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JANUARY 1958

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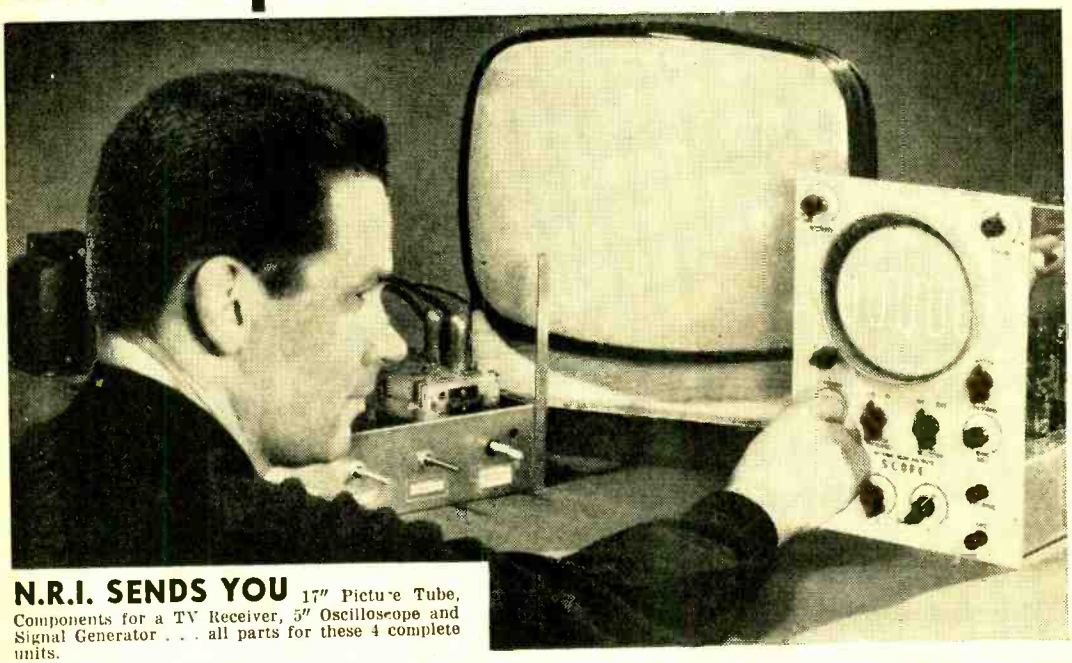

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VOLUME 8 NUMBER 1

JANUARY 1958

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DEPARTMENTS

COMING NEXT MONTH (FEBRUARY)

(ON SALE JANUARY 28)

In answer to the requests of many readers who want to build a proximity detector, our February cover shows a battery-operated unit that is completely independent of the household power line. When it detects the presence of a person in the vicinity of its sensing antenna plate, a warning lamp can be made to light or a bell to ring. All the details of its construction are included—except, of course, we don't furnish the young lady shown on the cover.

Articles on how to build more simple pocket-sized testers, a Conelrad warning alarm that every home should have, a wireless microphone, and how to make and use wave traps will also help you while away these long winter evenings on constructive projects.

IN THIS MONTH'S RADIO & TV NEWS (JANUARY)

Electroluminescence—Light of the Future
Measuring Tape Recorder Wow and Flutter
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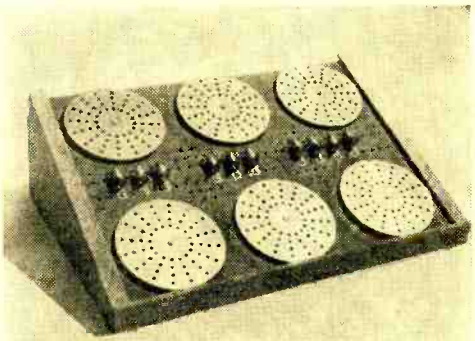

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By JOHN T. FRYE

Cupid and the Ions

OUTSIDE, the winter night was fit for neither man nor beast. A roaring wind drove sleet against the windows with a sound like the scratching of tiny claws. Inside, though, Carl and Jerry were warm and cozy and really living it up. They were sitting at a kitchen table drinking Cokes and eating buttered popcorn which was being freshly popped by an attractive girl in a bright blue sweater and dark toreador pants.

The girl was Norma, who lived next door to Jerry. She had asked the boys to see if they could find out what was wrong with her TV set. They had quickly spotted the trouble, a lead-in broken loose by the wind at a lightning arrestor; and after they repaired it, Norma had insisted they come out to her kitchen for popcorn.

Ordinarily Carl and Jerry were pretty girl-shy, but Norma completely disarmed them. In the first place, she was safely ancient by their standards, being in her early twenties; and in the second place, she was such a warm, personable, pleasant sort of person that it was almost impossible to dislike her or even be shy with her.

"Guess that'll hold us for a while," she declared, dumping another popper of corn into the huge bowl on the table. "I really appreciate your fixing that TV," she continued. "Tomorrow night my OAO is coming over to watch the fight, and I fascinate him so much that if he found my set wasn't working he'd probably stay home and watch it on his own."

She said this with a self-mocking grin, but the boys detected a little bitterness in her tone.

"Now don't tell us you're having trouble with your love-life again," Carl mumbled with his mouth full of popcorn; "not after Jerry and I got rid of Melvin for you with that supersonic oscillator and nearly deafened poor Bosco doing it."

"Yeah," Jerry chimed in. "What's the matter with this 'One-And-Only' of yours? Is he blind? If I liked girls, I'd certainly go —that is—I mean—"

"Why, Jerry, that's the nicest thing anyone has almost said to me in months,"

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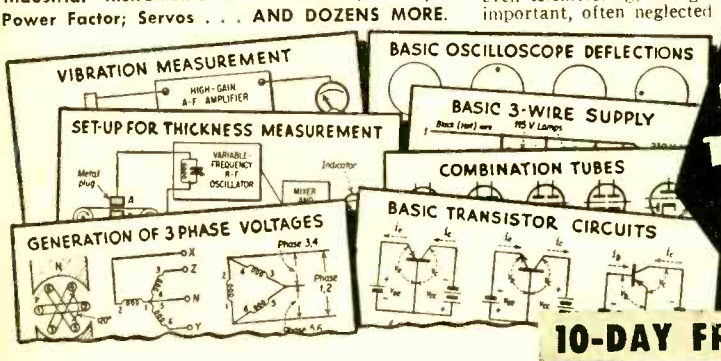

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Carl & Jerry (*Continued from page 8*)

Norma declared with a beaming smile. "No, I don't think Mike is immune to feminine charm; he's just cagey. He takes care of the accounting machines in our office, and we've been dating for three or four months now. I just happen to know he's dating two other girls about as often as he dates me. He's good-looking, a good dresser, polite, free with his money, intelligent—and just too darned cool, calm, and uninterested!"

"I suppose you've tried the usual feminine wiles," Jerry said solemnly.

"All of 'em! I've tried the poor-little-helpless-me-and-big-strong-smart-you routine. I've practically drenched myself with everything from 'Chanel Number Five' to 'Sweet Surrender.' I prepared and fed him a steak dinner that cost me half a week's salary for groceries. I've even taken up his hobby of bowling, which I despise. And I've tried being 'busy' when he asked for a date—you know, the old hard-to-get business. I've not missed a trick, but there's nothing."

"Your trouble," Carl offered, "is that you're trying to make *him* like *you*. You ought to be making him like himself when he's *with* you. Guys are dumb. When this happens to them, they think it's the girl they like."

Norma gave him an astonished, wide-eyed look as she said: "Hey, you're not supposed to know that! What do you think I was doing with that clinging-vine stuff?"

"That's too old and easy to see through. This character sounds like a smart cookie, and we need something more subtle. If we just had some way to make him feel better when he's with you than he does at any other time, he wouldn't be able to stay away from you."

"That's a pretty big 'if,' " Norma sighed.

"HM-M-M-M," Jerry said, with a wrinkled brow; "I'm beginning to get an idea. I was reading a theory the other day that there's a definite relationship between the ionization of the atmosphere and the moods of people. Now if we could just surround him with a favorable ionization when he's in your presence—" his voice trailed off as the far-away "inventing" look came into his eyes.

"What's the normal ionization of the atmosphere?" Carl asked.

"The ionosphere has a positive charge and the earth a negative one. Ordinarily a steady stream of positive ions flows down through the atmosphere to the earth. The current represented by this rain of ions averages about 3.7 microamperes per

Carl & Jerry (*Continued from page* 10)

square kilometer of the earth's surface, and this totals up to some 1800 amperes. A potential of around 300,000 volts between the ionosphere and the earth is required to force this current through the high resistance of the atmosphere."

"What produces the current?" Carl asked.

"No one is sure. There are several theories. One is that thunderstorms keep the ionospheric battery charged. At any rate, during thunderstorms the comparatively stable ionization of the atmosphere is upset. Franklin was getting both positive and negative charges from his kite flying in the storm. But have you ever noticed that during a thunderstorm and right after it many people seem to feel a mood of happiness and exhilaration?"

"I certainly have," Norma chimed in. "Children show it especially, probably because they're less inhibited. You know, they laugh and shout and run up and down through the water that flows in the gutters after a summer shower."

"Exactly! Now it just *could* be that they feel this way because the lightning has rendered the atmosphere negative—or at least less positive. I was thinking that we might use the high-voltage power supply out of an old projection TV set we have over in our lab so as to change the ionization in a small area. We could connect the positive side to ground and the negative side to a device with a lot of sharp points on it that would shove the negative electrons out into the air and neutralize the charge of the positive ions. Anyone in the vicinity would be in a negatively charged atmosphere—and might react accordingly."

"What say, Norma?" Carl asked.

"What have I got to lose?" Norma said recklessly. "How do we go about it?"

"WELL, suppose we install the gadget in your living room tomorrow and give it a try tomorrow night," Jerry suggested. "I suppose you and Mike will sit on that couch across from the TV set. We'll mount the de-ionizer close to the couch."

"Okay," Norma agreed; "but I think it'd be a pity if you two couldn't see how this experiment works out. I'll leave the shades up, and you can watch developments from Jerry's dining room right across from my living room. Really, though, you should be able to *hear* what's going on, too. Can't you geniuses manage that?"

"Easily, since you're agreeable," Jerry said. "We'll just put the pickup unit of an intercom set behind the couch and run leads across to a receiver unit in my house;

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Carl & Jerry (*Continued from page* 12)

but . . . are you sure you want us listening in on you?"

"Why not? If Mike runs true to form, he'll not be whispering any sweet nothings in my ear. And, of course, if he's too greatly influenced by your handy-dandy little mood-maker, I may need help."

"Never take science lightly," Carl said with a teasing grin, as he stood up and started buttoning his jacket; "you just might at that!"

THE NEXT DAY was Saturday; so the boys had plenty of time to fix up the high-voltage unit and install it at Norma's house. The point-discharge device, consisting of a whole envelope of large needles clamped between two metal strips to form a sort of comb, was concealed behind a large picture hanging above the couch. They put the power supply itself on the floor with the intercom pickup speaker, and plugged it into an outlet controlled by a wall switch near the door leading to the dining room. The heavily insulated wire from the power supply was concealed by a curtain hanging at the end of the couch.

The installation took longer than the

. . . The point-discharge device was concealed behind a large picture hanging above the couch. They put the power supply itself on the floor . . .

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tests all tubes completely, accurately and in seconds — RIGHT ON THE SPOT

The FC-1 is the only tube tester in its price range to give a complete tube test of over 600 tube types in seconds without multiple switching or annoying checking of roll charts. You make every call pay extra dividends by merely showing your customer the actual condition and life expectancy of the tube. The extra tubes you sell each day will pay for the FAST-CHECK in a very short time.

WIDE RANGE OF OPERATION

Checks quality of over 600 tube types, which covers more than 99% of all TV and radio tubes in use today, including the newest series-string TV tubes, auto battery-type 12 plate-volt tubes, 0Z4s, magic eye tubes and gas regulators • Checks for cathode-heater and cathode-grid shorts and detects inter-element leakage up to 1.5 megohms • Checks for life expectancy.

Model AD-1 PICTURE TUBE ADAPTER — Also available for the FC-1. Checks all picture tubes (including the new short-neck 110 degree RCA-type picture tubes) for cathode emission, shorts and life expectancy. Also rejuvenates and restores cathode emission of weak picture tubes.

Model AD-1 (factory wired only) **$4.50**

Model FC-1W factory wired **$58.50** Net

Model FC-1K — semi-kit **$48.50** Net
Comes completely assembled — Only wiring necessary

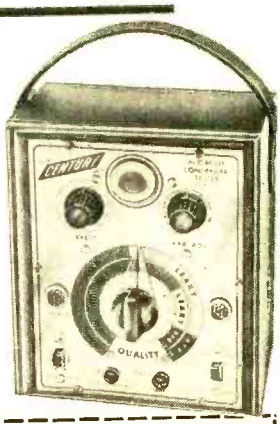
OUTSTANDING VALUE FEATURES

Checks each section of multi-purpose tubes simultaneously. If one section is defective the tube will read "Bad" on the meter scale • 41 tube sockets accommodate all present and future tube types • Less than 10 seconds required to test any tube • Large D'Arsonval type meter is extremely sensitive, yet rugged . . . with two multi-color "Good-Bad" scales • Selection of 12 filament voltages • Line isolated • 7-pin and 9-pin straighteners mounted on panel • Large easy-to-read quick reference chart for over 600 tube types in use today • New tube listings furnished periodically.

Here's an *in-circuit* condenser tester that *does the whole job!*

The IN-CIRCUIT CONDENSER TESTER Model CT-1

Actually steps in and takes over where other in-circuit condenser testers fail. The tremendous range of operation makes it an absolute must for every serviceman.



Checks in-circuit:

Quality . . . including *leakage*, shorts, opens, and intermittents • Value of all condensers 200 mmfd. to .5 mfd. • Electrolytics for quality — any size • Transformer, socket and wiring leakage capacity.

Checks out-of-circuit:

Quality . . . including *leakage*, shorts, opens, and intermittents • Value of all condensers 50 mmfd. to .5 mfd. • Electrolytics for quality — any size • High leakage to 300 megohms • New or unknown condensers.

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- ☐ Model CT-1W (wired) ... $34.95 — $9.95 within 10 days. Balance $5.00 monthly for 5 months.
- ☐ Model CT-1K (kit) ... $24.95 — $9.95 within 10 days. Balance $5.00 monthly for 3 months.

Prices Net F.O.B. Mineola, N. Y.

Name .....

Address .....

City ..... State .....

Carl & Jerry (*Continued from page* 14)

boys thought it would, and they barely had time to make sure there was no arcing and that the intercom was working when they got the third call to supper. They hurriedly showed Norma how to switch on the unit and left.

At seven-thirty, though, both were sitting in Jerry's darkened dining room shamelessly staring across at the blank windows of Norma's living room. Suddenly the lights came on, and Norma minced into the room on a pair of high heels and started straightening the cushions on the davenport.

"Wheee-whooo!" Carl wolf-whistled. "She's not just depending on our ionizer!"

"You can say that again," Jerry agreed, noting the perfectly fitted and becoming frock Norma was wearing. "She doesn't look much like the gal who was popping corn for us last night."

Norma switched on the TV set just as the boys heard her door chime. She walked over and flipped the switch that turned on the power supply; then, before answering the door, she turned toward the window and made a circle with a carefully manicured thumb and forefinger.

IN A MINUTE she was back with a tall, blond man whose hair was combed straight back from his high forehead. He politely waited until Norma had seated herself on the couch and then sat down beside her.

"I'm just in time," he commented, glancing at the TV screen. "It should be a good fight."

As he said this he leaned comfortably back on the couch—and suddenly his blond hair stood straight on end, giving him a look of stark horror. Norma, who turned toward him, opened her eyes wide in astonishment.

Hurriedly he slid forward to the edge of the couch and pulled a comb from his pocket and passed it through his strangely behaving locks. "That's funny," he muttered, pulling back his cuff and staring at his wrist. "It felt as though something was brushing the hair on the back of my hand."

"Static electricity attraction," Jerry explained with a chuckle.

"Sa-a-a-y," Mike was saying to Norma, "I really go for that new perfume of yours. I never smelled anything quite like it before. It has such a fresh 'ozonish' odor to it."

"It *is* ozone he's smelling," Jerry remarked.

"And come to think of it," Mike was saying as he edged closer to Norma, "you look mighty fetching yourself tonight, Norma;

Carl & Jerry (*Continued from page* 16)

I seem to be seeing you for the first time. You do things to my blood pressure."

"Why-why, thanks, Mike," Norma said, edging away from him a trifle; "but you're missing the fight. See! There's a knock-down!"

"Who cares about a silly old fight when he's sitting next to a lovely dish like you!" Mike exclaimed, as he settled back and slid an arm along the couch behind Norma. Instantly his hair stood up on end again, and he jumped away.

"You make me feel funny," he accused, clapping a hand to his scalp and trying to hold his hair in place.

"You *look* a little funny, too," Norma said as she tried to suppress a giggle. "Let me get you a drink."

As she went out of the room, she casually snapped the switch that cut off the power supply. Instantly Mike's hair fell back in place. He leaned forward and buried his flushed face in his hands without paying any attention to the fight that was still going strong on the TV.

Norma came back into the room with a glass of water which she handed him as gingerly as if she were feeding a wolf. He drank it in thirsty gulps and then said suddenly: "Norma, if you will pardon me,

. . . He slid an arm along the couch behind Norma. Instantly his hair stood up on end, and he jumped away. "You make me feel funny," he accused . . .

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Carl & Jerry (*Continued from page* 18)

I think I'd better go home. I just don't feel myself tonight."

She didn't try to keep him. The boys were all set to rush over and compare notes with her, but just as Mike left, two of Norma's girl friends stopped in, and they stayed until the boys reluctantly gave up and went to bed. The next morning, though, when Norma came home from church, Carl and Jerry were waiting on her front step.

"WELL, Norma, what do you think?" Carl asked. "Is our invention a success or is it a success! Mike was really paying plenty of attention to you for a while there last night!"

Norma smiled quizzically at the two boys for a moment before she answered slowly: "Fellows, I'm not quite sure if the invention is a success or not. Mike called me early this morning and said he was in bed with a terrific case of the flu. When he got home last night he took his temperature and found it was 103 degrees. He says he was so flighty that he hardly knew what he was saying, and he wanted to know if he said or did anything out of the way last night. He was very relieved when I told him he hadn't.

"So-o-o-o, there you are. Was it ionization or flu germs that made that big change in Mike last night?"

Both boys were downcast. Finally, though, Jerry brightened up and said: "So all we have to do is wait and try the experiment over again when Mike gets over the flu."

"I'm not sure I want to try it again," Norma said slowly, as though she were thinking out loud. "I thought I would give anything to see that gleam in Mike's eyes, but when I did see it I didn't feel the way I thought I would. Those other two gals can have my third of Mike's attention. I guess I'll live."

Jerry glanced at Carl and then said: "Well, Norma, we seem to be a great big fat flop when it comes to helping you with your love-life. This is the second boy friend of yours we've chased off. But to tell you the truth, maybe subconsciously we don't want to help you. Maybe we don't want to see our pretty neighbor and favorite popcorn popper married off!"

Norma gave a happy shout of laughter as she tousled the crew-cuts of both boys. "Who needs boy friends to sustain her ego with you two flatterers around?" she asked, "Let's go in and raid the refrigerator. I'm always hungry as a horse when I fall out of love." —30—

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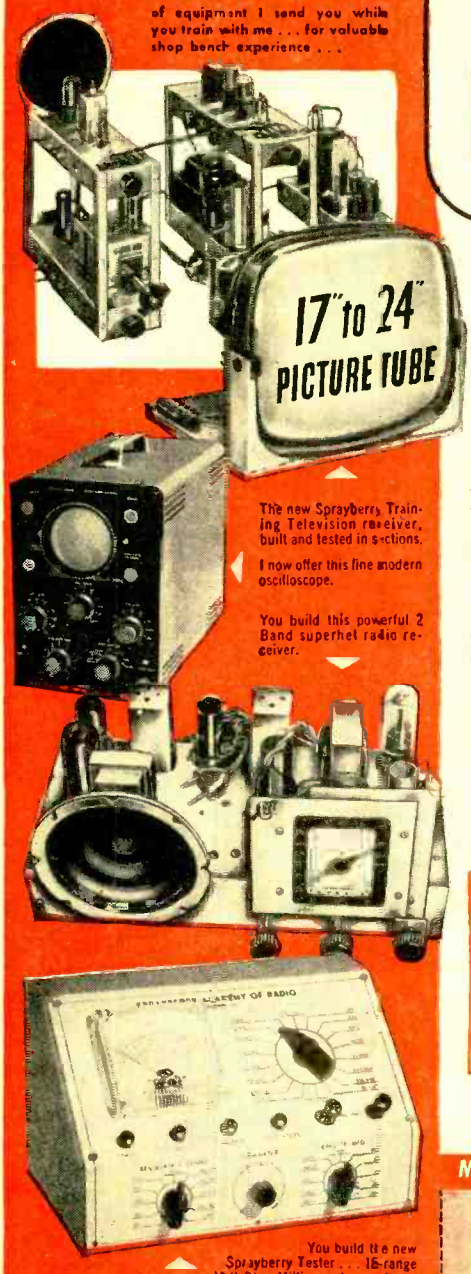

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LETTERS FROM OUR READERS

Homemade Hi-Fi

■ I am a subscriber to your very fine magazine. After reading several articles dealing with hi-fi, I have made a high-fidelity system. It is not completely finished, but I have the tuner and amplifier. My friends are amazed at the tone it produces. I plan to get my record changer later on. Keep up the good hi-fi articles.

