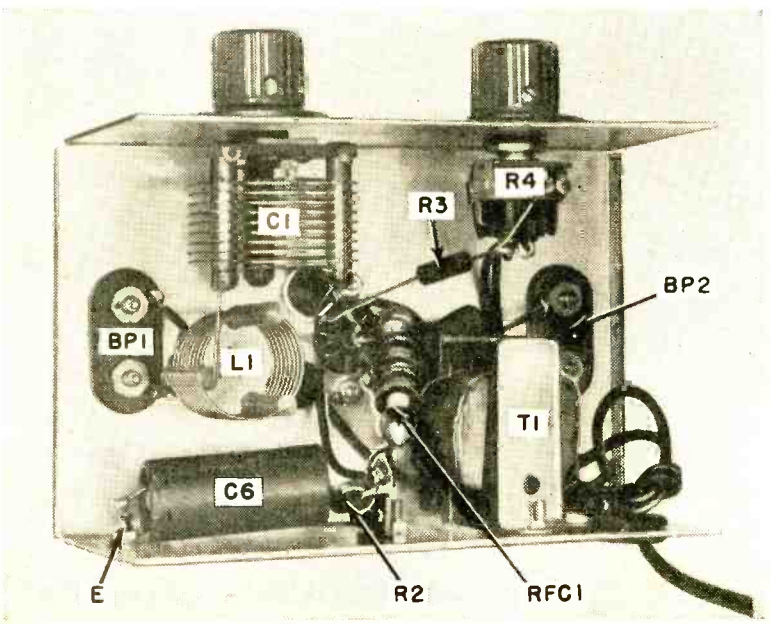
A block diagram of a simple superheterodyne is shown in Fig. 1. This receiver has all the basic components of a good short-wave receiver, but since it is built for minimum cost, it has none of the extras. One of the most important extras that may be easily added is an r.f. amplifier stage ahead of the converter tube. This amplifier works directly on the received signal, boosting it in strength.

A really substantial gain in signal-to-noise ratio of almost any receiver can be made with the addition of such a preselector. Below about 10 megacycles, a preselector stage can be eliminated without too much loss in receiver sensitivity. On the 15-meter band, the r.f. amplifier is a necessity. It is usually an impossible task to place the preselector stage in the receiver, but it may be made up on a small box and mounted atop the receiver.

Jerry was practically jumping up and down with excitement. *"That's for me!"* he cried. *"Where's the circuit? Let's get started on it right now!"*

Shown in Fig. 2 is the schematic of a unit that will provide substantial gain over the 12-mc. to 33-mc. frequency range. A single 6AS8





Placing the preselector stage in the receiver is usually an impossible task, but it can be conveniently made up on a small box and mounted atop the receiver. In this case, it is constructed on a 3" x 4" x 6" aluminum box, as shown above.

Major parts of the "Lucky 15" are identified in under-chassis photo at left. For ease in assembly, the components should be mounted in the order specified in the text.

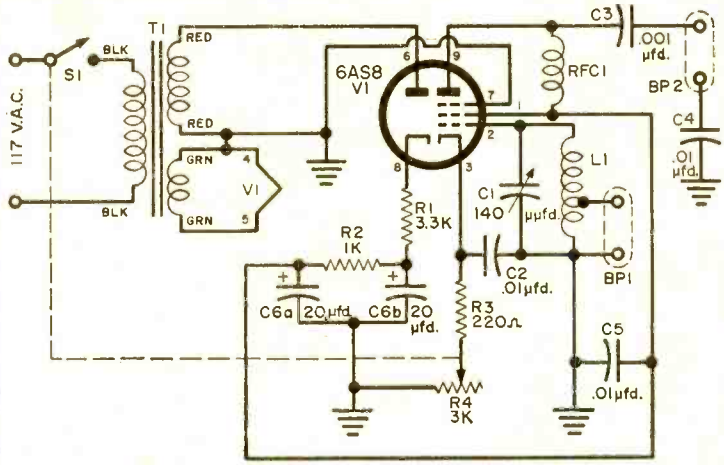
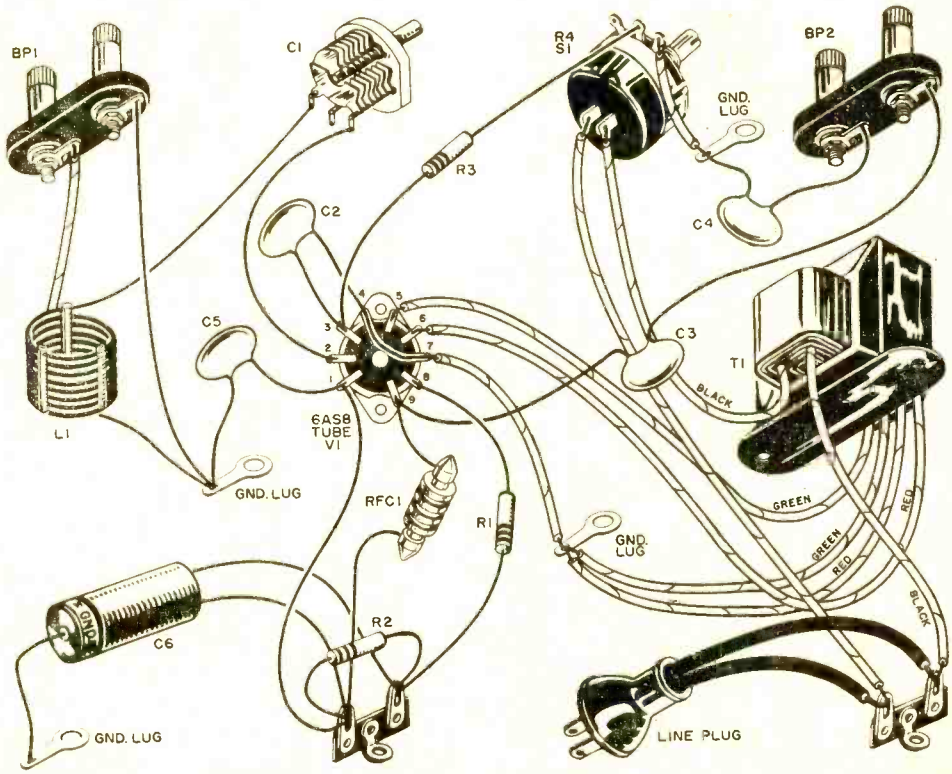


Fig. 2. Schematic diagram of the "Lucky 15." A single 6AS8 multi-purpose tube serves as both r.f. amplifier and power supply rectifier in this unit, which will provide substantial gain over the 12-mc. to 33-mc. frequency range. See parts list below.

$500

BP1—Input terminal strip
BP2—Output terminal strip
C1—140-µµfd. variable capacitor (Bud MC-1856)
C2, C4, C5—0.01-µfd. disc ceramic capacitor (Centralab DD-1032)
C3—0.001-µfd. disc ceramic capacitor (Centralab DD-102)
C6a, C6b—20/20 µfd., 150-volt capacitor (Sangamo MTD-1520)
L1—8 turns of Air-Dux 808T or B&W 3014, 1" long, 1" diameter
R1—3300-ohm 1-watt resistor
R2—1000-ohm, 1-watt resistor
R3—220-ohm, ½-watt resistor
R4—3000-ohm potentiometer (Mallory UM-8)
RFC1—2½-millihenry r.f. choke (National R-100)
S1—Line switch on back of R2 (Mallory US-26)
T1—Power transformer, 125 volts at 15 ma., 6.3 volts at 0.6 amp. (Stancor PS-8415)
V1—6AS8 tube
1—3" x 4" x 6" aluminum chassis (LMB #141)
2—Two-terminal phenolic tie-point strips (ICA 2435)



Pictorial diagram shows how the components of the preselector are interconnected.

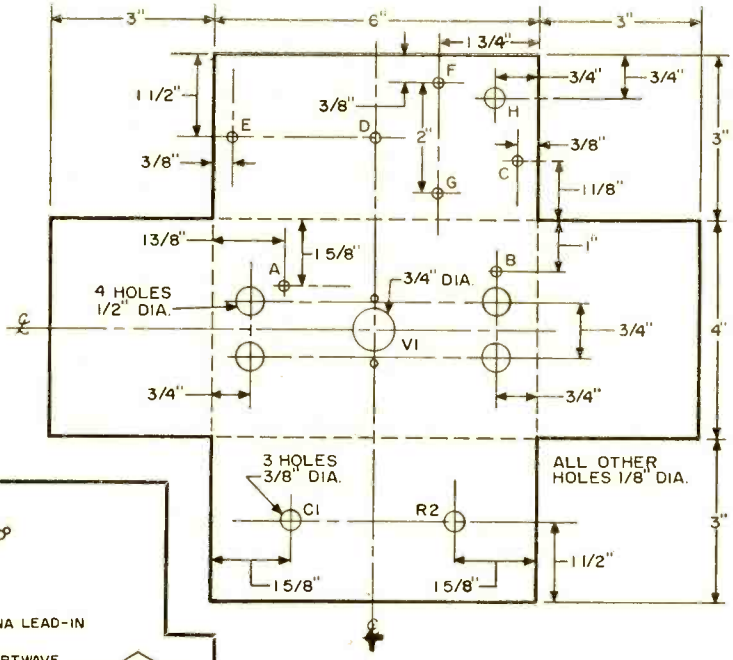


Fig. 3. Top view of chassis layout. All circuit grounds are made to the chassis by means of soldering lugs and lock washers placed beneath 6-32 nuts holding the various components to the chassis.

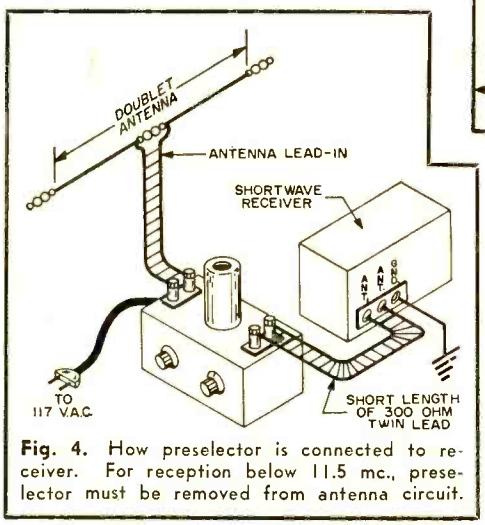


Fig. 4. How preselector is connected to receiver. For reception below 11.5 mc., preselector must be removed from antenna circuit.

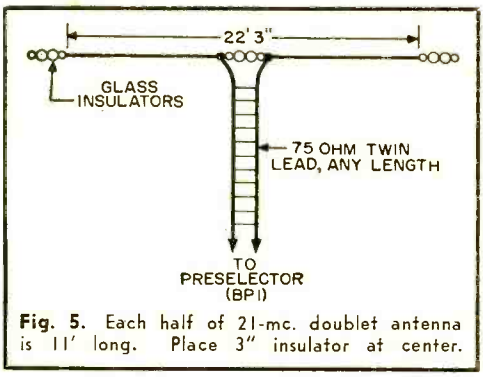


Fig. 5. Each half of 21-mc. doublet antenna is 11' long. Place 3" insulator at center.

multi-purpose tube serves as both r.f. amplifier and power supply rectifier.

The preselector input circuit, composed of *L1* and *C1*, is tuned to the listening frequency. The amplified signal is taken from the untuned plate circuit of the pentode section of the 6AS8 and coupled to the input circuit of the receiver. A good impedance match can be obtained over the complete tuning range of the preselector.

Gain of the preselector is controlled by the bias potentiometer *R4* in the cathode circuit of the amplifier stage. When loud signals are received, the control may be retarded, preventing the receiver from being overloaded. The switch on the back of the volume control serves as a line switch for the power supply of the preselector.

The diode section of the 6AS8 is utilized as a half-wave rectifier to supply plate voltage for the other half of the tube. A simple and inexpensive *RC* filter network is used to smooth the voltage obtained from the diode rectifier.

"Why can't we steal a bit of power from the receiver to run the preselector?" asked Tommy.

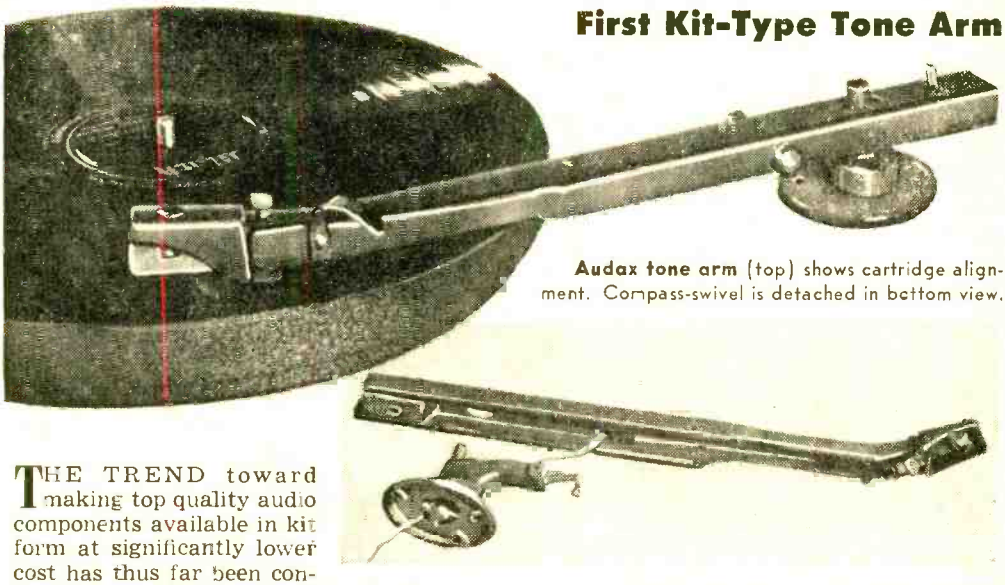
"Most small receivers like yours are a.c./d.c. sets, and it's very difficult to obtain the correct voltages when such a supply is used. The filaments of this kind of a receiver are connected in series across the 117-volt line, and it would be very hard to introduce another tube filament in such a series circuit," I replied.

"Righto!" said the Young Novice. *"Now, let's put this thing together!"*

The preselector is constructed upon a 3" x 4" x 6" aluminum box (LMB-141) which is drilled as shown in Fig. 3. All circuit grounds are made to the chassis by means of soldering lugs and lock washers placed beneath *6-32* nuts holding the various components to the chassis. Placement of the major parts may be seen in the under-chassis photograph. For

(*Continued on page* 110)

First Kit-Type Tone Arm



Audax tone arm (top) shows cartridge alignment. Compass-swivel is detached in bottom view.

THE TREND toward making top quality audio components available in kit form at significantly lower cost has thus far been confined to amplifiers and to loudspeaker enclosures. Now, one of the pioneers of high-quality audio equipment, the Audak Company, for the first time is applying the do-it-yourself kit principle to tone arms.

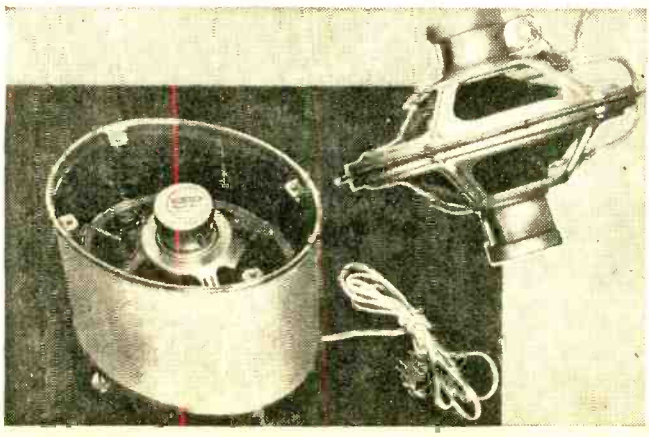
The new Audax tone arm kit contains only three parts which are quickly and simply assembled into a complete professional-type arm. The whole job takes less than 10 minutes and no tools are needed other than a nail file or a small screwdriver. A mounting template is furnished.

The new kit exactly duplicates the famous Audax transcription arm, long recognized as a leading design. Its rotating section seats over the pivot like a compass needle. This single-point contact minimizes the lateral drag of the arm, making it easy for the stylus to wander from one record groove to the next. At the rear of the arm, a sliding counterweight with a calibrated scale permits adjustment of any desired needle pressure.

Special care has been given to the design of the exchangeable pickup heads. The cartridge sits in the arm with its sides exposed, so that its correct alignment can be checked at a single glance. Wiper-type cartridge contacts provide assurance of good conductivity for the weak pickup currents and hence good signal-to-noise ratio. Problems of tracking, resonance damping, and vertical compliance have been carefully worked out.

Since the arm is balanced by the distribution of its own weight rather than by springs, it is immune to fatigue and assures constant needle pressure at all times. Retailing at less than $15.00, the new tone arm kit offers quality at a bargain price. The manufacturer is the Audak Co., 500 Fifth Ave., New York, N. Y.

Remote Speaker Adds Space Effect



FACE-TO-FACE speakers in a wicker cage (top off) are furnished with Grundig radios to provide omni-directional spread of mid-range and treble sound. Placing the unit at a small distance from the main radio set provides a 2-point sound source with quasi-stereo effect. Woofer is housed inside the radio receiver. This neatly brass-trimmed wicker cage is imported by Majestic Radio Co., Brooklyn, N. Y.

By HERBERT REID

How to Buy Your hi-fi Tuner

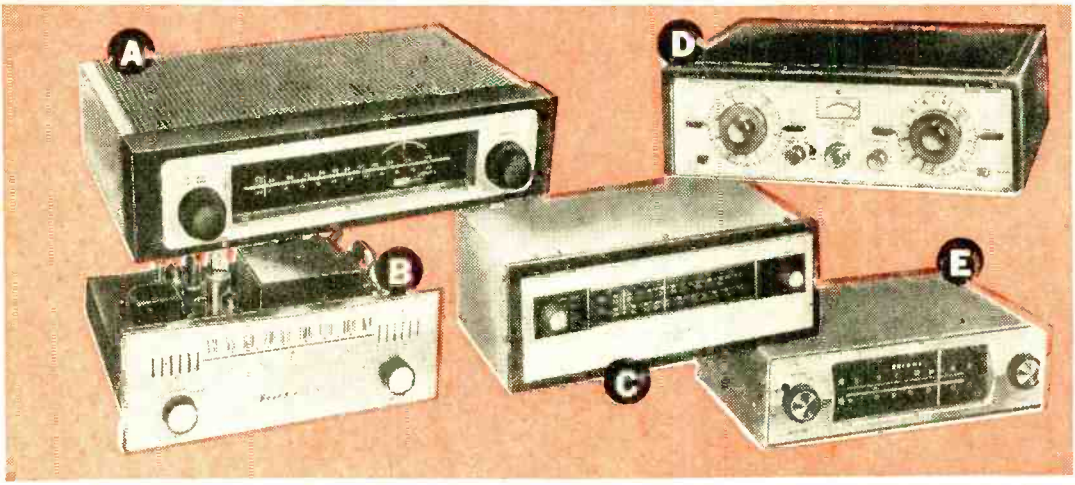
THE ELECTRONIC AGE literally put music in the air—and the best way to get it out is through a hi-fi tuner. A tuner brings in your favorite programs through your hi-fi system with a tonal quality no ordinary radio receiver could match. FM in particular offers the kind of programs and tone quality to delight any audio fan. In many parts of the country, special FM stations have sprung up to satisfy the musical taste of our growing hi-fi population. From symphonies to show tunes and opera to jazz, your FM tuner dips into an airborne stream of music, bringing you a far wider choice of musical selections than you could possibly afford on records or tape.

Yet music reproduction is not the sole reason for FM. News, sports, and drama also gain impact and realism from FM's higher fidelity. The crisp treble of a speaking voice, standing out boldly against the velvet silence of the noise-free FM background, tightens the suspense in *Dragnet* or, by ultimate fidelity, jerks another tear from *John's Other Wife*.

What Is a Tuner? A tuner is essentially a radio receiver without an audio section. It uses your present hi-fi amplifier and loudspeaker to amplify and reproduce the broadcast. It lets you take advantage of the full power and range of your hi-fi system rather than depend on the puny amplifiers and weak-kneed, unbaffled speakers which usually mar the performance of commercial-type radio receivers. The output of the tuner simply plugs into your amplifier, letting you use all your usual hi-fi volume and tone controls for radio reception as well as for records.

Unlike ordinary radios, good FM tuners are built to hi-fi standards. A top-notch tuner equals the quality of a good amplifier and speaker. With such equipment, radio reception need no longer be the bottleneck in your sound system. Now you can pick music from the air as clean and vibrant as you ever heard from records or tape. There is no longer any theoretical limit to the sound quality transmittable by radio. The results you get from a tuner can be as good as (but no better than) the amplifier or loudspeaker it feeds into.

The Rise of FM. This great technical achievement was largely the work of one man: Major E. H. Armstrong, who invented FM more than twenty years ago



Each hi-fi tuner shown here represents a different type. (A) is Harman-Kardon's Model FM-100, known as the "Counterpoint II." It features FM only, employs a full and highly sensitive Armstrong circuit, and uses the tone controls of the associated amplifier. Only tuning control, variable a.f.c. and a "squelch" control for silencing noise between stations are provided on the tuner itself. The high performance is matched by high styling in black and copper. (B) is Bogen's AM-only tuner, designed to bring higher fidelity to AM reception where no FM programs are available. This unit features variable AM bandwidth. (C) is Pilot's FA-540 FM-AM combination tuner which features a new type of cathode beam tuning indicator. (D) is a Scott AM-FM tuner incorporating a new type of wide-band circuitry and a full set of controls. Only a control-less power amplifier is needed in conjunction with this unit. (E) is Allied Radio's "Bantam" Knight AM-FM tuner in neat "pancake" styling, which provides clear reception at low cost. Most firms make several tuner types to suit the needs of various kinds of hi-fi installations.

and spent his health and fortune to fight for acceptance of his invention against the opposition of the broadcasters. Trying to protect their investment in already existing low-fidelity AM equipment, the broadcasters held back on FM development. The public, yet unaware of the pleasures of hi-fi, was indifferent. Only recently the broadcasting industry, sniffing the hi-fi trend, realized that enough people now care about good sound to make FM broadcasting profitable. Many major network outlets operate on both AM and FM, and independent FM stations with programs tailor-made for hi-fi are springing up in the larger cities.

AM vs. FM. There is no conflict between these two basic methods of broadcasting. Each suits its own purpose. AM spans longer distances and thus makes it possible to cover wide areas with a minimum number of broadcasting stations. This is the reason why the major networks rely chiefly on AM transmitters to reach all parts of the country. FM operates at much higher frequencies, where the distance range, as in television, is limited to slightly beyond the optical horizon.

But when it comes to fidelity, FM is so far ahead that AM is clear out of the running. FM owes its decisive lead over AM in the high-fidelity sweepstakes to a whole batch of complex physical principles having to do with sidebands, amplitude limiting, linear detector stages, and the basic laws of high-frequency radiation. Some of this we'll try to make plain in a separate article. For the present, let's take stock of the net results, leaving the causes for some other time.

FM, the new challenger, wins the hi-fi championship from old-timer AM by a technical decision on the following points: *(1) Wide frequency range to 15,000 cps, (2) No static and noise, (3) No interference between adjoining stations, (4) No fading, (5) Greater dynamic range, i.e. greater spread between soft and loud extremes, (6) Minimum distortion, (7) Uniform quality of reception at any time of day or night and in any kind of weather.*

Pick Your Tuner Type. You'll find price tags on tuners ranging from about $60 to $175. The higher priced tuners represent the ultimate in radio circuitry. However, many tuners in the $60 to $90 class do an excellent job, except in fringe areas of FM reception. For such locations it might be better to get a more sensitive and therefore more expensive tuner. Yet even in fringe areas, a lower priced tuner might work well with a well-placed outdoor antenna.

You can buy three basic kinds of tuner: FM only, AM and FM combined, and AM only. The choice depends on the programs available in your area, as well as your listening habits. For people living in places

with a wide choice of FM programs, the FM-only tuner suffices. Where no FM is available at all, get an AM-only tuner. Though AM necessarily lacks ultimate fidelity, a good AM tuner played through your hi-fi system is bound to bring you a truly startling improvement over ordinary radio reception. Thanks to carefully designed wide-band circuitry, such a tuner can give you a significantly wider frequency range and lower distortion even on AM. If in your area or in your mind there is no clear-cut exclusive choice between AM and FM programs, get a combination AM and FM tuner. It may cost a little more, but it lets you literally make the best of both.

Check Points. Decide where you want the controls. If your amplifier or preamplifier already has a full set of controls (volume, treble, bass, etc.), you can buy tuners with only a tuning knob and an ON-OFF switch. You just plug the tuner into your amplifier and then you use the knobs on your amplifier to control the sound of the incoming radio programs. Yet if your amplifier has no controls, you can get tuners with all the necessary control facilities built in. In those models, the controls on the tuner also work for the phonograph, tape recorder, or whatever additional program source you may use in your hi-fi system.

In picking out a tuner, keep in mind the following important points.

YARDSTICK FOR FM QUALITY

The performance of a tuner is pretty well spelled out in its specs. Look for these factors and figures as minimum requirements.

Sensitivity
5-10 microvolts for 30-db quieting in strong signal areas.
3-5 microvolts for 30-db quieting in weak signal areas.

A.F.C.
Should be provided and should have special cutout switch.

Drift
Should not drift from station after 1-2 minute warm-up.

Frequency Response
30-15,000 within ±1 db.

Distortion
No more than 1% at full output (1 volt).

Hum
50 db below full audio output.

Output
At least 1-volt tuner output is needed to drive the amplifier of your hi-fi system. Cathode follower stage should be provided if tuner is to operate far away from amplifier.

(1) *Sensitivity.* For FM, sensitivity is stated as the number of microvolts of signal strength required for a certain amount of "quieting." Quieting is the action by which an FM tuner cleans the signal of noise and static. Only if the signal of a given station exceeds the stated microvolt limit at the receiver input will the tuner bring in that station clearly. The lower the stated microvolt figure, the more sensitive is the tuner.

For AM tuners, a sensitivity of about 5 microvolts to produce the rated output (usually 1 volt) at a 20-db signal-to-noise ratio is considered a very good standard. Extremely sensitive AM tuners will even pull in stations with a signal strength of only 2 microvolts.

(2) *A.F.C.* This stands for Automatic Frequency Control. It is a circuit by which the tuner "locks" itself firmly to the frequency of the FM station you have tuned in. Since most FM receivers have some tendency to drift away from the frequency to which they are tuned, this circuit is needed to assure that your tuner "hangs on" to the station you selected, keeping reception steady. Every good FM tuner should have a.f.c. However, a special "a.f.c. defeat" switch should be provided for cutting out the a.f.c. circuit to let you tune "by ear" those stations which are too close to a strong neighboring station to be distinguished from it by the automatic circuit.

(3) *Tuning Meter.* This is not a necessity, but it certainly is a convenience. This meter lets you "zero in" on a station when you dial. Either a cathode-ray indicator or a swinging pointer tell you just when you got your station "on the nose." The meter itself, of course, has no direct effect on sound quality. Yet it assures accurate tuning, which is a vital factor in getting the full frequency range of the signal free of noise and distortion. Without such a meter, precise tuning takes a practiced hand and ear.

(4) *Cathode Follower Output.* This circuit contributes nothing to the operation of the tuner as such; it merely changes its output to a low impedance. This permits the use of long connecting lines between tuner and amplifier without danger of hum pickup or loss of high frequencies. If you are planning to place your tuner and your amplifier far apart (maybe a tuner with controls next to your easy chair and the power amplifier stashed away in a corner or under a sofa), you definitely need a cathode follower output. If tuner and amplifier are to stay close together on the same shelf or rack, you can do without this feature.

(*Continued on page* 98)

Transistor Topics

By LOU GARNER

WHAT'S in a name? That which we call a rose, by any other name would smell as sweet..... Romeo and Juliet.

Had Bill Shakespeare been able to see the volume of mail received by your columnist as a result of asking for a "name" for transistor experimenters, he probably would have hesitated to write those famous and oft-quoted lines. As you know, we've been trying to find a name for transistor enthusiasts that would be as good as *ham, SWL, audiophile,* or the "handles" attached to other enthusiasts. As a start, we mentioned *transistor tinkerers* . . . now we have dozens to choose from, suggested in your letters, notes, and post cards. Here is a small sampling:

TRANSTINKERS . . . suggested by Leo Remington, of 2934 N. W. Thurman, Portland 10, Oregon, as a logical combination of the words "transistor" and "tinkerers."

TRANSITECH and *TRANSTECH* . . . from Jeff Duncan, 1445 East Seventh St., Plainfield, N. J. . . . either word as a shortened version of "Transistor Technician."

TRANTHUSIAST . . . by Bill Hillgrove, 4911 Rosetta St., Pittsburgh 24, Pa., who has shortened the phrase "Transistor Enthusiast."