MELVIN NETHERY
Vernon, Texas

There's a certain pleasure and satisfaction that comes only to those who have built their own high-fidelity systems. Glad you have had that experience, Melvin. Future issues will keep you informed on all the interesting developments in the field.

We Aim to Please

■ I am interested in getting a diagram of a circuit used in musical amplifiers. Called a tremolo or vibrato, it is an oscillator circuit which will give a guitar an echoing effect if it is connected between the guitar and amplifier. At a music store this attachment costs about $35.00. I am positive that I could build it myself for less than one-half that price if I could purchase a schematic of such a circuit.

PATRICK WALLS
Tacoma, Wash.

See our December cover picture and construction article beginning on page 41 of that issue.

■ Congratulations! Your November issue, from my point of view as an SWL, was the best. Besides other articles of interest, there were many short-wave construction pieces which I enjoyed. The article by Stewart West was even better than the article which appeared in the February 1957 issue of POP'tronics, if that is possible! I believe this article will introduce many more people to the fine hobby of SWL'ing. The complete station list is an excellent supplement to the *Short-Wave Report* column by Hank Bennett.

CLAYTON HILLMARK
Shelby, Ohio

SWLL (L for Lady)

■ You asked to hear from women readers—here is another one. I am not a ham, but a SWL, so your *Short-Wave Report* is my favorite department. I got a new Telefunken SW-AM-FM radio last year and use a 66′ doublet antenna. I installed a switch to change the antenna to FM; it brings in stations from unusually long distances, such as Fresno (145 miles) and Marysville (120 miles). I have logged stations in all parts of the world and have over 25 QSL's now. One of my favorite stations is Brazzaville, French Equatorial Africa, which comes in with dependable regularity as loud and clear as any San Francisco station. *Radio Brazzaville* is most generous in sending pictures and information about the station and

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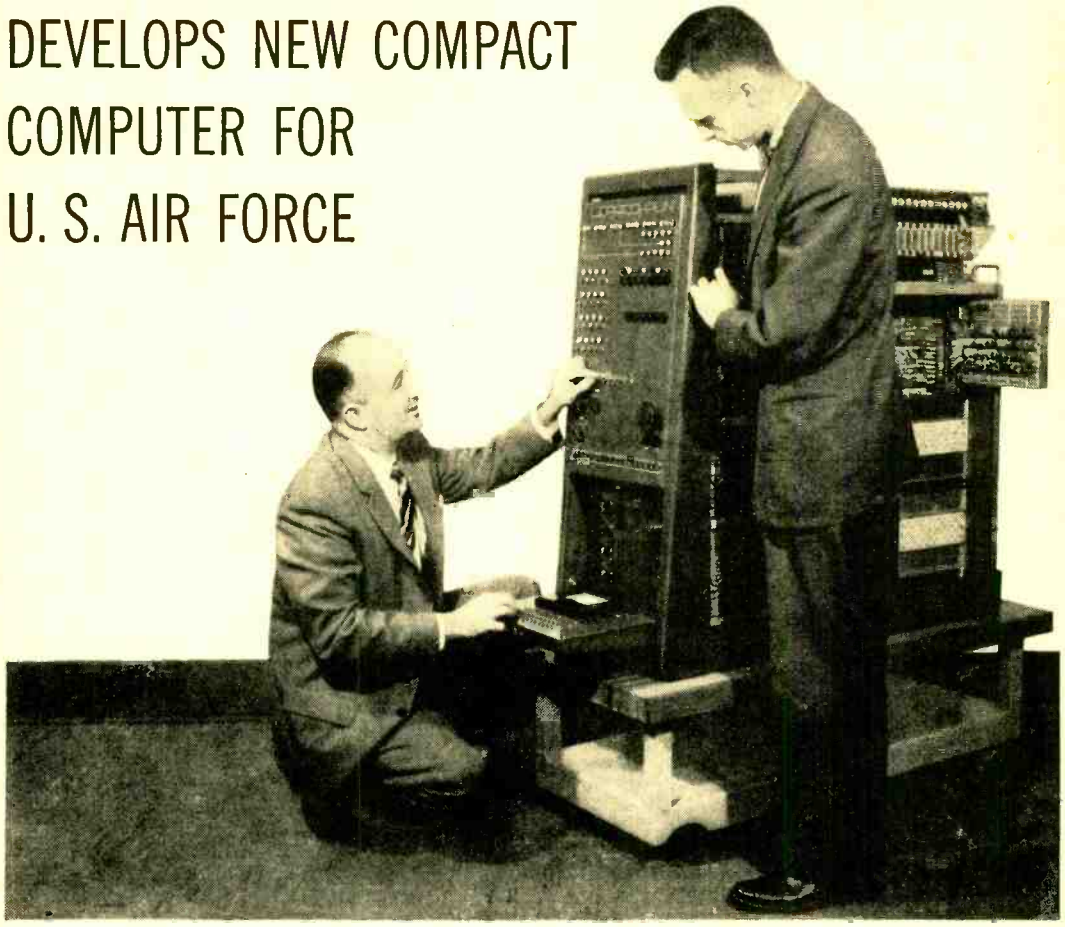

J. A. Githens, B.S. in E.E., Drexel Institute of Technology, and J. A. Baird, Ph.D. in E.E., Texas A. & M., check the control panel of Leprechaun, a new high-speed computer which solves extremely complex problems in one-tenth of a second. Small size and low power are made possible by new design principles and Bell Laboratories' invention of the transistor.

The United States Air Force assigned Bell Labs an interesting assignment: develop a new kind of electronic computer. The major requirement was greater simplicity. Of course, no computer is simple, but this one (known as "Leprechaun" to its designers) is much smaller and simpler than most of the computers currently in use.

It has only some 9000 electrical components; 5000 of them are transistors. As a result, Leprechaun utilizes less than one-third of the components required in conventional computers. This facilitates testing, experimentation, assembly and service.

Even in its experimental state, Leprechaun is a stimulating example of great strides in the simplification and miniaturization of circuitry . . . a problem of deep interest to Labs researchers as they develop radically new equipment for your future telephone service.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

Letters

(*Continued from page 22*)

the country. Your *Short-Wave Reports* are a great help in logging new stations.

ESTHER L. COTTINGHAM
Redwood City, Calif.

Thank you. We trust that our November issue, which contained a complete short-wave station list, helped you as it did so many other SWL's.

No-Toll TV Fan

■ I have just read your article on closed-circuit television ("Will You Pay for TV," Oct., 1957). As far as I am concerned, if it goes into effect, I will sell my television set and go back to radio entirely, as the set cost us a great deal and I cannot see putting out the additional money for pay-TV.

T. B. MEAD
San Leandro, Calif.

The FCC authorized tests of toll television . . . by coincidence, on the very day our article appeared. Good timing, we'd say.

Readers Tell Us Off!

■ We wish to call your attention to a slight error in *After Class* in the November issue. Under the subtitle "Synchrocyclotron," you state that "An ion having this energy (in excess of 400 m.e.v.) travels at a speed of approximately 93,000 miles per second or at a speed high enough to carry it to the sun in about 10 seconds flat!" This would, according to our calculations, put the sun 930,000 miles away, and the moon only 2500 miles away. The correct figures are 93,000,000 and 250,000 miles.

We believe that the article should have stated that "An ion having this energy (in excess of 400 m.e.v.) travels at approximately 93,000 miles per second or at a speed high enough to carry it to the sun in about 1000 seconds flat!" We will forgive you this time. but don't let it happen again. Seriously, we enjoy your magazine very much. Keep up the good work.

DAVE HERBERT
JAMES MORITZ
Students, Valpo Tech.
Valparaiso, Ind.

We agree. So many readers wrote in about this error that it was extremely difficult for us to pick one letter to publish. All kidded us, but forgave our slip. Our thanks to all who wrote in. You certainly have convinced us that you read POP'tronics very, very carefully.

Disa and Data

■ Thanks for "The Challenger." I made it and it works perfectly. I brought it to school and no one, including me, has found out the way to beat it. Since I am 13 years old and have a limited bankroll, I would like to see approximate prices on your construction articles.

JOHN FIEDLER
Tampa, Fla.

Check the November issue, Letters column, for

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

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build 16 Receiver, Transmitter, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for Television.

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

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

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

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

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build 16 different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, Instruction Manuals, wire, solder, etc.

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

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- SOLDERING IRON
- ELECTRONIC TESTER

- PLIERS-CUTTERS • ALIGNMENT TOOL
- WRENCH SET
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- MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • FCC AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

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

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

FROM OUR MAIL BAG

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

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

PRINTED CIRCUITRY

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

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

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497 Union Ave., Dept. 540D, Brooklyn 11, N. Y.

Letters

(*Continued from page 24*)

the "gimmick" in beating "The Challenger." Incidentally, since we can't know just how many parts you have in your "junk box," a check of it and a radio supply house catalog will enable you to estimate your cost better than we could.

Microphones for High Fidelity

■ Why not run an article or series of articles on microphones? With all the hi-fi equipment, tape recorders, etc., on the market now, it seems that an amplifier that can respond to 20,000 cycles is pretty useless if one must feed a signal into it with a mike that can only reach 10,000 cycles. Of course, better mikes are available—for a price. I was thinking specifically of an article on the variations in available materials and equipment.

JENNINGS G. SMITH
Duncan, Okla.

Thanks for the suggestion. We'll work on it.

How Deep Is the Water?

■ Could you do an article on an inexpensive Fathometer or sonic depth finder? Some of the newer commercial models have come out in a moderate price range but they are still prohibitive for my pocketbook. I am sure there are a number of readers who would be interested in a project of this type, especially those that live in an area where boating is a popular sport, as it is here in the Pacific Northwest.

F. R. BIXLER
Bremerton, Wash.

We agree that such an article would be of great interest but there are a lot of technical difficulties for home construction. We'll keep hoping, however.

Readers Need Help

■ I would like to know if you know where I can get a schematic for a Breting 9 receiver.

JERRY CLAPP
4761 Barbarossa Dr.
San Diego, Calif.

■ I have received a Hallicrafters Sky Challenger receiver as a gift. As this "oldie" doesn't work, I have to fix it. Where can I get a schematic for it? Could any of your readers possibly help?

DICK FRANEY
56 Seminary Ave.
Binghamton, N. Y.

If any of you can be of help to Jerry and/or Dick, please contact them directly.

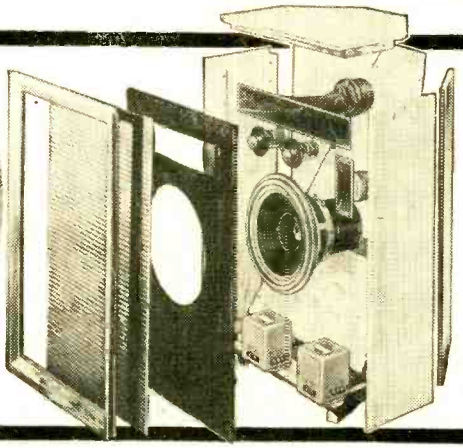
POP'tronics Cartoon

■ I really enjoyed your new cartoon series called "POP'tronics" on page 34 of the November 1957 issue. Keep it up. I would like to see some articles on radio control like you used to have, on equipment, model boats and model airplanes (R/C) especially. I am also interested in other radio-controlled applications.

LINDSEY LAWVILL
Herrin, Ill.

Thanks for your comments. We hope to have more articles on radio control of models and other devices in future issues. —30—

FOR HI-FI ON A BUDGET, FOLLOW THE ELECTRO-VOICE BUILDING BLOCK PLAN



Start with your basic speaker and improve your compatible E-V high-fidelity system one economical step at a time by adding Electro-Voice Speaker Building Blocks.

Here, we've started with an SP12—12-inch coaxial driver. *Later, you add BB2*—a T35 very-high-frequency driver, X36 crossover and AT37 level control with wiring harness. BB2, Net $50. *Still later, augment with the BB4*—to smooth and disperse treble range. It includes T25A treble driver with 8HD horn, a second crossover—800-cps X8—and a second AT37 level control with wiring harness. BB4, Net $114.

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Shown dis-assembled is E-V's KD 6 kit. In one short evening you can assemble a duplicate of our factory-built ARISTOCRAT enclosure of folded-horn corner design for use with 12-inch drivers or separate multi-way systems. Mounting boards are factory cut and fitted for later, easy addition of E-V treble and VHF drivers. KD6, Net $39.

These "DO-IT-YOURSELF" Books Show You How To Build It

Included Free with Each Kit ... or May Be Purchased Separately

Each book gives complete, easy-to-follow, step-by-step instructions, diagrams and photos. Makes it simple to build your Hi-Fi Speaker Enclosure with an E-V K-D Kit—or with your own materials purchased at your local lumber yard and hardware store. Get the book of your choice *today* from your nearest E-V High-Fidelity Distributor.

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Model IB5—For Empire	1.00
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"A GLOSSARY OF TERMS IN NUCLEAR SCIENCE AND TECHNOLOGY" published by American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y. 188 pages. Soft cover. $5.00.

The need for a glossary of nuclear terms became apparent after World War II. ASME, with the cooperation of the National Academy of Sciences—National Research Council, prepared this comprehensive dictionary which has been approved as a standard by the American Standards Association. The price is small indeed for so necessary and accurate a compilation. Formulas, graphs and tables are provided where they are required.

Recommended: To all those working in any field touching on nuclear science who need precise and accurate definitions in the areas of biophysics, instrumentation, radiation, and allied topics.

"BETTER SHORTWAVE RECEPTION" by W. I. Orr, W6SAI. Published by Radio Publications, Inc., Wilton, Conn. 140 pages. Soft cover. $2.85.

This is the fourth in a series of valuable books written by W. (Bill) I. Orr. Comparable to his previous achievements, Bill has now gone all out on the subject of SWL'ing—a topic that has long needed an up-to-date examination. As a hobby involving between 25,000 and 40,000 participants, it is surprising that there is only one monthly feature article on it (in POP'tronics, of course) and one short-wave station listing. This book should break the bottleneck. In it, short-wave receivers and antennas are discussed with emphasis on all the things that an SWL needs to know—how to buy, how to check alignment and calibration, etc. A variety of good antenna designs is outlined, and a bonus package showing step-by-step construction plans for a preselector Q-multiplier and calibrator is thrown in. Reception techniques are thoroughly discussed to answer questions about recording, SWL cards, time zones, strange signals, fading signals, jammers, etc.

Recommended: To anyone with an urge to twist a short-wave receiver dial—you will want to read this book beforehand.

—30—

This book is a Gold Mine
Send for it immediately!

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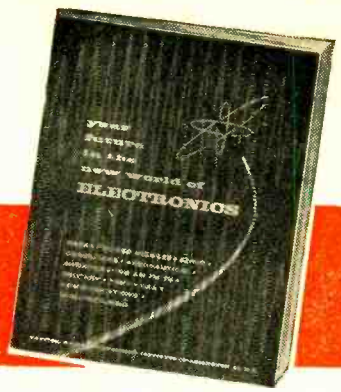

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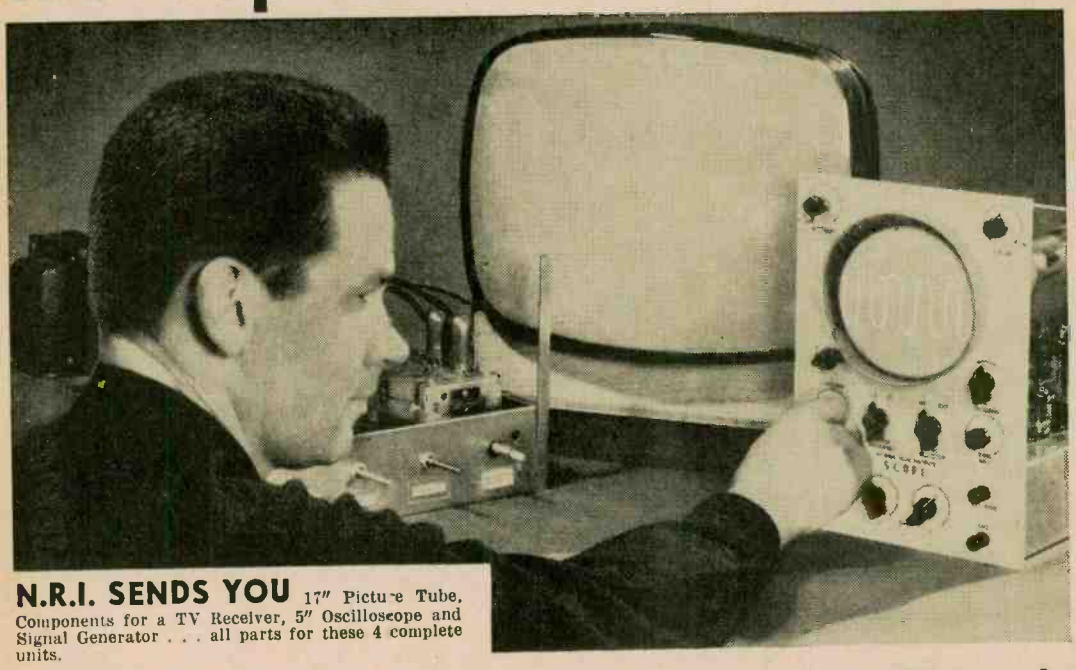

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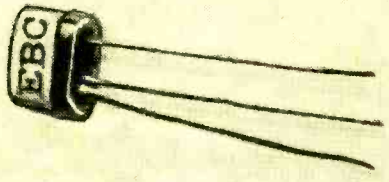
TIPS and TECHNIQUES

TRANSISTOR LEAD IDENTIFICATION

Radio students and transistor experimenters will find it easy to identify transistor leads in a hurry by cementing EBC labels on the transistors, as shown. Type

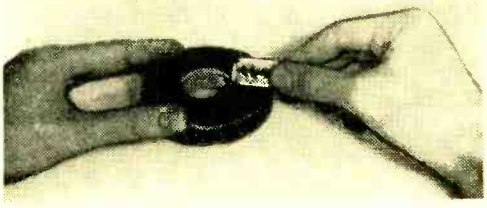


the letters "E," "B," and "C" on white paper (or hand-letter them with pen and ink). Then trim the paper to size and cement it onto the body of the transistor so that each letter corresponds to a lead.

You will find that the leads of different makes and types of transistors are arranged differently. Be sure to consult the manufacturers literature or a transistor handbook before applying the labels.—*A.T.*

CUTS AID REMOVAL OF TAPE

Ever try to remove some friction tape from a roll and find that small threads unravel from the edges? This can be prevented by making several shallow cuts in



either side of the roll with a razor blade or sharp knife. The cuts also aid in tearing off pieces of the tape. —*J.A.C.*

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If the tips in your soldering gun always seem to "give up" just as you're about to put the last connection in your gadget, try

(*Continued on page 94*)

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Dan Breece, Station KOVE, Lander, Wyo.	1st	12
Richard Meelan, 166 Jerome St., Brooklyn, N.Y.	1st	10
Leo Bishop, 37 Calle Contenta, Flagstaff, Ariz.	1st	12
Carl Deare, Jr., P.O. Box 467, Jeanerette, La.	1st	11
Jackson York, 1029 N. Quincy St., Arlington, Va.	1st	15

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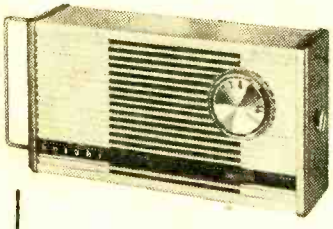

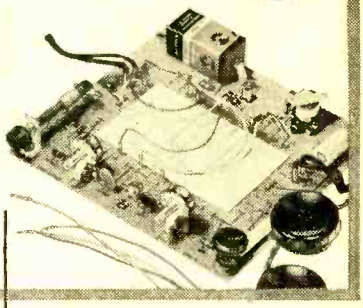

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Model Y-766. Net only.....$29.95

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Sensational transistor hobby kit! Assemble the basic parts once, then complete project after project (10 in all), just by plugging leads into proper jacks on printed-circuit board—no wiring changes needed. Make the following: AM radio; amplifier; wireless oscillator; code practice oscillator; electronic timer, switch or flasher; voice-operated, capacity-operated or photoelectric relays. Includes all parts, 2 transistors, battery, headphones, instructions for each project. Shpg. wt., 3 lbs.

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Model Y-262 $14.65

knight-kit 2-Transistor Pocket Radio Receiver Kit

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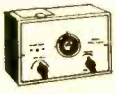

"OCEAN HOPPER" SW RECEIVER KIT Y-740 $11.95

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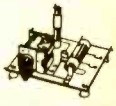

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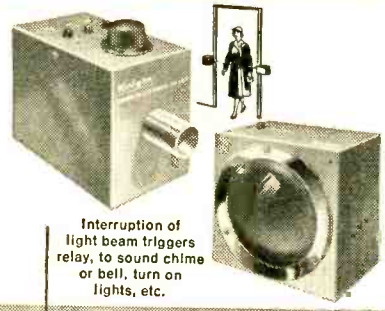

Interruption of light beam triggers relay, to sound chime or bell, turn on lights, etc.

knight-kit Transistorized Code Practice Oscillator Kit

Model Y-239 **$3.95**

Advanced-design code practice oscillator—ideal for beginners learning the code. Uses transistor circuit—operates for months from a single penlight battery. Has clear, crisp tone of approximately 500 cycles. Includes jacks for headphone tips; screw terminals for key. Compact black bakelite case with aluminum panel, only 2⅜ x 3¾ x 1½". Complete with all parts, transistor, battery and step-by-step instructions for quick, easy assembly. (Less earphones and key.) A fine code practice kit at very low price. Shpg. wt., 1 lb.

Model Y-239. Net only.....**$3.95**

knight-kit Photo-Electronic Relay Kit

Model Y-702 **$13.50**

Advanced-design, ultra-sensitive photo-electronic relay—build it yourself and save! Covers 250-ft. with white light; 125-ft. with "unseen" (red filter) light (made available in Light Source Kit listed below). Ideal as announcer, counter, burglar alarm (can be set to ring bell continuously when beam is broken). Hundreds of uses. SPST relay contacts. 6.3v. terminals provide power for accessories. 105-120 v. 50-60 cy. AC use. 6 lbs.

Model Y-702. Relay Kit. Net..**$13.50**

Model Y-703. Light Source Kit. With long-life sealed beam bulb and red filter. Shpg. wt., 3½ lbs. Net..**$6.75**

knight-kit 2-Way Intercom System Kit

Model Y-295 **$14.75**

Easy to build—ideal for home or office. Consists of Master and Remote unit, each with press-to-talk switch. Remote can be left "open" for switchless answering and baby-sitting. In "closed" position, Remote is private", but can be called and can originate calls. High-gain 2-stage amplifier and 4" PM speakers. Delivers full volume from only a whisper. With tubes and 50-ft. cable (up to 200-ft. may be added). Antique white finish. Size each unit, 4¾ x 6½ x 4⅜". For 110-120 v. AC or DC. Shpg. wt., 8 lbs.

Model Y-295. Net only.....**$14.75**

knight-kit "Space-Spanner" Bandswitching Receiver Kit

Model Y-243 **$15.95**

Thrilling 2-band receiver, easy to build, fun to operate—a terrific value. Bandswitch selects exciting short wave, including foreign broadcast, amateur, aircraft, police and marine radio (6.5 to 17 mc), and standard broadcast. Features highly sensitive regenerative circuit. Includes built-in 4" PM speaker and beam-power output for strong volume. Headphone connectors are available for private listening; switch cuts out speaker. Kit includes calibrated panel, punched chassis, all parts and tubes (less cabinet). Easy to build from step-by-step instruction manual. 7 x 10 x 6". For 110-120 volt, 50-60 cycle AC or DC. Shpg. wt., 5 lbs.

Model Y-243. Net only.....**$15.95**

Y-247. Matching cabinet for above.....**$2.90**

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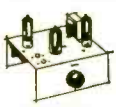
Y-770 **$8.45**

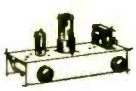
CRYSTAL SET HOBBY KIT
Y-261 **$2.15**



WIRELESS BROADCASTER KIT
Y-705 **$9.50**

PHONO OSCILLATOR KIT
Y-760 **$5.85**

ELECTRONIC PHOTOFLASH KIT
Y-244 **$28.50**



PHONO AMPLIFIER KIT
Y-790 **$9.45**

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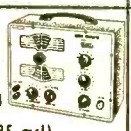

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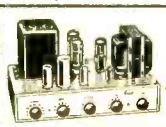

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By HARVEY POLLACK

Win at NIM with DEBICON

Play this old game with modern switching circuits instead of matches

ALTHOUGH the game of "NIM" has been popular for literally hundreds of years, most of the people who play it are not aware that it can be analyzed by a mathematical system. If you are handy with *binary* numbers (see *After Class* in this issue, page 68), you can win every time. Operating with binary numbers mentally, however, is a trick that is not easy to master.

The "DEBICON" (DEnary-BInary-CONverter) does all the hard work for you. When you learn to interpret the mathematical code of its flashing light panel—it's easy once you know the rules—you can beat the best "brain" among your friends every time! The fun of DEBICON is the challenge it offers your opponent to make use of the lights in the same manner you do; but just let him try to make sense of their changing patterns!

The Game Itself. To see how the DEBICON is used, let's do a quick rundown on the rules that govern the four-number version of NIM. This form of the game is more fun to play than the simpler varieties and is much more mystifying when you force a win.

Two players are involved. One of them sets out four piles of matches, toothpicks or coins, the number in each pile not to exceed ten. Fewer than ten objects may be used in any of the piles, but it's more fun to start with larger amounts. Instead of using coins or matches, the game can be played by setting the four numbered dials on the DEBICON.

Assume that player X has set out matchsticks as in Table 1. Pile A contains nine sticks, pile B seven, pile C three, and pile D six. Player Y is now allowed to remove any number or all sticks from any *one* pile. Let's suppose he takes seven from pile A. Then, player X takes two from pile B while player Y takes all the remaining sticks from pile A on his next turn. The progression of the complete game might run somewhat as shown in Table 1. Each time a player's turn comes up, he is allowed to operate on only one pile at a time, and the person who is left holding the last stick loses the game. In our sample game, player X is left holding the last one—the one in pile C. Player X is the loser.

Doing It Electronically. When NIM is played on the DEBICON, the piles are reduced by rotating the selected knobs from higher to lower numbers. Each player takes his turn and works one knob at a time. As each knob is twisted, the row of four horizontal lights fluctuates in pattern for each new setting. If you're the player that knows the "code," at your turn you simply reset one of the knobs in accord with the secret instructions flashed to you by the panel of lights.

Each time it is your turn to play, you reduce the setting of *one* of the knobs until each of the vertical columns has an even number of lit lamps. Zero (or no lamps lit) is "even," as are the numbers "two" and "four." You are now "safe" and your opponent is stuck. His next move will invariably change the pattern so that one or more of the columns will add up to an *odd* number. At your turn, you can reestablish a safe condition by resetting the appropriate dial for an "even" sum of glowing lamps.

Table 2 shows the complete sequence of moves for player X and player Y applied to the example given previously. Player Y is "in the know," and player X, sometimes called "sucker," is doomed! Once player Y acquires the "knack" of interpretation, he is unbeatable.

STEPS	Pile A	Pile B	Pile C	Pile D
Player X sets matchsticks out this way	/////////	///////	///	//////
Player Y takes seven from Pile A, leaving two sticks	//	///////	///	//////
Player X takes two from Pile B, leaving five sticks	//	/////	///	//////
Player Y takes the remaining two from Pile A, leaving none in this particular pile		/////	///	//////
Player X takes all from Pile D, leaving none in this pile		/////	///	
Player Y takes two from Pile B, leaving three sticks		///	///	
Player X takes all of Pile B, leaving none in this pile; the only sticks left now are three in Pile C			///	
Player Y takes two from Pile C, leaving only one; player X loses, being stuck with last stick			/	

Table 1. This is how two people might play the game of NIM using matchsticks.

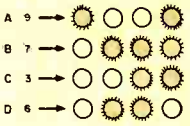
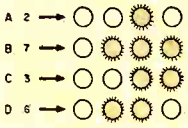
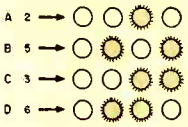
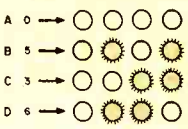
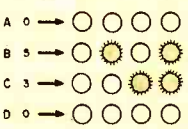
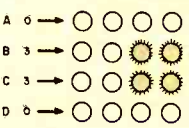
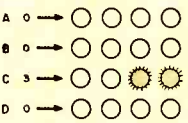
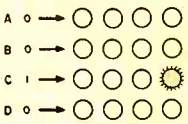
STEPS	4 3 2 1	RESULT
Player X sets up the numbers this way: 9 7 3 6		Columns 1, 2 and 4 have odd totals: UNSAFE
Player Y takes seven from Pile A, leaving two sticks in this pile: 2 7 3 6		All columns now total even (2, 4, 2): SAFE
Player X takes two from Pile B, leaving five sticks in this pile: 2 5 3 6		Column 2 is now odd again (3): UNSAFE
Player Y takes the remaining two from Pile A, leaving none in this pile: 0 5 3 6		All columns again total even (2, 2, 2): SAFE
Player X takes all from Pile D, leaving none in this pile: 0 5 3 0		Columns 2 and 3 now are odd (1, 1): UNSAFE
Player Y takes two from Pile B, leaving three sticks here: 0 3 3 0		Totals again even (2 and 2): SAFE
Player X takes all of pile B, leaving none in this pile; what remains is: 0 0 3 0		Both columns odd (1 each): UNSAFE
Player Y takes two from Pile C, leaving only one; Player X loses, being left with last stick: 0 0 1 0		End of game

Table 2. Using the secret code with DEBICON insures your winning the game.

There is one exception to the even-sum rule but since it occurs only at end-game it should cause no trouble. As you approach end-game, you must not leave an even number of "ones" on the *dials* of the DEBICON as the only remaining digits. Should the game happen to proceed toward this end result, adjust your last move so that three "ones" or a single "one" remain on the board. If your last move should leave your opponent with two "ones" or four "ones," he can wipe you out by removing a single "one" each time his turn comes around, forcing you to pick up the last.

Constructing the DEBICON. Locate the holes for the rotary switch shafts with plenty of clearance between adjacent wafers. Since all the finished switches are exact duplicates of one another, they can be prewired in identical fashion before in-

stallation. Wire color-coded leads about eight inches long from interconnected terminals for later connection to the indicator lamps. Each colored wire should be identified by associating it with a specific pilot lamp. Record this association to make your final connections easier.

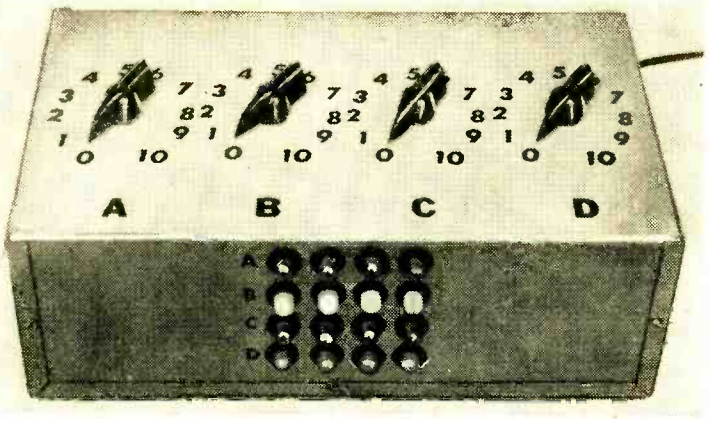
Position "zero" and all subsequent positions are determined as follows. Remove the shaft nut from the switch. This will free the adjustable stop which should be removed and discarded. Rotating the shaft should now provide eleven positions which we will number zero through ten. Turn the switch shaft fully *counter*clockwise and observe where the wiping contact comes to rest. This is the zero position. The next clockwise step is position one, then two, and so on. Make sure you can identify all even positions by counting them off as you twist the shaft clockwise step by step.

Drill 16 ½" holes in the front panel for the indicator lamps, forming a square of four vertical columns and four horizontal rows. Insert a ½"-o.d., ⅜"-i.d. *soft* rubber grommet in each hole, moisten the pilot lamps and press them in place gently for a friction fit. With the lamps installed, join their metal shells by spot-soldering one continuous piece of bare, tinned hookup wire to each one in turn. Then connect the end of this jumper wire to either terminal of the 6.3-volt transformer secondary.

Before mounting the individual switches, connect their wiper-contact terminals together with the same type of bare wire and ground the end of each jumper to the case. The remaining 6-volt transformer secondary lead is also grounded, completing the circuit to the individual lamps through the appropriate switch contacts.

Each of the four color-coded leads com-

Decals provide lettering for the switch positions and for the pilot lamps.

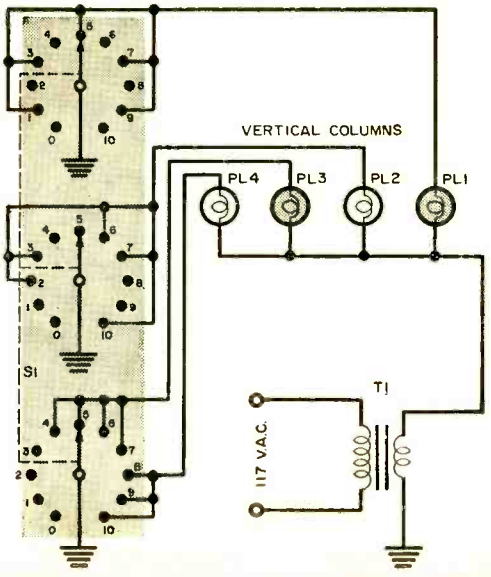


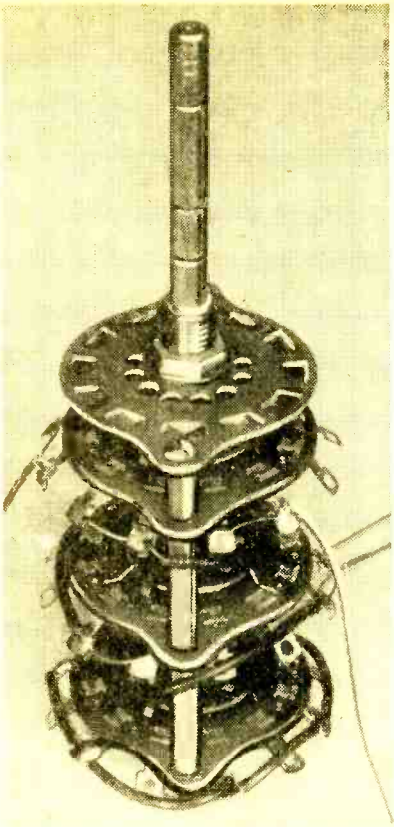
Wiring of one of the four rotary switches and one of the horizontal rows of lamps is shown below, right. The other three switches are wired exactly the same and each handles one horizontal row of lamps. Switches connect together only at common ground as shown.

HOW IT WORKS

The wiring of the DEBICON selector switches is arranged to set up the *denary* numbers from zero to ten in *binary* form. The game of NIM is based on the binary number system in which it may be shown that "even" digital totals in the columns—regardless of the number of columns—establish a "safe" condition. When any *one* of the numbers is altered, the condition becomes "unsafe."

In other words, it is not possible to go from a set of "even" columnar totals to a second set of "even" totals by resetting only one of the switches; hence, the play must oscillate from "safe" to "unsafe" on each successive move. As long as a player repeatedly restores the even totals, his opponent must set up odd totals in at least one of the columns on every move. This eventually results in the opponent being left with the last "one"—and he's lost the game!





STEP	LIGHT SEQUENCE
0	0 0 0 0
1	0 0 0 *
2	0 0 * 0
3	0 0 * *
4	0 * 0 0
5	0 * 0 *
6	0 * * 0
7	0 * * *
8	* 0 0 0
9	* 0 0 *
10	* 0 * 0

0 = Light OFF; * = Light ON

Table 3. If the wiring is correct, lamps will light as shown at switch positions.

ing from the switches is now connected to the associated base solder contact on each of the pilot lamps. Since each set of connections to horizontal rows A, B, C, and D is identical, only one set is shown in the diagram.

Test Your Wiring. After completing the wiring for the first switch and the first horizontal row, set the switch on the *zero* position and plug the unit into a convenient 117-volt a.c. receptacle. Rotate the switch clockwise step-by-step as you observe the sequence of glow, and compare the steps with those given in Table 3 at the top of this page.

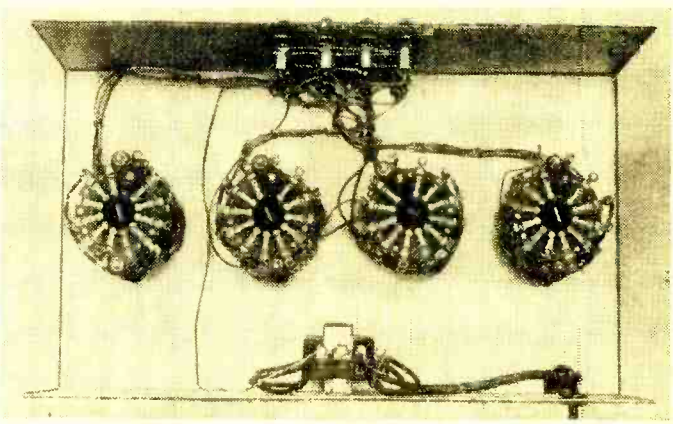
Be sure that neither leg of the a.c. line is accidentally grounded to the case. The *only* power lead which should be connected to the case is one of the 6-volt secondary transformer leads.

The numbers and lettering shown in the illustrations were applied by means of alphabet decals available from electronic supply houses.

—30—

Close-up above shows wiring of one three-deck switch.

Use care when soldering to base contacts of lamps.



PARTS LIST

PL1 to PL16—6.3-volt pilot lamp with bayonet base (#47)

S1, S2, S3, S4—3-circuit, 3-section, 11-position rotary switch (Mallory 1331L)

T1—6.3-volt filament transformer, 1 amp. secondary

1—7" x 12" x 4" Minibox (Bud CU-2111)

Misc. decals, grommets, line cord, terminal strip and colored hookup wire

POPULAR ELECTRONICS

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Detectors Test A-Blast Radiation Above and Below Ground

The U. S. Army is using a new network of radiation detectors to test the potency of atom rays after atomic tests. Scientists are stowing the gear in such places as tanks (above), balloons, and even under the ground. They hope to learn under what conditions troops may enter an area after atomic artillery bombardment.

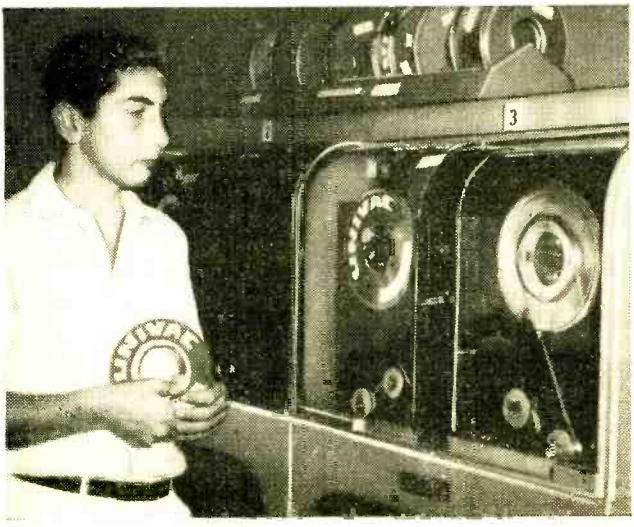
This equipment was developed at the Signal Engineering Labs. at Fort Monmouth, N. J. It keeps a continuous record of radiation hazards in the test area after a blast. Data are stored in well-protected underground recorders until the area can be entered safely. Such data could be used to prepare radiation charts for combat.