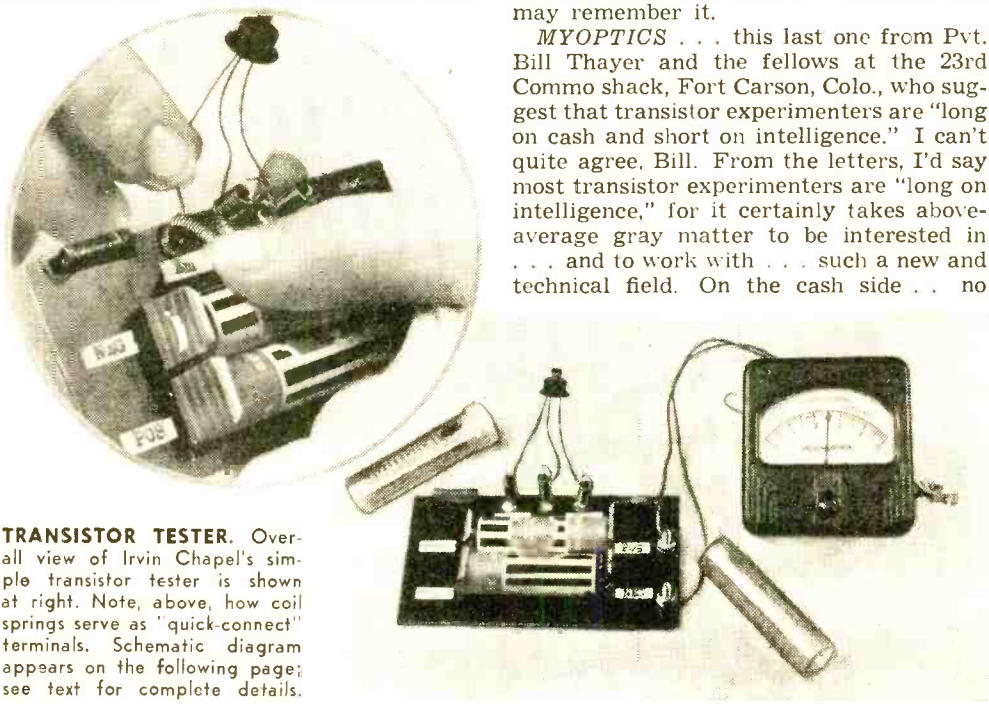
GERMANIAC . . . dreamed up by Jon Holzman, 2706 Moorgate Rd., Dundalk 22, Md., based on the fact that many transistors are made from germanium, and that a really enthusiastic person can be called a maniac.

TRANSISTOR PERSISTORS . . . suggested by Julian Pratt, 35-16 34th St., Astoria 6, N. Y., who *persists* at trying *transistor* circuits.

TRANS-SITTERS . . . from Ron Smith, 567 Harrison, St. Paul 2, Minn. We're not sure how Ron dreamed up this one . . . perhaps as a combination of "transistor" and "baby-sitter"?

TRANSISTOR PIONEERS . . . from Frank Seidita, 268 Degraw St., Brooklyn, N. Y. We published one of Frank's "pet" circuits some time back . . . perhaps you may remember it.

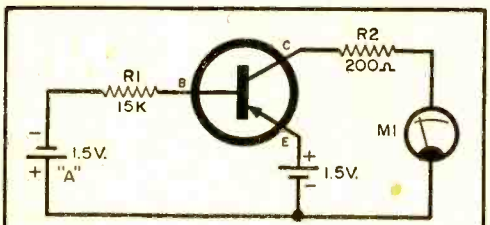
MYOPTICS . . . this last one from Pvt. Bill Thayer and the fellows at the 23rd Commo shack, Fort Carson, Colo., who suggest that transistor experimenters are "long on cash and short on intelligence." I can't quite agree, Bill. From the letters, I'd say most transistor experimenters are "long on intelligence," for it certainly takes above-average gray matter to be interested in . . . and to work with . . . such a new and technical field. On the cash side . . no



TRANSISTOR TESTER. Overall view of Irvin Chapel's simple transistor tester is shown at right. Note, above, how coil springs serve as "quick-connect" terminals. Schematic diagram appears on the following page; see text for complete details.

comment! Of course, we all know that Bill is just "poking fun" . . . and he who can't laugh at himself is in pretty poor shape . . . to misquote an old proverb.

Readers' Circuits. Readers frequently write in to ask why we seldom feature circuits requiring more than one or two transistors. There are good reasons . . . in most cases, we feel that the more complex circuits are worthy of a "full treatment" as a feature article. Then, too, we find that many experimenters like relatively simple circuits that can be wired and checked in a few



Circuit diagram of Irvin Chapel's transistor tester, described at right, gives essential parts values and shows electrical connections.

minutes . . . and circuits requiring a minimum cash outlay for parts. Finally, simple circuits are best for beginners . . . not only as far as wiring is concerned, but also from a trouble-shooting viewpoint. Mistakes in wiring, defective parts, or other troubles are easier to spot.

Simpler and Simpler! In our July column, we published an extremely simple receiver circuit suggested by author-reader Matthew Mandl . . . we closed with a question, asking if anyone could think of an even simpler circuit. Answer? *And how!!!*

Four of the many circuits submitted are shown in the diagram at right. All use a single transistor, an antenna, a pair of headphones, and a ground. Almost any transistor (either *n-p-n* or *p-n-p*) is satisfactory. Headphones should be moderate to high impedance (1000 to 8000 ohms). In general, a good-sized external antenna is required. For best results, the antenna length is adjusted experimentally to pick up the strongest local station with maximum volume. Sensitivity is approximately the same as that of a crystal receiver.

Readers suggesting these circuits include: Frank Seidita (Brooklyn, N. Y.); Bill Stanley (Pittsburgh, Pa.); David Ditmer (Clayton, Ohio); Tom Oosterhout (Holland, Mich.); and Ronald O'Neal (Delhi, La.).

Transistor Tester. We've received the circuit for a simple transistor tester from reader Irvin C. Chapel, 602 S. Christine Rd., Wichita, Kansas. The schematic diagram at the left gives essential parts values and shows electrical connections, while one of the photographs on page 61 shows Irvin's model in use.

Referring to the schematic, a fixed base current is applied to the transistor by two penlite cells . . . through *R1*. The collector current is indicated on a milliammeter (*M1*), protected by series resistor *R2*. The base bias current is limited to 100-200 microamperes by *R1;* the collector current will be higher, varying with the gain of the transistor, and the meter's reading is thus proportional to gain. Typical "experimenter's" transistors give collector current readings ranging from about 1 milliampere up. A very low collector current reading indicates a low-gain transistor.

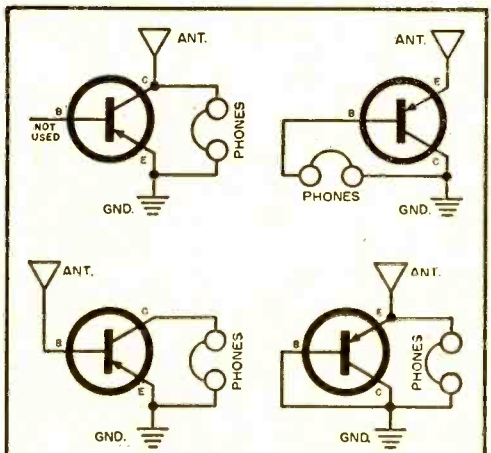
Construction is quite simple. Irving assembled his unit on a small Formica board, using eyelets for terminal connections. The spring wire clips used as "quick-connect" terminals are cut from small coil springs and soldered into eyelets on the board. Resistors *R1* and *R2* may be ½-watt units. The meter is an 0-5 ma. unit.

With the circuit connections shown, the instrument should be used to *check only p-n-p transistors.* To check *n-p-n* units, *reverse* the polarity of meter and battery leads.

Product News. From Argonne Electronics Mfg. Corp., 27 Thompson St., New York 13, N. Y., comes news of several additions to its line. More transistor transformers have been added, bringing the total to 77 different types. These miniature units are available from most distributors at under $3.00 each.

Another new Argonne item is the Type AR-88 *3-gang* Poly-Vari-Con variable ca-

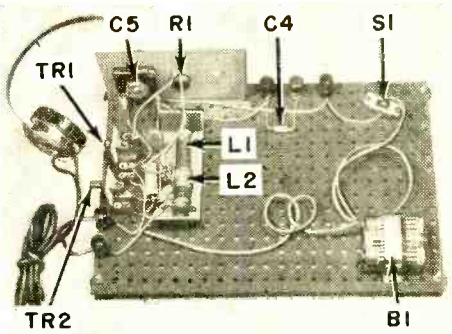
(*Continued on page* 122)

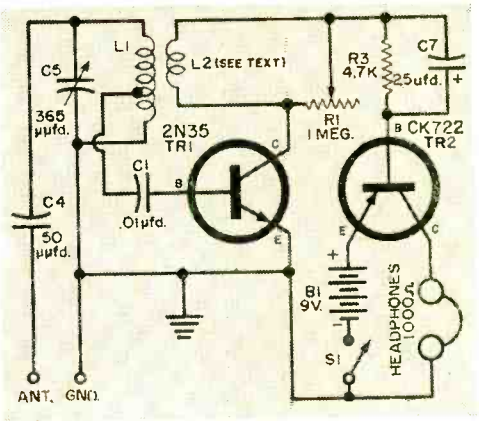


Four simple receiver circuits suggested by our readers. Details are discussed in text at left.

Transtopic Experiment No. 11

High-Gain Regenerative Receiver





IN THE MARCH and April issues, POP'tronics published a two-part series on simple transistor projects. The idea behind it we felt would appeal to most experimenters—practical construction projects which used essentially the same parts over and over again. Part 1 discussed some introductory projects using a single type 2N35 *n-p-n* junction transistor. In Part 2, we added a type CK722 *p-n-p* transistor, plus a few additional components, and discussed more advanced practical circuits.

We plan to continue this series and publish a new project each month using the same two transistors. Here is Project No. 11. Before starting, be sure to review the "Wiring Hints" given in the April issue (page 56). The circuit in the wiring schematic represents a combination of the *regenerative* receiver described in Part 1 with the two-stage *high-gain* receiver in Part 2. It provides more gain than either circuit alone and will pick up strong nearby stations.

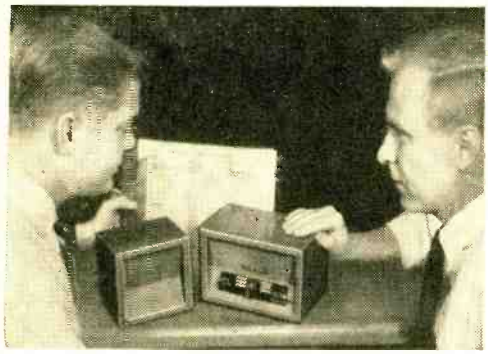
Regenerative feedback winding *L2* consists of about 12 turns of ordinary hookup wire between the middle and "GND." end of the antenna coil *L1*.

Listening to the headphone, adjust regeneration control *R1* over its range. At some point, a signal—either a low-frequency "putting" sound or an audio tone—should be heard. If you fail to receive such a sound, reverse connections to *L2*. Maximum sensitivity is obtained when *R1* is set to just before the point at which a putting sound or tone is heard.

In operation, radio signals are coupled through *C4* to the *C5-L1* resonant circuit, where the desired station is selected. The signal passes through capacitor *C1* to the base-emitter circuit of *TR1*, where both amplification and detection take place. The r.f. portion of the amplified signal is coupled from *L2*, in the collector circuit of *TR1*, back to *L1*, increasing the gain of the stage.

Regeneration control *R1* shunts feedback coil *L2* and determines the amount of regeneration. As the value of *R1* is reduced, r.f. energy is bypassed around *L2*, reducing the amount that is coupled back to *L1*. The audio portion of the detected signal passes through *L2* and is coupled through *R3*, bypassed by *C7*, to the base-emitter circuit of *TR2*. The amplified audio signal in the collector circuit of *TR2* drives the 'phone.

—Louis E. Garner, Jr.



Tape Aids Radio Broadcasts

SINCE the inception of professional magnetic tape recorders about ten years ago, the American broadcasting and recording industry has utilized to the full the versatility, endurance, and adaptability of these instruments.

A typical example is Station WBAY, CBS affiliate in Green Bay, Wis. This station uses seven Magnecord M-90 recorders. Five are rack-mounted on a panel within reach of the operator (photo above). The other two are used as portables: one for on-the-spot interviews and the other for pre-taping of programs to save time and smooth out pre-broadcast "program bugs." All seven may be operated by remote control.

Transistorized Intercom

THE FIRST INTERCOM to use printed circuits and transistors has been developed by the Teletalk Division of Webster Electric Co., Racine, Wis. An experimental model (at left) is said to have very high power output. Plans to set up production are under way, according to company spokesmen.

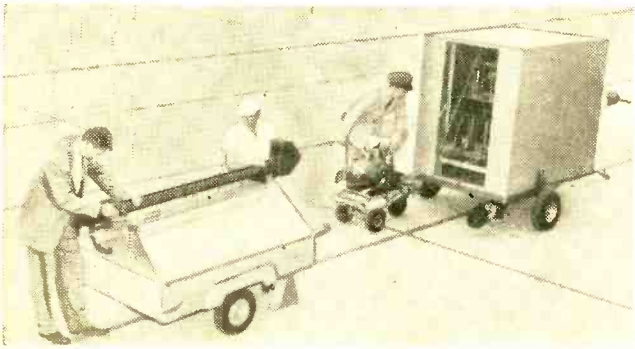
The model shown is a six-station system enclosed in a case measuring only 5" by 4" by 7". Because of the use of simplified circuits and the transistors, the new intercom requires smaller components such as resistors, capacitors, and transformers. It uses less power and generates less heat than conventional intercoms, yet boasts good sensitivity, sound pickup, and reproduction.

Webster plans to use transistors and printed circuits in all of its intercom systems ranging from 2 to 500 stations.

Magnetic Detective

ASSEMBLY-LINE automation appears to have moved a step closer to actuality with the development of a new switch by engineers at Minneapolis-Honeywell's Doelcam Division, Boston, Mass. Using no moving parts, the switch is effectively a "magnetic detective," keeping tabs on components as they move along the assembly line. The first application will be on 1956 engine block manufacture for the Ford Motor Co. Ford has purchased 2000 of them.

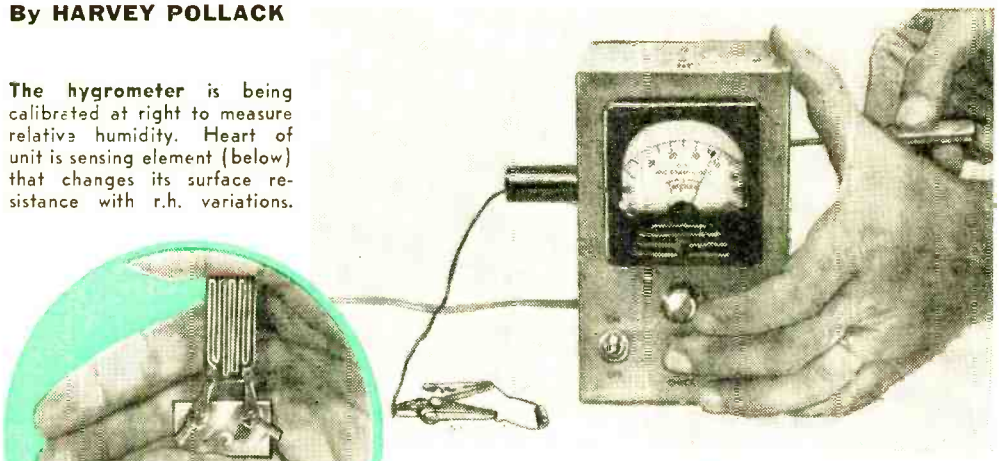
The switch, shown as it is assembled in the photo at right, can shut down the entire assembly line if it detects an error in parts or in assembly.



Runway Profiles

A VEHICLE that takes a statistical picture, or "profile," of an airplane runway is expected to reduce damage to aircraft caused by vibration in take-off. Built at Wright Air Development Center, it projects a light beam and records its distance to the runway surface. A computer then plots the curve or runway "profile" which reveals danger spots on runways.

By HARVEY POLLACK



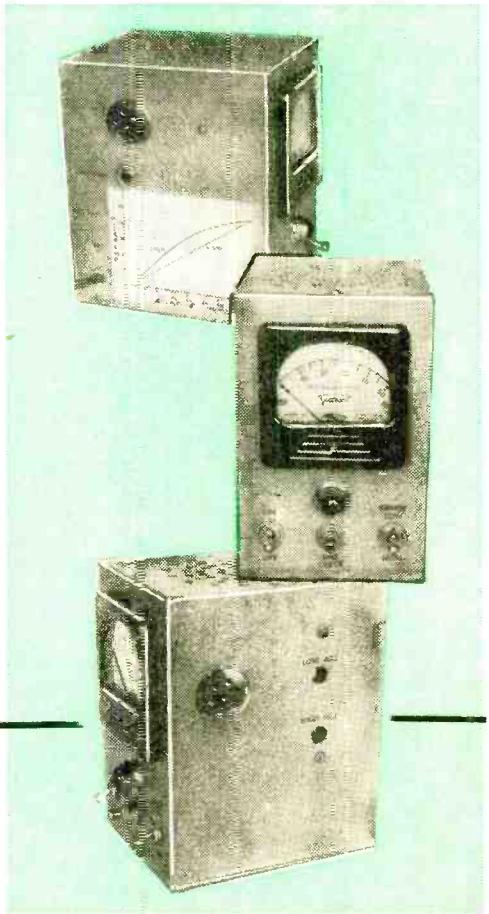
The hygrometer is being calibrated at right to measure relative humidity. Heart of unit is sensing element (below) that changes its surface resistance with r.h. variations.

Build an All-Electronic Hygrometer

A NEW PLASTIC humidity sensing element now makes it possible for you to build an electronic hygrometer for measuring relative humidity (r.h.). It can be used in your home, outside the house, in the egg incubator, in your refrigerator or freezer, or any other place where air moisture is significant. It combines the convenience of a hair hygrometer with the accuracy of the wet-and-dry bulb thermometer.

The photographs picture a double-scale instrument capable of reading r.h. from 30% to 100% on one scale, and from about 15% to 32% on the second scale. A simpler version involving only one scale with a range from 30% to 100% r.h. is shown in Fig. 2. You can determine for yourself which version will fill your needs better by deciding on the maximum and minimum readings you are likely to encounter. The heart of the instrument is a new El-Tronics sensing element which changes its surface resistance with variations in relative humidity.

Construction. Like any other electronic device, the hygrometer may be built into any one of a large variety of housings. Keep in mind that since moisture is air-



Three separate views of the author's model. The sensing element is inside the metal case and provision has been made to plug in a second element for external use. Note the vent plugs on both sides of the case, and the many small holes drilled in the top and bottom of the housing which are essential for quick and reliable action.

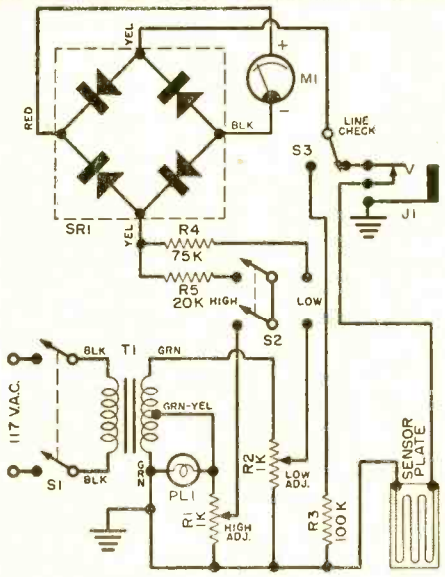
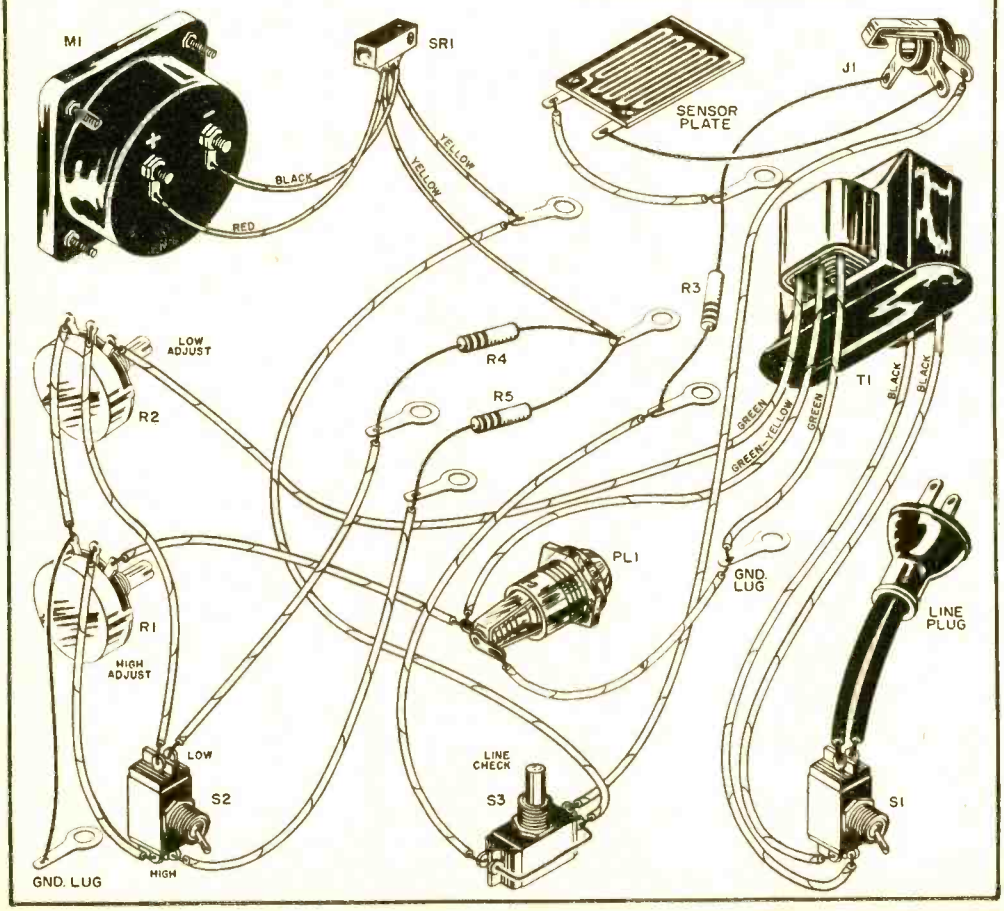


Fig. 1. Two-scale hygrometer circuit. Parts list appears at right and pictorial diagram below.

J1—Phone-plug-type jack, 2-circuit, shorting type
M1—0-50 microampere d.c. meter, 3" face (Triplett Model 327-T)
PL1—Green jewel pilot assembly
R1—1000-ohm, ½-watt potentiometer, linear taper
R2—1000-ohm, 1-watt potentiometer, linear taper (Centralab Radiohm Type A101, Taper 1)
R3—100,000-ohm, ½-watt, 5% resistor
R4—75,000-ohm, ½-watt, 20% resistor
R5—20,000-ohm, ½-watt, 20% resistor
R6—3700-ohm, ½-watt, 5% resistor plus assorted resistors for calibration
S1—D.p.s.t. toggle switch
S2—D.p.d.t. toggle switch
S3—S.p.d.t., spring-operated, push-button switch
SR1—Bridge-type rectifier for instruments (Conant Labs Series 160B, yellow code)
T1—12.6-volt transformer, c.t. at 6.3 volts (Thordarson 26F67—for single-scale version, the 6.3-volt center tap is unnecessary)
SENSING ELEMENT—El-Tronics plastic sensor supplied with resistance vs. r.h. curve (available from Allied Radio or Lafayette Radio—not from the manufacturer)
1—Standard phone plug
1—6" x 4" x 5" aluminum cabinet, grey hammertone, channel lock construction (ICA 29420)
Misc. graph paper, vent plugs, hardware, solder, wire, solder lugs, small sheet of Lucite (or Bakelite or polystyrene)



borne the sensing element must have free access to circulating air currents.

Your El-Tronics sensing element is accompanied by a graph which shows how its resistance varies with changing humidity. Before beginning construction, refer to this curve and read off: (1) the resistance of your particular element at 100% humidity, and (2) its resistance at 32% humidity. You will probably find the values to be about 4000 ohms and 100,000 ohms respectively. Use resistors with 5% tolerance or better.

Prepare the housing by drilling and punching all the necessary openings. A Greenlee No. 730-M meter punch (2-25/32" hole) is good for cutting the meter hole.

Note that no chassis is used. The calibrating potentiometers are mounted on a small plate of aluminum secured at the proper distance from the side of the case by long *6-32* machine screws and nuts. Resistors *R3, R4* and *R5* and the meter rectifier *SR1* are supported on a small plate of Lucite, which in turn is held in place by the meter terminal nuts. The sensing element is mounted on a second small plastic plate fastened to the side of the case near one of the vent plugs.

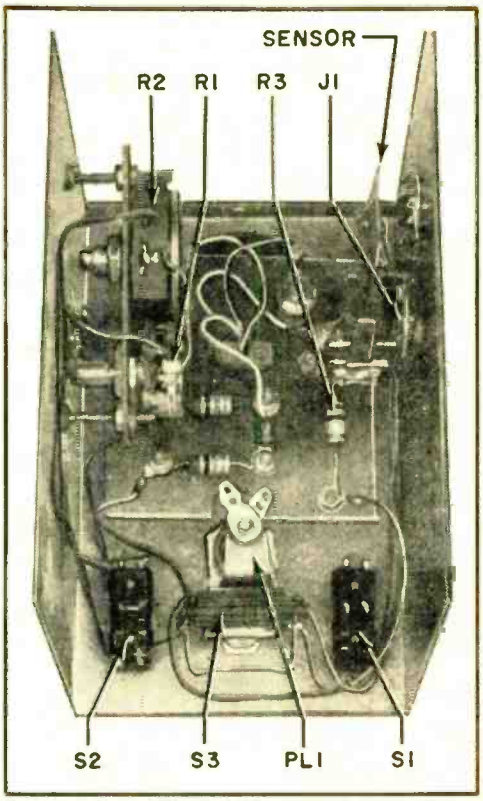
All wiring should be completed, including that of the internal sensor, without making any actual connections to the microammeter. When you have finished this portion of the work, your instrument should be complete; but you will have two wires—one that ultimately goes to the plus meter terminal and one for the minus terminal—still dangling and unconnected.

Testing. Just in case your wiring is incorrect in the smallest detail, you will want to do a preliminary test using a less sensitive meter than your valuable 0-50 microammeter. This could be a 0-1 milliammeter or a 0-5 milliammeter. Connect it to the meter leads and rotate both potentiometers fully counterclockwise, *but do not apply power*. Connect your 4000-ohm resistor

HOW IT WORKS

In either form, the electronic hygrometer is essentially a current-reading instrument. Since only a.c. may be used across the sensing element and a d.c. meter movement will read the current, a bridge rectifier is set up so that d.c. flows through the meter while a.c. flows through the sensor. A simple half-wave meter rectifier cannot be used since this would rectify the current through the sensor as well and cause polarization. The maximum current through the sensing element is 100 μa. and the maximum applied voltage is 20 volts. By using a 12-volt transformer and a 0-50 microampere meter, the operating power is maintained well below the ratings of the sensor at all times.

As humidity changes, the resistance of the sensing element changes in the opposite sense, i.e., an elevation of humidity results in a reduction of resistance. Thus, the meter reading rises as the air becomes more humid.



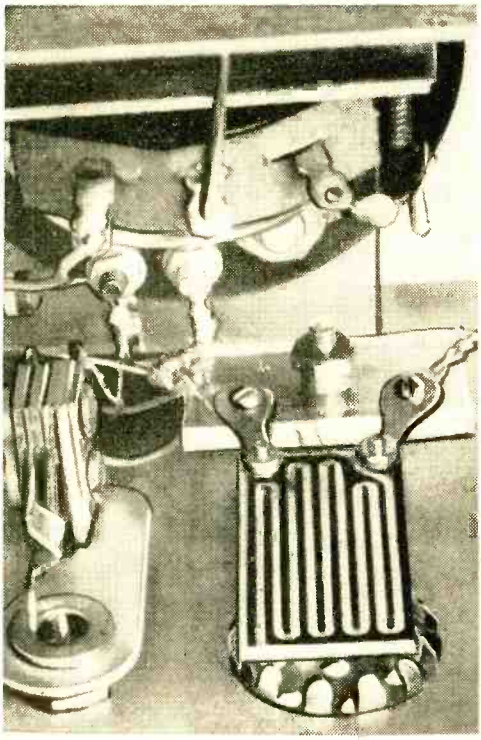
Under-chassis view of the hygrometer indicates location of many of the instrument's components.

across the wires that go to the auxiliary plug and insert the plug into jack *J1*. This places 3700 ohms in series with the meter and the voltage source to represent the sensing element's resistance at 100% r.h.

Make certain that the range switch *S2* is set on *HIGH* (down position) and that both potentiometers are fully counterclockwise. Then apply power by means of switch *S1* for a brief instant while you observe the test milliammeter. This meter *should not* show even the tiniest deflection. Remove power by opening switch *S1*.

Now depress the *LINE CHECK* button *S3*. Move the switch *S2* to the *LOW* position and again apply power briefly. *No reading should be obtained* in this setting either. If a deflection of the meter needle occurs in either case, the potentiometers have probably been wired in backwards and should be checked against the diagrams.