One such probe has been installed in a Sherman tank to determine how close to a blast such an armored vehicle can be without danger to its crew.

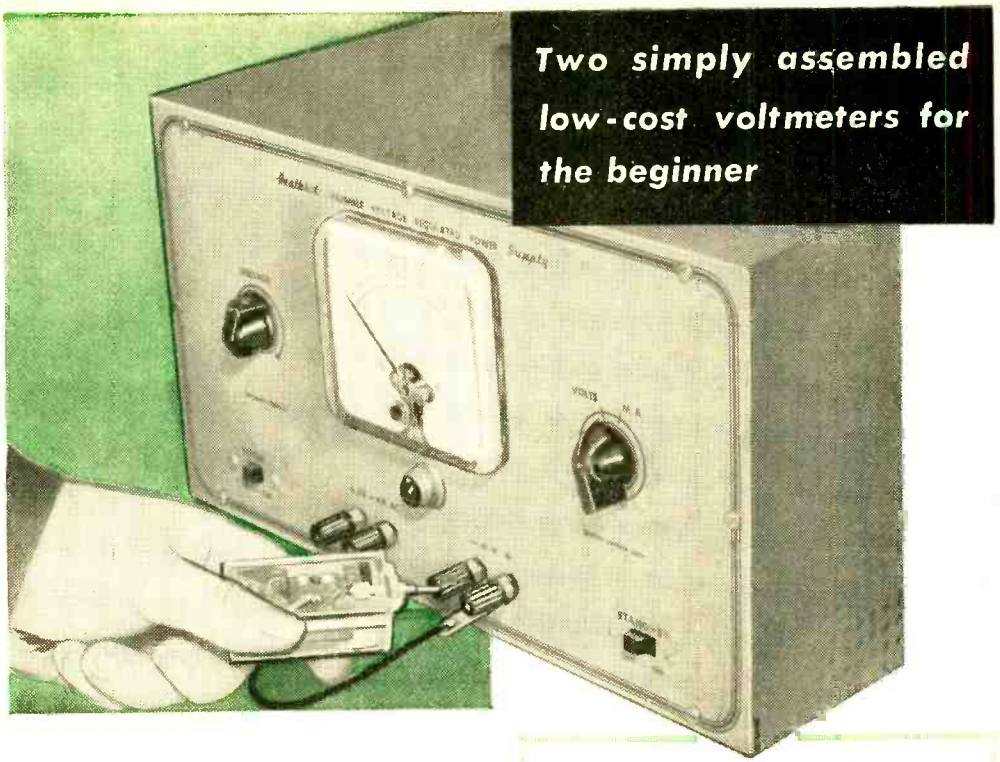
Experimental 60-kc. Standard Frequency

The Bureau of Standards has determined that the regular h.f. standard broadcasts are sometimes subject to frequency shift of 3 parts in 10 million. Therefore, the Bureau has initiated experiments at low and very low frequencies designed to overcome the problem which is said to be due to changes in the propagation medium. The first, at 60 kc., has started at Boulder, Colo., with the call letters KK2XEI. In this way they hope to find a practical way to minimize propagation errors and allow high-accuracy frequency comparisons in a shorter period of time.

They Start Young in the Electronic Computer Field



There's nothing very unusual about a 14-year-old boy attending school—unless it happens to be a class in programing a Remington Rand high-speed digital computer. Bill Rosenberg of Los Angeles is the youngest student ever to attend this class, from which he emerged with "a truly outstanding record." Shown at left ready to mount a tape for running a problem on his thesis, Bill is now occupying his spare time designing and building an electronic computer. He intends to become an electronics engineer, and his goal is the invention of a memory device for a computer smaller and better than anything that has yet been devised.



Two simply assembled low-cost voltmeters for the beginner

Pocket Size Test Instruments

Part 1

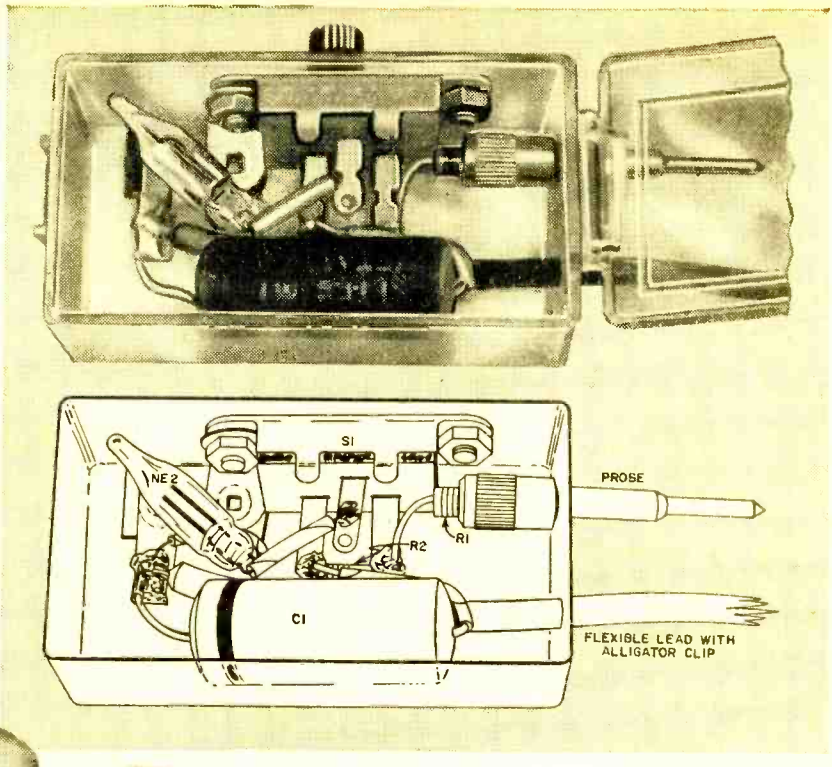
By E. G. LOUIS

WHETHER you're a part-time or full-time serviceman, a student-experimenter, an R/C enthusiast, a ham, an audio fan, or a home builder of electronics gear, chances are that you've often wished for a set of pocket-sized test instruments. The serviceman can use miniaturized equipment for quick checks of receivers and amplifiers in a customer's home; the ham can use such instruments for testing his mobile rig or for checking out his portable equipment on periodic field days; the home experimenter will find that pocket-sized instruments require less of his limited—and valuable—bench space, leaving more room for construction projects and circuit assemblies.

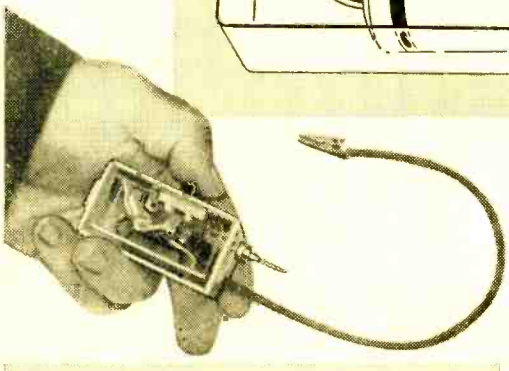
If you're willing to invest a few dollars and two or three hours of your time, you can assemble your own set of "tom-thumb" instruments. With a well-stocked junk box, you may be able to reduce out-of-pocket cost to small change. All you'll need is a handful of resistors and capacitors, a few controls and switches, and an assortment of small metal or plastic boxes, plus the usual "hardware" found around the lab or workshop. For an indicating device you can use a low-cost neon bulb instead of a relatively expensive meter.*

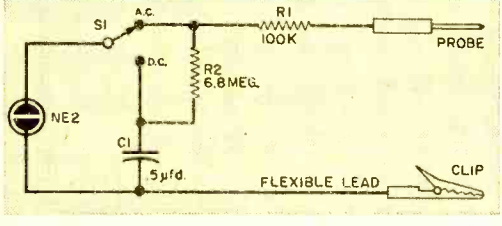
The voltmeter is one of the basic instruments needed in electronics servicing or in

* For a bench-type neon-bulb volt-ohmmeter, see "Make Your Own 'Economy' Multitester" in the October, 1957 issue of POPULAR ELECTRONICS.



Probe tip in pulse rate meter at right may be secured in place with Duco cement or glue.





Pulse rate meter operation is based on a special neon lamp characteristic. Calibration may be upset by exposure to intense light during measurement because of the lamp's particular sensitivity to changes in breakdown point under strong illumination.

laboratory work. So you'll probably want to start with one of these. Described below are *two* types of pocket-sized neon-bulb-operated voltmeters that you can assemble. In later articles, we'll discuss the construction of other instruments, including an audio generator and a unique R/C tester.

PULSE RATE VOLTMETER

Often, when making a quick check of amplifiers and radio receivers, our immediate interest is to see if B+ and plate voltages are available, and what their *approximate* value is, rather than *exactly* how much voltage is available. We may need to know whether we have, say, *about* 300 or *about* 100 volts rather than exactly 285 or 300 volts. The pulse rate voltmeter is designed to simplify this type of measurement. Even though the instrument has no meter to read nor dials to adjust, it is still possible to obtain a fairly good approximation of d.c. voltages with it.

Using only two resistors, one capacitor, a slide switch and a neon bulb, the pulse rate voltmeter is inexpensive and easy to build. Just follow the wiring diagram and illustrations. Don't worry about layout and circuit lead dress—they aren't critical. But make sure that the switch is easy to manipulate when the instrument is held in one hand, and that the neon bulb is clearly visible.

PARTS LIST

C1—0.5-μfd., 400-volt metalized paper capacitor
R1—100,000-ohm, ½-watt resistor
R2—6.8-megohm, ½-watt resistor
S1—S.p.d.t. slide switch
1—NE2 neon bulb
Misc. small plastic case, terminal strip, alligator clip, wire, solder, machine screws and nuts, etc.

With normal B voltages such as are found in radio and TV receivers (90 to 450 volts), the pulse rate is slow enough to follow with the eye. By mentally counting the number of pulses per second, the operator can make a close estimate of the voltage applied to the instrument. The higher the voltage, the more rapidly *C1* can charge to the firing voltage of the neon bulb, and hence the higher the blinking rate.

When connected to a source of a.c. voltage, the capacitor acts as a "short" across the neon bulb and the bulb does not light. The switch (*S1*) is turned to the "AC" position, changing the instrument into a simple neon-type indicator, with *R1* serving as a current-limiting resistor. With this arrangement, the bulb lights whenever the applied voltage "peaks" above the nominal firing voltage of the bulb—say from 70 volts (r.m.s. a.c.) up.

Although it is difficult to estimate a.c. voltage values—except by the relative brightness of the neon bulb—this is no drawback to the instrument's application. In most cases, when used as an a.c. voltmeter, the unit is primarily employed to indicate the *presence* of, say, a.c. line voltage.

To "calibrate" the voltmeter, simply connect the unit to measure known d.c. voltages and note the approximate number of pulses (blinks) obtained per second. Different d.c. voltages can be obtained from an adjustable d.c. power supply, or from the B supply circuits of radio and TV receivers. If you don't know the voltages that are available in a particular test, you can use a standard voltmeter while you calibrate the instrument.

The pulse rate voltmeter is not "polarized," i.e., *either* lead may be connected to the positive terminal (with the other lead connected to the negative side of the voltage source). To check the polarity of an unknown voltage, just note *which* of the neon bulb's two electrodes lights with a given arrangement of the test leads during the initial "calibration tests." Remember which electrode lights when, say, the "ground lead" is connected to B—, and you won't have any trouble identifying unknown voltages.

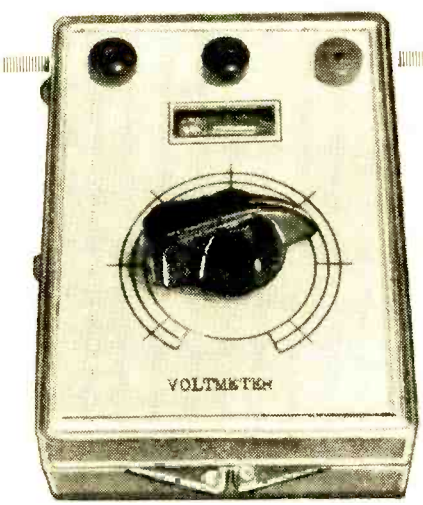
When you want to check a.c. line voltages, flip the switch (*S1*) to the "AC" position. On these measurements, the neon bulb will glow steadily (will not blink), and *both* electrodes will light.

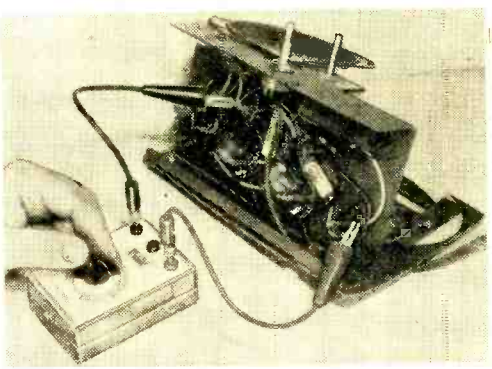
HOW IT WORKS

This is a basic relaxation oscillator for d.c. measurements and a simple indicator for a.c. voltage tests.

With *S1* in the "DC" position, and the instrument connected to a d.c. voltage source, capacitor *C1* is charged slowly through series resistors *R1* and *R2*. When the charge across *C1* reaches the "firing voltage" of the neon bulb, the bulb "fires," discharging the capacitor.

The capacitor then recharges slowly until the firing voltage is reached again, and the action continues. The neon bulb "blinks" or lights each time it fires; this blinking rate is dependent on the *RC* time constant and *on the voltage applied to the circuit*. Since the *RC* time constant is fixed by the values of *R1*, *R2* and *C1*, the blinking or pulsing rate depends only on the d.c. voltage applied to the instrument.



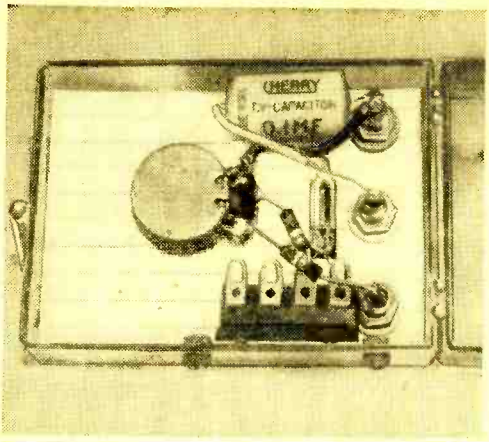


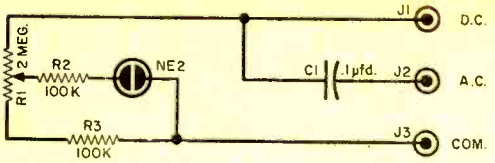
Neat panel layout and compactness characterize the volt-output meter. Its plastic case eliminates possibility of shock during measurement. At right, the meter is shown in operation. Rubber-shielded alligator clips are recommended for all connections to receivers when they must be worked on "live."

COMBINATION VOLT-OUTPUT METER

While the compact and easy-to-use pulse rate voltmeter is quite satisfactory for quick preliminary tests, you may want to make more accurate voltage measurements, or you may sometimes want to measure the a.c. component of a pulsating d.c. signal. This last measurement is generally made with an *output* meter.

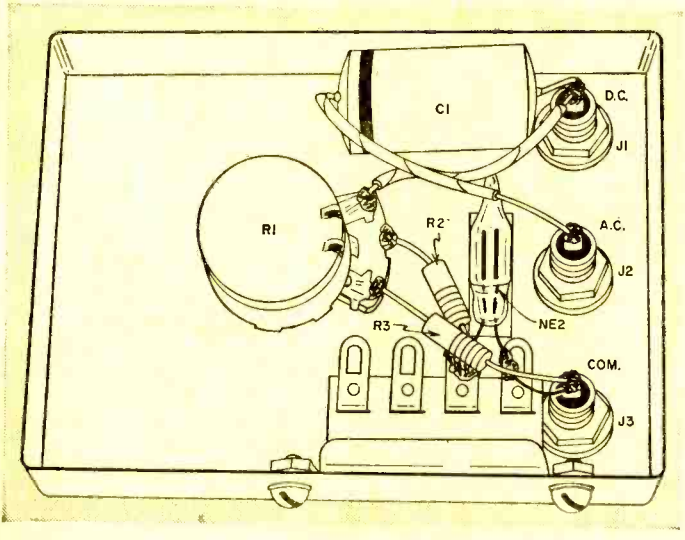
You needn't go to an expensive instru-





PARTS LIST

C1—0.1-μfd., 600-volt metalized paper capacitor
J1, J2, J3—Phone tip jack
R1—2-megohm potentiometer (linear taper)
R2, R3—100,000-ohm, ½-watt resistor
1—NE2 neon bulb
Misc. small plastic case, knob, terminal strip, wire, solder, machine screws and nuts, etc.



Internal view of the volt-output meter shows the extreme simplicity of layout and construction. Component cost is exceptionally low.

HOW IT WORKS

In operation, potentiometer *R1* and fixed resistor *R3* form a simple adjustable voltage divider, while series resistor *R2* serves to limit the current through the neon bulb to a safe value.

With a d.c. voltage applied to the "COM." (*J3*) and "DC" (*J1*) input terminals, and the center arm of *R1* turned all the way "down," the only voltage applied to the neon bulb (through *R2*) is the voltage appearing across *R3*. This is relatively small compared to the applied voltage due to the relative sizes of *R1* and *R3*.

As the center arm of *R1* is advanced "up," the voltage applied to the neon bulb increases until its "firing voltage" (about 60 to 70 volts) is reached, at which time the bulb lights. The point of *R1* rotation at which the bulb lights depends on the voltage applied between the "DC" and "COM." terminals; hence, a dial indicating the rotation of *R1* can be calibrated directly in applied voltage.

An a.c. voltage can be measured in much the same manner, except that the bulb lights on the "peak" of the applied voltage rather than on its r.m.s. value. Thus, separate calibration scales are required for a.c. and d.c. measurements. Where d.c. and a.c. voltages are available at the same point (pulsating d.c.), as on the plate of an audio output tube, and it is necessary to measure *only* the a.c. components of the voltage, a blocking capacitor is connected in series with one of the leads. In our combination instrument, the blocking capacitor (*C1*) is built-in, and is connected to a separate "AC" terminal (*J2*).

ment for such tests. By wiring a potentiometer-type neon voltmeter in a plastic box about the size of a package of cigarettes, adding an indicator dial and a d.c. blocking capacitor, you can assemble a versatile and useful combination instrument—one that can be used both as a direct-reading a.c./d.c. voltmeter and as an output meter on your test bench.

The completed instrument may be calibrated by the same technique used with the pulse rate voltmeter. To make each reading, the control (*R1*) is set all the way back, then advanced gradually until the neon bulb just lights. Separate readings are obtained as different voltages are applied to the instrument.

If you don't have—and can't borrow—an adjustable output power supply, you can use a fixed B voltage supply and a simple voltage divider consisting of two resistors totaling 250,000 ohms across the power supply output. A variable output voltage is ob-

(*Continued on page* 101)

FLOAT-PHASE AMPLIFIER

for Hi-Fi Fans

Speaker system courtesy of Lafayette Radio

By PAUL HARVEY

HAVE YOU EVER been discouraged by the complexity of high-fidelity push-pull phase-inversion amplifier circuits? Do "cathode-coupled," "long-tailed pairs" and "floating paraphases" have you stopped cold before you begin? Relax and cast an eye on the schematic of this little job. That's right, it's push-pull, but there's no separate phase-inverter stage. And its low percentage of harmonic distortion approaches conventional push-pull performance so closely that even a trained ear finds it hard to tell the difference. Yet it has enough output to drive a three-speaker system—with volume to spare.

Parts Mounting. If the amplifier is to be located in the open, on a bookshelf or table top, it is best to plan its construction using a professionally finished amplifier foundation base and cover as shown. Lay out the components to be mounted on top of the chassis with these thoughts in mind:

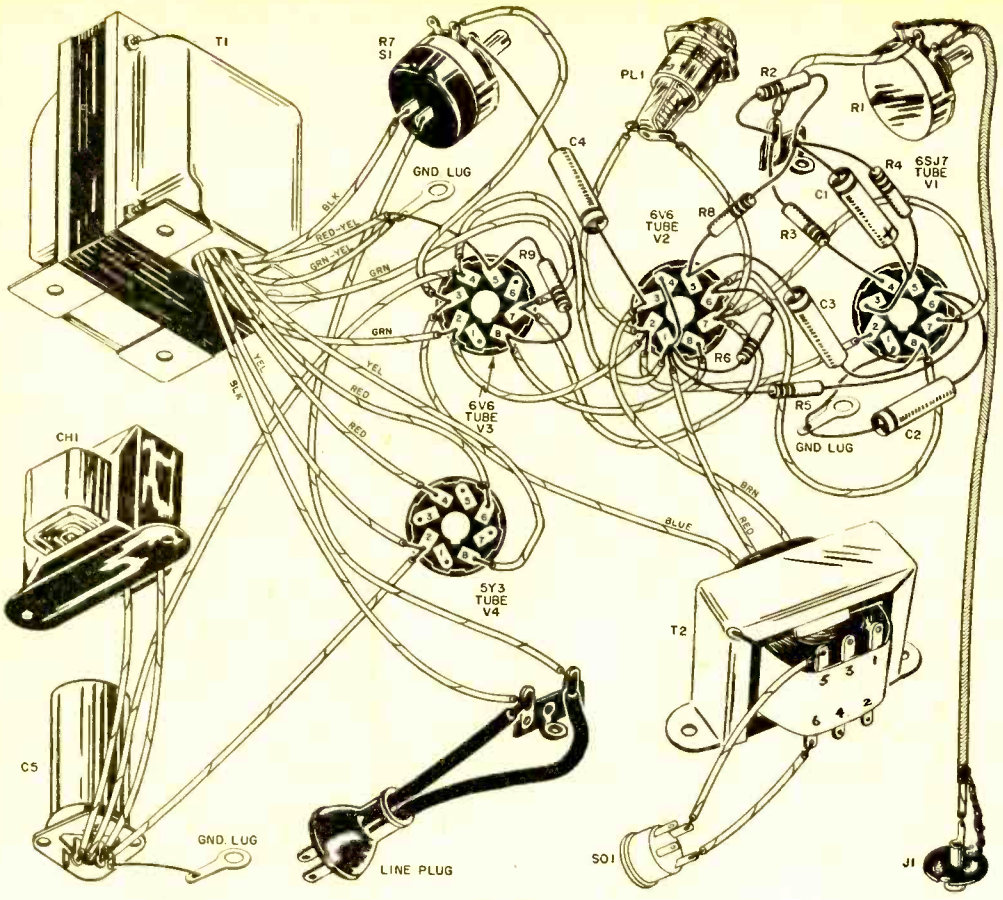
(1) The power transformer (*T1*), filter capacitor can (*C5*), and rectifier tube socket (*V4*) should be grouped around one corner of the chassis—at the rear, left, is more or less customary. Don't mount the capacitor too close to the tube because the heat will shorten its life expectancy radically.

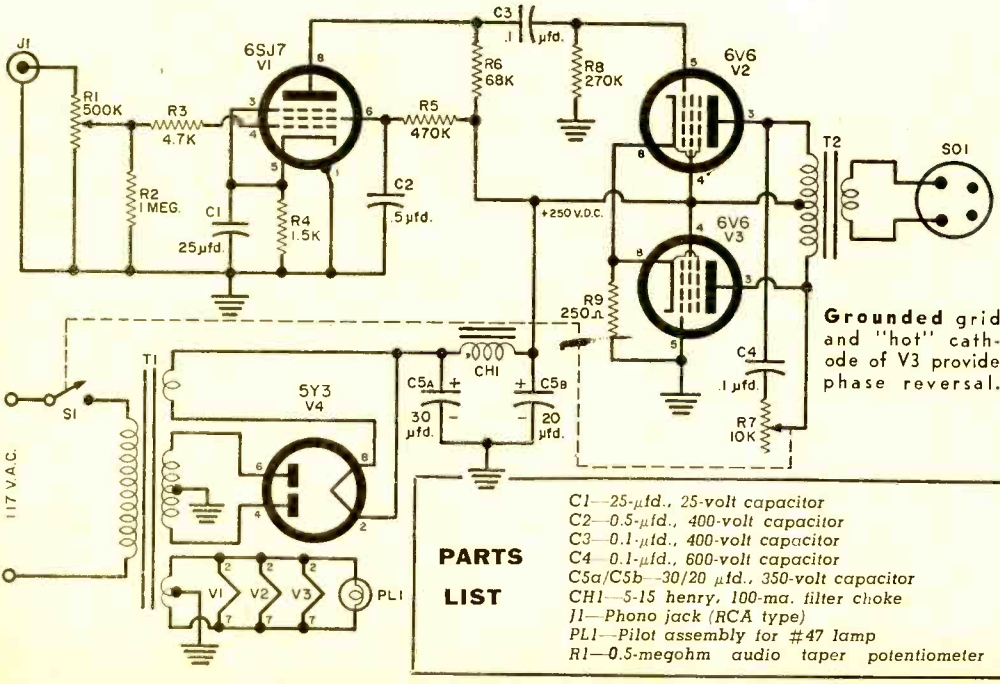
(2) Locate the socket for the high-gain voltage amplifier tube (*V1*) at the corner diametrically opposite from that of the transformer.

(3) Space the two power output tubes (*V2* and *V3*) in line along the front of the chassis, allowing room for the lip of the metal cover to clear all parts as it settles into place.

(4) Mount the filter choke (*CH1*) on the inside of the rear apron of the chassis immediately below *T1*. The output transformer (*T2*) is mounted as shown. All sockets should be left in the clear to expedite assembly and simplify wiring.

(5) Mark the chassis for a standard phono jack (*J1*) on the rear apron opposite volume control potentiometer *R1*. The cen-





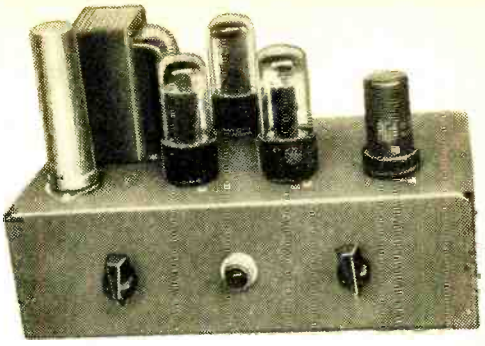
Grounded grid and "hot" cathode of V3 provide phase reversal.

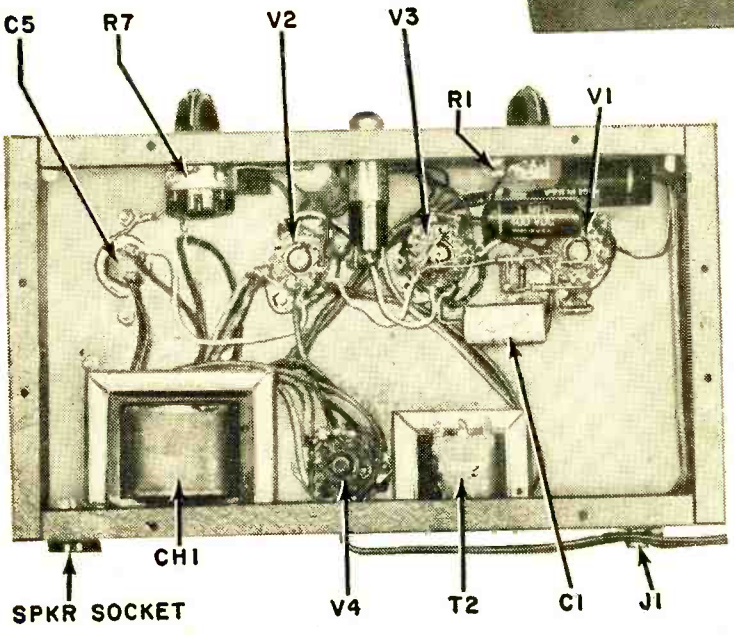
PARTS LIST

C1—25-μfd., 25-volt capacitor
C2—0.5-μfd., 400-volt capacitor
C3—0.1-μfd., 400-volt capacitor
C4—0.1-μfd., 600-volt capacitor
C5a/C5b—30/20 μfd., 350-volt capacitor
CH1—5-15 henry, 100-ma. filter choke
J1—Phono jack (RCA type)
PL1—Pilot assembly for #47 lamp
R1—0.5-megohm audio taper potentiometer

ter of this side of the chassis should be drilled for the a.c. line cord hole and, on the far end, the speaker output socket. The front apron has the tone control and on-off switch (*R7* and *S1*) on the right side, the pilot assembly (*PL1*) in the center, and *R1* at the left.

Hum Problems. By following the mounting and layout instructions carefully, you'll avoid 60-cycle hum problems, since the high-gain input circuit will be physically isolated from the power supply. The small parts beneath the chassis are supported by their leads. Only two insulated terminal strips are used—for the resistors and the line cord.





Top and bottom views of amplifier show parts placement that should be followed for best results.

Shield the input leads from phono jack *J1* to the volume control and ground pin #1 of *V1* to stop hum pickup. The shield braid can be soldered to grounded chassis lugs at *J1*. Ground at one point only.

When wiring the power supply, keep the leads dressed close to the chassis. Twist the 6.3-volt filament leads tightly together to help cancel the a.c. field around them.

After the input stage is completed, the remainder of the wiring is not at all critical provided that you observe the usual precautions against short circuits, cold solder joints, etc.

Testing. One way to "test" any electronic device is to turn it on and see whether or not it works. But too often this quick-and-easy test procedure results in

(*Continued on page 96*)

HOW IT WORKS

The input stage is a standard high-gain amplifier circuit with its values chosen for minimum distortion. Amplified signal voltage is coupled to the output tubes via *C3*.

When a positive part of the signal voltage is fed to the grid of *V2*, the current through the tube increases, causing a rise in the voltage between its cathode and B— or ground. Tube *V3's* grid is normally negative with respect to its cathode by the amount of the voltage across *R9*. Any increase in this voltage makes the grid more negative with respect to its cathode, so that its plate current decreases. Thus, as *V2's* plate current goes up, *V3's* goes down, and vice-versa. It is from this type of operation that "push pull" earned its name.

By proper choice of component values, a reasonably good balance between the output tubes is established. In reality, phase inversion is taking place—not in a separate or preceding stage—but right in the output stage itself.

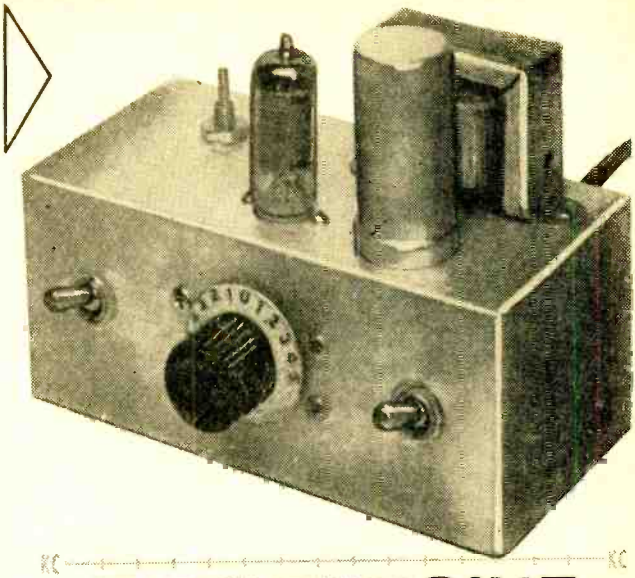
R2—1-megohm resistor
R3—4700-ohm resistor
R4—1500-ohm resistor
R5—470,000-ohm resistor
R6—68,000-ohm resistor
R7—10,000-ohm pot. with on-off switch (S1)
R8—270,000-ohm resistor
R9—250-ohm, 5-10 watt wire-wound resistor
SO1—Two-connector socket with plug
T1—Power transformer, 520 volt c.t. at 90 ma., 5 volt at 2 amp., 6 volt at 3 amp., c.t. (Stancor PC-8404 or equivalent)
T2—Output transformer, universal type, secondary lugs 5 and 6 used (Stancor A-3823)
V1—6SJ7 tube
V2, V3—6V6-GTA tube
V4—5Y3 tube
1—5½" x 10" x 9" amplifier cabinet (ICA 3971)

INVENTORS START YOUNG

THE Ford Motor Co. is one of several giant industrial firms which, with an eye to the future, sponsor scientific achievement in youth. At Ford's 11th annual Industrial Arts Awards and Student Craftsman's Fair, 394 winners split $50,000 in cash prizes. The contest drew 40,000 entries from high school students.

Typical of the winners are David Howell, 18, of Whittier, Calif. (top), who relaxes in a hammock in New York's Central Park as he operates his remote-control lawnmower—this has tremendous possibilities for the suburban do-it-yourself set. Another top winner is Dennis Garrabrant, 17, of Paterson, N. J. (left), who designed and built an electronic combination lock that works on a three-number telephone dial principle. —30—

This oscillator will set inexpensive receivers for best bandspread



INEXPENSIVE DIAL SETTER

By Robert J. Murray, W1FSN

MANY short-wave listeners and hams-to-be experience difficulty in properly setting the general coverage dials so that the bandspread dials are properly calibrated according to their markings. Sometimes an error in setting the general coverage dial by as little as the width of the pointer results in a 25 to 100 kc. error on the bandspread dial.

The gadget described in this article is a simple high-stability self-excited oscillator with its own power supply. It was deemed necessary to include the power supply because many less expensive receivers are a.c./d.c. with no provision for accessories.

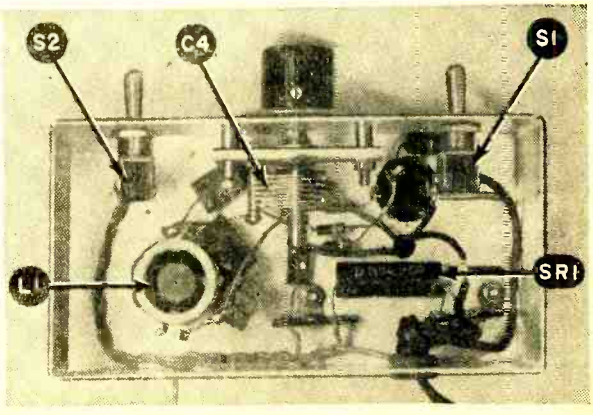
Basic frequency of the oscillator is 1000 kc. It is roughly set to this frequency by tuning in a broadcast-band station. Of course, if there should be a local broadcast station operating on 1000 kc., it may be set on the nose. Leeway is provided on the front control for more precise measurements of frequency if slightly more or a little less than 1000 kc. is required.

The layout of the calibrator should be followed as closely as possible as all major heat-producing components are mounted above the chassis, while the frequency-controlling components are mounted below the chassis where the heat is least apt to affect them. In operation it is recommended that the unit not be placed on top of the receiver or other equipment which will add to the temperature rise within the calibrator itself.

To place the calibrator in operation, both switches should be turned on and the tube allowed to come to operating temperature. It is well to allow it to run for about fifteen minutes before setting the frequency of the oscillator. Capacitor *C4* is then set at half capacity. The receiver is tuned to 1000 kc. on the broadcast band and the slug in *L1* is turned in or out until a strong unmodulated carrier is heard on the receiver.

The calibrator is now roughly set at 1000 kc. and will provide strong harmonics at

All major heat-producing components are mounted above the chassis (see top photo), and all frequency-controlling components below the chassis where heat will least affect them.



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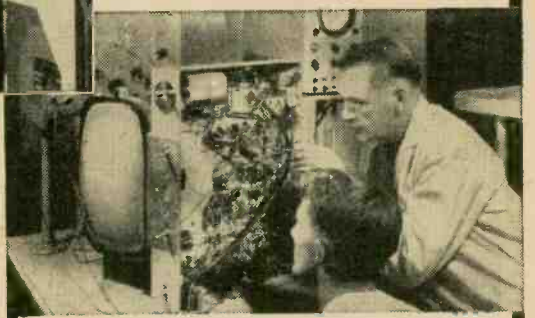

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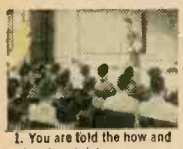

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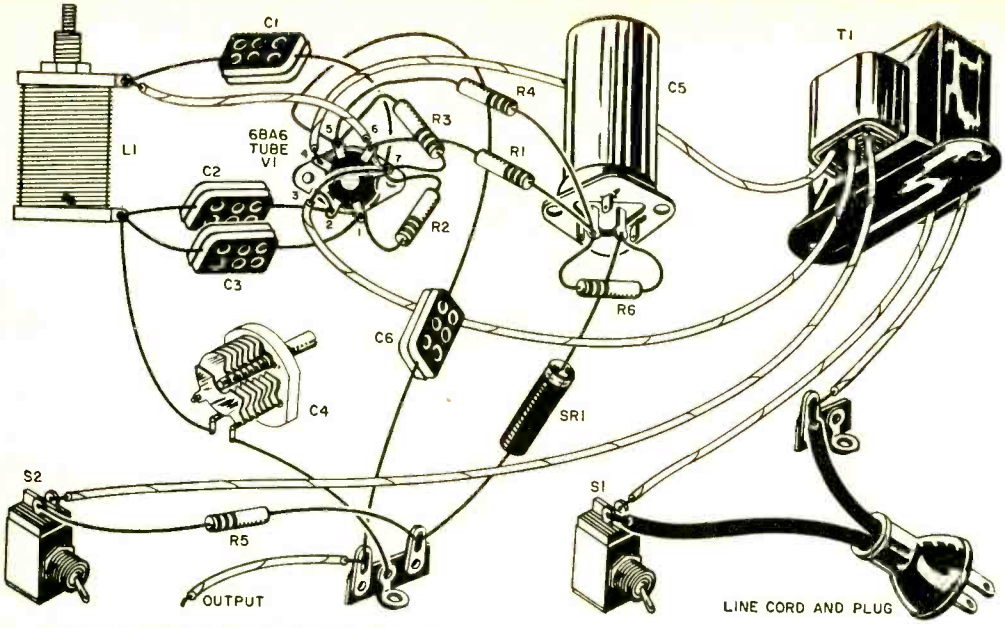
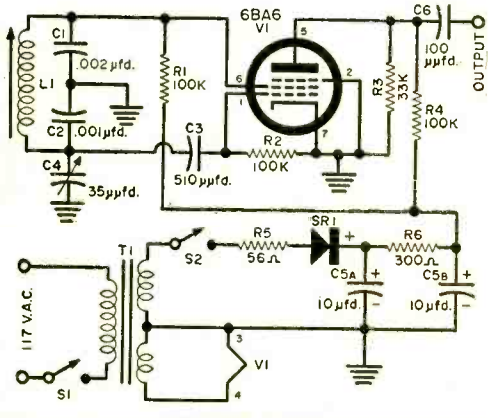


Follow the pictorial and schematic diagrams in building the dial setter. Note that C5 is grounded through its metal mounting plate.



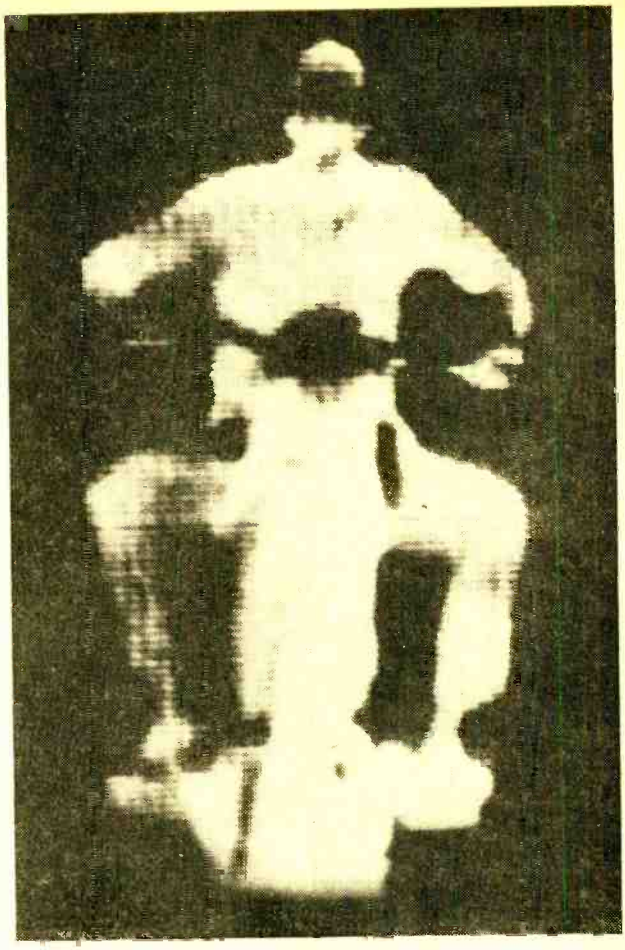
PARTS LIST

C1—0.002-μfd. silver mica capacitor
C2—0.001-μfd. silver mica capacitor
C3—510-μμfd. silver mica capacitor
C4—35-μμfd. air variable capacitor (National UM-35)
C5a/C5b—10/10 μfd. (or 20/20 μfd.) dual 150-volt electrolytic capacitor
C6—100-μμfd. mica capacitor
L1—40 turns of No. 26 Formvar on National XR-62 ceramic coil form
R1, R2, R4—100,000-ohm, ½-watt resistor
R3—33,000-ohm, ½-watt resistor
R5—56-ohm, ½-watt resistor
R6—300-ohm, 1-watt resistor
S1, S2—S.p.s.t toggle switch
SR1—20-ma. selenium rectifier (Sarkes Tarzian #026-28H-Q or National T657-1)
T1—Power transformer (Stancor PS 8415)
V1—6BA6 tube
1—6" x 3" x 2½" aluminum chassis
1—Knob (National HRS-5)

every multiple of 1000 kc. throughout most of the short-wave spectrum, i.e., 2000 kc., 3000 kc., 4000 kc., 5000 kc., etc. At this point the calibrator may be set exactly on one of the Bureau of Standards' stations (WWV) at either 5.0 megacycles or 10.0 megacycles. The receiver should be tuned to WWV at either of the above frequencies and the tuning slug in *L1* adjusted carefully for zero beat with the station.