If the meter reads zero in both cases, the microammeter may now be permanently installed and a performance test given the instrument as follows. With no power applied, the range switch *S2* should be set on *HIGH*, and the 4000-ohm resistor plugged into jack *J1*, both potentiometers



Close-up view of the El-Tronics sensor plate.

fully counterclockwise. Apply power and slowly rotate the *HIGH ADJ* potentiometer *R1* until the microammeter deflects full-scale. Remove power and then the auxiliary plug with the 3700-ohm resistor.

Return switch *S2* to the *LOW* position, depress *LINE CHECK* button *S3*, and again apply power. Carefully rotate the *LOW ADJ* potentiometer *R2* for a full-scale reading. Throw the range switch back to the *HIGH* position before releasing the *LINE CHECK* button. This is a precaution that should always be observed: never release the *LINE CHECK* button unless the range switch is in *HIGH* position.

The *LINE CHECK* button *S3* has a second important function. If you suspect that the line voltage is lower or higher than it was when you calibrated the instrument, you can check it quickly and effectively this way: first depress the *LINE CHECK* button, then move the range to *LOW*. If the line voltage is correct, the meter will read full-scale just as it did during calibration. If it is wrong, a touch on the *LOW ADJ* potentiometer will correct it for this scale. Similarly, a reference reading is obtained for the *HIGH* scale (about 9 microamperes) when the *LINE CHECK* button is depressed while the range switch is on the *HIGH* position under normal line voltage conditions. Re-setting for the *HIGH* range is accomplished by means of *R1*.

Calibration. This is a very simple procedure. Provide yourself with a sheet of graph paper, a sharp pencil, and a handful of resistors ranging from about 5000 ohms to 1 megohm, 5% tolerance, if possible.

You set the full-scale 100% r.h. reading when you used the 3700-ohm resistor in the testing procedure. Set the switch *S2* on *HIGH*, insert the auxiliary plug in the jack, and connect the resistors across the clips one at a time, noting the current in microamperes for each. Remembering that each resistor corresponds to a certain r.h. as given on the manufacturer's curve, plot r.h. on the horizontal axis and microamperes on the vertical axis, so that when you are finished you will have a curve of your own that shows the relative humidity vs. microamperes. For the high scale calibration, the resistors should range from about 5000 ohms to about 120,000 ohms to provide an r.h. sweep from 100% down to 30%.

Using the same graph paper, add the range from 32% down to 18% r.h. on the horizontal axis. Using resistors from about 100,000 ohms up to about 1.4 megohms, with switch *S2* set on *LOW*, repeat the procedure above. Make the graph small enough to be cemented to side of case for easy reference as shown in photos.

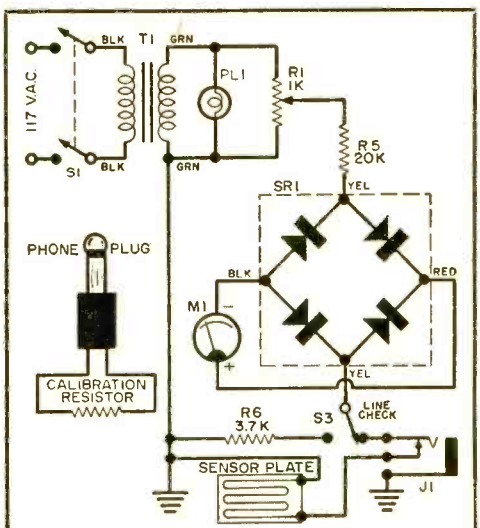


Fig. 2. Simplified single-scale hygrometer.

Using the Hygrometer. Always start with switch *S2* in the *HIGH* position. Observe the reading in microamperes, refer to the graph and determine the r.h. If the reading is below 32%, throw the range switch to *LOW* for a more exact reading between 32% and 18%. —30—

Tuning the Short-Wave Bands

with Hank Bennett

THIS MONTH we would like to take our readers on a visit to the home of another POP'tronics reporter. Our knock on the front door of 5318 Walker Ave., Richmond, Va., is answered by Floyd F. Backus. By way of introduction, Floyd is 43 (he'll be 44 on October 8), married, and the father of one boy, Raymond (18). He's a Special Officer in a Richmond bank.

Floyd Backus, of Richmond, Va., is shown with his HQ-140X, RME 45, and DB22A preselector.

Floyd tells us that he began SWL'ing in 1952 and that it has since grown into a large job. His shack is well equipped with three receivers, a Hammarlund HQ-140X, a National NC-125, and an RME 45. Extra equipment includes only an RME DB22A preselector. The antenna system at the Backus Listening Post consists of the old, reliable "inverted L."

Our featured DX'er has proven that a highly elaborate (and often inefficient) antenna system is not always conducive to the best reception. With his antenna-ground system, Floyd has logged 208 countries on the short waves, with 186 verified. He prizes as his best veri one from a medium-wave station, 2YA, in New Zealand. His best DX catch is *Radio Peking,* China, and his favorite DX band is 19 meters. He likes *Radio Switzerland* and *Emissora Nacional,* Portugal, best because of their fine variety programs.

Floyd is a member of the American Radio Relay League, International Shortwave League, Japanese Shortwave Club, the OTC Amongst Friends Club, the New Zealand DX Club, and Newark News Radio Club.

If you are fortunate enough to be in Richmond and can pay Mr. Backus a real visit, you may be entertained by the music of a Spanish electric guitar—which represents another of Floyd's hobbies. But he says that DX'ing is the most interesting hobby of all as far as he is concerned. It is all clean fun and a fine way in which to make worldwide friendships. To which, we heartily agree!

How To Be a Successful DX'er

Is your receiver in top operating condition? Are you able to hear those rare DX stations that other DX'ers can hear? Or do you just shrug off those reports of rare stations with the remark: "That reporter must be cheating; he could never hear that one!" Here are a few tips that all of us might do well to consider:

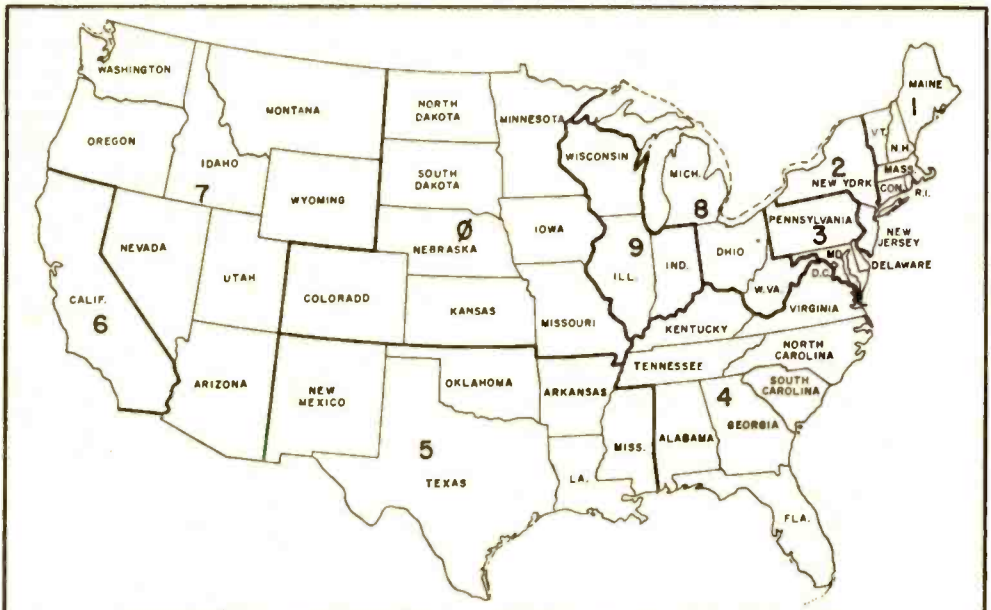
(1) Every radio tube in each stage should be operating at its highest efficiency.

(2) The first detector-r.f. must be aligned to the highest sensitivity.

(3) The i.f.'s (two or three) should be in

Mrs. Mary Ryan, of Honolulu, Hawaii, also a POP'tronics reporter, operates station WH6BUF.

Editor's Note: Although Floyd didn't mention this, he is also a printer of SWL and QSL cards. We've seen his work and we like it—you will, too!



As promised in a recent issue, here is a call letter area map of the United States.

perfect alignment with each other for best results.

(4) The bandspread dial must be calibrated 100%.

(5) A well-insulated antenna and external ground connection are needed. If the ground weren't important, the manufacturer wouldn't have put a ground post on your receiver.

(6) In order to hear the really rare DX, a preselector is a MUST.

(7) A complete understanding of the crystal phase control and how to use the crystal (if your set has one) is necessary to get the most out of your DX'ing.

(8) A complete knowledge of the stations and frequencies in s.w. bands helps a lot.

(9) Patience for a long time, every day, is a necessity if you want to be able to tune in those rare stations. You should also have full and complete knowledge of how to tune *your* receiver.

(10) *Remember*—it takes a long time to gain all the knowledge that will enable you to become a successful DX'er.

Monitoring Identification Cards

Many of the reporters for this column have received their Monitoring Identification Cards by now. Next month we hope to list the credits in the reports by number, rather than by initials. This will eliminate having to "invent" initials for two or more reporters that have the same initials. Your number will remain the same when new cards are issued next year. If you haven't gotten your card as yet, you will shortly.

Current Reports

Now for the latest batch of reports. All times shown are EST, 24-hour system. At the time of compilation, all times and frequencies shown were correct. Since the column was written, however, certain stations may have changed frequency or the times of operating.

Albania—*Radio Tirana* apparently is experimenting with a new service to North America, using 9700 kc. and the xmtr of *Radio Sofia*. They have been noted in German at 1930-1945 and in Albanian at 1945-1958. Identity was *Hier Spricht Tirana*. (*PM*)

Andorra—On a DX program from *Radio Australia*, it was reported that *Radio Andorra* was out of business and off the air. A letter from Paul Renaud of *Radio Andorra* states that the station is definitely operating at 0700-1900 on 5980 kc. and has been operating, without interruption, since 1939. (*JH*)

Argentina—LRU, 15,290 kc., The Overseas Service of *Radio El Mundo*, Buenos Aires, has been noted at 0700-0730 in English and Spanish. This xmsn runs dual with 9660 kc. (LRX) and 11,835 kc. (LRT). News in Spanish is heard at 0700-0705 and in English at 0725-0730. (*SW, GF*)

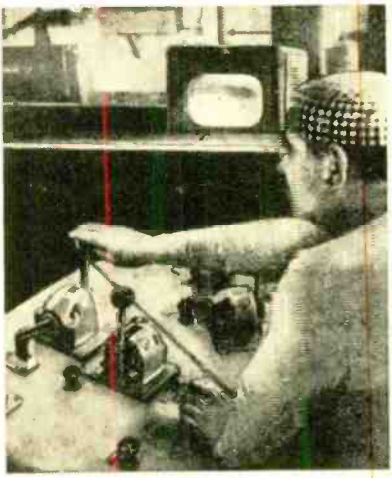
Australia—*Radio Australia* has moved from 17,800 kc. to 21,600 kc. and is heard at 0000-0045 in English to South Africa. Other moves are from 15,320 kc. to 15,200 kc., at 2329-0700 (Sunday to Thursday), at 1959-0700 (Friday and Saturday); from 15,320 kc. to 15,160 kc., at 0500-0900; from 11,900 kc. to 11,770 kc. at 0714-1230 daily; from 11,900 kc. to 17,790 kc. at 1714-1930. These xmsns are in South and Southeast Asian Service. VLK15, 15,230 kc. (a domestic s.w. station), is heard at 0150-0200 with popular music and at 0200-0230 with a children's program. (*BV, SW, AB*)

In a letter from Robin Wood, Director of

(*Continued on page* 102)

Surveying by Radar

NEWEST USE for radar is in land surveying (left), according to a recent announcement by the U. S. Army Signal Corps. Equipment developed at the Corps' laboratories at Fort Monmouth, N. J., is capable of measuring off 50 miles at once. Conventional optical surveying equipment can cover such a distance only by making 20 to 30 small hops, and requires meticulous sighting each time. The "radar ruler" is highly accurate, even over long distances, and works well in any kind of weather. Two jeeps, each carrying a portable radar station, are used—one at each end of the distance to be measured for land surveys.



ITV "Sees" for Steel Industry

OPERATORS 150 feet away "see" and control processing operations inside huge reheating furnaces at the Weirton Steel Co., Weirton, W. Va., by using an industrial television (ITV) system developed and installed by RCA (above). The TV camera "looks" inside the furnace to provide the operator with a close-up view of the hearth and furnace discharge chute. Guided by what he sees, the operator can control the entire process remotely from his observation post, with accuracy, speed, and no personal danger. Closed-circuit TV is used throughout the plant, resulting in improved production.

One-Inch Memory

AN INCH-SQUARE "memory screen," announced by General Electric, will store nearly a million bits of information for use in computers. Developed by Dr. Harold R. Day, of the G.E. Research Laboratory, Schenectady, N. Y., the new device consists essentially of a thin sheet of glass in which small holes have been etched and then filled with metal plugs. An enlarged view of the honeycomb is shown on the screen to right of Dr. Day in the photo. Each square inch of glass contains 250,000 holes, or cells. Information is "written" into the cells by an electron beam scanning the screen. Another beam "reads" it.

Push-Button Shopping

AUTOMATION may be coming to the supermarket. Introduced at the Food Store Convention at the Waldorf-Astoria Hotel, New York City, the device shown below selects items from shelves when the shopper presses the desired buttons. Prices of food chosen are tabulated. Food is delivered by conveyor belt to the front counter. A method for after-hour shopping uses remote control units operated from outside the store. System was invented by Bruno V. Stiller, Wheeling, Ill., restaurant owner who spent 6½ years perfecting the device.

Wide World Photo

MUM THAT HUM!

Photo courtesy Altec Lansing Corp.

By Eugene F. Coriell
Lt. Col., USAF

How to keep a.c. power lines from disturbing audio signals

ASK AN AUDIO ENTHUSIAST what equipment bug annoys him most and he'll say: "Hum!"

He's talking, of course, about hum that develops after the equipment is installed. Hum shouldn't be confused with other kinds of "noise." Often the two are related, but the term "noise" covers other problems to be discussed in a later article. "Hum" is, specifically, a low-pitched tone that results when the a.c. power line gets too familiar with the audio signal circuits.

Outside the System. When your rig develops hum, look around for little difficulties. Perhaps your set was grounded to a water pipe during installation. If so, the connection may have become loose or broken. See if any of the interconnecting cable plugs are loose in their sockets. It's also possible that a recently installed household appliance—such as a freezer, air-conditioner, or fluorescent lamp—may be at fault. Such devices may cause a harsh, hum-like disturbance which could be conducted to the home music system via the a.c. house wiring.

Often, this type of interference can be reduced by a plug-in filter inserted in the a.c. wall socket supplying either the appliance or the hi-fi set. If this doesn't do the trick, the difficulty may be a major one, such as the radiation—rather than simple conduction—of hum. Unless the appliance can be relocated, the only practical remedy is to install suppressors on it. This is a job for the professional service technician. Experimenters who would like to explore this field will find interesting reading and practical hints in the book *How to Eliminate Radio & TV Interference* by Fred D. Rowe, available from John F. Rider Co.

Within the System. If the hum is definitely in your rig, turn on—one at a time—each signal source along with the main amplifier (and preamp, if used). With music playing, try to localize the hum to a specific piece of apparatus, such as the record player, tuner, or tape recorder.

Let's assume this procedure hits pay dirt: the hum is heard only when, say, the tuner is being used. See if gently shaking the output cable, or moving the cable plugs in their jacks, stops the hum but not the music. Many cases of hum are due to loose, bent, dirty, or broken plug and jack contacts, or to broken connections between them, especially shield connections.

Check too that the tuner gain control is advanced far enough to provide enough driving voltage to the amplifier. Too little tuner output will result in a poor signal-to-hum ratio. This precaution applies to other signal sources also. If cables, plugs, and tuner output are all okay, then the hum is inside the tuner. More on this later.

Hum in the Amplifier. If the trouble cannot be localized to the tuner, record player, etc., in this way, the hum is probably in the amplifier or preamplifier.

First, make sure all unused input channels have their "level" or volume controls turned down to minimum—they often

POP'tronics REFERENCE GUIDE — A.C. HUM

	CAUSE	WHAT TO DO
LOUD HUM	**a.** Broken ground connection on signal cable at shielding, plug, or jack. **b.** Signal lead and ground lead reversed.	**a.** and **b.** Inspect visually. Listen to system while jiggling cables and connectors. This usually locates defective connection. Repair, using solder. If this method does not locate defective connection, shut off equipment. Use an ohmmeter to test for continuity in cables, checking for shorts and opens.
MILD OR INTERMITTENT HUM	**c.** Badly leaking or completely open filter capacitor.	**c.** Test capacitors following procedure outlined in text of article. Replace defective ones.
	d. Slight leakage in filter or bypass capacitors.	**d.** Same procedure as for **c.**
	e. Stray a.c. pickup by signal cables.	**e.** Make sure all signal cables are completely shielded and insulated. Try arranging their physical locations, changing relative positions with respect to each other. Isolate all power cords from signal cables. Keep signal cables away from power transformers.
	f. Stray a.c. pickup by magnetic phono cartridge.	**f.** Check for continuity and good connections between phono cartridge and leads in tone arm, and out to amplifier input jack. Make sure turntable motor is grounded. Make sure mounting plate is grounded. Try using rubber mat on turntable. If not successful, motor probably needs overhauling, or cartridge is defective.
	g. Ground loop.	**g.** Make careful diagram of all connecting cables and their interconnections on various chassis. Avoid a closed ground bus that returns on itself. Rewire so that all input jacks connect via a common ground bus to one central ground point. If any component is grounded to water-pipe, or similar point beyond its own chassis, try removing such connection.
	h. Two chassis of unequal a.c. potential connected by common ground.	**h.** First, reverse power plug in a.c. wall socket. If not successful, measure with a.c. voltmeter the potential difference between circuit B-minus and chassis. If some reading is obtained, that chassis is hot. Disconnect all ground signal connections from such a chassis. Re-ground through shielded cable of another component whose chassis is not hot (where B-minus equals chassis ground, or zero). If hum persists, try using "floating shield" hookup (see POPULAR ELECTRONICS, March 1956, page 77).

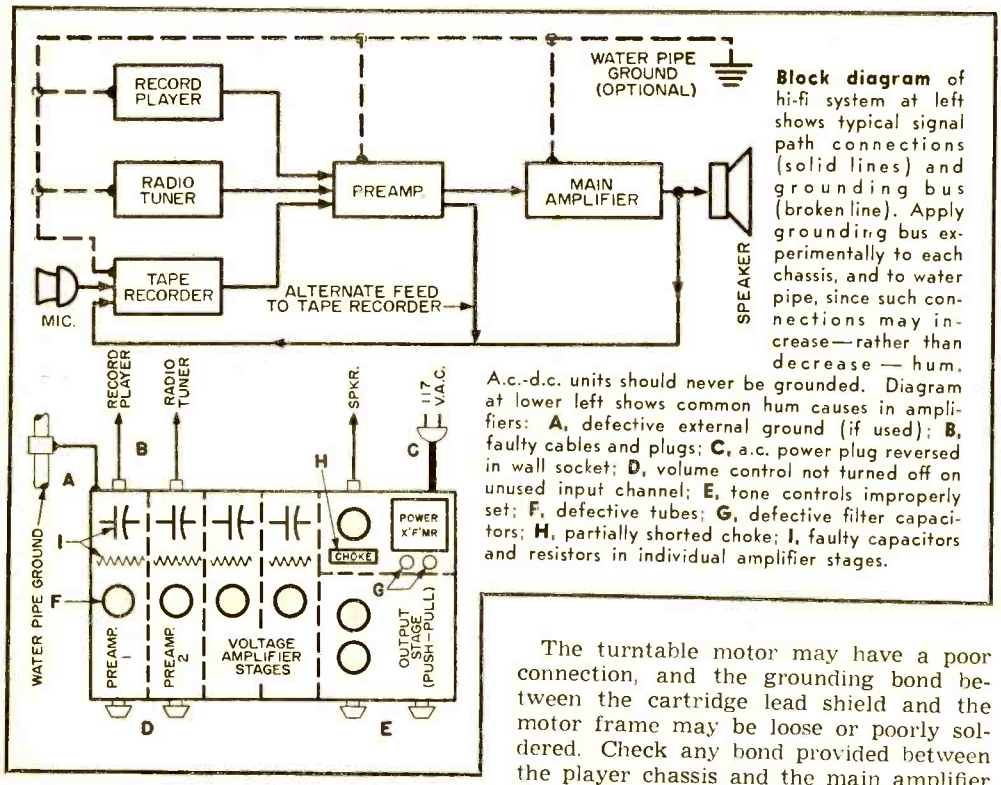
cause hum when turned "up." If the amplifier has separate treble and bass controls, is it possible that somehow the treble has been turned completely "down" and the bass all the way "up?" Such control settings might cause hum, to say nothing of tonal unbalance.

Sometimes the hum sensitivity of an amplifier depends on how the a.c. power cord plug is inserted in its wall socket. Try reversing it. This simple dodge has often reduced hum considerably.

Next, feel the power transformer and the electrolytic filter capacitors. These parts may feel warm when operating normally, but can get very hot if the capacitors are leaking badly due to the excessive current flowing through them. Under these conditions, the rectifier tube plates may glow red. It is also possible that the rectifier tube will cause hum or other trouble without overheating very noticeably.

Getting back to filter capacitors: they may be weak or open-circuited, either condition being a common cause of hum. A quick check here is to clip a test electrolytic capacitor across the suspected units, being careful to observe polarity. If the hum disappears, your culprit has been found. If you don't have a test capacitor, try shorting the positive leg of the doubtful unit to chassis with an insulated screwdriver or test wire after the rig has been turned off. Weak capacitors will show little spark, and open ones none at all. Since electrolytic capacitors may retain enough voltage to cause shock or damage to test gear, always discharge such components before working on them—and this goes for the test capacitor, too.

If the hum is still present, try tapping the tubes. A tube may develop an internal short from heater to cathode which can often be broken by tapping. Also try replac-



Block diagram of hi-fi system at left shows typical signal path connections (solid lines) and grounding bus (broken line). Apply grounding bus experimentally to each chassis, and to water pipe, since such connections may increase—rather than decrease — hum. A.c.-d.c. units should never be grounded. Diagram at lower left shows common hum causes in amplifiers: **A**, defective external ground (if used); **B**, faulty cables and plugs; **C**, a.c. power plug reversed in wall socket; **D**, volume control not turned off on unused input channel; **E**, tone controls improperly set; **F**, defective tubes; **G**, defective filter capacitors; **H**, partially shorted choke; **I**, faulty capacitors and resistors in individual amplifier stages.

ing tubes one at a time. A weak but otherwise good tube in the push-pull output pair may cause hum because of the resulting unbalance.

If these checks do not eliminate the hum, try to isolate the hum to a particular stage of the amplifier by shorting out each tube input grid to cathode or chassis. Start with the output stage and work back toward the input. The first stage you come to that can be shorted out without killing the hum is the stage where the hum originates. From here on, it's a matter of checking each soldered joint in the stage. Pay particular attention to shielding braid grounds. Test for open, weak or shorted capacitors and resistors. Bypass capacitors of the plate, screen and cathode circuits are often at fault. Be very careful in checking the first stage as even a very slight hum can be louder than the signal at this point and will stay that way through all the other stages. This is especially true if the first stage of the amplifier is a built-in preamp.

Other Components. So much for the amplifier. Hum in other components can also be traced and eliminated. The record player may have a defective soldered connection on one of the cartridge leads, particularly the shielding braid which is usually the low side of the cartridge circuit.

The turntable motor may have a poor connection, and the grounding bond between the cartridge lead shield and the motor frame may be loose or poorly soldered. Check any bond provided between the player chassis and the main amplifier or other parts of the system. Don't overlook the possibility of turntable rumble. Any undue motor vibration may be communicated to the pickup stylus and be reproduced as hum or rumble in the speaker. Make sure the motor is properly suspended and that its rubber mountings are not loose, hardened, or squeezed solid by mounting screws being pulled up too tight. See that the motor board is properly secured to the cabinet frame. A rubber pad on the turntable often reduces noise pickup.

The radio tuner has some possibilities for hum in common with the amplifier, such as defective tubes and filter capacitors, as well as some troubles of its own. Sometimes a hum appears only when a station is tuned. Known as "tunable" or modulation hum, this may be caused by weak or open line filter capacitors connected between each leg of the a.c. line and chassis. Heater-to-cathode leakage in the oscillator or converter tube is another cause of this trouble in superhet tuners. In t.r.f. tuners, it may be due to inadequate filtering of the plate voltage in the r.f. stages. Try reversing the a.c. power plug in the wall socket.

If following the steps described in these paragraphs doesn't correct the hum, you have earned the right to call in a radio-TV sound technician. —30—

AFTER CLASS

Special Information on Radio, TV, Radar and Nucleonics

SOME FACTS ABOUT LIE DETECTORS

TOO MANY inaccurate headlines and too little comprehension have made the electronic lie detector a scientific "football" in recent years. The reluctance of the courts and some psychologists to accept the findings of lie detectors as evidence in criminal cases has raised understandable doubts about the whole concept of the instrument.

Let's take a technical and unbiased look at some modern lie detectors.

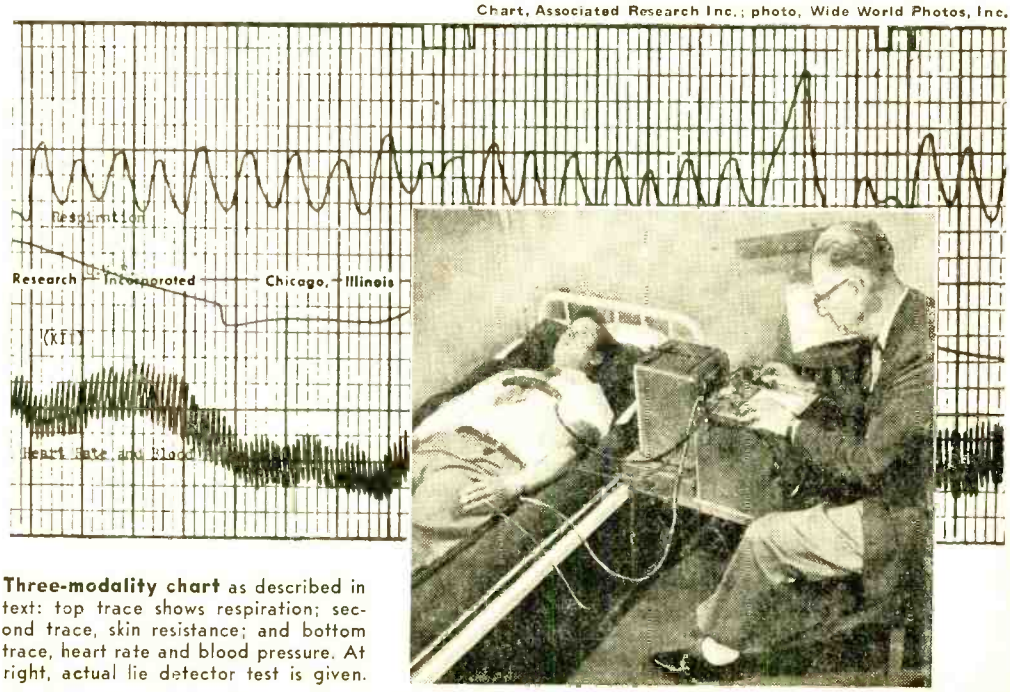
Types of Detectors. Among the simplest of these devices is the type which measures or indicates variations of skin resistance during a period of questioning. Based upon the principle of the Wheatstone bridge, an instrument of this type contains a highly sensitive microammeter which responds to minute changes in the resistance of the skin. Electrodes made of amalgamated zinc are pressed against the palms of the hands. Surface resistance and polarization effects are reduced by using a special electrolytic paste between the electrodes and the subject's skin.

The theory of operation is simply that the emotional strain of telling a lie affects the sympathetic nervous system. Sweat glands are thus stimulated and the moisture produced simultaneously over wide areas effectively lowers skin resistance. The swing of the microammeter needle is recorded manually by the operator; such records are always open to skepticism even when supported by the testimony of witnesses to the test.

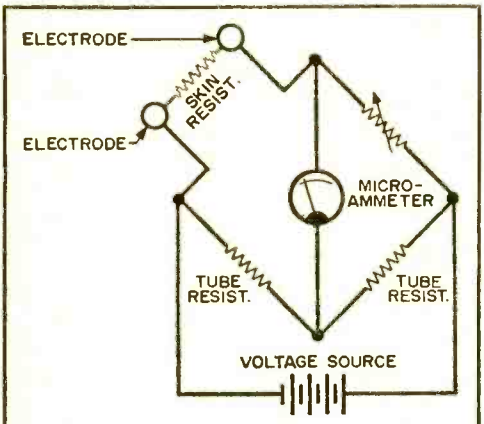
This objection is overcome by making the instrument self-recording. Psychogalvanometers, as recording lie detectors are called, utilize a moving tape upon which an inked stylus traces the resistance variations. The tape moves slowly—five to twelve inches per minute—to enable the operator to annotate directly upon it information that will interpret the trace later on.

The question is: does a variation in skin resistance indicate conclusively that a "lie-telling" emotional strain is taking place? People experienced in the application and

Chart, Associated Research Inc.; photo, Wide World Photos, Inc.