As a final word of caution, it should be pointed out that some simpler superheterodyne receivers have a relatively poor signal-to-image ratio at the higher frequencies and it is possible for the operator to mistake an image for the true signal. Images are signals that are heard at a frequency twice the i.f. removed from the true signal. In other words, if your receiver has an intermediate frequency of 455 kc. and its local oscillator frequency is above the signal, the image of any one signal heard will be found 910 kc. lower in frequency on the dial. If the receiver's oscillator is lower in frequency than the signal, the image will be found 910 kc. higher in frequency on the dial.

These 910-kc. points are very close to the next 1000-kc. calibrator harmonics; therefore the operator should be careful to differentiate properly between a true signal and an image. This problem will not present itself on the lower frequencies but should be looked for and recognized for what it is when you are operating on the higher frequency ranges. —30—



This is what cyclist (left) looks like to infrared camera.

INFRARED

Jack of all Trades

By MELVIN MANDELL

NEXT TIME you relax under a "heat lamp," bathing away those aches and pains, stop a moment and consider. Just what is it that's soothing your muscles and warming your fibers? "Heat," you'll say.

True. But just what is this heat? The heat you feel is infrared energy, an electromagnetic radiation whose frequency ranges from about 1 million to 500 million megacycles—between the microwave region used for high-definition radar and visible light waves.

"Swell," you'll say, and promptly forget about it as you relax under the lamp, your mind turning over new ways of increasing the range of radar, or wrestling

with the problem of aircraft proximity detection, or other such burning problems of the day.

Little do you realize that perhaps right at your finger tips is the answer to your head-scratching. Yes, infrared (IR to the trade) may be just what you're looking for.

Consider for a moment:

- IR detectors are used on the new Sidewinder missile, a weapon so accurate that it almost literally can climb up the tailpipe of a speeding jet.
- Tests are under way with IR detectors which might do more to wipe out air-to-air accidents than radar or any other method under consideration.
- IR detectors for some time have been eliminating railroad "hotboxes," saving untold thousands of dollars and possibly many lives through prevention of accidents.
- IR is being used by modern police laboratories in crime detection.
- IR instruments and controls are already saving industry untold amounts of money, savings which normally are passed on to the consumer.

These and many other examples of the versatility of infrared radiation are actually only the beginning in the development and exploitation of this little-known area of the spectrum, but if all goes as per expectations, millions of dollars will be poured into research and development of infrared in the coming years, and what rich harvests they will reap for civilization can only be guessed at this time.

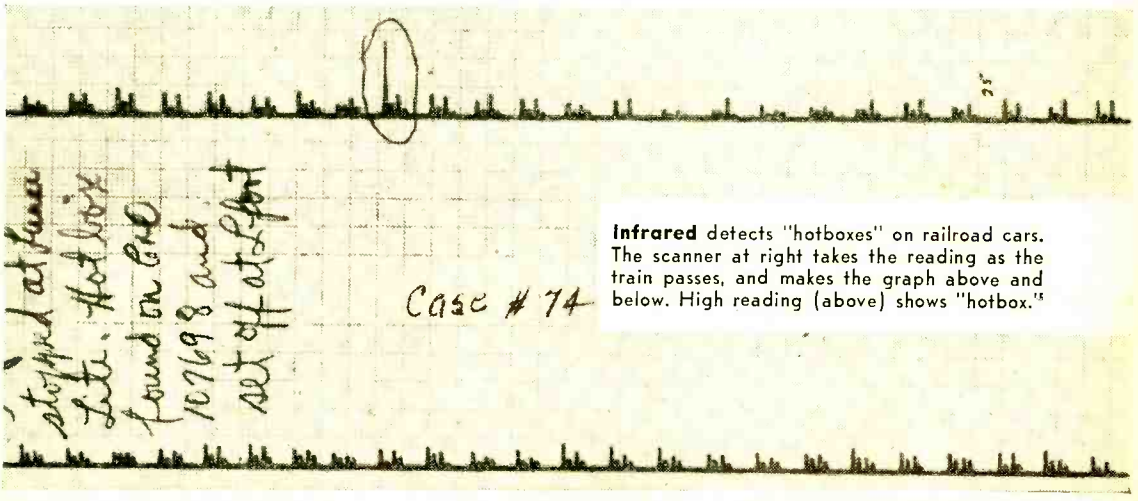
IR Is Heat. Although anyone can feel infrared radiation as heat when he turns towards the sun on a clear day, the place of infrared in the spectrum was not discovered until 1800. The famous British scientist, Sir William Herschel, was experimenting with a prism. When he held a thermometer out beyond the red portion of the spectrum he had cast on the wall, the mercury rose. Obviously, there was some invisible radiation from the sun reaching us as heat. It was named "infra-red," from the Latin prefix "infra," meaning below.

Although scientists continued to investigate the infrared region—one even measured the temperature of the moon in the 1880's—no practical applications were developed until the early part of this century, when it was discovered that IR was a powerful tool in identifying unknowns. If you pass infrared radiation through a substance, it will absorb certain parts of the IR spectrum. Each of the millions of different kinds of molecules absorbs a different characteristic infrared frequency.

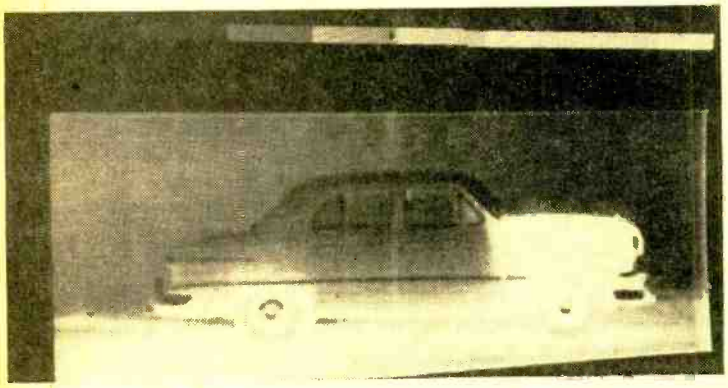
Despite the fact that identifying unknowns is one of the most widespread activities in industrial research, a practical infrared instrument was not developed for this purpose until the middle 30's. The honor goes to the American Cyanamid Co. Infrared spectrophotometers proved themselves by helping to keep up production at the Government's vital synthetic rubber factories during World War II.

Fighting Crime. Now thousands of these IR tools, which have the additional virtue of not destroying the sample as several other methods of analysis do, are used in chemical, petroleum, biological, medical, pharmaceutical and crime laboratories.

At the New York Police Laboratory, a physical chemist, Dr. James Manning, has shown that raw opium can be identified as to country of origin by infrared spectrum analysis. His work is contributing to United Nations' efforts to halt the international drug traffic. Dr. Manning has also used the spectrophotometer to help solve many crimes which had baffled the police.



Infrared detects "hotboxes" on railroad cars. The scanner at right takes the reading as the train passes, and makes the graph above and below. High reading (above) shows "hotbox."



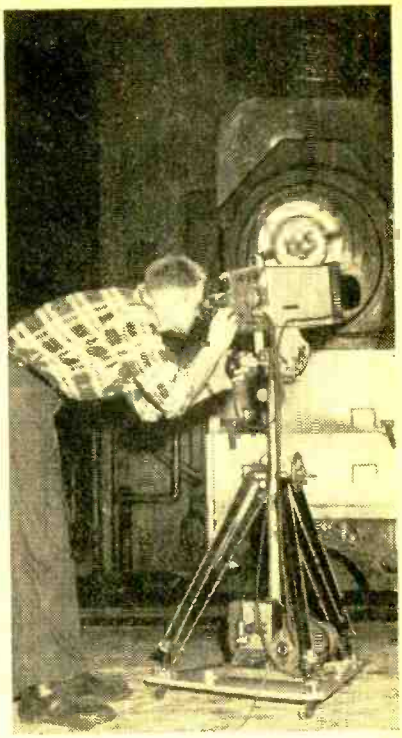
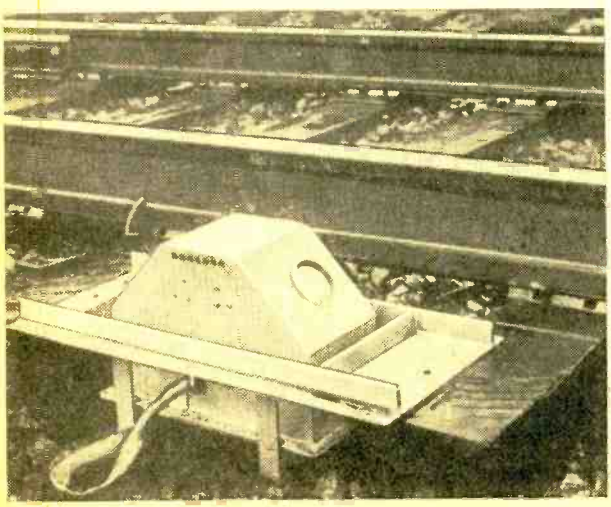


Photo by Barnes camera (above) shows an auto which has just parked. Note heated areas of motor and tires. Strip above car is gradation scale to measure temperature value. Man at right is using Baird-Atomic "Evaporograph" in steel mill.

New and better drugs are another benefit. A spectrophotometer guided the synthesis of cortisone, the miracle drug for arthritis, and is used to check the quality of many drugs during production. The infrared spectrophotometer has also been used by Gerard P. Kuiper, a University of Chicago astronomer, to determine the composition of the rings of the planet Saturn. He has detected gases on two of Jupiter's nine known moons and confirmed the presence of carbon dioxide on Mars.



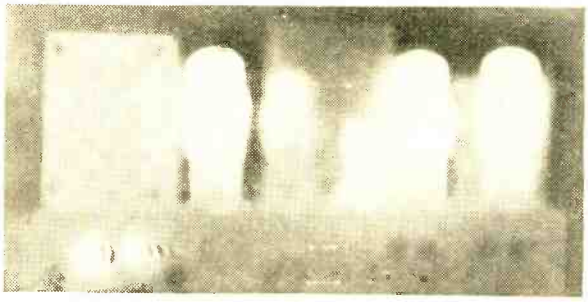
During World War II attempts to develop a first cousin of the spectrophotometer, the infrared analyzer, were made both in this country and in Germany. The Germans produced the first practical instrument, and their design has been reproduced here by a few companies. Working over only a small portion of the IR spectrum, the analyzer compares an unknown with a known sample by passing infrared radiation through both. Impurities in a chemical plant's "stream" can be detected down to the parts-per-million level with this sensitive instrument.

Saving Lives. By adjusting the analyzer to detect carbon dioxide, a surgeon can be warned of small but significant changes in his patient's breathing while under the knife. At Presbyterian Hospital in New York, an analyzer has been hitched up to control the volume of air given to patients undergoing surgery. This partial automation of the operating room doesn't eliminate any nurses, but means that the patient's needs are met more rapidly and accurately.

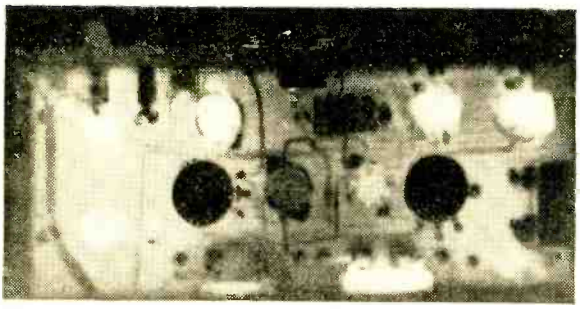
Analyzers are used in respiratory centers —where polio victims are maintained in iron lungs—to check the breathing of each patient a few times a day. One of the $5000 instruments also monitors the air on board the atomic submarine "Nautilus."

Aids Smog Solution. City dwellers may some day thank the infrared analyzer for

helping to end smog. In Los Angeles recently, one thousand cars were studied while under way with an analyzer sitting in the back seat constantly recording what came out of the exhaust pipe. The findings could contribute to development of some new muffler that burns or catches objectionable unburned fume-making hydrocarbons.



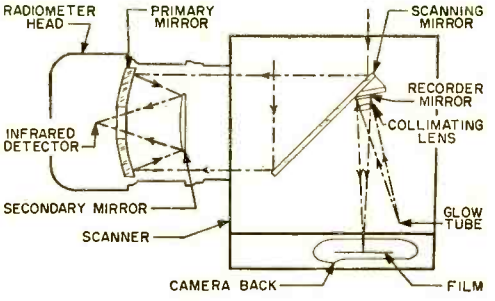
Typical shots of electronic chassis taken with Barnes scanning camera (right) appear above and below. Note the hot tubes above, and the heated resistors and cold potentiometers below. In both cases, the chassis have picked up some heat from the hotter parts and are gray.



Agricultural researchers are also finding the analyzer to be a valuable tool. By reading the carbon dioxide given off by a plant, the instrument tells just how fast it is growing. Changes in the plant's environment can be evaluated in days instead of a season. When northern Maine was struck by a plague of beetles that ate the leaves off of many thousands of trees, the analyzer was used to tell if the trees were still alive. The dead ones were cut down before worms ruined them as lumber, while the live ones were treated to reach full growth.

The Infrared Camera. The most exciting of the IR instruments—for both industry and medical research—is the infrared camera. Originally developed for military purposes about five years ago, the first IR camera, called the "Evaporograph," was declassified about two years ago, but is just coming into use. Since it converts heat patterns into visible light, it has all sorts of applications where it is important to find one spot that is hotter or colder than its surroundings—and shouldn't be. It is made by Baird-Atomic in Cambridge, Mass.

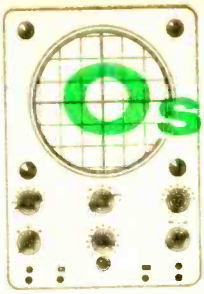
For example, it can find spots in the walls of power plant or steel mill furnaces that are hotter than the rest. This usually means that the refractory brick at that point is crumbling away. Finding the spot quickly can save a lot of expense and trouble later.



Just a short time ago, the military released another type of infrared camera for peace-time use—the scanning-type instrument. Unlike the completely optical Evaporograph, which produces the picture all at once, the newer machine builds up the image in a series of horizontal scan lines like a TV set. While a TV receiver scans the complete screen 30 times a second, the first versions of the scanning IR camera took 12 to 14 minutes to produce a photograph. The latest (still classified) versions of the camera scan in fractions of a second, and if the scanning speed continues to rise, engineers may eventually produce an infrared TV. Then they could study changing heat patterns instead of being limited to stable situations as at present.

Cancer Detection. A Canadian surgeon has experimented with a scanning camera made by Barnes Engineering Co. in Stamford, Conn., as an aid in finding cancers lying close to the surface of the skin. These cancers may reveal themselves to the camera because they contain more blood and

(*Continued on page* 96)



Oscilloscope Traces

I.F. Check

Some difficulties that arise in the i.f. stages and how to find them

By HOWARD BURGESS

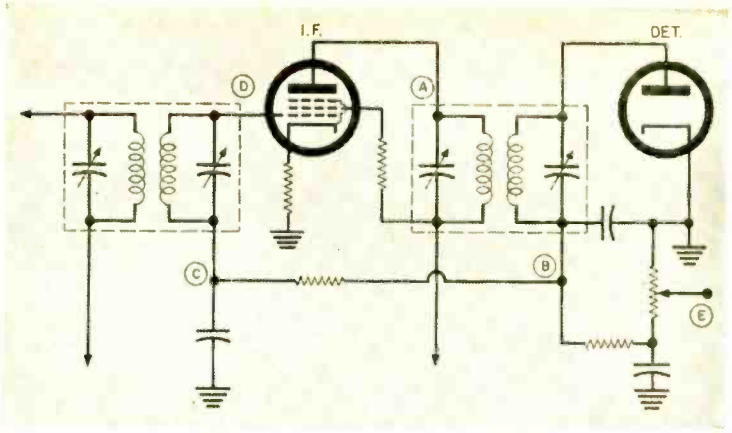
DESPITE the fancier methods of signal transmission, FM, SSB and the like, old AM remains the backbone of radio communications. More AM receivers are in use today than ever before, and almost all of them have one or more i.f. stages which, in general, will determine the set's quality of performance. A quick check of operating conditions and distortion levels in the i.f. stages can be simply made with an oscilloscope. Here's how it's done.

The Test Setup. Since most home receivers have i.f. systems tuned to about 460 kc., the i.f. pattern can be observed directly. Frequencies this low can be handled by most 'scopes, even the inexpensive ones.

The probe that you constructed for square-wave testing applications (November 1957 issue) will prove useful in i.f. checks also, but the tests can be made without it. Note that when connections are made to points in an i.f. or r.f. stage, a slight amount of detuning of the circuits in the receiver may result due to the capacitance of the test leads.

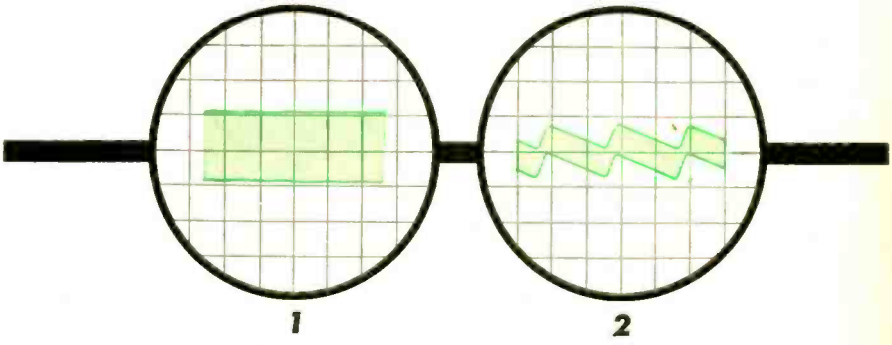
Let's examine the schematic of a "final" i.f. stage on p. 58. The last i.f. is usually followed by a diode detector and automatic volume control (a.v.c.) system. The points

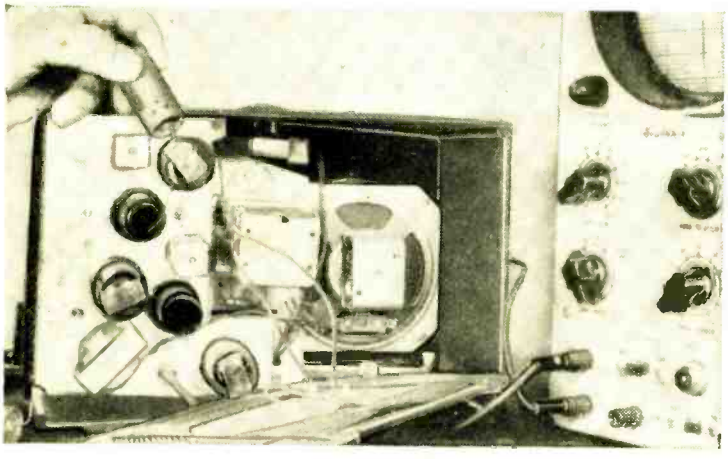
Use care when applying the oscilloscope probe to a.c./d.c. sets. An isolation transformer is recommended.



Schematic of a common i.f. stage arrangement. Lettered points are used for the tests described.

The waveforms at right are what your 'scope will show at the check points suggested. See text for complete explanation of Figs. 1-6.





Addition of extra filtering will often remove hum modulation of Fig. 2.

designated with letters will be used as test take-offs for our checks.

Injecting a strong signal can show several types of distortion and we will do so for the first test. With the 'scope connected at *A*, tune in an *unmodulated* signal supplied by an r.f. signal generator.

Hum Checking. Set the oscilloscope sweep at about 50 cycles. As the r.f. generator output is increased, the oscilloscope's base line will widen into a band as shown in Fig. 1, but only if there is no modulation on the signal. If the trace takes the shape of Fig. 2, you have hum voltage in the amplifier stage. By checking with your 'scope's sweep rate control, you'll find that the peaks are at either a 60- or 120-cycle rate.

If hum is found on the signal, this should be corrected before going further. You will find that better filtering of the B+

supply will frequently cure the trouble.

After obtaining a trace similar to that in Fig. 1, reset the r.f. generator for a *modulated* signal. If the receiver is operating properly, the trace will appear as in Fig. 3. You might have to readjust the sweep rate of your 'scope to make the pattern stand still because synchronization now depends upon the frequency of the modulating audio signal.

The height of the peaks and the depth of the troughs in Fig. 3 are determined by the percentage of modulation in the signal generator. The average generator has a signal modulated about 30%. If your generator is one whose modulation can be varied up to 100%, the troughs can be made deep enough to touch each other at the zero center line as in Fig. 4.

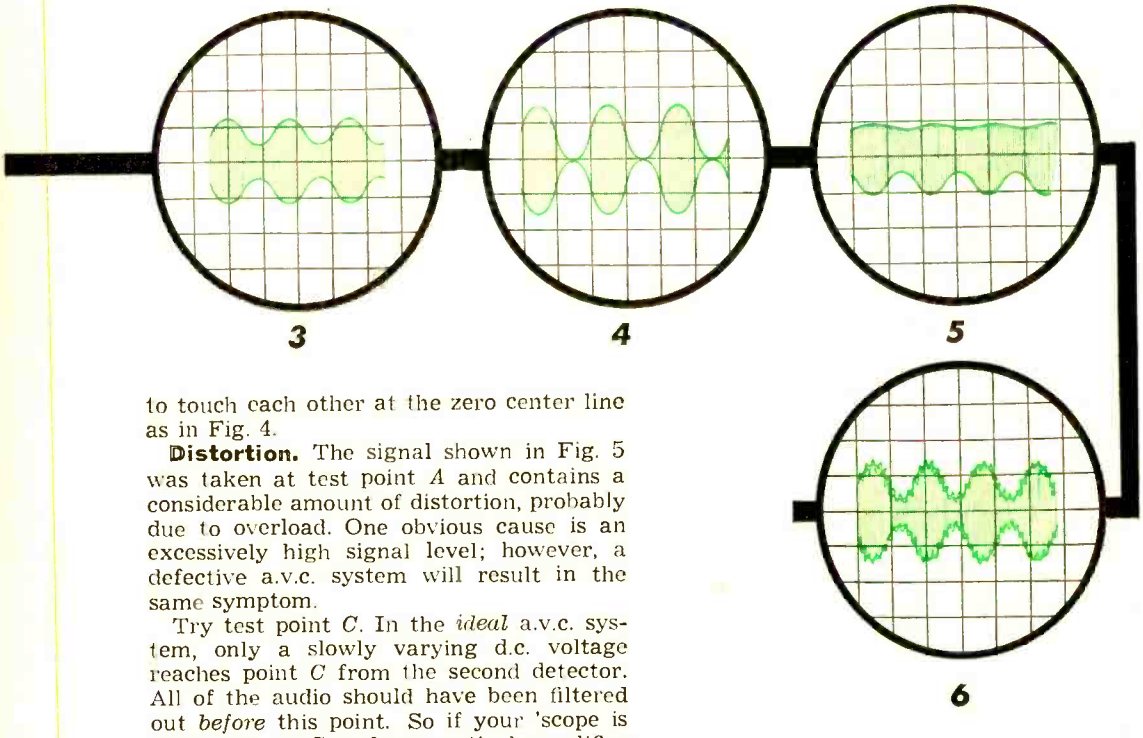
Distortion. The signal shown in Fig. 5 was taken at test point *A* and contains a considerable amount of distortion, probably due to overload. One obvious cause is an excessively high signal level; however, a defective a.v.c. system will result in the same symptom.

Try test point *C*. In the *ideal* a.v.c. system, only a slowly varying d.c. voltage reaches point *C* from the second detector. All of the audio should have been filtered out *before* this point. So if your 'scope is connected at *C* and its vertical amplifier gain turned up full, no audio should be seen. Audio voltage "sneaking" through at this point would be applied to the a.v.c. system, thus causing the gain to vary at an audio rate—resulting in severe distortion.

Audio Only. At test point *E*, the opposite condition should exist. A test here should show *only* the audio voltage modulation. This trace should consist of a narrow clean-cut line. If the trace seems blurred or out of focus, the odds are that i.f. signal voltage is getting through the filter network of the volume control portion of the circuit and into the audio circuits.

A very small amount of i.f. signal can be tolerated at this point, but only if it is subsequently removed in the first audio stage. Otherwise it can be the cause of a very annoying feedback or supersonic overload of audio amplifier stages. Either of these effects can ruin the tone quality or reduce the output of an otherwise excellent system.

Whistles and Squeals. Another form of distortion which may be found in some cases is shown in Fig. 6. The pattern is that of a modulated carrier with self-oscillation of an i.f. or r.f. stage. If this trace is found, make sure that the capacitance of the 'scope probe is not causing the oscillation by pushing some critically tuned circuit "over the edge" into instability.



Point *B* does not give as much information as those previously tested. If the receiver is operating and a modulated signal is tuned in, both the audio component and a certain amount of i.f. voltage will appear here. The actual proof of the circuit depends upon what is delivered at *E* and *C*.

Tests and More Tests. Many other methods are available, varying in complexity, for testing the i.f. system of AM receivers. Some of these tests require specialized equipment that is beyond the means of the average oscilloscope owner. However, if you're interested in the more advanced methods, we'll cover them later. —30—

WINTER hi-fi SEASON

SOUND EQUIPMENT gets no chance to hibernate when cold weather and long nights drive potential listeners indoors, reaching for the switch. The audio winter season had a kind of official kick-off at the annual New York and Chicago high-fidelity shows. The eager crowds thronging the exhibits attested to the growing popularity of hi-fi. In the general din of the occasion, it is often difficult to evaluate individual components by attentive listening, but the visitor gains a broad perspective on hi-fi trends.

This year's shows gave further evidence that hi-fi is definitely "on the move." For one thing, hi-fi no longer resides only in the hobbyist's workshop and den. It is now firmly ensconced in the family living room and shows signs of becoming something like a standard fixture in American home life.

"Housebroken" Hi-Fi. The invasion of the living room began when component manufacturers started to dress up their assorted gear so that it wouldn't look like an overwired blight in a messy corner. Restyling is now in full swing. Some of the recent models of tuners, tone arms, amplifiers and speaker systems embody the simple elegance that marks the best contemporary design.

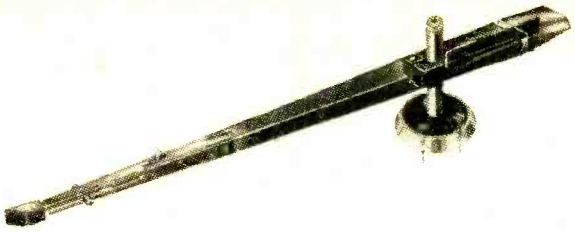
ALTEC-LANSING seemed particularly intent on matching the inner excellence and good sound of its products with equally pleasing exteriors. Generally, restyling of components is toward sleek, long, horizontal lines. HARMON-KARDON and BELL are sounding the keynote in this trend. The accentuation of flatness in looks (as well as frequency response) has become known as "pancake" styling.

The only components that have thus far escaped being "flattened" are the higher power amplifiers in the 50-watt categories. To deliver undistorted audio power of such magnitude requires sizable output tubes, heat dissipation, and hefty transformers that defy the low contours favored by the stylists. But since such bulldozer-type amplifiers are usually stashed in closets or hidden in cabinets, it doesn't really matter how they look. Only their svelte control units remain in sight.

All this high-styling hi-fi is plainly aimed at the distaff side of the family. If a piece

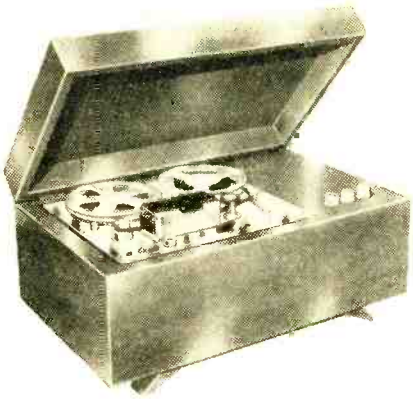
PICK OF THE RECORD RACK

RECORD	PERFORMERS	COMMENT
Beethoven: **Ninth Symphony** Columbia ML-5200	New York Philharmonic Orchestra, Chorus, Soloists Bruno Walter, conductor	A great, enduring masterpiece of music—a powerful, deeply moving work, possibly Beethoven's best. The performance ranks among the finest ever heard. And the fact that the entire hour-plus score is recorded on a single disc makes this a bargain to boot.
Prokofiev: **Fifth Symphony** Angel 35527	Philharmonia Orchestra T. Schippers, conductor	One of the best symphonies written in our time. Unlike many other moderns, Prokofiev infuses his music with warm lyric feeling and genuine humor. The performance under Schippers, a young American conductor, makes the most of the brilliant orchestration, and the recording makes the most of the brilliant performance. Highly recommended.
Serenade for Strings Victor LM-2105 or Columbia ML-5187	Boston Symphony Munch, conductor or Philadelphia Orch. Ormandy, conductor	Tschaikovsky's tuneful *Serenade for Strings* and Samuel Barber's solemn and soaring *Adagio for Strings* are the main offerings on each of these two discs. Together, they provide a telling comparison between the two finest string groups in America, each with a tonal personality of its own. Both records capture the glowing sound of massed strings with fine realism, but Columbia's closer miking catches the breath of life.

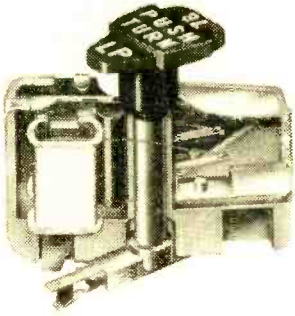


The Shure integrated cartridge and tone arm is constructed so as to make record damage virtually impossible. With a unique damped counterbalance, 1 to 2 grams of stylus pressure produce from 20 to 20,000 cps frequency response.

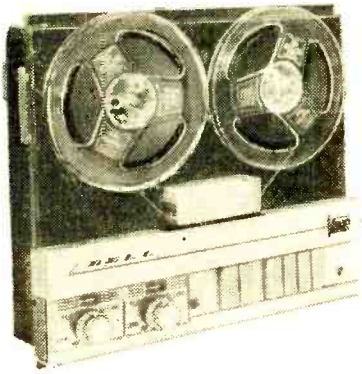
A radically new tweeter equally astounds eye and ear in the new Eico HFS-2 speaker system, designed by A. S. Hegeman. This is the first speaker with a fully free-floating cone, radiating evenly to all sides as well as upward, simulating the open sound spread at an actual concert.



Professional quality distinguishes the Tancordex Stereo Tape Transport, sold by Lafayette Radio Co. Single or dual record and playback amplifiers may be added.



Model VR-II is the up-to-date successor to the famous General Electric magnetic phono cartridge. Response extends to 20 kc.; tracking force is four grams.



Norelco's push-button-controlled tape recorder features a tape-saving slow speed of 1⅞ inches per second in addition to the usual 3¾ and 7½ ips speeds.

Various versions of this Bell recorder are available for monaural and/or stereo, recording, or playback only. Prices range accordingly from $99.95 to $239.95. Keyboard controls simplify the operation.

DEPARTMENTS

COMING NEXT MONTH
(FEBRUARY)

(ON SALE JANUARY 28)

In onswer to the requests of many readers who want to build a proximity detector, our February cover shows a battery-operated unit that is completely independent of the household power line. When it detects the presence of a person in the vicinity of its sensing antenna plate, a warning lamp can be made to light or a bell to ring. All the details of its construction are included—except, of course, we don't furnish the young lady shown on the cover.

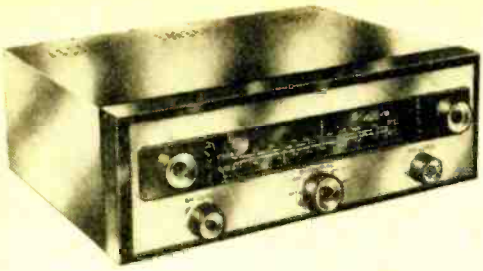
Articles on how to build more simple pocket-sized testers, a Conelrad warning alarm that every home should have, a wireless microphone, and how to make and use wave traps will also help you while away these long winter evenings on constructive projects.

IN THIS MONTH'S

RADIO & TV NEWS

(JANUARY)

Electroluminescence—Light of the Future
Measuring Tape Recorder Wow and Flutter
Stereo Control Center
Subminiature Transistor Power Supply
30-Watt Transistor Mobile Modulator



Lafayette's Model KT-500 is an AM-FM tuner kit with independent AM and FM sections for stereo use in areas where stereo broadcasts are available. A full Armstrong circuit features a.f.c. and tuning eye indicator. The kit sells for $69.50.

This Telematic 40-watt amplifier kit has twin channels for stereo. Note dual knobs for various controls, with indicator lights in a row above.

The new Tandberg tape recorder offers the extra-slow 1⅞-ips speed in addition to 3¾ ips. Available for both monaural and stereo, the slow speeds make operation economical.

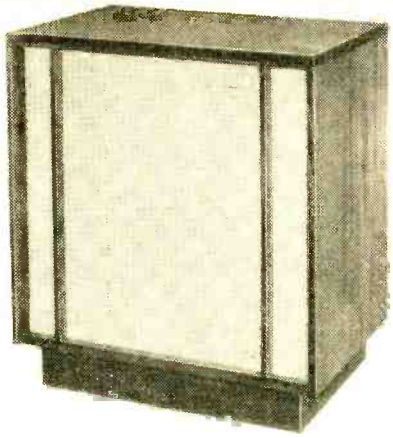
Arkay offers this 25-watt stereo amplifier to kit builders for $59.95. It also comes ready-wired and factory-tested at a higher price.

of equipment can be made to look good as well as sound good, so much the better. But in tailoring hi-fi to the housewife's taste, some manufacturers have introduced models that combine all components (turntable, tuner, amplifier and speaker) in a single cabinet. This, of course, runs counter to basic hi-fi principles, which demand a separate enclosure for the loudspeaker to avoid acoustic feedback, insure proper baffling and suitable speaker placement. Let us hope that these new unified "packages" won't wipe out the hard-won hi-fi progress of past years and take us back to the console-radio "boombox." After all, in "housebreaking" hi-fi, let's not break the poor beast's back!

From a strictly electronic point of view, the shows brought no surprises. Among amplifiers, the Williamson circuit and its variants still reign supreme.

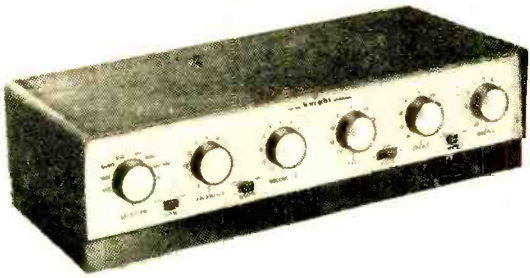
However, Eico's 50- and 60-watt amplifiers use a modification of the British Mullard circuit with an ultralinear output stage and fixed bias. Acro is one of the few firms introducing a new circuit featuring a special Acro output transformer with a tertiary winding which provides feedback to the input-phase inverter stage.

Behind the scenes, there are rumors of an impending revolution triggered by the advent of all-transistor amplifiers with spectacularly noise-free characteristics. From California came word that Vico of Los Angeles had started actual production on the first all-transistor 20-watt amplifier, to be sold for $98.50. Pop'tronics will report more fully on this pioneer after analyzing

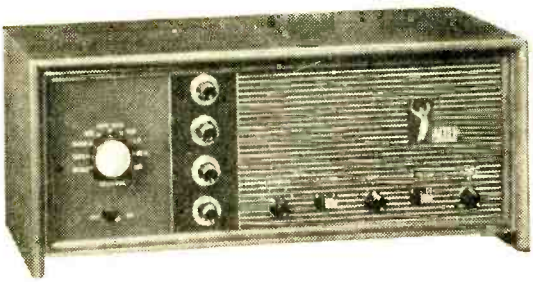


Speaker systems now also come "packaged." This Pilot "Companion" contains a 12" woofer, a 6" mid-range speaker, and two 3" tweeters. Including level controls, it sells for $149.50 in mahogany wood.

A real innovation is this first all-transistor amplifier by Vico. The use of transistors virtually eliminates hum. Output is 20 watts.



Flat "pancake" styling is evident in this Knight KN-530 30-watt amplifier. It is available from Allied Radio, ready-wired at $94.50.



Elegance is the keynote of Altec Lansing's Model 334 "Quartet" amplifier. Note four vertically arranged level controls, allowing each major input channel to be individually adjusted and left set.

its design and comparing its performance with conventional amplifiers.

Show-Stoppers. The real "show-stoppers" were some radical transducer designs, i.e., pickups and loudspeakers—those tricky go-betweens that unite the highly diverse fields of acoustics and electronics in the common task of sound reproduction.

An ingenious cartridge-and-tone arm combination by SHURE offers some novel solutions to the old problem of picking sound out of a record groove. The cartridge itself is of the magnetic type, but instead of the customary moving-coil and fixed magnet design, the coil is stationary and the magnet moves. Tracking force is at the low, one-gram level, so light that it actually cannot damage the records. The tone arm is so well designed that despite the low needle pressure it will play records "uphill" or "downhill" on a turntable tilted up to 30 degrees. The arm also has a cue button which gently lowers the stylus into the record groove; this feature should be especially attractive to jittery people. Resonance is moved out of the audible range by special measures including mounting the counterweight on a viscous damping block.

To provide optimum tracking for practically any pickup on almost any turntable, GARRARD has designed what is probably the most adaptable tone arm ever produced. The new Model TPA-10 has separate adjustments for over-all length, tracking angle, and stylus pressure. Instructions furnished with the arm indicate the proper settings for the interdependent factors of

(*Continued on page* 98)

Short-Wave Report

By HANK BENNETT

WE OFTEN receive letters from readers complaining that they can't hear certain stations because of the fact that their receivers are too old. Such is *not* the case with J. Ross Brownell, of 1535 West 65th Ave., Vancouver 14, British Columbia. His receiver is over 20 years old and still going strong. It's a Scott Philharmonic XXX, vintage of 1935. Judging from his reports, we can only say that there should be more of these old-time receivers around!

A chartered accountant, Ross is 38, married, and has two children—Elaine and Michael. He first began to tune the short-wave bands in 1937, and kept at it for a year or so. In May, 1955, he took up where he had left off 17 years before. He has been filling the pages in his log book at a steady clip ever since.

Ross picks up his DX with an antenna peaker. His antenna is basically a TV antenna atop the house. Employing a number of guy wires as part of the system, he has achieved an "umbrella" antenna, 30′ high. An alternate—which he very seldom uses—is a 50′ straight wire, running north to south.

Like your Editor, and very possibly for the same reason of too little time, Ross listens and logs but rarely writes for verifications. To date he has 15 veries covering 10 countries out of 76 countries logged. His best veri is an old one from HS8PJ, Bangkok, Siam.