Three-modality chart as described in text: top trace shows respiration; second trace, skin resistance; and bottom trace, heart rate and blood pressure. At right, actual lie detector test is given.

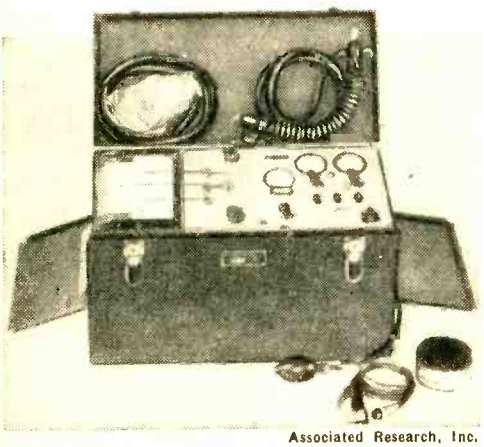


Basic Wheatstone bridge circuit used in the non-recording type of lie detector.

manufacture of these devices steadfastly maintain that it does not. They insist that other "modalities" of response must be measured—such as blood presssure, heart or pulse rate, breathing rate and depth, and even the presence or absence of muscular flexure.

Response Recorded. One particular instrument in widespread use throughout the nation in city, county, and state police departments utilizes a total of three modalities. Two of the three major sections of the instrument are not electronic at all: heart rate and blood pressure are shown in a single trace (lowermost on the chart) in which the fine, closely spaced zig-zag lines count heart beats while the broad, slow variation of the line-groups measures the changes in blood pressure.

The uppermost trace records respiration effects in terms of frequency and depth; a large amplitude of stylus deflection indicates a deeper-than-normal breath, while the changes in spacing between the waveforms reveal irregularities in rate of breathing. Both of these curves are obtained by pneumatic methods which have no electrical or electronic aspects. The lower one employs a standard type of blood pressure cuff in which air pressure variations activate the stylus; the respiration trace is similarly produced by a pneumatic tube which fastens around the subject's chest.



Associated Research, Inc.

This instrument produced the three-modality chart featured on the preceding page.

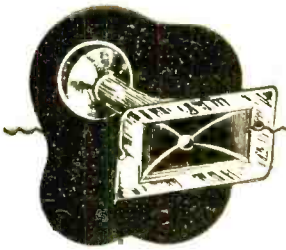
Lovett Garceau

The simplest form of lie detector measures or indicates variations in skin resistance only.

The skin resistance presentation is obtained by means of a Wheatstone bridge using balanced tubes as two of the arms, a calibrated precision potentiometer as the third arm, and the skin of the subject as the remaining one. When the skin resistance changes, the bridge balance is disturbed and a current is passed into the stylus drive mechanism, causing it to shift its position on the moving tape. According to one manufacturer, this trace is the *least important* of the three. Tests upon literally thousands of subjects prove, he says, that the heart-blood pressure and respiration records are the most revealing and the most reliable indications of deception or emotional response.

There is a specialized technique that has to be learned if one is to make competent use of lie detection equipment. In fact, a course of at least six weeks dealing with chart interpretation, methods of interrogation, basic physiology and psychology,

(*Continued on page* 120)



Hi Tide in the Tweeter

By CARL KOHLER

PERCHED atop the rocking channel buoy like an ant riding a gyrating cork, I did my level best to affect an air of *savoir faire* as the Coast Guard Cutter came thunderously alongside. Moments later, with the tape recorder still safely harnessed to my back, I stood on deck and chatted as nonchalantly as possible with the Commander of the boat.

"What were you doing on that buoy in the first place?" Suspicious military eyes scanned the recorder. "Those buoys are government property, you know."

"Well, officer," I chuckled . . . to show that the whole thing was nothing more than a slight *faux pas* and there was no harm meant. "I went out there to record some seals."

"To *what* some *which?*"

"Record the sounds made by those seals. Guy that lives on the beach assured me I could get some marvelous recordings of those seals if I just quietly sat on the buoy and let them regain their confidence around me."

The look he gave me said plenty. It more than made up for the silent ride all the way back to the docks, where my anxious wife awaited her intrepid Boswell of the Salty Deep. And while I *can* erase the memory of that officer's caustic expression—in due time—from my shattered ego, I haven't been able to figure out, just yet, how I'm going to erase the adventure from Friend Wife's sadistic sense of ridicule. It's obvious she has no intention of allowing herself (or me) to let a folly, whether originally based upon sincere and painstakingly scientific research or not, quietly fade away.

But I still think the premise was soundly superb—and I've got the fascinating sounds of high tide in the tweeter to prove it . . . not to mention the background cries of feeding, rollicking seals.

Here's how the caper came about.

WE WERE peacefully rearranging our music library, composed of both discs and tapes, when I happened upon a long-forgotten set of hi-fi test records . . . purchased at the time of installing the complicated, inter-room system which keeps our house well filled with flawlessly reproduced music.

I can thrill to Ravel's *Bolero,* dreamily soak up Debussy's *Clair de Lune,* or gracefully cavort to the haunting bars of Jelly-roll Morton's *Yew Cain't Haul Mah Ashes Anymo', Baby, 'Cause We Clashes* as enthusiastically—if not as impressively—as the next music lover. My tastes range from *Night On Bald Mountain* to *Short-'nin' Bread* (with or without Nelson you-know-who's aid), and nary a measure is unappreciated to the last quarter-note or flatted fifth. But my *real* fetish, my true Achille's instep is . . . natural sound. When it comes to bizarre, enchanting sounds of hill and dale, town or country, this world or some other—I'm nuttier than an almond grove at harvest time.

Consequently, I was playing these test recordings for, maybe, the sixth time—carefully drinking in the delicate overtones of *Santa Fe Limited Passing Signal Green: Full Horn Communications*—when Friend Wife snapped off the phono.

"My God, man, that's *enough!*" she rasped.

"Don't care for it, eh?" I slid a short stack onto the record changer composed of *Boeing Bomber With Flaps Down Approaching Field, Freeway Traffic At The Impatience Point* (the contrapuntal effect

. . . Perched atop the rocking channel buoy like an ant riding a gyrating cork, I did my level best to affect an air of savoir faire . . .

of the Chevvy horns against the Ford klaxons is the most stimulating thing I've heard since static was captured for the human ear) and *Myna Bird With Head Cold Humming Aimlessly*. "Well," I observed, democratically, "it would be a dull

. . . I happened upon a set of hi-fi test records and was playing them for, maybe, the sixth time —carefully drinking in the delicate overtones . . .

old world if everyone liked the same things. Would you care to savor the sharp nuances of, say, *Seattle Tugboat Leaving Dock,* or the more silken treatment as found in *Aftertones Produced In The Wake Of Guided Missile?"*

She beat me to the changer, slamming a stack of archaic (if, admittedly, spirited) Mickey Katz *Tribal Chants With No Theme And You Should Have The Variation* on the turntable.

"Those test records are enough to drive a girl nuts," she complained, bitterly. "And I've listened to them played enough times to drive a gaggle of girls completely wacky. You play that weird stuff any more and you can reserve me a bench in the funnyhouse, chum."

"Don't care for them, eh?"

"Loosely understating it . . . *No!*"

RIGHT THEN and there, inspiration gave me a swift kick in the nether mental-quarters. A *fabulous* idea! Only a dolt whose wife loathed test discs would have been so long in seeing the need for *interesting, soothing-type* test *recordings*. I hugged Friend Wife gratefully, and bent a merry-eyed grin upon her startled face.

"Thanks to your womanly dissatisfaction, you have just moved sonics and sonic enjoyment ahead by years, love! With me as the feverish instrument of experiment, toil and patient searching—"

"If you're scheming up some madness that requires tearing the whole house apart, again, you can—"

"—always faithfully searching for better ways to better living through electronic study, theory and philosophy—"

"—forget it, chum, because I'm not stumbling over a lot of half-baked nonsense strewn around *my* house just so you can enjoy hearing a high-register squeak."

I unbent my gracious smile of joy.

"Listen, lady," I said coldly. "I have long known it's a marital felony to move anything around this joint but the furniture . . . and *that* only under your restless supervision. But it so happens that this project will take place entirely in the God-given freedom of the great outdoors, beyond your picayune regulations."

"So, get huffy," she chittered, an expression of self-doubt clouding her shamed features. "What dazzling sort of flop do you have in mind *this* time?"

"I'm going to make recordings of vast import to the hi-fi field. My contribution to sonics—once I offer a select series of sounds captured in the actual sites and under the extemporaneous conditions of Mother Nature—will most likely put the name, Kohler, enshrined for the ages, in the halls of Sound History."

"Break that mish-mosh into English, will you?"

I flicked a glance of undented dignity at her.

"Simply speaking, I'm going down to the beach and collect the voices of the sea

. . . With the tape recorder on my back, I garnered all manner of sound treasure, among which was the soft "clik-clik" of multi-colored crabs . . .

creatures, the symphonies and melodies of wind and sea and tide."

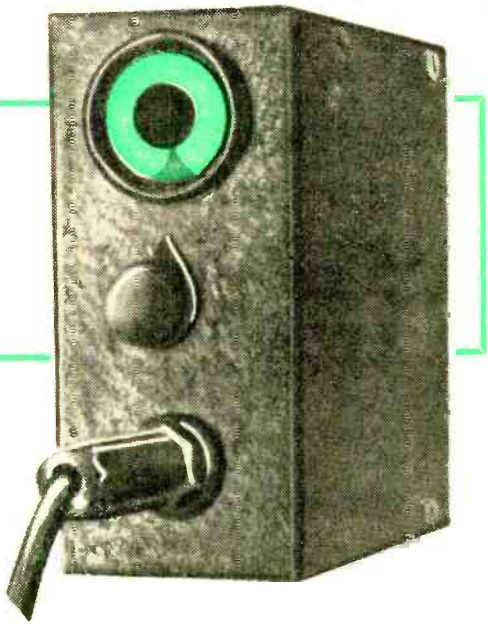
"Great!" She leaped to her feet. "I'll go start packing the sunburn lotion . . . and wait'll you see how I look in that new sunsuit I bought!"

And while she—naive female of the frivolous mind—prepared to have a typical

(*Continued on page* 124)

By Owen A. Marsh

UNIVERSAL TESTER USES "MAGIC EYE"



DO YOU BANG the meter needle off scale when an unexpected voltage appears as you probe an unknown circuit? Would you like to save the time necessary to set up the proper polarity, range, and a.c. or d.c. switches on your voltmeter?

With the one probe of this tester, and without any switching, you can be "screwdriver" happy. Any point in a radio, TV set or other electronic device from less than 0.5 volt to 500 volts can be safely probed and the nature of the voltage will be indicated on the "magic eye."

The "magic-eye" tester is not limited to showing only the nature of the voltage, positive or negative d.c. or a.c. It will also differentiate between low and high voltage d.c., which will enable you to tell cathode and suppressor-grid from plate and screen.

Alternate construction methods are suggested, differing only in the source of power. If you have a power supply furnishing 6.3 volts a.c. and from 150 to 250 volts d.c., then the simple circuit shown in the upper part of the schematic drawing is all you will need. Leads from the points marked "X" and "Y" are brought out for connection to the external power supply.

Exact construction details are not important and may be easily changed to suit the desire or available material of the builder. Reasonable differences in component values may be substituted without critically changing the tester's utility.

The entire power supply shown in the photos was built on a piece of Micarta insulating material 2" x 2½" x 1/16" thick. Rectifier units are mounted on one side and the capacitors on the other, with their leads laced through holes in the board for support. The power cord plug should be polarized so that the side indicated in the schematic will be at ground potential. This can be done by soldering a small wire around the edge of the prong so that it may only be inserted in the wide (ground) side of the receptacle.

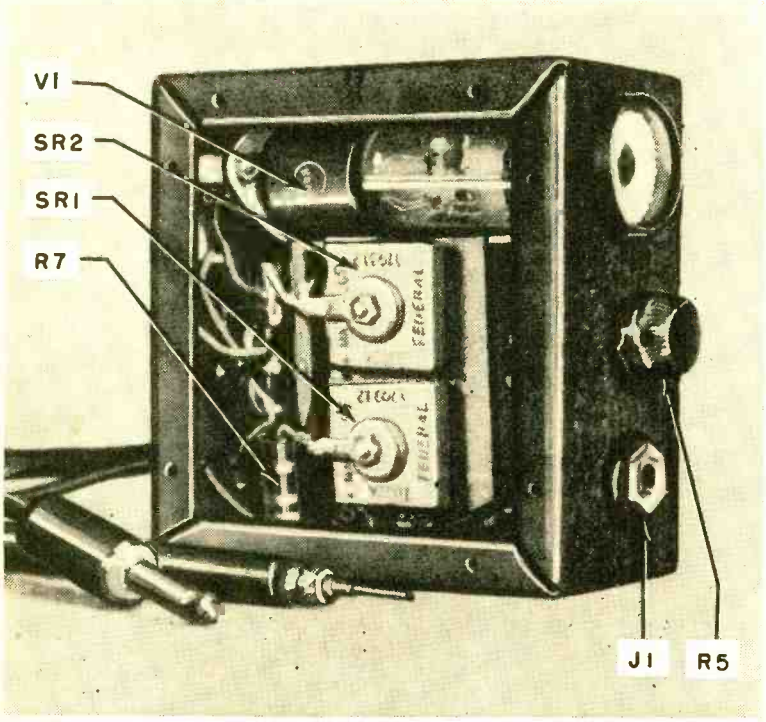
The test lead incorporates a 1-megohm resistor in the test prod which is similar to the d.c. test leads of most vacuum-tube voltmeters. If you have one of these leads, it can be conveniently used for the tester and thus eliminate the need for constructing another.

Placing the unit in operation requires but two simple adjustments. First, with no signal applied to the probe, the cathode resistor, *R5*, is adjusted so that approximately one-half of the normal shadow angle shows on the 6U5 tube. The "eye" should now completely close, without overlap, when about 10 volts negative d.c. is applied at the probe. Second, the plate resistor, *R4*, is adjusted so that the "eye"

HOW IT WORKS

Connections to the magic-eye tube, *V1*, are routine. However, in the *RC* circuit, *R1*, *R2*, and *C2* are unusual in that they are used to determine voltage by a time delay method. If a d.c. voltage is applied between the probe and "ground wire" return, the capacitor will charge up. This will force the shadow to its widest possible limit. Removing the d.c. will enable the capacitor to discharge through *R1* and *R2*. Time involved until the shadow returns to its normal width will be of the rough order of magnitude of the voltage. The longer the delay, the greater the applied voltage.

The plate and target supply is a conventional full-wave doubler circuit which supplies approximately 300 volts d.c. and is sufficiently filtered by the two 20-μfd. capacitors, *C3* and *C4*. The two resistors, *R6* and *R7*, are inserted in the negative side to limit the alternating current to approximately 2 ma., which reduces the shock hazard inherent in transformerless power supplies. These resistors reduce the target voltage to approximately 180 volts for satisfactory operation of the 6U5 tube.

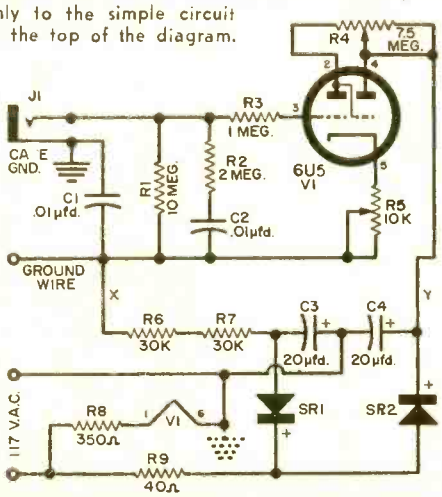


With the "magic-eye" tester, you can probe any point in a radio, television set or other electronic device from less than 0.5 to 500 volts. The "magic eye" indicates whether voltage is positive or negative d.c. or a.c. and differentiates between low and high d.c. voltages. At left, the unit is shown with power supply installed and major components identified. Capacitors are mounted on the other side of the Micarta insulating board.

closes, except for about one-eighth inch, and shows a decrease in illumination when 6-volt 60-cycle a.c. is applied to the probe. The ground clip should be connected to the ground of the voltage source of the equipment tested.

If the equipment to be tested is of the a.c./d.c. transformerless type, it should be operated through an isolation transformer. In transformerless equipment, one side of the power cord is directly connected to one side of the power supply. This condition creates a hazard to personnel and may result in serious equipment damage if an isolation transformer is not used. In transformer-operated equipment, this isolation is accomplished by the power transformer in the equipment.

Schematic diagram of tester and power supply, with parts list at right. If you have a supply which furnishes 6.3 volts a.c. and 150-250 volts d.c., refer only to the simple circuit at the top of the diagram.



Circuit Tester

C1—0.01-μfd., 600-volt ceramic capacitor
C2—0.01-μfd., 600-volt tubular capacitor
J1—Single-circuit jack (Switchcraft S-11)
R1—10-megohm, ¼-watt carbon resistor
R2—2-megohm, ¼-watt carbon resistor
R3—1-megohm, ¼-watt carbon resistor
R4—7.5-megohm potentiometer (IRC Q11-142)
R5—10,000-ohm potentiometer (IRC Q11-116)
V1—6U5 electron-ray indicator tube

Power Supply

C3, C4—20-μfd., 450-volt electrolytic capacitor (Pyramid TD20-450)
R6, R7—30,000-ohm, ¼-watt carbon resistor
R8—330- or 350-ohm resistor line cord (IFD 2189 or 2175)
R9—40-ohm, 2-watt carbon resistor
SR1, SR2—65-ma., 130-volt selenium rectifiers (Federal FTR 1002)
1—Micarta insulating board, 2" x 2½" x 1/16" thick

Probe (see text)

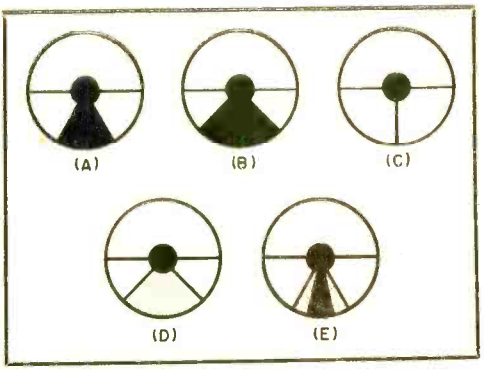
1—Single-circuit plug (Switchcraft 250)
1—Single conductor shielded microphone cable, about 30"
1—Test prod
1—1-megohm, ¼-watt carbon resistor

To approximate d.c. voltages above those which give completely open or closed "eye" indications, we make use of the voltage stored in capacitor *C2*. When the applied voltage is removed, it will cause a slow return to the normal shadow angle. The rate of this return to normal, which is proportional to the original applied voltage, will be slower for large voltages and faster for small voltages.

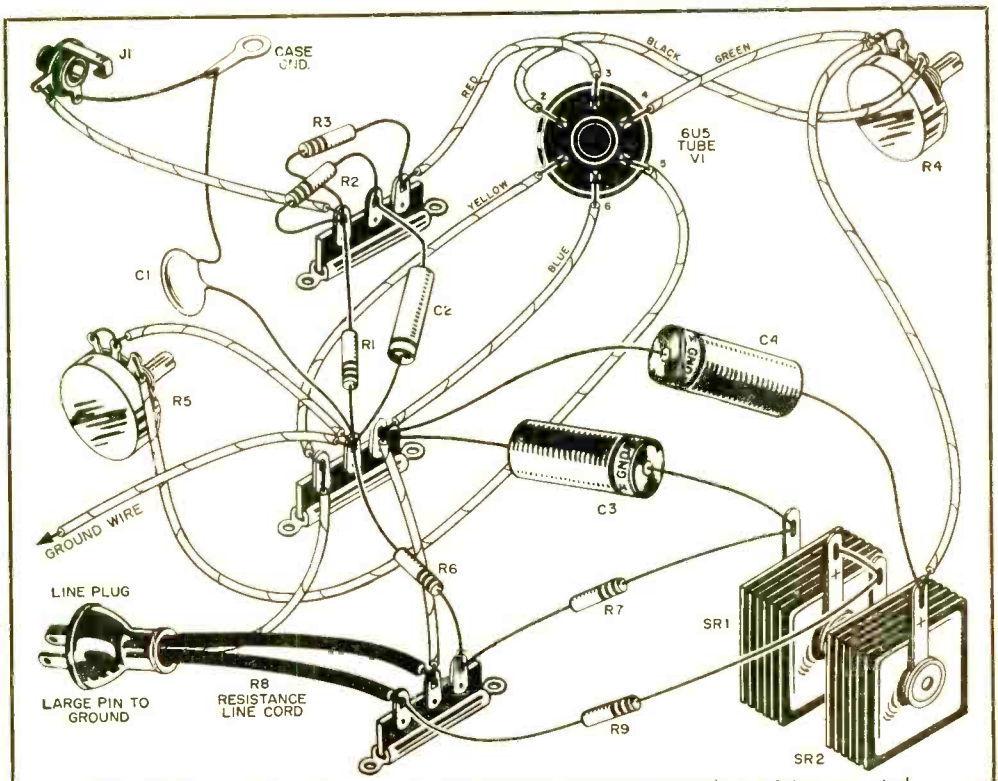
The tester indications of the four basic voltages found in electronic equipment can be used in many practical servicing applications. You can quickly check for a leaky coupling capacitor by observing the voltage polarity at the grid side of the capacitor. Further, by connecting a capacitor of about 0.001 μfd. on the end of the probe, you can check for the signal voltage, even though a d.c. voltage is also present. If this signal voltage indication is not the same for both ends of the coupling capacitor, then it is either open or grounded.

When the probe is connected to the a.g.c. or a.v.c. line in a receiver, it will serve as a conventional tuning indicator and may be used for making alignment adjustments.

With a little experience in its use, the serviceman or novice will find this tester the answer to problems where random probing is indicated; in fact, it may well be used for the first speedy voltage observation of any receiver, and the conventional meter used only where further critical determinations are required. —30—



Voltage indications: (A) normal adjustment with no voltage applied to probe; (B) positive d.c. voltage —"eye" will change for a voltage as low as 0.5 volt, will open completely on about 20 volts; (C) negative d.c. voltage—"eye" will change for 0.5 volt, close on about 10 volts; (D) a.c. voltages as low as 0.5 volt rms will show some partial illumination; (E) a.f. peak voltages as low as 1 volt will be indicated, partial illumination varying with the signal voltage.



Pictorial diagram shows how components of tester and power supply are interconnected.

Better Bass *in* Less Space

Special panel helps bass sound in enclosure of reduced size

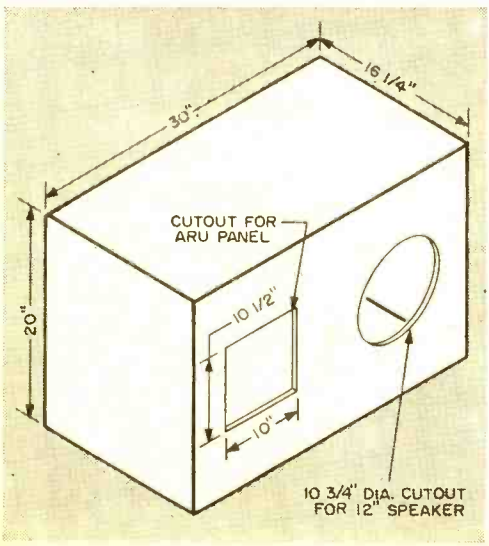
HOME CRAFTSMEN and professional cabinet-makers alike often run aground on one big bump when building speaker enclosures. This is the bump in the curve of loudspeaker resonance which effectively detours the enthusiast on the otherwise smooth road to hi-fi enjoyment.

The bass reflex enclosure, long regarded as one adequate solution to this problem, can smooth that bump and provide good clean bass. Yet many an attempt to construct what seems to be a very simple enclosure of this type ends up as little more than a "boom box." Then, too, the dimensions of such enclosures (minimum of 10,000 cubic inches for a 12" speaker) have stopped many hi-fi'ers cold.

But the main problem with bass reflex cabinets has been their proper tuning. To be used correctly, a bass reflex enclosure must be *matched* to a particular speaker. Once matched, it sounds fine; but often an enclosure that sounds good with speaker "A" will sound horrible with speaker "B." Speaker and enclosure comprise a *system* in which the two partners are very closely coupled—acoustically as well as physically.

The enclosure to be described here has the advantages of simple construction with none of the pitfalls of conventional bass reflex designs. It is slightly more than two-thirds the size of a conventional bass reflex, can be used with any make speaker

Dimensions of enclosure shown in above photo.



of a given diameter, and—most important—requires no critical port or tuning to provide optimum loading on the cone.

Tuning Eliminated. The secret is a special new panel developed recently by Goodmans Industries, Ltd. of England, and marketed here by the Rockbar Corporation, 650 Halstead Ave., Mamaroneck, N. Y. Known as the "Acoustical Resistance Unit" (ARU), this panel provides a new element of impedance in a speaker enclosure which permits dimensions to be reduced and eliminates tuning of the port. In fact, the ARU effectively replaces the port.

In construction, the ARU is fitted into one of the walls of the enclosure. Its action on the air cavity within the enclosure is much like that of a resistor in an electrical circuit: it lets just the right amount of energy pass, enough to damp speaker resonance and extend bass response an octave below that frequency. Details on how this happens are given in the "How It Works" box at the right.

An enclosure dimensioned and built around an ARU panel requires two cutouts: one for the speaker and one for the ARU. The ARU itself is a flat, rectangular wire mesh covered with a critical amount of flock, and suspended in a wooden frame. The frame is flanged to fit snugly into its rectangular cutout.

Construction Hints. Once the speaker cutout and the ARU cutout are made, the rest of the enclosure is completely a matter of personal taste as regards styling and relative dimensions—as long as the over-all cubic volume is maintained. The one built here (see dimensional drawing) contains about 7800 cubic inches of inside space as compared to the minimum of 10,000 cubic inches required for the conventional bass reflex. These 7800 cubic inches can be distributed in any way desired, as for example, in a corner shape.

Another thing: the ARU panel need not be mounted on the front wall of the enclosure. It works equally well on any surface, so long as there is a minimum distance of three inches between it and an adjoining floor, wall, or ceiling.

The ARU permits you to compromise without the limiting effects of compromise. The 7800-cubic-inch space has a tolerance of 10%. In other words, your enclosure can be 10% smaller or larger than 7800 cubic inches with no ill effects on the sound.

Regardless of how you custom this enclosure, remember to use nothing less than ¾" plywood on all sides. All joints should be glue-sealed and secured with wood screws. All inner surfaces, except the speaker panel, should be padded with sound-absorbent material such as Ozite.

HOW IT WORKS

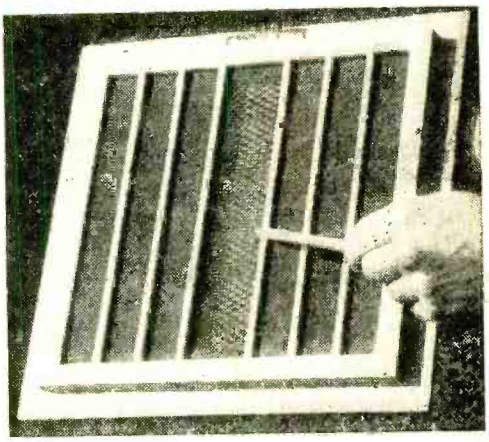
A bass reflex speaker system is a resonant system in which the capacitive (C) element, or air cavity, is tuned by the inductive element (L), or port. When C and L are tuned to the resonant frequency of the speaker, the cone's resonant peak is damped, and circuit Q (ratio of reactance to resistance, X/R) is said to be lowered.

Lower Q means less specific response to a particular frequency and a more general response to a wider range of frequencies. In terms of sound, this means smooth, extended bass with no "boom." At best, however, such an LC system is highly critical as regards correct tuning: slight changes in either C or L will detune the system. The need for a different resonant point (which could arise with a substitution of loudspeakers) would require a new tuning of L, or port adjustment.

Adding a resistive (R) element to such a system will not only lower its Q but will eliminate the need for critical adjustments of the L factor. The ARU does exactly this. At the same time, its damping action permits a substantial reduction of C.

The flock on the ARU acts as a friction loading device, or resistive element to the movement of air. Impedance offered to the passage of air has the same effect as if the energy were traveling a longer path from cone to port. The flock covers all but a narrow aperture which serves as a "port" over a relatively wide range of low frequencies. Damping action thus provided is spread over such a relatively wide range that no changes are needed if a new loudspeaker, with somewhat different resonant characteristics, is used in the same enclosure.

Any speaker so loaded can be counted on for response an octave below its own resonant point. Thus, a speaker with a natural resonance of 40 cycles can be used to reproduce as low as 20 cycles. A speaker with a natural resonance of 50 cycles will reach down to 25 cycles, provided, of course, that the speaker has an output at these lower frequencies.



Close-up of the ARU reveals the critical amount of flocking used. Pencil points to opening in the flocking. Flanged edges of wooden frame help secure the ARU in its cutout in the enclosure's wall.

In calculating the required inside cubic volume, remember to subtract the thicknesses of the walls. For example, if the over-all dimensions of a piece of ¾" plywood are 30" by 20", the 30" will probably be reduced to 28½", allowing for the thickness of the plywood pieces to be butted to its ends. It's also good to subtract the compressed padding thickness.

Improving Old Enclosures. Besides helping you build a new enclosure correctly, economically, and easily, the ARU can

NO. AND SIZE OF SPEAKERS	ARU MODEL	ENCLOSURE (cu. in. ± 10%)
1—10"	180	5,900
2—10"	280	8,300
4—10"	480	11,700
1—12"	172	7,800
2—12"	2—172	11,700
1—15"	280	8,300
1—18"	480	11,700

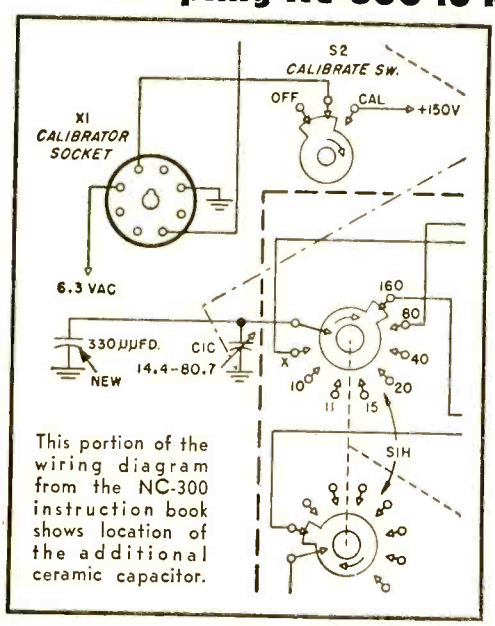
Chart shows possible combinations of standard loudspeakers that may be used with the four models of the ARU now available. The unit was developed for use with "Axiom" loudspeakers but may be used with speakers of similar characteristics. For best results, speaker used should have natural resonance of not much more than 40 cycles, preferably lower.

be used to correct deficiencies in existing bass reflex enclosures. First, substitute the required ARU cutout for the existing port. Then, reduce the over-all cubic content of the box by 4½/6±10%. Use your own ingenuity to do this. One method is to remove the back panel and reset it closer into the box. Other ways to partition off part of the existing cabinet will suggest themselves.

Changing from one speaker to another of the same size presents no problem to the ARU. Its resistive action is spread over enough of a range to provide loading and damping for speakers of varying characteristics. The combination of opening and partial flocking on the ARU panel handles frequencies as low as 20 cycles, assuming the speaker can put out that kind of bass. When used in conjunction with a speaker that has a fairly low resonant frequency, the ARU tends to smooth the resonant peak and extend bass response below that frequency. Details on number and sizes of speakers that may be used with the ARU are given in the chart at left.

The ARU panels were developed on the basis of design theories worked out by E. J. Jordan of Goodmans Industries, Ltd. As such, they were originally intended to be used with that company's line of "Axiom" loudspeakers, but they have since been found to work satisfactorily with other makes of speakers. There are currently four models available, of which the "172" used in this construction is recommended for 12" speakers. Low on cost and short on space, the resultant enclosure will not short-change you on good sound. —30—

Adapting NC-300 to Receive WWV on 10 Mc.



This portion of the wiring diagram from the NC-300 instruction book shows location of the additional ceramic capacitor.

IF YOU ARE the proud possessor of the new National NC-300, you may be wondering if anything can be done to receive WWV on it. Checking WWV not only insures accuracy of the built-in crystal calibrator, but enables time signals and ionospheric storm warnings to be received.

To beat WWV (10-mc. signal) into the 40-meter band, simply ATTACH TWO ALLIGATOR CLIPS to a 330-μμfd. ceramic capacitor. Lift the cover of the receiver and attach the clips so that the capacitor is between the stator of the h.f. oscillator section of the main tuning gang (front section) and the chassis ground. Set the antenna trimmer to minimum capacity and tune across the 40-meter band until WWV is heard. The circuit diagram shows the electrical positioning of the new 330-μμfd. capacitor.

Obviously this is just a temporary lash-up and must be disconnected when you want to listen to 40. —30—

THE TRANSMITTING TOWER

Herb S. Brier, W9EGQ

FEATURED on these pages are pictures of the Heathkit DX-35 transmitter, which I assembled from a kit manufactured by the Heath Company, Benton Harbor, Mich. The complete transmitter in its 13" x 8½" x 9" aluminum cabinet weighs 21 pounds. The cabinet is finished in grey, and the panel is silver, with the contrasting panel design in black, making for a good-looking piece of equipment.

Technically speaking, the DX-35 is a completely self-contained, band-switching phone and c.w. code transmitter for the amateur bands between 3.5 and 29.7 mc. It uses a 3-tube radio-frequency circuit, consisting of a 12BY7 crystal oscillator, 12BY7 buffer amplifier, and a 6146 power amplifier. For phone operation, a 12AX7 and a 12AU7 serve in the audio system. All power is furnished by the internal power supply utilizing a 5U4GB rectifier. It delivers 600 volts, d.c., and 6.3 volts, a.c.

Circuit Details of DX-35. The oscillator employs a modified Pierce circuit. It has sockets for three crystals, selected by means of a 4-position rotary switch. Eighty-meter crystals are required for 80-meter operation and may be used up to 20 meters. Forty-meter crystals are used for output on 40 meters and above. An access door in the rear of the transmitter cabinet makes it convenient to change crystals.

The fourth position on the crystal switch permits the transmitter frequency to be controlled by an external variable-frequency oscillator (VFO), such as the Heathkit VF-1, which can be powered from the accessory power socket on the back of the transmitter.

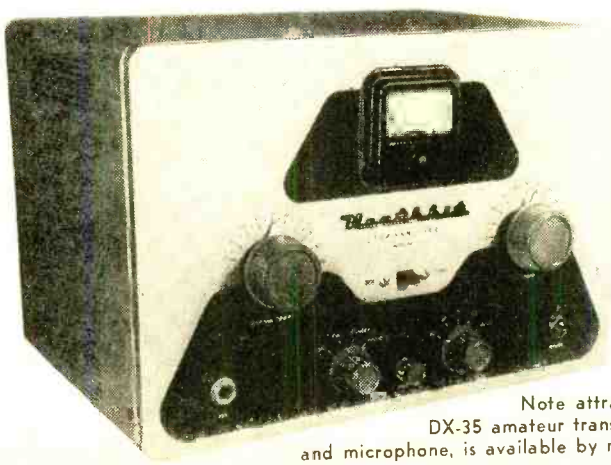
The 12BY7 buffer plate circuit is tuned to the transmitter output frequency on all bands by means of individual coils switched into the circuit by the bandswitch. An 11-$\mu\mu$fd. variable capacitor across the coils serves to control grid excitation to the 6146 power amplifier.

In one respect, the buffer stage is decidedly unusual. Its tube is connected in series with the oscillator tube across the output of the power supply, so that the 600 volts is divided equally between them. Such a circuit arrangement is fairly common in television receivers, but this is the first commercial transmitter to use it, to my knowledge.

Its advantages are that it conserves current from the power supply and eliminates the resistors that would otherwise be required to drop the 600 volts from the power supply to the 300 volts required by the oscillator and buffer tubes.

The performance of this part of the circuit is completely normal. About the only time that the circuit might cause confusion would be if an attempt were made to service the transmitter without a circuit diagram. It would cause some head-scratching to discover 600 volts on the plate and 300 volts on the cathode of the buffer tube under these conditions. The circuit diagram which comes with the kit immediately eliminates any possible confusion.

Advancing to the 6146 output stage, it is conventional in all respects. It employs a



Note attractive appearance of assembled Heathkit DX-35 amateur transmitter. The complete kit, less crystals, key and microphone, is available by mail from the Heath Company for $56.95.

HELP US OBTAIN HAM LICENSES

In this section of the Transmitting Tower, the names of persons requesting help and encouragement in obtaining their amateur licenses are listed. To have your name listed, write to Herb S. Brier, W9EGQ, c/ 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

Ray Schinzel, WN1LCX, RFD #2, Skowhegan, Me. (Wants skeds with western states, except Calif.; will answer all letters)

Barbara Herzig (13), 18 Harlow Ave., Northampton, Mass.

Jim Boober (15), 30 Abbott St., Brewer, Me.

Bill Stark, A-Whittier Rd., Wellesley Hills, Mass.

Ronald Stygar, 64 Turner St., Willimantic, Conn. (Code and theory)

Ray Thombs, 252 Woodford St., Portland, Me.

K2/W2 CALL AREA

Harold J. Ellerman (39), 23 Marsae Place, Newark 6, N. J. (Code and theory)

Paul Helfer, Brookside Place, Pleasantville, N. Y. (Code)

Louis Macknik, KN2SZR (14), 11 Ford Hill, Deposit, N. Y.

Richard Herman, 806 Hamilton St., Rahway, N. J.

Mike Vinocur, 1776 E. 13th St., Brooklyn 29, N. Y. (Code and theory)

Emmett E. Miller, 167-17 Brinkerhoff Ave., Jamaica, L.I., N.Y. Phone: JAmaica 3-1972. (Code)

Thomas Maher, 65 East Suffolk Ave., Central Islip, L.I., N.Y. Phone: Central Islip 4-6735. (Code, Novice theory)

Jack Buswell, Box 117, Grahamsville, N. Y. (Theory and regulation)

George Dick, 1288 Sheridan St., Camden 4, N. J.

Lou Macknik, 11 Ford Hill, Deposit, N. Y. (Theory for General license)

Ed Bujanowski, 21 Edward St., Lancaster, N. Y. (Code and theory; pen pals)

Kenneth Nencga, 211 Lincoln Ave., Syracuse 4, N. Y. Phone: 76-9730. (Code; wants QSL cards)

Tom Juliano (12), 9 Courter Ave., Maplewood, N. J.

Dave Loder, Box 256, Islip, N. Y. (Theory)

Julian A. Pratt, 35-16 34th St., Astoria, L. I., N. Y. (Code and theory)

John J. Wilker, 191 St. Marks Ave., Brooklyn 38, N. Y. (Code and theory)

K3/W3 CALL AREA

Robert Rominoff, 2207 Washington Ave., Silver Spring, Md.

Terry Howe (13), 10230 New Hampshire Ave., Silver Spring, Md.

Roy Crockett, Box 734, Pocahontas, Va.

Charles Schuman, WN3EGP, 5610 Talbot Place, Baltimore 7, Md. (Wants help with code and theory and is starting a Pen Pal Club)

Nathaniel F. Byrd, 246 East Hortter St., Philadelphia 19, Pa.

Stephen A. Crouch (16), 581 Crystal Dr., Pittsburgh 34, Pa.

Albert Hast (16), RFD #3, Valley Road, Cumberland, Md.

Arthur Gonzalez, 1711 Rhode Island Ave., N. W., Washington, D. C. (Code and theory)

Barry J. Staltz, 465 McCully St., White Oak (McKeesport), Pa.

Benny Montalbono (14), 115 Willow St., Dunmore 12, Pa. (Code, theory, and someone to give him Novice test)

Earl V. Paltas Jr. (16), 1854 N. Front St., Philadelphia 22, Pa. (Code, theory, and someone to give him Novice test)

Lester Jarver, 15360 Woodlawn, Midland, Pa. (Code and theory)

K4/W4 CALL AREA

Booker T. Mickel, 1503 Orchard St., Greensboro, N. C. (Code and theory)

Mac Russell, 602 West Main St., Manchester, Georgia.

Edward Clark, Montvale, Va. (Theory)

Franklin Penn, 204 Short St., Hartselle, Ala.

William H. Driver, 1420 O'Shaughnerry Ave., Huntsville, Ala. (Code and theory)

Gil Bateman, 7840-46 Ave. No., St. Petersburg, Fla.

K5/W5 CALL AREA

Furman Crouch (13), 4611 Erath St., Fort Worth, Texas.

Brace Maxwell (13½), 2104 Caphes, El Paso, Texas.

Eddy Brooks, KN4JSG, (16), P. O. Box 3162, Knoxville, Tenn. (Needs help in General theory especially)

Paul Valentino (14), 825 Meadow St., Columbia 5, S. C.

Arthur Sanders, Box 956, Apopka, Fla. (Code and theory)

Robbie Stedeford (14), 1312 Wolfe St., Jacksonville 5, Fla. (Novice, code, theory and a DX pen pal)

Myron Smith, Rt. No. 1, Box 150, Owasso, Okla. (Code speed for Novice test)

Glenn Hatcher, 1141 So. Braden, Tulsa 12, Okla. (Help in choosing transmitter; would also like to receive QSL cards)

Dennis Brown, 277 Evans, Houston 17, Texas. (Novice theory)

Michael Grimes, P. O. Box 992, Gladewater, Texas. (Code and theory)

Don B. Heckman, 4337 Orange Grove Dr., Houston 16, Texas. (Code; also would like QSL cards)

Jimmy Powell (14), 126 McNeel Rd., San Antonio, Texas.

James R. Moore, 1414 Ward St., Rosenberg, Texas.

K6/W6 CALL AREA

Andrew Frederickson, P.O. Box 354, Folsom, Calif.

Jimmy Jackson (14), 1809 90th Ave., Oakland 3, Calif.

Ed Mentzer (16), 719 Taraval St., San Francisco 16, Calif. (Code and theory)

Heimo Turovaara, 275 Crescent Ave., San Francisco 10, Calif.

Lynn MacCarty, 20300 Bear Creek Rd., Los Gatos, Calif.

Dennis Hahn, 1343 S. Cloverdale Ave., Los Angeles 19, Calif. (Code)

Dave Charleston, 188 Wilshire Ave., Daly City, Calif.

J. Douglas Cline, 1211 Parker Place, San Diego 9, Calif.

Jack Bollinger, 679 Yuber St., Richmond 9, Calif. (Code and theory)

PFC Jerome Birnbaum, K2JBK, RA12468771, HQ Btry 57 F. A. Bn., APO 6, San Francisco, Calif. (Pen pals)

K7/W7 CALL AREA

Terrence H. Wolfley (15), Route #3, Blackfoot, Idaho. (Novice code and theory)

Stephen L. Sala, Box 1, Osburn, Idaho. (Mostly code)

Luman Coad, P.O. Box 7, Buhl, Idaho. (Radio theory and code)

John Beck, Gen. Del., Glasgow, Montana. (Code and theory)

K8/W8 CALL AREA

Harry Burton, Jr. (13), 501 Meadowlane Rd., Dearborn, Mich. (Code and theory)

Jim Carpenter (15), 610 Washington St., Martins Ferry, Ohio.

Garry Glasgow, 1826 Glenwood Road, Ann Arbor, Mich.

Michael Stanley, Route 5, Fairmont, W. Va. (Code)

K9/W9 CALL AREA

Steve Gallion, 1621 North Ill. St., Decatur, Ill. (Code and theory)

Tom Burch, WN9PHL, 221 East 6th St., Muncie, Ind. (Will answer all cards and letters)

Jim Potter, 203 Court St., East Peoria, Ill. (Needs help with code; will help others locally or by mail with Novice and General theory)

Stanley Partain (14), 606 W. St. Louis St., West Frankfort, Ill. (Code and pen pals)

George Lacy, 305 Cedar St., Gillespie, Ill.

James K. Heminger, 3215 Burr Oak Ave., Elkhart, Ind. (Code and theory)

Bill Ritchie, 3832 N. Neva Ave., Chicago 34, Ill. (Theory)

Mary Zettelman (15), 1432 Asbury, Evanston, Ill. (Wants tips and help on obtaining General Class license and equipment)

Dick De Smet, 3059 So. 47th St., Milwaukee 15, Wis. (Code and theory)

William E. Friedel, 15 W. Bank St., Fond Du Lac, Wis. (Theory)

KØ/WØ CALL AREA

Gary Swelander (14), 6921 46 Ave., No., Minneapolis, Minn. (General class code and theory)

VE AND OTHERS

Wayne Cook (15), 453 Niagara St., Winnipeg, Manitoba, Canada.

Jos. Deidun (23), 165 Carlaw Ave., Toronto, Ont., Canada. (Code, pen pals; will answer all letters)

Jacqualine Satohovitch (15), 411 6th St., N.W., Portage La Prairie, Manitoba, Canada.

William H. Sheils (32), 411 6th St., N.W., Portage La Prairie, Manitoba, Canada.

Gilles "Pag" Page, VE2-SWL (15), 7199 De Gaspe St., Montreal 10, Quebec, Canada. (Help in starting an SWL-ham club; would also like to receive QSL cards, all of which he will answer; wants pen pals, SWL's in Canada)

Herb Klassen, 425 Edison Ave., Winnipeg 5, Man., Canada. Phone: ED 1-5246.

Henry Ewert, 386 Edison Ave., Winnipeg 5, Man., Canada. Phone: ED 1-5086.

Nancy Baughman (13), Apt. #3, 742 L St., Anchorage, Alaska. (Code and theory and general information about amateur radio; will answer all letters)

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, Suite 800, Wyatt Bldg., 777 Fourteenth St., N. W., Washington 5, D. C.

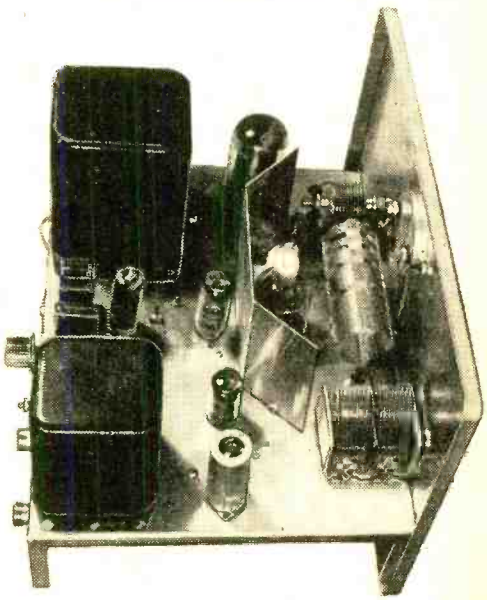
pi-network output tank circuit, which does a good job of putting power into a wider range of antenna systems. The amplifier coil is "air wound" of #16 tinned wire. Its inductance is changed for operation on the different bands by means of taps on it going to the bandswitch. Rated power input to the 6145 is 65 watts for code operation.

For phone operation, the 6146 screen-grid voltage is fed through one half of the 12AU7 twin-triode modulator tube to vary the instantaneous screen voltage and thus the instantaneous output power of the transmitter in accordance with the sound waves striking the microphone. At the same time, the other half of the 12AU7 controls the average 6146 screen voltage.

With no sound striking the microphone, the screen voltage is low (40 volts) and the power output from the transmitter is also low, but as you speak into the microphone, the average screen voltage rises. Simultaneously, this average value is varied at an audio-frequency rate by the modulator. The result of these combined actions is that, without modulation, both the resting plate current and the output (carrier) power of the 6146 are low. Under modulation, however, they increase to accommodate the audio signal superimposed on the carrier. This is "controlled-carrier" modulation.

The two halves of the 12AX7 speech amplifier tube are connected in cascade to

(*Continued on page* 114)



Out of its aluminum cabinet and from the top, the clean, efficient layout and high quality of the components used in the DX-35 may be readily seen.

Sound Impressions

WHAT should I play on my hi-fi system? Should I get *this* recording or *that* recording? How do I know that a record release I like now will be as interesting a year from now? So-and-so's performance is fine, but how good is his record from a hi-fi point of view? Isn't there a recording that captures both the musical as well as the technical qualities I'm looking for? How do different recording techniques effect the way a record will sound in my living room?

These are some of the questions that race through the mind of hi-fi enthusiasts as they leaf through the pages of a record catalog or browse among the shelves of a record dealer. To a great degree, the answers to them are subjective, but there are some specific things that can be said about recordings. These "specific things" have to do with the public's enthusiasm for hi-fi as well as its attendant interest in music of all types.

Sound Impressions is a new POP'tronics department which will answer these questions in terms of specific releases.* New (and some old) pressings will be reviewed from the standpoint of the hi-fi listener as well as the music lover. As a matter of fact, we believe that music lovers are made, not born, and hi-fi is making more music enthusiasts than possibly all the so-called music-appreciation courses ever could.

In addition to reports on records, this department will report on unusual sound programs available on FM and AM, on outstanding tapes, and on news developments behind the scenes at recording studios.

This month brings a batch of new releases, noteworthy for their excellent sound and program material, which should appeal to hi-fi fledglings and veteran record collectors alike.

Piano and Orchestra. The Rachmaninoff *Piano Concerto No. 2* abounds in melodies you will hum and whistle long after you hear it. Even Tin Pan Alley has borrowed liberally from its storehouse of tunes. Add to this its rhythmic excitement, orchestral power and exacting piano passages, and you have a work that can't fail to please almost anyone.

Two new versions of this work appeared this month. On Columbia ML 5103, Eugene Ormandy leads the Philadelphia Orchestra with Eugene Istomin at the piano. This recording is notable for the "presence" of its solo passages. With good transient response in your hi-fi system, you can almost "feel" the piano hammers hit the strings. The piano sound has plenty of bite and remains well balanced against the massive weight of the orchestra's lush strings.

For even more vibrant sound, try the London version (London Philharmonic Orchestra conducted by Adrian Boult with Clifford Curzon at the piano). The piano blends in with the orchestra for some really solid tone. With a high-power hi-fi system, you may get the feeling of being right in the concert hall. The performance itself, though first-rate, seems to lack some of the special excitement imparted by Istomin and Ormandy on the Columbia pressing. Listen to both before making your choice.

Organ and Orchestra. The tonal possibilities of contrasting organ and orchestra have challenged and intrigued composers for centuries. About 200 years ago, Mozart and Handel wrote concerti for organ and orchestra in which the organ acted as solo instrument, set off by a small body of strings. These compositions seem to have inspired many French composers—among them Saint-Saens and Franck—to write similar works.

In his *Concerto for Organ, Tympani and Strings,* the modern French composer Poulenc uses the organ in a lively "duel" with the orchestra. This give-and-take, punctuated by the kettledrum, alternates with quiet, lyrical passages in which the organ takes the parts that would normally be assigned to the woodwinds. But soon the calm is broken again. The organist literally pulls all his stops and the organ chases the strings through a breakneck allegro to a photo-finish.

The mood hearkens back to its 18th century models, but the clanging chords and off-beat dissonances are strictly of our own day. So is the feeling of nervous excitement that pervades the piece under the lively direction of Arthur Winograd as he con-

* Between running his own hi-fi shop, conducting a course in audio at a local school, writing for RADIO & TELEVISION NEWS—to mention only a few of many activities—Bert Whyte has found it impossible to continue his monthly "Disc and Tape Review" for POPULAR ELECTRONICS. "Sound Impressions" is its replacement.

ducts the Philharmonic Orchestra of Hamburg, with R. Ellsasser, organ soloist (MGM -E3361).

Winograd, incidentally, is a still-very-young American who has made quite a name for himself as the 'cellist of New York's Juilliard Quartet. Recently he quit to try conducting. This record, made in Hamburg, Germany, proves that the 'cello's loss is the podium's gain. It also proves that, while many European conductors have enriched America's musical life, the deal also works in reverse.

The flip side of this record contains another organ-orchestra work. This one, by Nebraska-born Howard Hanson, is a *Concerto for Organ, Harp and Strings*. Less sprightly and dramatic than the Poulenc, this piece sustains a calm meandering mood.

Both sides of MGM-E3361 are strictly hi-fi as regards tonal clarity and definition, if somewhat lacking in the "spacious" feeling that puts all the instruments in proper perspective.

Home-Spun Hi-Fi. Interested in folk music? Try *Shivaree* with Jean Ritchie, Oscar Brand, Tom Paley and others (Esoteric ES-538). Nothing except the label is "esoteric" about this record. It's a down-to-earth load of fun crammed with the kind of singing, stomping and strumming you don't ordinarily hear unless it be Saturday night and the hill-folk know for sure "you ain't no reven-ooer!"

Seems like Jean and Oscar just got married, but the Shivaree won't let them get off by themselves and keeps them around for two full LP sides, swapping songs and dances. Unless you are a strictly "no-nonsense" type, you won't be able to resist the innocent charm of this record. It makes a fine disc for a party, or just for listening. The five-string banjo, guitar, mouth organ and Jew's-harp clang merrily in what is perhaps the cleanest hi-fi ever applied to folk music.

Unearthy Sounds. A bold experimenter in sound is Alan Hovhannes. Though a classical musician, Hovhannes composes music for rare and exotic combinations of instruments. A dreamy, hypnotic mood pervades the various pieces of MGM record E3164. Celesta, saxophone, percussion, harp, tuned wood blocks, tom-toms, etc., mix in a heady tonal brew. Try *Orbit No. 1*! Even the title suggests that here we go beyond the sphere of mood music into what might be called "moon" music. Tuned metal bars give out with eerie bongs as they are struck with rubber mallets, floating their clangor on wispy chords. Bright sounds, weaving an airy floating texture, mix eerily with misty moods.

(*Continued on page* 98)

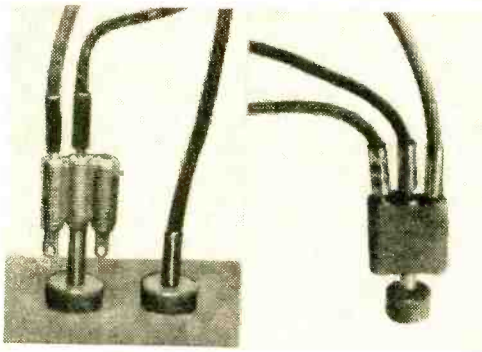
Candid shots of the recording session of "The Most Happy Fellow" show composer Frank Loesser (left center) talking with Jo Sullivan and Robert Weede. At right, Jo Sullivan and Art Lund seem pleased with playback of duet just taped. Below, orchestra and chorus are well separated in the recording studio for better acoustic perspective.

TIPS and TECHNIQUES

MULTIPLE TIP-JACK ADAPTER

This simple adapter allows one or two wire leads (having phone-tips on ends) to be connected to a tip-jack without interfering with the earphone connections. Two of these adapters will allow one or two extra pairs of earphones to be connected in parallel. Or you can use these adapters to join together wire leads (having tips on ends) to obtain a longer lead. Other uses will suggest themselves.

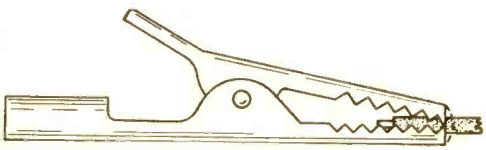
As shown in the photos, you simply remove the hardware from three ordinary phone-tip-jacks, and solder the jacks side-



by-side. Then solder the lugs on the center jack into the sleeve of a phone-tip. Note how you can plug in one or two wire leads without interfering with the earphone connections. To dress up the adapter, clip off the lugs on the two outside jacks and wrap some wide Mystik tape around them. —*A. T.*

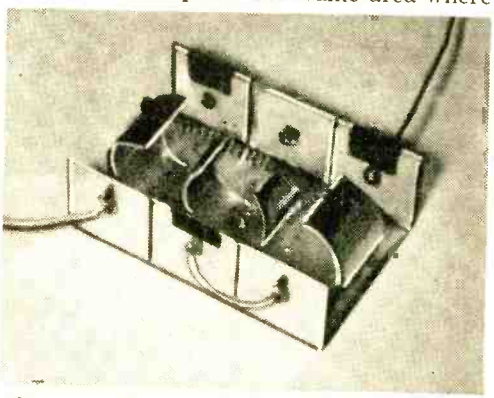
AUXILIARY WIRE STRIPPER

To remove wire insulation in tight spots, where a knife or regular stripper can't get in, try using the "auxiliary wire stripper" shown below. Obviously, it is merely an alligator clip whose jaws have been filed down to form sharp upper and lower cutting edges. Use the end of the file to ream out a small round hole between the new edges. This hole will accommodate the small diameters of the wires to be inserted and stripped of their insulation. —*F.E.B.*



BETTER BATTERY BOXES

Aluminum battery boxes have a slight drawback. As a cell is inserted, its center terminal often contacts the box's metal frame. Since the case of the cell is already contacting the frame, the new contact places a very low resistance across the battery. To prevent this, attach a strip of vinyl plastic tape on the frame area where

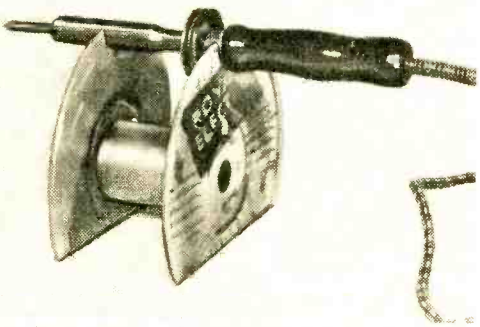


the unwanted contact occurs. This tape may be extended to the outside of the box to indicate cell polarity.

Further improvement can be made by lining the cell-holding clips with strips of tape. This prevents cell leakage from providing a low-resistance path through the cell's cover to ground. It also makes it easier to insert the cells. —*J.E.P.*

SOLDERING IRON HOLDER

Most experimenters own a small-size soldering iron, but few usually have a proper holder for it. When the iron is hot, during use, such a holder makes for safe and con-



venient work. A suitable holder may be fashioned quite readily from an empty 6" metal wire reel. Such reels are available from radio or electrical supply houses. Simply cut off a section from each of the flanges on the reel, and then cut out the opposite sides to hold the iron. —*H. L.*

BUILD THIS NEW FABULOUS

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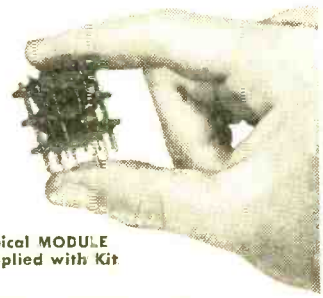
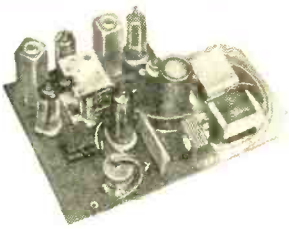


Typical MODULE Supplied with Kit



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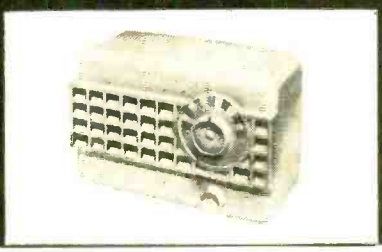

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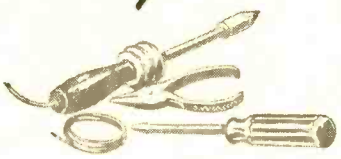

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Every Heathkit comes complete with detailed step-by-step instructions and large pictorial diagrams that insure successful construction—even for the beginner. Enjoy both the satisfaction and the economy of "building it yourself."

Circuit boards cut assembly time in half

1% resistors insure instrument accuracy.

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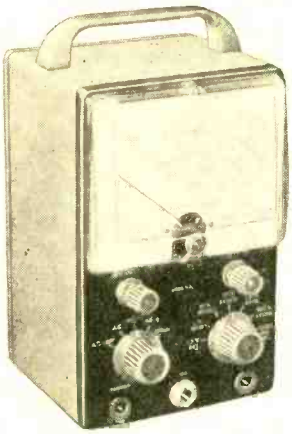

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In addition to measuring AC (rms), DC, and resistance, the modern-design V-7A incorporates facilities for peak-to-peak measurements. These are essential in FM and television servicing.

AC (rms) and DC voltage ranges are 1.5, 5, 15, 50, 150, 500, and 1500. Peak-to-peak AC voltage ranges are 4, 14, 40, 140, 400, 1400, at 4,000. Ohmmeter ranges are X1, X10, X100, X1000, X10K, X100K, and X 1 megohm. A db scale is also provided. Polarity reversing switch provided for DC measurements, and zero center operation is within range of the front panel controls. Employs a 200 microampere meter for indication. Input impedance is 11 megohms.

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The Model M-1 measures AC or DC voltage at 0-10, 30, 300, 1000, and 5000 volts. Measures direct current at 0-10 ma and 0-100 ma. Provides ohmmeter ranges of 0-3000 (30 ohm center scale) and 0-300,000 ohms (3000 ohms center scale). Features a 400 microampere meter for sensitivity of 1000 ohms per volt. Handy and portable. Will fit in your coat pocket, tool box, glove compartment, or desk drawer.

Heathkit **VOM KIT**

20,000 ohms/v. DC and 5,000 ohms/v. AC sensitivity. Ranges (AC and DC) are 0-1.5, 5, 50, 150, 500, 1500, and 5000 v. Direct current ranges are 0-150 ua, 15 ma, 150 ma, 500 ma, and 15 a. Resistance ranges provide center-scale readings of 15, 1500 and 150,000 ohms. DB ranges cover −10 db to +65 db.

Features 4½" 50 ua meter and 1% precision resistors.

MODEL MM-1

$29.50 Shpg. Wt. 6 Lbs.

HEATH COMPANY *A Subsidiary of Daystrom, Inc.*
BENTON HARBOR 5, MICHIGAN

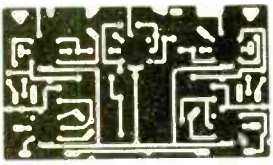
Heathkit 3" oscilloscope kit

ETCHED CIRCUIT

- Push-pull vertical and horizontal amplifiers.
- Light weight and small size for portability.
- Good sensitivity and broad frequency response.
- Etched metal circuit boards for simplified assembly.
- Attractive panel and case styling.

MODEL OL-1

$29.50 Shpg. Wt. 14 Lbs.



This compact little oscilloscope is just the ticket for use in the ham shack or home workshop. Measures only 9½" H. x 6½" W. x 11¾" D. Weighs only 11 pounds.

Employing etched metal circuit boards, the Model OL-1 features vertical response with in ±3 db from 2 cps to 200 kc. Vertical sensitivity is 0.25 volts rms per inch, peak-to-peak, and sweep generator operates from 20 cps to 100,000 cps. Provision for direct RF connection to deflection plates. Incorporates many features not expected at this price level. The 8-tube circuit features a type 3GP1 cathode ray tube.

- Cathode-follower output for isolation.
- No oscillator calibration required.
- Covers 160 kc to 220 mc (including harmonics).

Heathkit signal generator kit

This signal generator covers 160 kc to 110 mc on fundamentals in 5 bands. Calibrated harmonics extend its usefulness up to 220 mc. The output signal is modulated at 400 cps, and the RF output is in excess of 100,000 microvolts. Output controlled by both a continuously variable and a fixed step attenuator. Audio output may be obtained for amplifier testing.

MODEL SG-8

$19.50 Shpg. Wt. 8 Lbs.

This is one of the biggest signal generator bargains available today. The tried and proven Model SG-8 offers all of the outstanding features required for a basic service instrument or for use in experimenting in the home workshop. High quality components and outstanding performance. Easy to build, and no calibration required for ordinary use.

Heathkit grid dip meter kit

This extremely valuable instrument is a convenient signal source for determining the frequency of other signals by the comparison method. Range is from 2 mc to 250 mc. Uses 500 ua meter for indication, and is provided with a sensitivity control and headphone jack. Includes prewound coils and rack. For hams, experimenters, and servicemen.

MODEL GD-1B

$19.50

Shpg. Wt. 4 Lbs.

Heathkit ANTENNA impedance meter kit

Used in conjunction with a signal source, the Model AM-1 will enable you to measure RF impedance. Valuable in line matching, adjustment of beam and mobile antennas, etc. Will double as a phone monitor or relative field strength indicator. A 100 microampere meter is employed. Covers the impedance range from 0 to 600 ohms. An instrument of many uses for the amateur. Easily pays for itself through the jobs it will perform.

MODEL AM-1

$14.50 Shpg. Wt. 2 Lbs.

HEATH COMPANY A SUBSIDIARY OF DAYSTROM, INC.

BENTON HARBOR 5, MICHIGAN

Heathkit

vfo

KIT

- ☆ 6AU6 electron-coupled oscillator.
- ☆ 0A2 voltage regulator tube for stability.
- ☆ Smooth-acting illuminated dial.
- ☆ Easy to build and attractively styled.

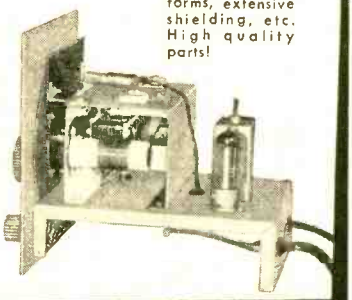
MODEL VF-1 **$19.50***

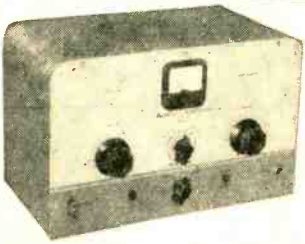
Shpg. Wt. 7 Lbs.

This variable frequency oscillator covers 160-80-40-15-11 and 10 meters with three basic oscillator frequencies. RF output is better than 10 volts average on fundamentals. Enjoy the convenience and flexibility of VFO operation at no more than the price of crystals. May be powered from a socket on the Heathkit Model AT-1 transmitter, or supplied with power from most transmitters.

Features illuminated and pre-calibrated dial scale. Cable and plug provided to fit crystal socket of any modern transmitter.

Extra features include copper-plated chassis, ceramic coil forms, extensive shielding, etc. High quality parts!





Heathkit CW amateur transmitter kit

SPECIFICATIONS:

RF Amplifier Power Input	25-30 watts
Output Connection	52 ohms
Band Coverage	80, 40, 20, 15, 11, 10 Meters
Tube Complement:	
5U4G	Rectifier
6AG7	Oscillator-Multiplier
6L6	Amplifier-Doubler

This CW transmitter is complete with its own power supply and covers 80, 40, 20, 15, 11, and 10 meters. Incorporates such outstanding features as key-click filter, line filter, copper plated chassis, pre-wound coils, and high quality components. Employs a 6AG7 oscillator, 6L6 final amplifier. Operates up to 30 watts plate power input.

MODEL AT-1 **$29.50***

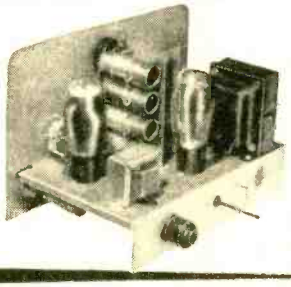
Shpg. Wt. 15 Lbs.

Single-knob band-switching for 80, 40, 20, 15, 11 and 10 meters.

Plate power input 25-30 watts.

Panel meter monitors final grid or plate current.

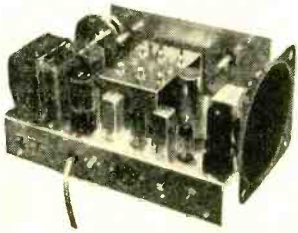
Best dollar-per-watt buy on the market.



Slide-rule dial-electrical band-spread-ham bands marked.

Slug-tuned coils and efficient IF transformers for good sensitivity and selectivity.

Transformer-operated power supply for safety and high efficiency.



Heathkit COMMUNICATIONS TYPE

all band receiver kit

$27.95* MODEL AR-3 Shpg. Wt. 12 Lbs.

CABINET: Fabric-covered cabinet available. Includes aluminum panel, speaker grille, and protective rubber feet. Measures 12-1/4" W. x 6-3/4" H. x 7-3/4" D. No. 91-15. Shpg. Wt. 5 Lbs. $4.50.

The Model AR-3 covers from 550 kc to 30 mc on 4 bands. Covers foreign broadcast, radio hams, and other interesting short wave signals.

Features good sensitivity and selectivity. Separate RF and AF gain controls—noise limiter—AGC—VFO, headphone jack—5½" PM speaker and illuminated tuning dial.

SPECIFICATIONS:

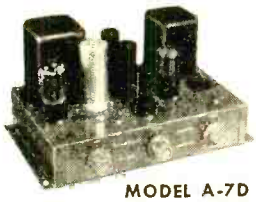
Frequency Range	550 kc to 30 mc on four bands
Tube Complement	1—12BE6 oscillator and mixer
	1—12BA6 IF amplifier
	1—12AV6 second detector, AVC, first audio amplifier and reflex BFO
	1—12A6 beam power output
	1—5Y3 full wave rectifier

HEATH COMPANY A SUBSIDIARY OF DAYSTROM, INC.

BENTON HARBOR 5, MICHIGAN

HEATHKIT ECONOMY 7-WATT HIGH FIDELITY

amplifier kit



MODEL A-7D

$16.95 Shpg. Wt.

This is a 7-watt high fidelity amplifier that will produce more than adequate output for normal home installations. Its frequency characteristics are ± 1½ db from 20 to 20,000 cps. Output transformer is tapped to match speakers of 4, 8, or 16 ohms. Separate bass and treble tone controls provided. Features potted transformers, push-pull output, and detailed construction manual for easy assembly.

MODEL A-7E: Provides a preamplifier stage with two switch-selected inputs and RIAA compensation for low-level cartridges. Preamplifier built on same chassis as main amplifier. Model A-7E. Shipping weight 10 lbs. **$18.50.**

Free 52-Page 1956 Catalog

Describes more than 65 interesting "build-it-yourself" projects. Amateur equipment, hi fi amplifiers, and the complete Heathkit line of test instruments. Get yours today!

HEATHKIT BROADCAST BAND

receiver kit

MODEL BR-2

Shpg. Wt. 10 Lbs.

$17.50 Less Cabinet

You can build this table model radio and learn about radio circuit and parts during assembly. Complete instructions simplify construction, even for the beginner. Covers 550 to 1600 kc and features miniature tubes, 5½" PM speaker, and built-in antenna.

CABINET: Fabric-covered plywood cabinet as shown. Parts #91-9, shipping wt. 5 lbs. **$4.50**

HEATHKIT HIGH FIDELITY

fm tuner kit

MODEL FM-3

$24.50

Shpg. Wt. 7 Lbs.

Tunes from 88 to 108 megacycles and features sensitivity and selectivity not expected at this price level. Cabinet supplied with the kit. Built-in power supply and a stage of audio to insure adequate output. Easy to build from step-by-step instructions and large pictorial diagrams.

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TOOLS and GADGETS

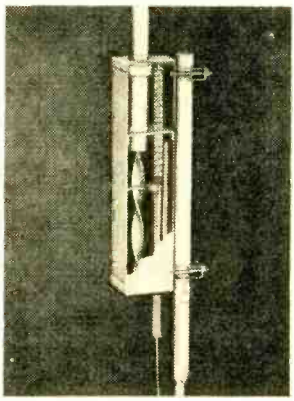
SERIES-STRING FILAMENT CHECKER

So compact that it will fit in the palm of your hand, the Model SS-10 is said to be the ideal answer to the open-filament locating problem now encountered in TV sets which use series-string tubes. Completely self-contained and battery-powered, it provides a quick check of filament continuity for radio receiver and TV picture tubes, checks TV and radio set fuse continuity, a.c. circuit continuity in TV sets, and pilot lamps (bayonet and screw-base types).

Model SS-10 is handsomely styled in a custom-molded case with a striking gold and black anodized aluminum panel. Price, $6.50 complete with batteries and ready to operate. (*Precision Apparatus Company, Inc.*, 70-31 84th St., Glendale 27, L. I., N. Y.)

MOTORLESS ANTENNA ROTATOR

Since there is no motor to burn out, and no gears to wear out and stick, the major service problems common to most rotators are eliminated in the Helix Model H. It employs the age-old mechanical principle of a flat spiral helix to give full 360° rotation, without an electric motor.

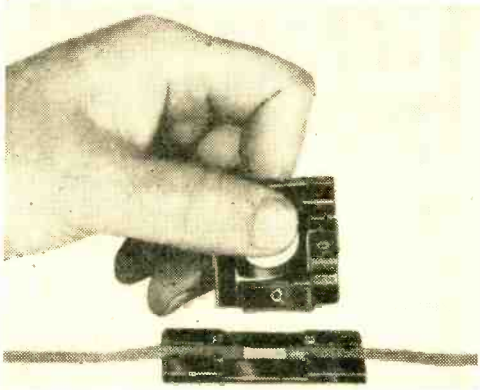


A slotted crossarm within the housing is moved downward by an easy pull on the manually operated steel cable with a direction indicator which may be mounted inside the house, outside, or on a porch. As the arm moves down, the antenna is rotated clockwise through 360°. The design of the crossarm and flat spiraled helix causes the antenna to lock positively in any position to prevent drift. (*Helix Rotor Company*, 220 Live Oak, Marlin, Texas)

TAPE SPLICER

A new addition to the family of "Gibson Girl" tape splicers is the "Semi-Pro" SP-4, for semi-professional and amateur use. Consisting of a tape guide which may be fastened on any tape recorder, and a hand splicer which has two different cutting actions, it miter-cuts and trims the tape splice without the use of scissors or razor blades.

One side of the splicer makes a diagonal cut in the tape; the other side trims the splice with the "Gibson Girl" shape—two concave indentations which form a slight



"waist" in the tape, preventing adhesive from contacting critical parts of the recorder and preventing layer-to-layer adhesion of the tape. List price, $3.50. (*Robins Industries Corp.*, 214-26 41st Ave., Bayside 61, N. Y.)

SOLDERLESS PHONO PLUG

No soldering is necessary with the Model #PP phono plug. Accommodating all sizes of coaxial wire and cable commonly used in audio, it can be attached by anyone in one minute. The built-in handle eliminates danger of pulling out the center pin when disconnecting the phono plug from the jack.

You prepare the coaxial cable end by stripping off about 1½" of outer insulation and then trimming off about ½" of the shield braid. Force the center conductor onto the sharp pin on the Model #PP plug. With center conductor in place, you bend the tab over and crimp it on the plug to make good contact with the exposed shield braid on the cable. That's all! (*Workman TV Inc.*, Teaneck, N. J.)

R/C ESCAPEMENTS

Now available to the R/C fan and experimenter are the first three units in Lafa-

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- ☐ PRACTICAL TELEVISION ENGINEERING
- ☐ PRACTICAL AERONAUTICAL ELECTRONICS ENGINEERING

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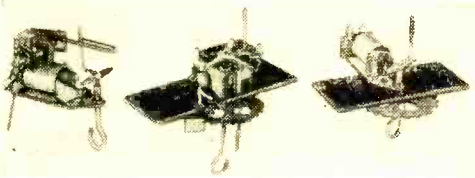
yette's new line of R/C escapements: a two-arm, self-neutralizing model; a four-arm self-neutralizing compound design; and an engine control escapement. All three units are ruggedly constructed and maintain low current drain. Ratchet gov-



ernor wheels provide smooth rotating speed.

The two-arm escapement, F-255, is priced at $2.45; the four-arm design, F-256, at $3.95; and the engine control, F-256, at $3.45. (*Lafayette Radio*, 100 Sixth Ave., New York 13, N. Y.) —30—

Sound Impressions

(*Continued from page* 89)

Yet all of this is first-rate music, put together by a young American composer of rapidly rising fame. Very careful microphoning sets all these strange sounds in proper balance with each other. The recording is literally clear as a bell and the performance under the composer's own direction couldn't be better. This is indeed a unique hi-fi thrill and a musical experience as well.

The Old-Time Wurlitzer. Raucous sound may be hard on the ears, but here it evokes nostalgic memory. The clangor of the theater organ at the Fox in San Francisco takes you right back to the days before the talking pictures when these monstrous sound machines made up for the silence of the films. The tunes themselves date back about thirty years: *Little Girl Blue, My Funny Valentine, The Man I Love, Old Man River,* and others are pumped out with gusto by George Wright on *"Showtime"* (Hi-Fi Record No. R-708).

Picked up from six different microphone locations, a fancy assortment of tinkles, booms, and strange pipe mixtures emerges from the grooves with a bigger-than-life wallop. The lows on the old Wurlitzer plumb a depth of 16 cps; the highest pipe gives out with a 16-kc. peep. Along with sharp transients, this puts your sound system (and ears) through a strenuous workout.

Musical Comedy. Two musicals opened on Broadway this year, both based on famous stage plays. *My Fair Lady* and *The Most Happy Fella* are sprightly, cheerful, witty, and tuneful works. The albums containing the songs and music of both these shows are easy delights to the ear.

My Fair Lady (Columbia OL-5090) boasts some of the finest artistry that ever found its way from the Broadway stage into the LP recording studios. Hi-fi recording has here projected the bite and vigor of Rex Harrison's half-singing and half-talking of his rhythmic lines; the fetching charm of Julie Andrew's clean lyrical singing; the burly swaggering of Stanley Holloway's big-barrel voice. Words and music are solidly integrated; the one complements the other. The recording is splendid—you get the feeling that everyone concerned, from conductor to "miker," had one fine time doing the job. The story unfolded is the familiar Pygmalion legend in modern dress. There is, within the framework of such a plot, much room for wit, charm, humor, satire, tenderness, and even a little sadness. And Alan Jay Lerner's book and lyrics, set to Frederick Loewe's music, elicit all these and more. The whole thing, brilliantly performed and recorded, is served up as a delectable listening treat you will want to hear again and again.

More literature set to music is Frank Loesser's *The Most Happy Fella* (Columbia OL-5118). This perhaps overly exuberant show is based on Sidney Howard's play *They Knew What They Wanted,* the story of a middle-aged fruit grower who takes a young and beautiful wife, and the complications that ensue. The musical version subtracts some of the depth from the original play and replaces it with a bouncy kind of surface sentiment. At that, the production contains a fair mixture of fast and slow, happy and sad, raucous and tender singing. Orchestration and performance are vigorous and ambitious—ranging from folksy simplicity to near-symphonic cadences.

Both of these Columbia recordings are truly hi-fi as regards sound. Singers are easily understood; voices stand out nicely in front of orchestras. The orchestras, themselves, are recorded in just the right perspective; with plenty of lows, highs, and everything in between. Surfaces are very clean. —30—

How to Buy Your Hi-Fi Tuner

(*Continued from page* 60)

(5) *Suitable FM detector.* The detector in a radio sorts out and separates the intermingled audio and radio frequencies arriving over the air. The design of this circuit largely determines the fidelity of reception.

In FM tuners we have the choice of two types of detectors: (A) the *Armstrong circuit* employing a combination of *"limiter"*

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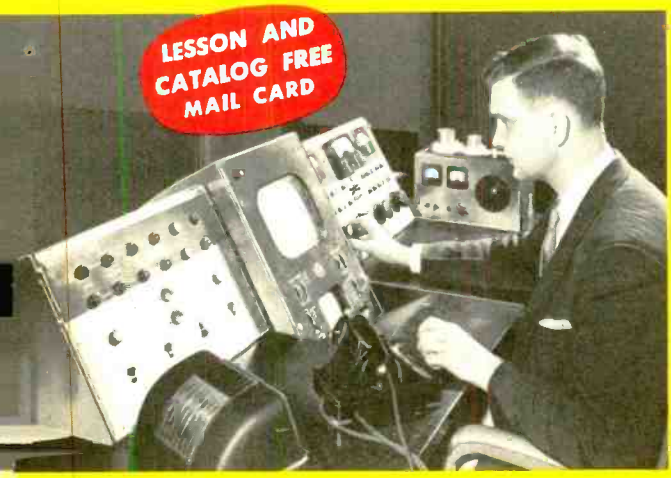

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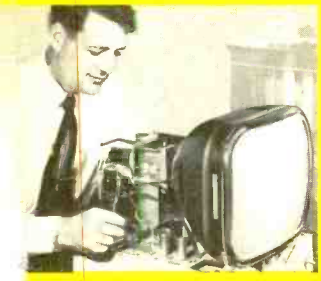

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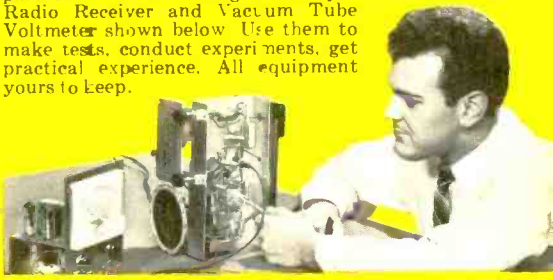

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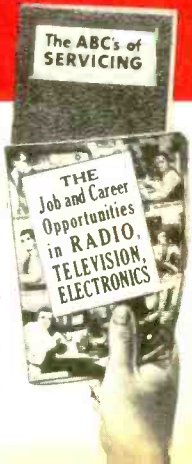

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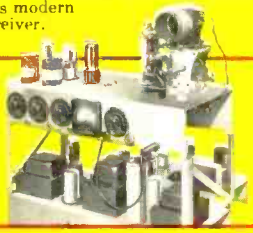

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and *"discriminator"* stages; (B) the *ratio detector*. Each has certain advantages and certain drawbacks. We will sketch them briefly to help you choose a tuner suitable to your needs.

The *Armstrong circuit* is capable of top audio quality, but only works well with a strong signal. This means the tuner must be *sensitive* enough to raise even a weak signal to the strength required to operate the Armstrong circuit efficiently. High sensitivity can be gained only by extra stages of i.f. amplification, which reflects itself in the price of the tuner. The Armstrong circuit itself requires at least two stages (called "limiter" and "discriminator"). For best interference and noise rejection, a dual-stage "cascade limiter" is used, which again raises the price. Of course, you get what you pay for. In a highly sensitive tuner, where no corners are cut to save money, the Armstrong circuit can't be beat.

The low-cost alternative to the expensive Armstrong circuit is the *ratio detector*. It needs no limiter stages and is less demanding in its input requirements. Able to function at far lower input levels than the Armstrong circuit, the ratio detector gets by with lower sensitivity and hence with fewer stages of i.f. This means dollars saved.

Admittedly, the ratio detector falls short of the ultimate in audio. Yet if the ratio detector is well engineered as part of a quality tuner, it sounds so good as to be virtually indistinguishable from the Armstrong circuit. A ratio detector FM tuner made by a reputable manufacturer thus seems a very happy solution to the cost vs quality dilemma.

(6) *AM bandwidth control.* The better AM tuners provide a switch for broadening or narrowing the audio frequency passband, to let you achieve the optimum compromise between selectivity and frequency response for any given station. You can widen the frequency response for AM stations coming in clear and strong. Or, by narrowing the frequency band, you get greater selectivity when you try to pick a weak or distant station from among its interfering neighbors.

Of course, factors like distortion, hum level, etc., should be as low as possible, or at least match the corresponding values in your amplifier. That way the tuner won't be the weak link in your chain of audio components. Look for the exact numerical values listed separately as your "yardstick for quality."

Your investment in a good tuner pays off in years of pleasure. For all the plays and music in the air, you'll get the best seats in the house—your own house. —30—

Tuning the Short-Wave Bands

(*Continued from page 70*)

Programmes, the following is stated: "The new 50-kw. outlet, VLD, is expected to be in operation for the Olympic Games and it is planned to have it in regular service early in 1957." Additional xmtrs for *Radio Australia* are also indicated for use in the near future. (*SW*)

Austria — The latter part of the *Radio Osterreich* xmsn on 25,945 kc. at 0520-0620 should be audible occasionally during September and October. Reception of this North American service would be improved if it were moved one hour or more later. (*RL*)

The daily English program on 25,615 kc. is noted at 0200-0400 and on 25,945 kc. at 0525-0625. (*CM*)

Bolivia—An opportunity to hear this difficult-to-log country is provided by CP5, *Radio Illimani*, La Paz, now operating on a new frequency of 9555 kc. It is heard in Spanish at 0600-0700 and also at 1900-2200, although interference from XETT, Mexico City, is severe during the latter period. (*RL*)

Brazil — ZYR78, *Radio Bandeirantes*, Sao Paulo, 11,925 kc., carries no English but is being heard about 0500 with Latin-American music. This one can be identified by the rooster crow after each selection. (*RB*)

A station identifying as *Radio Cocacabana* has been noted on 4960 kc. Further details are requested. (*WRH*)

British Somaliland—VQ6MI, Hargeisa, 7126 kc., is noted from 0930 to 1000/ close in Somali. The QSL says the station is on in Somali daily at 0830-1000. They use a Redifon xmtr with 1000 watts and a simple antenna. (*PF*)

ABBREVIATIONS

A—About this frequency
ABC—American Broadcasting Company
BBC—British Broadcasting Corp., London, England
B/C—Broadcasting service or station
c.w. QRM—Interference from code station
kc.—Kilocycle
kw.—Kilowatt of power
mc.—Megacycle
m.c.w.—Modulated code transmissions
m.w.—Medium wave
QRN—Static interference
QTH—Exact location
R.—Radio
s/off—Sign-off of station
s/on—Sign-on of station
V—Verified frequency
xmsn—Transmission from a radio station
xmtr—Transmitter used by station

Canada — The station reported in July, CFJB, Goose Bay, 7918 kc., probably was the sixth harmonic of CFGB on 1320 kc. CFJB is the call for a station in Brampton, Ontario, on 1090 kc. Meanwhile, an Air Force station has been reported on 7325 kc. at 1900, with QRM from CHU on 7335. No other details are available as yet. (*MP, FW*)

Ceylon—The Commercial Service of *Radio Ceylon*, Colombo, 9520 kc., has a very strong signal with English language broadcasts from 0945 to 1230 close-down. (*EM*)

China—*Radio Shanghai*, 6270 kc., is heard at 0900 with classical type of music, dual to 9985 kc. (*PF*)

Radio Hong Kong, on 3940 kc., can be heard in Chinese at 1100-1200. This should not be confused with Peking on 3960 kc. It is a good catch. (*GN*)

Colombia — *Radiodiffusion Militar de Colombia*, HJCT, 6155 kc., has news in Spanish at 2000 followed by *"English By Radio"* and an English music program. (*DX*)

Costa Rica—TIFC, San Jose, 9645 kc., can be heard at 2300-0000 with religious programs in English. Other programs, at 0700-2300, are in Spanish. Address is TIFC, Box 2710, San Jose. (*RC, JB*)

Denmark — OZF, Copenhagen, 9520 kc., is heard at 2100 in Danish: this is followed by an English session consisting of music and news. (*LB, CT*)

Ecuador—*The Voice of the Andes*, HCJB, Quito, is asking for reports of outlets in the 19- and 31-meter bands. (*JM*)

New stations operating are: HC3RM, *R. Cultural Machala*, Machala, 4845 kc., 250 watts; HC4JB, *Ondas Manabitas*, Sucre, 3385 kc., 250 watts; HC5HM, *R. Amazonas*, Cuenca, 4805 kc., 250 watts; HC5TO, *La Voz Del Pueblo*, Riobamba, 6025 kc., 250 watts; HC5JC, *La Voz de Salcedo*, Salcedo, 3380 kc., 200 watts. Two Guayaquil stations are again operating: HC2ET, *R. El Telegrafo*, 4825 kc., 250 watts; and HC2DC, *Radio Cenit*, 6150 kc., 250 watts. (*WRH*)

England—The BBC is using two channels in the 11-meter band: GSR on 25,720 kc., scheduled at 0530-1230 to Africa; and GSQ on 25,750 kc., operating at 0400-0915 to South Asia. Both are audible from about 0700 on days when the maximum usable frequencies are high. (*RL*)

Finland—The North America xmsn is scheduled to be moved to 0700-0900, effective Sept. 22, replacing the 2200-0000 summer schedule. Reception at the 0700-0900 time is best via their 100-kw. xmtr on 15,190 kc., with fair reception at times on 17,798 kc. News in English is scheduled at 0700. (*RL*)

France—Paris can be heard on an unlisted channel (in *WRH*) of 3965 kc. at 1400 with an interval signal and *Ici Paris*. A program in Czech follows. (*BB*)

French Cameroons — *Radiodiffusion du Cameroun, Yaounde*, 9270 kc., is fair to good from 1530 to 1600/close with French news and music. (*PM*)

A new station is *Radio Garoua* on 9900 kc. at 1300-1400 (news at 1300-1310). Reception reports should go to *Radiodiffusion du Cameroun*, Yaounde. (*WRH*)

French Somaliland—*Radio Djibouti*, on 4975 kc., is on the air daily at 0400-0515 and 1015-1415. News in French is heard at 1215-1230 (Sunday, at 1230-1240). Address is *Service de Information et Radiodiffusion*, Djibouti. (*WRH*)

Germany—*The Voice of Germany*, Cologne, has English news daily at 2130-2140 on 5980, 9640, and 11,795 kc. Address is Box 129, Cologne. (*WW, AE, SD, DD*)

Greece—*Radio Athens* is heard at times on 15,345 kc. at 1800-1830 with Greek for Mediterranean fishermen. It identifies as *Edeo Athinae, Radiofonikos Stathmos Athinon Vrakeon Kimaton, Efoni Tis Ellados*. Other stations, as yet not positively identified, are

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Adjust the *bass* and *treble tone controls* to correct for the characteristics of your loudspeaker and for the acoustic characteristics of the room. Choose settings which, in your total system, create the proper sense of aural balance. Now reduce the loudness setting to a level, lower than the normal listening level in your room. Note that the full bodied, lifelike quality you experienced at high listening level has disappeared. This is typical of human hearing since it loses sensitivity to very low and very high pitched tones as the sound level is reduced. With all other controls unchanged, switch quickly through the four positions of the loudness contour control until you find the one which most nearly duplicates the full bodied sound you enjoyed at high level.

Turn the loudness control up to the level at which you wish to listen. The controls are now properly organized and your system should perform at its very best!

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probably Jannina (7090 kc.) and Kozani (7950 kc.) Forces Stations. Both s/on at 0000. (*PM*)

Guatemala—TGWA, Guatemala City, 9760 kc., is readable at 0700-0000 with news, marimba music, pop orchestras, and varied programs. (*LB*)

TGWB, Guatemala City, has returned to 6180 kc. from 6190 kc. It is being heard at 1900-0000. (*RL*)

New stations are: *R. Programas de Guatemala,* Guatemala City, TGZB, 3355 kc., 90 watts, and TGZA, 6160 kc., 250 watts; *R. Victoria,* Mazatenango, TGLAB, 4900 kc., 20 watts, and TGLA, 5970 kc., 100 watts. Another new station is *R. Centro Musical,* Guatemala City, 6050 kc., call letters and power not known. The station on 6160 kc., *Radio Oriental,* Zacapa, is off the air. (*WRH*)

Haiti—4VWI, 21,525 kc., Cap Haitien, is now heard Saturday and Sunday in English to Europe at 1500-1700, and in French at 1700-1800. (*SW*)

4VEH, Cap Haitien, 9657 kc., is noted at 0325 with the "Mailbag" program. Some items from this column were mentioned; unable to get reporter's name due to poor signal. (*RB*)

4VHW, *Radio Haiti,* Port-au-Prince, 5990 kc., moved here from 5984 kc. It is fairly well heard from 1900 to 2200 s/off. (*RL*)

Honduras—HRTW, *Union Radio,* Tegucigalpa, 6165 kc., has moved here from 6175 kc. and is heard at 0600-0630. HRXW, Comayaguela, has returned to 6110 kc. from 6105 kc. and is being heard all evening now that BBC is off this channel. (*RL*)

HRQ5, *Radio Supaya,* San Pedro Sula, 6124 kc., 1 kw., relays HRQ, Tegicigalpa, 1600 kc. All programs are in Spanish. (*SD*)

India—*AIR,* Delhi, India, is regularly heard on 15,310 kc. at 0500-0600 with English programs at fair to good strength. (*SW*)

Indonesia—YDF6, *The Voice of Indonesia,* 9710 kc., Jakarta, is heard in English, s/on at 0600. News is heard at 0615-0925, "Mailbag" at 0630-0645; remainder was Indonesian and pop music. (*PM, EM*)

This station is also heard Sundays at 0900-0930 in Urdu with Oriental music. At 0930 they start English to Southeast Asia and Western North America. English ended and Hindi began at 1030. (*BV*)

YDF3, Jakarta, 11,795 kc., was logged at 2334 after Germany signed off. (*JW*)

Radio Angkatan Udara, Jakarta, 11,943 kc., operated by the Indonesian Air Force, has been noted from 0430/ open to 0930/ close in Indonesian. (*PF*)

Iran—The Teheran English program has been increased to 30 minutes. It is now heard at 1500-1530 on 15,100 kc. (*RL*)

Israel—4XB31, Tel-Aviv, carries English to North America on 9008 kc. daily at 1615. (*AE*)

Japan—Far East Network, Camp Drake, 3800 kc., is noted about 0728 with popular music. (*PF*)

Radio Japan is now excellent on 17,825 kc. on both 1800-1830 and 1930-2000 xmsns to North America. Complete current schedule is as follows: at 0030-0130 to Hawaii on 15,235 and 17,785 kc.; at 0145-0245 to Europe on 15,235 and 17,825 kc.; at 0300-0400 to Australia and New Zealand on 15,235 and 17,785 kc.; at 0415-0515 to South America on 9675 and 11,705

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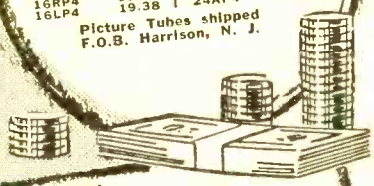

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	Console	$31.00
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	Console	$34.95
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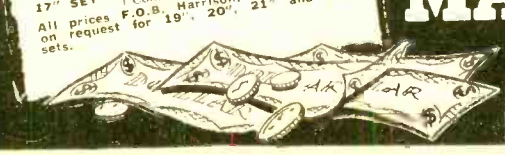

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1G6GT	.41	5Y3	.31	6BZ7	.88	7A4	.45	12SR7	.45
1H4G	.43	5Y4G	.36	6C4	.37	7A5	.53	12V6GT	.45
1H5GT	.47	5Z3	.41	6C5	.35	7A6	.45	12X4	.37
1J6GT	.47	6A7	.57	6CB6	.49	7A7	.43	14A7	.42
1L4	.45	6A8	.45	6CD6G	1.15	7A8	.45	14B6	.38
1L6	.55	6AB4	.43	6D6	.48	7B5	.39	14Q7	.50
1LA4	.57	6AC7	.67	6E5	.44	7B6	.42	19BG6G	1.15
1LA6	.47	6AF4	.79	6F5	.37	7B7	.41	19T8	.65
1LB4	.57	6AG5	.50	6F6	.38	7B8	.45	24A	.39
1LC5	.49	6AG7	.69	6G6	.40	7C4	.39	25AV5GT	.78
1LC6	.47	6AH6	.69	6H6	.38	7C5	.42	25BQ6GT	.78
1LD5	.57	6AJ5	.70	6J4	1.79	7C6	.43	25L6GT	.47
1LE3	.57	6AK5	.54	6J5	.39	7C7	.45	24W4GT	.43
1LG5	.57	6AL5	.39	6J6	.47	7E5	.45	25Z5	.37
1LH4	.64	6AQ5	.46	6J7	.43	7E6	.55	25Z6	.37
1LN5	.47	6AR5	.46	6J8G	.85	7E7	.70	27	.25
1N5GT	.50	6AS5	.48	6K6GT	.37	7F7	.59	35A5	.46
1R5	.50	6AS6	1.70	6K7	.39	7F8	.70	35B5	.50
1S5	.42	6AS7G	2.19	6K8	.65	7G7	.75	35C5	.50
1T4	.50	6AT6	.39	6L6	.68	7H7	.50	35L6GT	.47
1U4	.47	6AU4GT	.65	6L7	.42	7J7	.75	35W4	.34
1U5	.42	6AU5GT	.59	6N7	.60	7K7	.75	35Y4	.34
1V2	.65	6AU6	.42	6Q7	.40	7L7	.75	35Z3	.39
1X2	.61	6AV5GT	.65	6S4	.40	7N7	.50	35Z5GT	.34
2A3	.55	6AV6	.39	6SA7	.45	12AT6	.37	37	.29
2A5	.57	6AX4GT	.60	6SC7	.48	12AT7	.66	50A5	.46
2A7	.55	6AX5GT	.57	6SG7	.41	12AZ7	.63	50B5	.50
3A4	.51	6B4G	.52	6SH7	.43	12AU6	.41	50C5	.50
3A5	.50	6B8	.69	6SJ7	.43	12AU7	.53	50L6GT	.43
3AL5	.45	6BA6	.47	6SK7	.45	12AV6	.35	75	.42
3AU6	.46	6BA7	.58	6SL7GT	.55	12AV7	.67	76	.42
3BC5	.54	6BC5	.47	6SN7GT	.55	12AX4GT	.65	77	.38
3BN6	.70	6BC7	.80	6SQ7	.39	12AX7	.58	78	.38
3C8G	.52	6BE6	.45	6SR7	.42	12B4	.68	80	.34
3Q4	.46	6BF5	.40	6SS7	.41	12BA6	.46	84/6Z4	.44
3Q5GT	.57	6BF6	.50	6T4	.95	12BD6	.48	117L7GT	1.09
3S4	.47	6BG6G	1.15	6T8	.68	12BE6	.46	117N7GT	1.09
3V4	.47	6BH6	.50	6U8	.75	12BH7	.60	117P7GT	.35
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kc.; at 0530-0730 to China on 9675 and 11,705 kc.; at 0745-0845 to Philippines and Indonesia on 11,705 and 15,225 kc.; at 0900-1000 to South China on 11,705 and 15,235 kc.; at 1000-1100 to S. E. Asia on 11,705 and 15,235 kc.; at 1115-1215 to India and Pakistan on 11,705 and 15,225 kc.; at 1230-1330 to Near East on 11,705 and 15,225 kc.; at 1800-1830 and 1930-2000 to Eastern North America on 15,235 and 17,825 kc.; at 2230-2330 to Western North America on 15,235 and 17,825 kc. (*RL, SW, DX*)

Kenya—African B/C Service, ZHW2, 4934 kc., is heard from 1230 at good strength. (*PC*)

Other details are as follows: Mombasa, ZHW4, 4923.5 kc., and ZHW22, 7172 kc.; Kisumu, ZHW6, 4943 kc., and ZHW23, 7288 kc.; Nyeri, ZHW24, 6170 kc. The outlet on 4934 kc. is located in Nairobi, and is scheduled at 2230-2330 (Tuesdays), at 0845-1310 (Wednesdays), and at 0100-0530 and 1000-1315 (Sundays) (*WRH*)

Lebanon—The Lebanese Armed Forces Station on 6500 kc. is now on regular program schedule Tuesdays and Saturdays at 0930-1000 only, relaying the Armed Forces program in Arabic from *Radio Liban*. No announcements. They are also testing irregularly with short periods of Arabic music at various times during the day. (*WRH, MP*)

Madagascar—FIQA, Tananariva, 9513 kc., can be heard at 2230/ open in French. The program is setting up exercises until 2250 when they have music. French news is heard at 2300. (*PF*)

Malaya—The new identification for BFEBS is now *The BBC Far Eastern Station*. This station can be tuned with news from 0600 to 0615 s/off. They often relay cricket matches around 0500. (*SW, LK*)

Mexico—One of the consistently best point-to-point stations being heard is XDA232, Mexico City, 21,770 kc. It can be heard from 1100 to 1900 with test programs of music and Spanish announcements. (*MA*)

Netherlands—*Radio Netherlands*, 9590 kc., can be tuned at 2130-2140 with news from Holland, dual to 15,365 kc. (*HU, RB*)

New Caledonia—*Radio Noumea*, 6035 kc., can be heard at 0200 s/on with group singing. The identification is *Ici Noumea, La Voix de la France dans le Pacifique*. (*DX*)

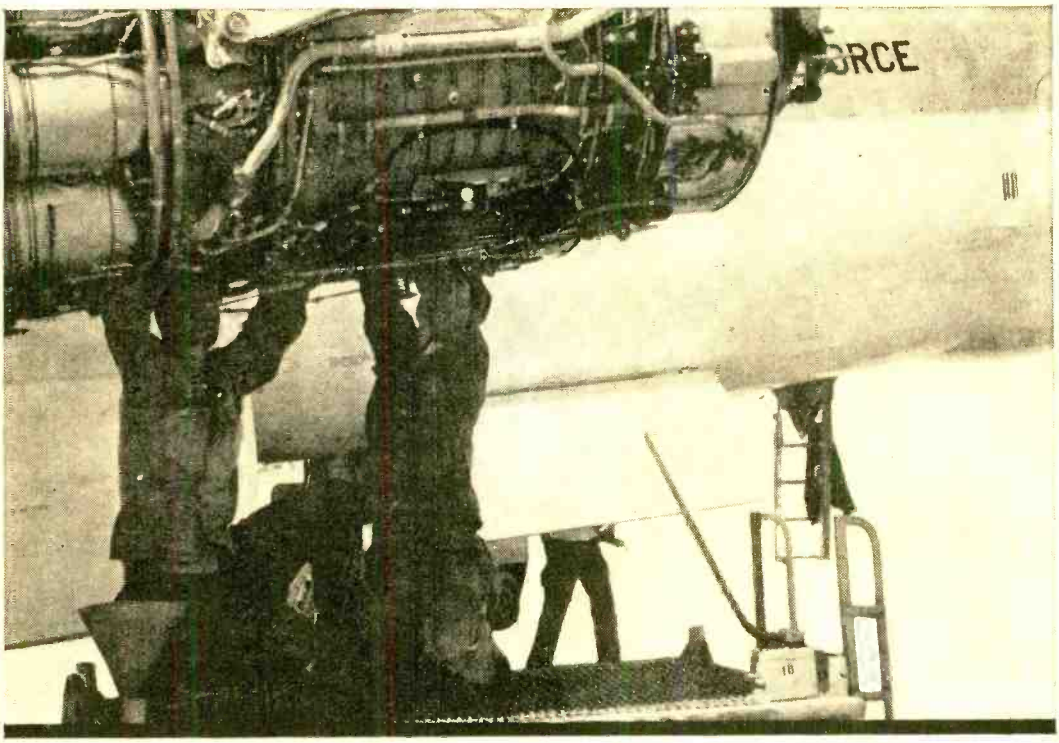
Nicaragua—YNRM, *Radio Musun*, Matagalpa, 7590A kc., was noted at 2130 with identity but heavy QRN. (*DX*)

Pakistan—*Radio Pakistan*, Karachi, is on a new channel, 21,580 kc., with English at 1315-1400 for Turkey and at 1415-1500 for England. The English program for S.E. Asia at 1930-2015 is now on 15,335 and 17,750 kc. (*RL, MH*)

Peru—*Radio Nacional*, Lima, is coming in strong on 9562 kc. with music programs at 2330-0000. S/off is in Spanish at 0000. (*JJ*)

OBX4C, *Radio El Sol*, Lima, is again active and currently being heard on 15,190 kc., although listed for 15,180 kc. It is heard best at 2100-2200 between periods when *Radio Canada* and *Radio Finland* are using this frequency. (*RL*)

New stations operating in Peru include the following: OAX4K, *R. Selecta*, Lima, 9585 kc., 300 watts; OCX4B, *R. El Pueblo*, Lima, 4860 kc., 300 watts; OAX2G, *Radio Cajamarca*, Cajamarca, 4770 kc., 500 watts; OAX1M, *Ra-*



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dio Progresso, Piura, 3330 kc., 500 watts. *Radio America*, Lima, is now operating on a third s.w. outlet: OBX4U, 3240 kc. with 500 watts. (*WRH*)

Portugal—Current schedule of *Emisora Nacional* is as follows: on 21,700 kc. at 0530-0830 and 1200-1515 (Sundays, 0530-1515) to Africa; on 17,895 kc. at 0530-0830 to Macao/Timor, at 0830-1145 to Portuguese India, at 1200-1600 to Africa, at 1615-1945 to West Africa and Brazil; on 17,880 kc. at 0845-1200 to Portuguese India; on 15,380 kc. at 1630-1945 to North Atlantic; on 15,125 kc. at 1500-1630 to Africa and at 1700-2030 to West Africa and Brazil; on 11,840 and 9775 kc. at 2000-2230 to Eastern North America; on 9635 kc. at 2045-2230 to Western North America. English broadcasts are at 0830-0915 on 17.895 kc. and from 0845 on 17,880 kc.; also at 1200-1245 on 17,895 and 21,700 kc. (*RL*)

Sarawak—The Sarawak B/C Service, Kuching, 5052 kc., is heard at 0645-0715 with a relay of BBC's Far Eastern Service. It is also being noted at 0800-0810 with BBC news, at 0810-0815 with stock reports, then music until 0900 when they begin a program in Chinese. They verify by letter and send a photo of the station. (*GN, RH*)

Sierra Leone—A new station, the Sierra Leone B/C Service, is operating on 3316 kc. daily at 1250-1700 with 5000 watts. (*DX*)

This station is noted with English news at 1600, news in an African language at 1608, then continued with English until close-down. Location is Freetown. (*PC*)

Solomon Islands—VQO2, Honiara, is heard on 5960 kc. at 0230-0300 s/off. There is often much QRN on this frequency. Address is Public Relations Officer, Western Pacific High Commission, Honiara, Guadalcanal Island. (*GN*)

South Korea—The Armed Forces Korean Network (AFKN) on 6895 kc. operates daily in English at 1630-1230. Power is 250 watts. Reports should be addressed to Headquarters AFKN, 8214th Army Unit, APO 301, San Francisco, Calif. (*GN*)

Spain—The current schedule of *Radio Nacional de Espana* is as follows: at 0600-0730 to Far East on 11,815 and 15,415 kc.; at 0830-0900 in Arabic on 15,415 kc.; at 1045-1120 in Arabic on 9360 kc.; at 1045-1115 to Africa on 9677 kc.; at 1130-1700 to Europe on 9605 kc. (to 1515), on 9360 kc. (to 1550), on 7100 and 6130 kc. (from 1530); at 1715-2200 to Latin America on 9360, 9695 and 11,815 kc.; at 2215-2300, 2315-0000, 0015-0100 to North America on 6130 and 9360 kc. The Home Service Relay is at 0200-1930 on 5995 kc. Best reception is on 9360 kc. on the North America and Latin America xmsns. (*RL, JJ, JM*)

Surinam—Paramaribo has a weekly English broadcast at 2030-2045 on Mondays, on 4745 and 15,407 kc., followed by Spanish at 2045-2100. This station transmits programs in Dutch daily at 0430-0600 on 4745 kc., and at 1430-2030 on 4745 and 15,407 kc. (*RL*)

Sweden—*Radio Sweden*, Stockholm, is being noted on 15,155 kc. with an English xmsn to Western North America at 1100-1115 with talks and music; at 1115-1130 in Swedish; from 2205 again in Swedish. (*BV, CG*)

The outlet on 11,705 kc., SBP, is heard at

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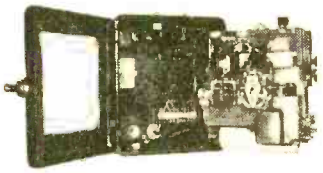

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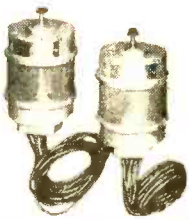

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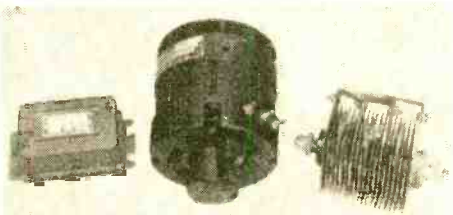

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(Full addresses available on request)

0000-0015 with news and at 0015-0030 with music. (*TG*)

Switzerland—Berne is being heard at 1440-1530 in English to the United Kingdom and Ireland with music, news, and talks. Signal was only fair for the last thirty minutes. (*BV*)

Another xmsn is from 9535 kc., HER4, at 2315-0000 to Western North America with news at 2315. (*AB*)

Union of South Africa—The South African B/C Service is heard in the Afrikaans Service on 3385 kc. with news at 0000. This is parallel to 4897 kc. (*PF*)

ZRG, Cape Town, 4897 kc., signs on in Afrikaans at 2340 with a religious reading; setting up exercises at 2345-0000; Afrikaans news until 0010; music until 0030. All Afrikaans language. This is believed to be in Cape Town, although most lists show Johannesburg. (*PM*)

According to a QSL from SABC, the exact frequency for the tests in the 11-meter band is 25,880 kc. The station name is *Roberts Heights*. (*WRH*)

Syria—The current schedule for the *Syrian B/C Service* from Damascus is as follows: to Europe in French and English on 9555 kc. at 1430-1630; to Central America in Arab, Spanish, and Portuguese on 11,915 and 9555 kc. at 1900-2100; in an omni-directional xmsn in English and French on 7145 kc. at 0030-0130 and 0330-0730. All transmissions daily. (*PB*)

Damascus on 17,865 kc. signs off at 1630 after an English program. (*AE*)

Tahiti—*Radio Tahiti* is apparently keeping its experimental English program on 6135 kc. to the South Pacific Islands from 0245 to 0300/close. French can be heard at 0200-0230. (*PM, JM, MN*)

Thailand—Bangkok continues to be heard around 0540 with English news on a frequency of 11,670 kc. (*AE*)

Turkey—*Radio Ankara* has dropped the program in Turkish at 1500 and is now broadcasting the German program at 1430-1515 on 15,160 kc. The Ankara State Police Radio, announcing as *Busari Ankara Turkiye Police Radyosu*, is now operating on regular schedule at 0400-0500 and 0900-1000 daily on 6160 kc. (*WRH*)

Radio Ankara has a daily xmsn to North America at 1815-1900. They feature the "Mailbag" program on Sundays, with letters from listeners. (*DQ*)

Vatican City—*Radio Vaticana* can be heard at 1000-1015 and at 1315-1345 in English on 7280, 9465, 11,865, 15,120, and 15,280 kc. They have a French program from 1345 to 1400. (*CM, FW*)

-30-

"Lucky 15" Preselector

(*Continued from page* 56)

ease in assembly, the components should be mounted in the following order:

1. Mount the input and output terminal strips, *BP1* and *BP2*. Run a *6-32* screw through hole A adjacent to *BP1*, to be used as a grounding point. Place a second ground screw in hole B, next to strip *BP2*.
2. Ground the rear terminals of *BP1* to A, and bypass the rear terminal of *BP2* to B, with a .01-μfd. ceramic capacitor.
3. Mount the tube socket (*V1*) with pin #9 to the rear of the chassis.
4. Mount phenolic tie-point strips in holes C and D.
5. Mount the tuning capacitor *C1* and the gain control *R4* in the panel holes. Place a grounding screw in hole E.
6. Bolt the power transformer *T1* to the chassis, using holes F and G. Place the $\frac{3}{8}$" rubber grommet in hole H.
7. Place the dual filter capacitor *C6a-C6b* between a tie-point strip and ground lug E. Solder a red lead of *C6* to each terminal of the tie-point strip. Ground the black lead to E.

The smaller components should be mounted next. Capacitors *C2* and *C5* are soldered directly to the pins of socket *V1*, using pin #4 as a ground terminal. Resistor *R2* is soldered across the insulated terminals of the tie strip in step 7, and resistor *R3* is attached between pin #3 of *V1* and the center terminal of potentiometer *R4*. Resistor *R1* is soldered between one end of *R2* and pin #8 of *V1*. The radio-frequency choke (*RFC1*) is connected between pin #9 of *V1* and the remaining tie-strip terminal. Capacitor *C5* is soldered between pin #1 and the ground lug of the tube socket. The output coupling capacitor *C3* is connected between the front terminal of *BP2* and pin #9 of *V1*.

Using Fig. 2 as a guide, the remaining wiring may now be completed. The last step is to mount coil *L1*, which consists of eight turns of prefabricated coil stock. Cut the coil to a length of ten turns, then carefully peel the extra turn back on each end to provide

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mounting leads. The coil is mounted vertically in the space between *C1* and *C6*. Ground the end of the coil nearest the chassis to ground lug A. The opposite end of the coil is soldered to a stator terminal of *C1*. The antenna terminal of *BP1* is attached to *L1* by a short length of flexible hookup wire, tapped one turn up from the ground end of *L1*.

When all wiring is completed, pass the 117-volt line cord through the rubber grommet in hole H. Tie a knot in the cord and connect the ends to the two insulated terminals of the previously unused tie-point strip.

"Oh, boy! She's just about ready to go!" exclaimed Tommy. *"Plug it in!"*

"Calm down, Old Timer," I said. *"We'd better check over the wiring just to make sure there are no errors. You don't want to blow it up!"*

The final step is to check all connections visually for poor joints or short circuits to ground. The resistance between pin #9 and pin #8 of *V1* should be measured, and a reading of about 4400 ohms obtained. Finally, measure the resistance between pin #3 of *V1* and ground. As *R4* is turned clockwise, the resistance should decrease from the counter-clockwise value of 3220 ohms to a lower value of 220 ohms.

When the preselector wiring has been thoroughly checked, the unit may be connected to the receiver antenna terminals by a short length of 300-ohm TV-type ribbon line, as shown in Fig. 4. The 6AS8 tube should be inserted in the socket, and a tube shield slipped over it. A good 21-mc. antenna (such as the doublet shown in Fig. 5) is attached to the antenna terminals of the preselector.

Initial tests should be made with the receiver tuned to a steady signal in the vicinity of the 21-mc. band. *R4* should be turned clockwise and the tuning control *C1* should be slowly tuned to peak the signal to maximum strength. The tuning of *C1* will be quite sharp, as the preselector covers a relatively large portion of the high-frequency spectrum. It will be necessary to retard the gain control *R4* when strong signals are received to prevent receiver overload. The preselector tuning is adequate to cover the complete 15-meter Novice band without the necessity of retuning *C1* after it has been peaked about the middle of the band.

Operation of the preselector in the 10-meter band occurs with *C1* set at about 10% capacity. Fifteen-meter tuning results in a setting of about 25% capacity for *C1*, and 20-meter resonance occurs at about 50% capacity.

If excessive coupling exists between the input and output circuits, it is possible to make the preselector oscillate at the maximum clockwise setting of *R4*. Make sure that the antenna leads to the preselector are well separated from the 300-ohm line that connects the preselector to the receiver. Always run the preselector just under the point of oscillation.

"A few final pointers before you rush off, Little Beaver," I said. *"First of all,*

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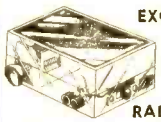

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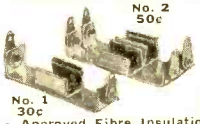

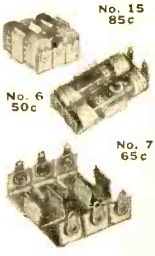

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put some rubber mounting feet on the bottom corners of the box so that it won't scratch the top of your receiver. Secondly, if you ever feel that the preselector isn't working right, or if you want to see just how much gain you actually get from the unit, disconnect the input and output leads from the preselector and connect 'em together, leaving the preselector out of the circuit. You'll be surprised at the difference!"

"*O.K.*," laughed Tommy, as he disconnected the little unit and prepared to leave. "*Thanks for the help. I'll be on the 15-meter band at six a.m. and knock all the DX dead! Just watch my smoke.*"

"*Fine, Tommy,*" I replied. "*Next weekend you come around and we'll have a big pow-wow about DX antennas for the Novice 15-meter band. O.K.?*" —30—

The Transmitting Tower

(*Continued from page* 87)

amplify the weak audio frequency generated across the microphone to the value required to drive the modulator tube. Any moderately priced crystal or high-impedance dynamic microphone is suitable for use with the DX-35.

A flip of the control switch changes the DX-35 from one mode of operation to the other.

Assembling the Transmitter. Anyone who is reasonably competent with a soldering iron, a pair of pliers, and a screwdriver, and who will follow clear, step-by-step instructions, will have little trouble assembling the DX-35. Its 36-page instruction book assures that. The secret is to take your time. Check your work each time a group of instructions are carried out. At the start of a work session, review your previous day's work with the aid of the instruction book while you are still fresh. In this way, you will catch any possible mistakes before they are covered up by other parts and wiring.

How long does it take to assemble the kit? This will vary a great deal with different constructors, but for the average one, 20 hours or so spread over a week or ten days would seem about right. Trying to rush the job through in a couple of concentrated sessions makes a lot of work out of what should be fun.

Making Tests. After assembling the kit and adjusting the oscillator plate coil slugs for maximum excitation to the 6146 on 10 and 15 meters (a five-minute job), I fed the output of the transmitter into a 40-watt light bulb. When loaded to the maximum recommended plate current

of 125 milliamperes, the estimated transmitter output was approximately 50 watts up to 15 meters. On 10 meters, however, output dropped off a trifle, as it does in most multiband transmitters at ten meters.

One minor "bug" showed up in these tests. Recommended 6146 grid current is 2.5 ma., with 3 ma. as a maximum. On 80 meters, it was almost 5 ma. As a cure, the instruction book suggested reducing the value of the 3300-ohm resistor across the r.f. choke, which acts as the plate load impedance on this band. A 2700-ohm resistor did the trick.

The resistor in question is mentioned in the 14th item from the top on page 21 of the instruction book. I suggest that you do not wrap its leads as tightly around the choke leads as I did, until you are sure that you will not have to change it.

After putting the transmitter through its paces with the operations switch in the "c.w." position, I connected a crystal microphone to the microphone connector and turned the switch to "Phone." The 6146 plate current dropped to about 50 ma., and the light bulb glowed with about a tenth of its former brightness.

Speaking into the microphone caused the plate meter to flick upward and the bulb to get brighter. A sustained "o-o-o" in the microphone would drive the plate current to about 100 ma. and the bulb would glow about two-thirds as brightly as it did with the operate switch in the "c.w." position.

Working Stations. My first attempt to work stations with the DX-35 was on Sunday afternoon in the 20-meter phone band. I did not succeed in a half hour of calling. Shifting to 20-meter c.w., I raised an SP (Poland) on a "CQ," but he faded out before reports could be exchanged. A few minutes later, I worked a W6, with RST-589X reports each way, for a 20-minute contact.

On other bands, results were similar to those on 20 meters. It was quite easy to work stations with good reports on c.w., as long as conditions were at all favorable. On phone, however, contacts were hard to make, unless conditions were good and interference was low on my frequency.

This does not mean that it was impossible to "get out" on phone with the DX-35. I made a number of excellent phone contacts with it. But, as is to be expected with any phone transmitter having an effective carrier power of approximately 15 watts, the high-power stations could cover me up quite easily. The speech quality of the transmitter is good; especially so for controlled-carrier modulation, noted more for its simplicity than for its quality.

Incidentally, the DX-35 does not contain

an audio volume control. This, combined with the controlled-carrier modulation, means that—up to a certain level—the louder you talk, the stronger the phone signal you put out. But it does no good to shout into the microphone. The speech amplifier has enough gain so that full output is obtained by speaking at a normal voice level with your lips a few inches from the microphone. Talking too loudly simply causes the audio signal to flatten out and sound distorted, without increasing output a bit.

Conclusions. The DX-35 makes an excellent transmitter for the Novice who wishes to run close to the Novice power limit in the low-frequency Novice bands. It will also serve him well when he gets his General Class license. In fact, its versatility makes it an excellent transmitter for any amateur who prefers to operate on c.w. with a moderate amount of power but does like an occasional phone contact.

Considering the quality of the parts used, the price of the kit gives the amateur who likes to build things full value for every dollar he invests in it.

News and Views

Mick Warren, WN7CXZ, 2542 So. 18th East, Salt Lake City, Utah, says: "In two months of operating with a 6L6 transmitter running 20 watts and a BC-455 receiver, I worked 15 states in five call areas. A month ago, I got a new SX-99 receiver. Since then, I have worked 11 new states and all call areas, except the fourth. My best DX is two WH6's (Hawaii). I'd like to schedule some W/K4's or anyone needing Utah. I work 40 meters only. Oh, yes, I just passed my General!"

Another western state reports. **Gordon Levine, W7DCN,** 311 East Whitton Ave., Phoenix, Ariz., says: "I was a Novice for four months, but I never got on the air as a Novice. I went on as a 'General' about a week ago. Since then, I have made 32 contacts in eight states, including New York, Kentucky, and Washington. My rig is an AT-1, my receiver an NC-98. The antenna is a 66' Windom; it is 15' high at the ends, sagging to 10' in the center. It looks like I will stay on c.w. (code) permanently. It is surprising what low-power c.w. will accomplish. I will be glad to help any prospective amateurs in the area."

Hans Rohrbacher, DJ2NN, Freiburg, Germany, likes to work USA Novices on the 21-mc. band from his crystal-controlled frequency of 21.126 mc. You'll find a letter from Hans in the adjoining column.

From the east coast, **Dick Amster, KN2QYA,** 14 Barnyard Lane, Roslyn Heights, L.I., N.Y., tells of his experiences. "I have had my Novice ticket for about six months. In that time, I have worked 14 states and four countries. I started out on 80 meters but soon switched to 40 meters. I have been on 15 meters for a week, and I am really amazed at the DX you can work so easily there. I use a Globe Scout, 65-watt transmitter and an NC-98 receiver. My antennas are a full-wave dipole on 15 meters and a full-wave 'zepp' on 40 meters. I'd like skeds with stations in the 4th and 7th call areas."

John Desloge, KNØGSD, 6807 Pershing Ave., St. Louis 5, Mo., writes: "Thanks for putting my name in your 'Help Wanted' column. I got many calls offering advice and help, and I've had my Novice license for a month now. I work only 15 meters. With a Knight 50-watt transmitter, a 3-element beam, and an S-20R receiver, I have worked 20 states, Alaska, and Puerto Rico. I have a crystal for 40 meters, too, but no antenna for that band yet."

Need a Rhode Island QSL card? **Frank Heiss, W1WJY,** 112 Maplewood Ave., Cranston 99, R. I., offers one to every station he works. In addition, Frank says: "After my name and call appeared in the *Tower* the last time, quite a few wrote asking for help, which I gave as best I could. I was on phone with my Globe Scout transmitter for a long time, but I have wrapped up my microphone, and I am on c.w. (code) all the time now. I get out much better, and have made a lot of contacts. I work 40 meters and 80 meters and am on the air almost every evening. I'll be glad to hear from other readers of the *Tower* by mail or c.w."

Charles E. Hanley, KN6SWV, 2625 35th Ave., San Francisco, Calif., tells us: "From the *Tower* and the 'Help Wanted' list, I finally got my Novice ticket, and I am now boning up for my 'General.' In one week on the air, I have had 25 contacts, all in California. I use an AT-1 transmitter, and an S-38D receiver. My antenna is a 125' long wire and is 35' high. I'll help anyone to get a ticket."

George "Big Foot" Martin, K5EKQ, 2448 Owen Ave., Groves, Texas, says: "I just got my General Class license, but I plan to stay on c.w. a lot. My receiver is an SW-54, and I am using a borrowed 3-watt transmitter. I stick to 40 meters, because that is where the other locals are. My best DX is Calif., Georgia, and Connecticut. I like to SWL as well as 'Ham.' Zanzibar and Ifni in Africa are my best catches."

From Germany, **Hans A. Rohrbacher, DJ2NN,** Joh. v. Weerthstr. 5, Freiburg, who described conditions in Germany last month, comes through with some more news. "It will be a great advantage for 15-meter Novices to operate between 21.1 and 21.16 mc., but no higher, for working Europe. In Europe, the

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phone stations mostly operate above 21.13 mc. I have much trouble hearing S5 (or weaker) Novices through their S8/S9 signals. My crystal frequency for working Novices is now 21.126 mc. I promise to answer all letters received.

"A true story is this. On May 20th, I worked K2ABB. Some days later, I got a letter from him that his father-in-law's name was Hans Rohrbacher, too! So I find we are near relations! A brother of my great grandfather emigrated in 1849. After 1854 we heard nothing from him or his children. But amateur radio gave us news."

Albert Cohen, K2KQU, 41 Leo St., Rochester 21, N.Y., writes: "I started my ham career with a wonderful receiver. It was an 'all-band' set with no bandspread, no BFO, no a.v.c., intermittent sensitivity and selectivity. So, in a year and four months, I have worked one state and Canada (I think). Now I have a couple of 'Command' receivers, with which I expect to do much better.

"In April, you had a letter from K2KQS. His call letters being so similar to mine, I dropped him a note. We found that our ages (15), equipment, experiences, interests, and problems were surprisingly alike. Now, we correspond regularly.

"I am president and code instructor at the Radio-Electronics Club at Benjamin Franklin High School. George Beine, K2KQR, is the theory teacher. At the club, we have an AT-1 transmitter and a BC-454 receiver. Our only trouble is local QRN (static) grinning out at us from the wall sockets. Any suggestions will be appreciated."

Tony Wheeler, K9BBA, 1123 E. Grove St., Bloomington, Ill., gets right to the point. "I have been a Conditional for two months now and, before that, a Novice for eight months. I worked 41 states and three countries as a Novice, and I had a lot of fun doing it. I still have my Novice rig, an AT-1 and an S-38. I work 80-, 40-, and 15-meter c.w. mostly, but I get on 75-meter phone occasionally. I'll be glad to schedule anyone needing Illinois. I am 16 and a Junior in high school."

Tommy, KN4JOU, 2220 Roswell Ave., Charlotte, N.C., wastes no time either. "I have worked 23 states in ten days with a Ranger transmitter and an S-76 receiver and a Windom antenna. I operate on 40 meters."

Lloyd Higuera, KN6RLQ, 3033 Sylvan Ave., Oakland 2, Calif., says: "I have been on the air for three months and have worked 54 stations in ten states. My transmitter is a Knight running 50 watts, and my receiver is an SX-99. I operate on 80 and 40 meters and use dipole antennas. I would like some ideas for a 15-meter beam. I'll be glad to help anyone in my area with code and theory, so that he can get his license. I think you should run a list of those offering to help others obtain their licenses."

That uses up my allotted space once again. Keep writing and sending pictures of yourself and your equipment. Please include some information with your pictures about what bands you operate, how many states you have worked, and similar data. Otherwise, I must hold the pictures until I write back for that information. 73,

Herb, W9EGQ

After Class

(*Continued from page 76*)

and actual case work is considered mandatory for reliable operation of the three-modality type of detector. Thus, using the machine is not simply a matter of asking the suspect questions and then looking at the chart to see whether he has told the truth or a lie. Some of the important elements involved in correct interrogation can be best illustrated by an example.

Taking a Test. A vagrant in a small mid-West town was apprehended in the vicinity of a drug store that had been burglarized, and was accused of having stolen $350, several bottles of a morphine compound, and a gallon of grain alcohol. After denying the crime, he agreed to take a lie detector test in the Sheriff's office. The test was carried on in a comfortable, closed room containing only Sam, the accused, and his questioner. Outside the room, however, were several observers who could view the proceedings via a one-way mirror on one of the walls without the knowledge of the man being questioned.

"Sam," asked the deputy, "did you steal the $350 from the drug store?" Answer: "No." "Did you take any drugs from the store?" Answer: "No." "Do you smoke, Sam?" "Yes." "Are you a drug addict?" "No." "Do you drink?" "Yes." "Do you make your own liquor, Sam?" "Sometimes." "Do you know the difference between ethyl and methyl alcohol?" "No."

The questions went on in this pattern. The deputy intermixed questions concerning the crime with other unrelated ones to test the subject's ability to lie without becoming confused. When this group of questions was complete, Sam was told to relax for a bit while the next set was prepared. Then he was handed half-a-dozen ordinary playing cards and instructed to pick one from the group, look at it secretly, and put it back with the others. The outside observers noted that the card he selected was the four of diamonds.

"Sam, I'm going to ask you some mixed-up questions," the deputy said. "Among them will be a few about the card you picked out. I want you to answer 'no' every time I ask you about the card, even if I mention the right one. Yes, I know you'll be lying when you say 'no' to the right card, but I want you to play along with me. All right?" Sam agreed, and the questioning proceeded.

"Did you steal a gallon of alcohol?" "No." "Did you hide the $350 in your room, Sam?" "No." "Did you steal that morphine?" "No." "Did you pick up the king of spades?" "No." "Did you take any packages out of that store at about

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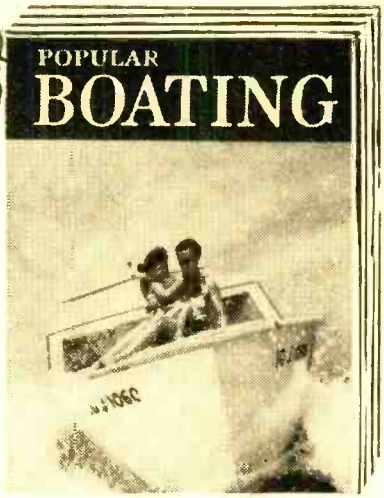

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- OUTBOARDS UNLIMITED—There's no limit to the fun outboarding offers. Here's how to enjoy it more fully!
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A NEW MAGAZINE BY THE PUBLISHERS OF POPULAR ELECTRONICS

3:00 a.m. yesterday?" "No." "Was the card the eight of clubs?" "No."

As the questioning continued, the three traces on the chart continued to wobble in very much the same fashion as it rolled out. Then came the question: "Was the card you picked the four of diamonds?" Instantly, all three wavy lines showed significant changes, particularly the one which recorded respiration. Sam answered "no" to that question, too, as he had been instructed. The trace variations demonstrated that when this particular suspect lied his emotional reaction strongly distributed itself; in short, he was a man who could not lie well even when instructed to do so. After four successive runs, Sam was completely exonerated; the lie detector had established his innocence. —30—

Long-Wave DX

(*Continued from page* 52)

Union, Geneva, Switzerland. Aero-DX'ers will find that the same organization publishes something for them: *List of Aeronautical and Aircraft Stations.*

Listen Tonight! Why not "sample" the long waves, just to see for yourself. Tonight, the later the better, tune your communications receiver down to the lowest end of the standard broadcast band. Chances are that you will hear at least one radiobeacon, possibly more. Some of the most widely reported stations operating in this portion of the band are listed in Table 2 (page 52).

If you collect QSL cards, you will probably be interested in the fact that almost all of the long-wave stations will "QSL" upon receipt of a detailed reception report, and a stamped reply card. Long-wave stations are glad to know that they are "getting out" and will be pleased to hear from you.

All you need is the will to listen, a little patience, and a receiver to be a member of the rapidly growing long-wave DX fraternity. —30—

Transistor Topics

(*Continued from page* 62)

pacitor. Designed specifically for transistorized superhet receivers employing an r.f. stage, this unit measures only $1\frac{3}{32}$" x $1\frac{3}{32}$" x $2\frac{5}{32}$", yet contains an r.f. section, an antenna section, and an oscillator section. The antenna and r.f. sections have a maximum of 235 $\mu\mu$fd., the oscillator section a maximum of 111 $\mu\mu$fd. All three have a minimum

of 11 $\mu\mu$fd. Self-contained trimmers are provided, and matching antenna, r.f., and oscillator coils are available.

Sylvania has introduced a new transistor kit. It contains three Type 2N35 and three Type 2N94 transistors, plus a 1N34A crystal diode, and an instruction booklet on assembling a portable transistorized receiver.

Lafayette Radio, 100 Sixth Ave., New York 13, N. Y., one of the pioneer suppliers of transistor construction kits, lists a number of new items in its Fall Catalog (No. 10-56). Among the components is a Hi-Q "Loopstick" tapped to match the input impedance of a transistor (No. MS-299). Among the new kits are the following:

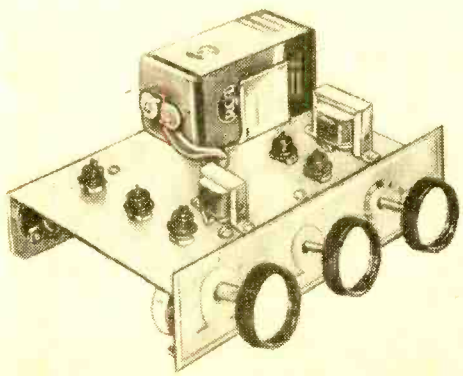
(1) Class "B" audio amplifier kit—a five-transistor kit with an output of ¾ watt and a response of 30 cps to 10 kc. Inputs are provided for crystal and magnetic cartridges and for a tuner. Separate bass and treble controls are included in the design. *Lafayette's* stock numbers are KT-104 (to match a 3.2-ohm voice-coil) and KT-105 (to match an 8-ohm voice-coil). Net price is about $19.50.

(2) Telephone pickup and amplifier—a four-transistor kit providing loudspeaker output from a telephone. It uses a flat telephone pickup coil, supplied as a separate accessory. Catalog No. is KT-95. Net price is about $17.50.

(3) Transistor checker—an improved and redesigned model of the transistor checker kit described in our July column. New features include a calibrated gain scale and a colored "good—fair—poor" leakage scale, plus provision for checking gain at different full-scale ranges.

Other new Lafayette transistor kits include a push-pull output amplifier with self-contained speaker and several new transistor receivers.

Subminiature transistor transformers



Lafayette's KT-104 transistorized audio amplifier.

have been introduced by Merit Coil Products Co., Inc., Chicago, Ill., and the Microtran Company, Valley Stream, N. Y., thus adding two additional names to the growing list of transistor component manufacturers.

Things To Come. "In the works" and scheduled to appear in forthcoming issues of your favorite magazine, POP'tronics, are several transistor construction projects . . . including a 3-transistor pocket receiver using a *superhet* circuit, an "electronic roulette" game, a "child's radio" which turns itself *off* automatically when laid down . . . and many, many more.

Well, fellows, I'm about "talked out" for this month. See you again next month . . . and good luck with your projects!

Lou

Hi Tide in the Tweeter

(*Continued from page* 78)

seaside outing, I retired to my workshack to fit the tape recorder to some sort of shoulder-harness and make ready for sonic adventure.

A DAY, several miles and much impatience later, found us in a secluded little cove that sparkled under the summer sun, rocks awash in the playful surf, tidal pools glimmering with myriad lights and marine life. Slinging the recorder on my back (Happy Girl having grudgingly consented to aid scientific progress by stitching up the harness I devised), I struck out for the tidal pools and exposed sea-caverns . . . forcing myself into an icy calmness as unnatural to the occasion as fresh air is to Los Angeles County.

Behind me, my child-bride dabbled gleefully in the sand, her gaily flowered figure industriously engaged in the juvenile task of building sand-castles. As I stepped lively along the water-carved path of rock and ledge, she rose, waved a girlish arm, and cried, "Don't get shark-bit, chum! Your insurance doesn't cover it!"

I fought back the blinding, hot tears of emotion. Always concerned for my welfare, that girl. Silently, I vowed to make good for her sake.

In the succession of pleasant hours that followed, I garnered all manner of sound treasure: the soft "clik-clik" of the multicolored crabs, scuttling among the caverns and crannies of the ebb-tide areas; the raucous chatter of gull and sand-piper; and I gloated to myself as the recorder quietly bagged the divergent noises of the wild and mysterious shoreline. As I wan-

dered across the tidal flats—peering into this cavern, listening at that pool—I could visualize the neatly packaged sounds already: *Sea Urchin Bubbling, Seepage From Natural Basin Seeking Own Level, Octopus Threshing Nervously In Shallow Water, Barnacle Cries, Intermittent Murmurs From Clam Disturbed At Sleep, Ground Swells Smashing Low Reef. . . .*

Exultantly, I pressed onward—happier than a recluse with the patent on closed circuits—frequently pausing only long enough to insert fresh tapes into the hungry recorder. And it was during one of these pauses that the young, tanned, skin-diver exploded from the water at my feet.

"WHAT'CHA doing with that gismo on your back, dad?" His youthful face was a browned question mark. "I've been watching you for more'n hour. What's the scam, man?"

I explained the scam . . . in detail.

"See that there buoy out there?" I followed the direction indicated by the muscular, well-toasted arm. Twenty feet distant bobbed a huge, metal buoy, its bell clanging faintly as the wavelets pushed the merciful marker to and fro.

"Yes?" I inquired.

"Lot'sa seals hang out there. The place is lousy with them. You go out there and lay low until they get used to you—you can get the darnedest sounds you ever heard. Honest, dad, they're the craziest! And you wanna collect sea noises and all. What's the collection without seals, I ask ya?"

What, indeed, I decided. "Sure, but how can I get out there . . . dressed for land, not water?"

"Simple, dad. Roll up your threads and stalk out there. In low tide like this, water's only about three feet deep."

Thanking this unwitting contributor to science, I rolled up my trousers thigh-high and, carefully navigating the rocky bottom, was clambering aboard the channel buoy minutes later. I waved cheerily to my departing adviser—who disappeared into the sea like a fallen gull—and lay quietly waiting for the seals to overcome their shyness.

When they began romping and swimming gracefully, effortlessly again around the buoy, I snapped the recorder into action and enjoyed the sweet flavor of triumph: those seals were the most musical, stridently melodious loudmouths I've heard in a week of Mondays. *And I,* I rejoiced, *am getting every bark, every guttural snortle!* Overhead the bronze bell crooned metallically, setting the beat for the sequence. Mentally, I determined to label

this achievement: *Seals Frolicking In Hidden Cove.*

And, about then, I decided that the sun was getting a bit low and, perhaps, I had best head back for the car. Just as I was readying myself to slide off the buoy (now bobbing forcefully), I noticed that all the rocks, previously high and drying in the brilliant sunlight, were gone. *Gone?* GONE!

"Obviously," I whimpered, climbing back to the little flat place on the buoy and clutching the bell supports as if they were long-lost brothers, "time and tide wait for *no* man."

A nasty ground swell thundered by, tossing the unstable buoy in six directions simultaneously. And *that,* reader, is where you came in.

IN CLOSING, I'd like to inquire if anyone knows where I might place the following test recordings, recently taped by myself under ideal conditions: *Lawnmower In Full Cry, Child's Laughter In Front Of TV Set,* and *Tap Water Hitting Sinkful of Unwashed Dishes.* —30—

Dry Battery Rejuvenator

(*Continued from page* 49)

Small, high-voltage batteries like those found in hearing aids and transistorized equipment should be re-activated more slowly.

There are too many different varieties of batteries now being manufactured to permit drawing up a rate chart that would have any meaning. Charging rate in specific cases then becomes a matter of individual judgment. The simple rules given below should help you approximate the correct rate for each case.

1. Don't wait until the battery is dead before recharging.

2. The condition of a single cell should be determined only while it is under its normal load. A 15% loss of rated voltage indicates that rejuvenation is necessary (4-5 ma.).

3. Short series combinations such as 3-volt, 4.5-volt, 6-volt, and 7.5-volt groups should also be tested under load or with a meter having a sensitivity of 1000 ohms per volt or less. Again, 15% drop-off calls for charging (4 ma. max.).

4. Larger batteries from 15 volts up may be tested with an ordinary multitester. These batteries need charging when the rated voltage has fallen about 10% (3 ma. max.) and the small types should be re-activated after a drop-off of no more than 20% (1-3 ma.). —30—

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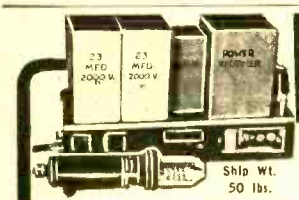

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TO-27	Output	500CT	3.2	0
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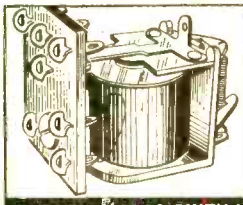

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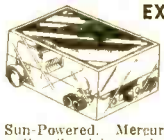

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How to Demonstrate Your Hi-Fi

(*Continued from page* 43)

sound" that has been cut into vinylite discs, courtesy of the organ, are Audiophile's *Organ Music* (AP-9) and Vox's *The Cadet Chapel Organ* (DL-210). The Audiophile release is cut for microgroove (.001) stylus but runs at 78 rpm. This is said to be good for frequency response, especially on highs, but may put an extra tracking burden on your pickup, particularly during high amplitude passages. Therefore, Audiophile Records recommends the AP-9 for playing on professional-type turntables with carefully weighted arm and top-quality pickup. The reading of the Bach works on AP-9 is sturdy, forthright, and shows a lively appreciation of the drama inherent in this music. Selections include the *Toccata and Fugue in D Minor,* and the *Prelude and Fugue in E Minor.*

The all-Bach program on the Vox release contains fairly familiar music, but artist and recordist combine to provide a new excitement, amounting to a rediscovery of the breadth and dimension of Bach. The organ in the Cadet Chapel at the U.S. Military Academy, West Point, N.Y., is the world's fourth largest, with over 14,000 pipes, 1800 miles of wiring, and a 60-horsepower blower unit. The music made by this titan is—in a word—titanic. It was recorded with some of the hall reverberation present in the chapel. If you can let go at full room volume on your rig, you may experience some of the feeling of being in the live hall. It's almost not like listening to a record at all. Warning: both of the above records will put bass strain on any but a good speaker system.

Coda. It was the 17th century philosopher Spinoza who pointed out that ". . . music is . . . neither good nor bad to the deaf." The wisdom of this dictum is apparent to anyone who has observed a hi-fi'er "listening" to a sound system by studying trace patterns on an oscilloscope. To be sure, a system which reproduces an undistorted square wave will do very nicely with music—but you'll never really know until you listen to music. The best record-making in the world and the best hi-fi system money can buy mean relatively little if their main purpose—that of providing music—be obscured. The "complete hi-fi'er" may be the one who can balance decibels with triads in a listening and participating approach that tempers response curves with a healthy dose of melodies and rhythm. It is in this spirit that the above examples of recorded sound have been presented. —30—

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Superior's New Model 670-A

SUPER-METER

A COMBINATION

VOLT-OHM MILLIAMMETER
plus **CAPACITY REACTANCE**
INDUCTANCE AND DECIBEL MEASUREMENTS

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

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 electrolytic condensers.)
REACTANCE: 50 to 2,500 Ohms 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
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28.40

Superior's New Streamlined Model TC-55

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QUICKLY AND EFFICIENTLY TESTS RADIO AND TV TUBES INCLUDING: SEVEN PIN MINIATURES; EIGHT PIN SUBMINARS, OCTALS AND LOCTALS; NINE PIN NOVALS

YOU CAN'T INSERT A TUBE IN THE WRONG SOCKET.
It is impossible to insert the tube in the wrong socket when using the new Model TC-55. Separate sockets are used, one for each type of tube base. If the tube fits in the socket it can be tested.

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The Model TC-55 incorporates a newly designed element selector switch system which reduces the possibility of obsolescence to an absolute minimum. Any pin may be used as a filament pin and the voltage applied between that pin and any other pin, or even the "top-cap."

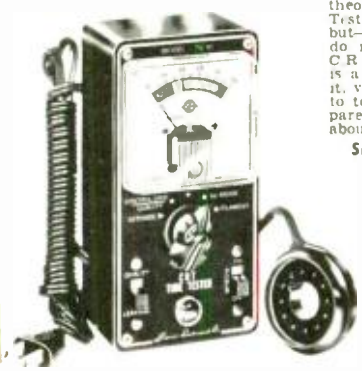
CHECKS FOR SHORTS AND LEAKAGES BETWEEN ALL ELEMENTS.
The Model TC-55 provides a super sensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals.

ELEMENTAL SWITCHES ARE NUMBERED IN STRICT ACCORDANCE WITH R.M.A. SPECIFICATION.
One of the most important improvements, we believe, is the fact that the 4 position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system. Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.

The Model TC-55 comes complete with operating instructions and charts. Use it on the bench—use it for field calls. A streamlined carrying case, included at no extra charge, accommodates the tester and book of instructions.

26.95

ABOUT TESTING PICTURE TUBES . . . Of course you can buy an "adapter" which theoretically will convert your standard Tube Tester into a picture-tube tester. Sounds fine—but—it simply doesn't work out that way! We do not make nor do we recommend use of C.R.T. adapters because a Cathode Ray Tube is a very complex device and to properly test it, you need an instrument designed exclusively to test C.R. Tubes and nothing else. As compared to a make-shift adapter, which sells for about five dollars, our Model TV-40 C.R.T. Tube Tester sells for $15.85. But, if you believe that Television is here to stay, then you must agree that the difference in price is more than justified by the many years of valuable service you will get out of this indispensable instrument. Incidentally, the Model TV-40 is the ONLY low-priced C.R.T. Tube Tester, which includes a real meter. Neons are fine for gadgets and electro-line testers, but there is no substitute for a meter with an honest-to-goodness emission reading scale.



Superior's New Model TV-40

PICTURE TUBE TESTER

Tests ALL magnetically deflected tubes . . . in the set . . . out of the set . . . in the carton!!

• Tests all magnetically deflected picture tubes from 7 inch to 30 inch types. • Tests for quality by the well established emission method. All readings on "Good-Bad" scale. • Tests for inter-element shorts and leakages up to 5 megohms. • Test for open elements.

EASY TO USE. Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube base (Ion trap need not be on tube). Throw switch up for quality test . . . read direct on Good-Bad scale, switch down for all leakage tests.

Model TV-40 Picture Tube Tester comes absolutely complete — nothing else to buy. Housed in round cornered, molded bakelite case. Only

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Superior's new Model TV-11 **STANDARD PROFESSIONAL**

TUBE TESTER

★ Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, 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 Model TV-11 as any of the pins may be placed in the neutral position when necessary.

★ The Model TV-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.

★ Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.

★ **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.

EXTRA SERVICE — The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

The model TV-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

Superior's New Model TV-12 **TRANS-CONDUCTANCE**

TUBE TESTER

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.

ALSO TESTS TRANSISTORS!

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 TV-50

GENOMETER

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.

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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.

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