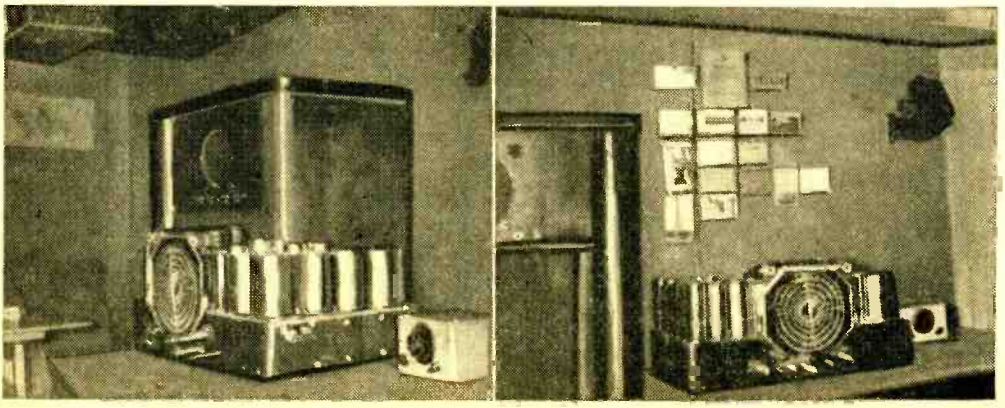
Visitors to the Brownell Listening Post will usually find the old receiver set to the 31-meter band. He has logged his greatest number of stations there, although the 16-, 19-, and 25-meter bands rate high with him. His reports also show a good bit of activity in the 49-meter band.

As for his favorite s.w. station, Ross says: "I'm sure my favorite hasn't been heard yet but it will be something like Mauritius." (Editor's Note: Try for Mauritius around 15,060 kc. at 2300-2315 in English.) Of the stations normally heard at any time, Ross prefers the Armed Forces Radio Service for their baseball games, and *Radio Australia* during the winter for pop music programs. His best DX so far is Lourenco Marques, Mozambique.

A member of the Newark News Radio Club, Ross hopes to be able to "stay with radio" for the rest of his life. He is now in the process of adding a communications switch to his receiver. As this necessitates boring a hole through the receiver cabinet, the chassis is temporarily outside of the cabinet, as you can see in the two photographs below.

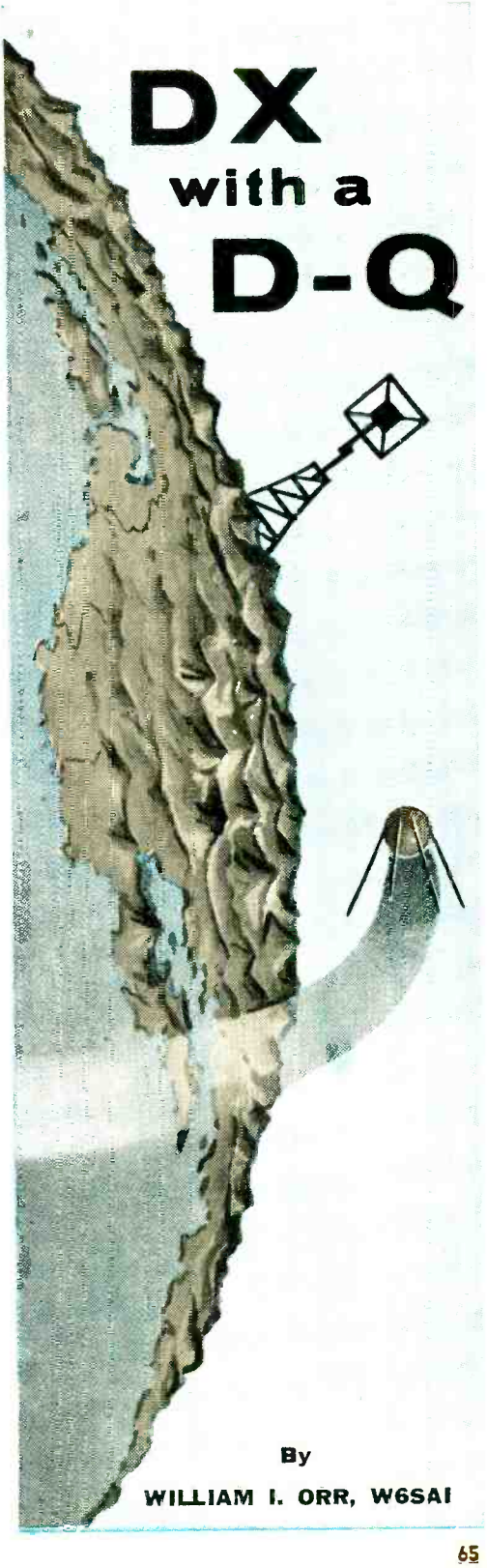
(*Continued on page* 110)

Two views of Ross Brownell's Scott Philharmonic XXX receiver cabinet and chassis (he is adding a communications switch). This POP'tronics reporter achieves good results with his vintage receiver.



Novices and SWL's can transmit or receive with this directional antenna for the 15-meter band

DX with a D-Q



By
WILLIAM I. ORR, W6SAI

TOMMY looked lower than an eel's tummy as he slouched down in the chair next to the operating position. *"Who are you working?"* he asked.

"Just signed off with DL4AAP on 15 meters," I replied, snapping off the filament switch of the transmitter and removing my earphones. *"How's the budding young Novice coming along? Working much DX?"*

"No," muttered the young Novice. *"I might as well sell the rig and take up stamp collecting or bird watching."* He traced his call letters on the rug with the tip of his shoe and sighed.

"Come on, tell poppa all about it," I said, sensing that something was wrong. *"Did the R.I. revoke your ticket?"*

"It's almost that bad," he replied. *"Remember I had the far end of my folded dipole tied to old man Lee's pine tree? Well, he made me take it down yesterday. I have no other place to hook the antenna! Guess I'm QRT for good."*

"How would you like an antenna that's only half as long as your dipole, mounts from a single support, and has good signal gain over a dipole? You can build it for about five dollars or less. Does that sound good?"

"Sound good?" Tommy jumped out of the chair in his excitement, *"It's great! That means I won't have to overhang the property line with my antenna! And boy! If I can get some gain—like a real beam—I can really work some good DX!"*

"You're right!" I agreed. *"When you can pick up signal gain, reduce the 'wingspread' of your antenna, and do it all for a couple of bucks, you are a lucky lad, indeed. Hand me that pencil, and I'll draw you a sketch of the 'Demi-Quad' Antenna!"*

The Demi-Quad is a single rotary beam antenna that can be used with great success on the 21-mc. amateur Novice band. It is compact in size, requires absolutely no adjustments, and may be fed with a 52-ohm coaxial transmission line. Thus, it is ideally suited for the Novice who wants the best possible results for a minimum of size and cash. Since most of the modern Novice transmitters are designed to operate with a coaxial transmission line, this antenna is a natural.

Figure 1 shows the principle of the Demi-Quad. A closed-loop antenna of high efficiency, it bears a resemblance to one-half of a Cubical Quad beam antenna. The Demi-Quad

is mounted in a vertical plane, and radiates a "figure-8" pattern at right angles to the loop.

The impedance of the Demi-Quad is close to 200 ohms, making it very tolerant of the operating frequency. Because of this, the D-Q may be cut to size and erected in place with no worry that it isn't the correct size and length. The signal gain of the D-Q in the

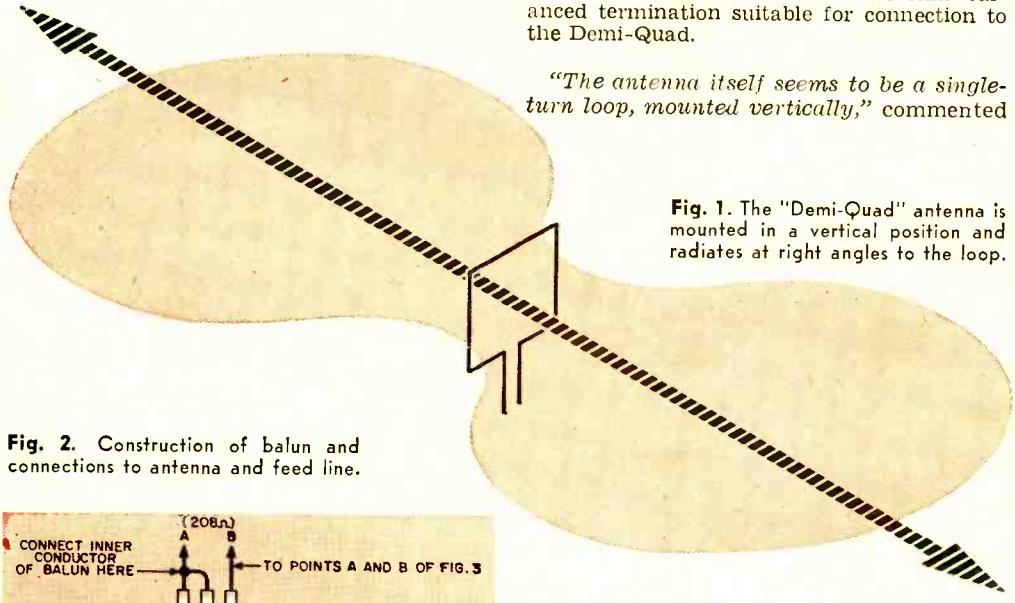
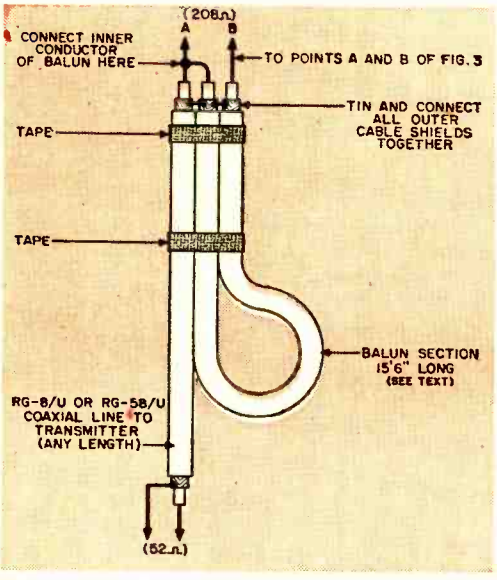


Fig. 1. The "Demi-Quad" antenna is mounted in a vertical position and radiates at right angles to the loop.

Fig. 2. Construction of balun and connections to antenna and feed line.



"line of fire" path is about 1.4, meaning that a 20-watt transmitter will have the equivalent signal of a 30-watt transmitter operating into a simple dipole antenna. Best of all, this gain is also apparent on reception, where it often may make the difference between a QSO and not hearing the signal at all!

"But if the impedance is about 200 ohms, isn't it a problem to feed it?" asked Tommy.

"No," I replied. *"You can make a simple balun using coaxial cable. Connected at the bottom terminals of the D-Q beam, it permits an efficient match to a 52-ohm coaxial transmission line."*

Construction of a suitable balun is shown in Fig. 2. The balun acts as an impedance-changing transformer, matching the 52-ohm unbalanced coaxial line to a 208-ohm balanced termination suitable for connection to the Demi-Quad.

"The antenna itself seems to be a single-turn loop, mounted vertically," commented Tommy, sitting on the edge of his chair.

"Yes, that's just about right," I replied.

Follow the bill of materials and the assembly drawing (Fig. 3) of the D-Q. Make the supporting arms of the framework from 8½′ lengths of 1″ bamboo poles. The bamboo should be clear and free of splits or checks. You can probably obtain these poles at a large fishing supply store. You'll need four of them.

The supporting structure for the D-Q beam is a 1′ square piece of ⅜″ plywood. Give the plywood and bamboo two coats of spar varnish to prevent splitting and weathering. The poles are held to the plywood square by means of galvanized U-bolts, obtainable at any large hardware store. You'll need eight U-bolts, two per pole. Be sure you get washers with the bolts so that the nuts won't dig into the plywood when you tighten the connection.

Before you assemble the antenna, drill a small hole in the tip of each bamboo pole, about 8′4½″ from the butt end. This hole should be big enough to pass the antenna wire freely. When you have done this, loosely bolt the four bamboo poles to the plywood support plate.

The next step is to string the antenna wire through the holes in the tips of the bamboo poles. You'll need about 11′10″ of wire per side, so a 50′ roll of #16 enameled wire should do the trick. After you have threaded the

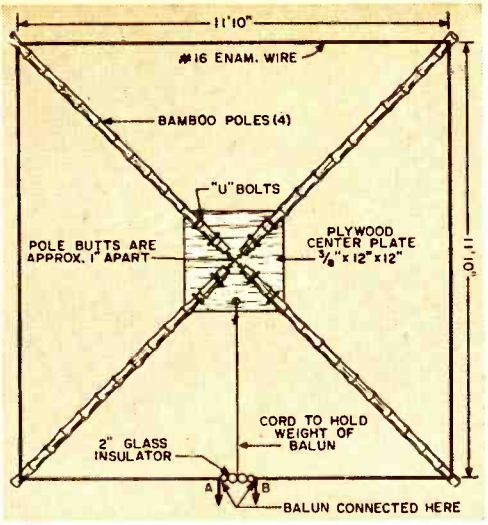


Fig. 3. Antenna assembly is held together by U-bolts attached to center plate.

Fig. 4. Typical installation of the Demi-Quad beam. A crossarm can be attached to the mast and guide ropes added for rotation.

antenna wire through the tips of the poles, manipulate it back and forth until the two ends meet in the middle of one side. Take a small 2" glass or ceramic antenna insulator and temporarily wrap the ends of the wire through the insulator holes. Tighten the wire until it's no longer floppy.

When you have established the correct wire length for each side, loosen the ends of the wire, and scrape them clean of enamel past the point where the wire passes through the insulator. Rethread the insulator, but don't retwist the wires until you check the separation of the bamboo poles at the center of the plywood plate. There should be a gap of about one inch or so between the butt ends of the poles. Gently push outward on the poles to obtain this gap, and then firmly twist the ends of the antenna wire around the insulator. Solder both joints.

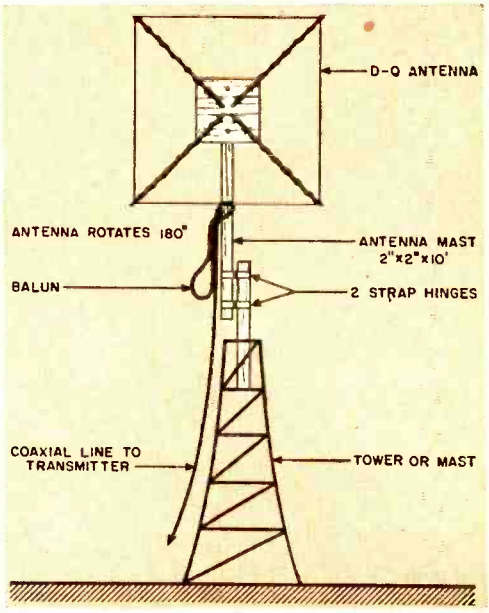
"Should I keep the wire tight?" asked Tommy.

"You can keep tension on the wire by pushing outward on one or more of the poles as you tighten the U-bolts," I told him. *"And that takes care of the antenna. The whole assembly job shouldn't take you more than an hour!"*

To make the balun transformer, cut a section of coaxial line and follow the dimensions of Fig. 2. Tin the outer braid of each end of the balun, making sure that no "frizzly" ends of the shield can short out the connections. Don't overheat the cable, or you'll find that the inner dielectric has a tendency to melt. Take it easy, and you'll have no trouble.

The length of the balun from end to end of the outer shield will be 15'6" on the nose. Leave an extra two inches on the center conductor of the cable so that you can fasten it to the antenna. You had better cut the balun piece of coaxial cable about 15'9" long, to allow extra material at the ends to play around with.

The balun and coaxial transmission line can be suspended by cord from the center plate, as shown in Fig. 3. It is best to use a wooden mast, since a metal support will tend to interfere with the performance of the antenna. You can bolt the D-Q beam to a vertical section of 2x2 lumber about 10' long which will serve as a fine mast section. The mast can be hinged at the base end and fastened to any ordinary tower or mast as shown in Fig. 4.



BILL OF MATERIALS

4—8½'-long bamboo poles, 1" in diameter at butt end
8—1" galvanized U-bolts, with nuts and washers
1—12" x 12" x 3/8" plywood center plate
1—50' length of #16 enameled soft-drawn copper wire
1—15'9" length of 52-ohm coaxial cable for balun (RG-8/U or RG-58/U)
1—52-ohm cable to transmitter

Since the antenna has a bi-directional pattern, it is only necessary to turn it through 180° to obtain full coverage. Erect the antenna as high in the air as your pocketbook will permit. If you can buy a 40' TV-type crank-up tower, you'll be in good shape to snag all the DX you can hear!

"I'm off," cried Tommy, heading for the door. *"Thanks a lot . . . you'll be hearing from me!"*

—30—

AFTER CLASS

Special Information on Radio, TV, Radar and Nucleonics

THE LANGUAGE OF DIGITAL COMPUTERS

CLOSE YOUR EYES and think of several apples standing in a row on a table-top. Can you do it? Sure you can! Like any normal human being, you can imagine a number of objects associated with any one of our common *denary* digits (0, 1, 2, 3, 4, 5, 6, 7, 8, 9). But the fact that you can imagine even simple numbers makes you a member of the most unique species on earth! No other living thing or machine has the facility to visualize quantities as you have.

Very early in the history of computer design, it was recognized that real digital accuracy and speed could be obtained most readily by taking advantage of a natural method of mechanical representation of numbers. A lamp is either on or off, a tube or a standard transistor can be considered as either conducting or not conducting, a relay contact is either closed or open. In other words, mechanical and electrical devices naturally seem to rest in either one or the other of two states—*on* or *off*.

Binary Notation. Why not adopt a number system for computers, then, in which any number can be symbolized by a combination of only *two digits* instead of *ten digits,* a number system in which zero (0) would stand for an *off* condition and one (1) for an *on* state? Fortunately, computer engineers did not have to invent such a scheme. For it had been known for centuries that any number could be stated in terms of 0 and 1 by properly combining them in a logical sequence called *binary notation.*

We can demonstrate how a computer "thinks to itself" by a device familiar to all of us. The normal *odometer* (mileage indicator on an automobile) consists of little wheels, each of which carries the digits from 0 to 9. Starting with the right-hand wheel, every time one of them goes completely around and begins to shift back from 9 toward zero, it carries the adjacent wheel to its next digit. Thus, as the right-hand wheel completes the ninth mile and returns to zero, it causes the next one to move to 1, so that the reading becomes 1 0. Your car's odometer is therefore based on the familiar denary system.

Now picture an odometer containing discs or wheels that bear only two digits—1 and 0. Each time one of these discs moves from 1 to 0, it carries the adjacent one on its left around one-half a turn, causing it to shift its digit from one "state" to the other. Figure 1 shows the steps such an odometer would follow during the first eight counts.

Stop for a moment now and note that a new wheel is brought into action every time the count reaches the *next power of two.*

No. of Discs	*Count*		
1	1	or	2^0
2	2	or	2^1
3	4	or	2^2
4	8	or	2^3

If you follow this through, continuing with the counting and rotation of the odometer

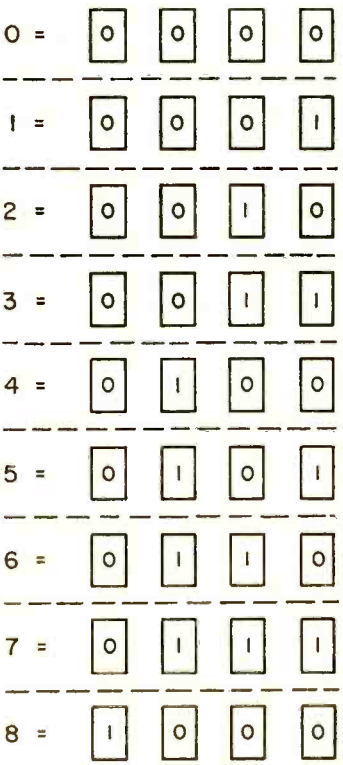


Fig. 1. The progression of a binary odometer from zero to eight.

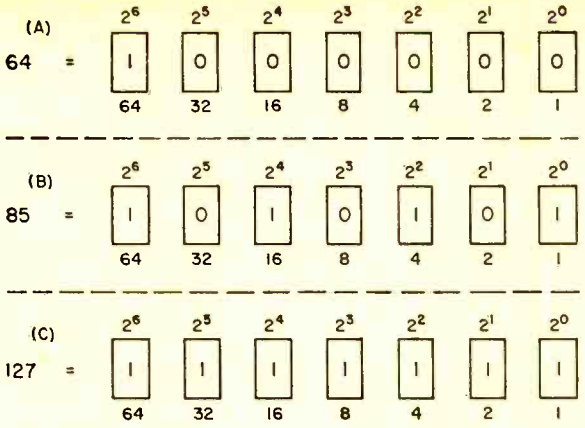


Fig. 2. Significance of the numbers on the odometer as related to the powers of two. Sequence (A) represents the number 64, (B) the number 85, and (C) the number 127 in binary notation.

wheels, you will find that this rule holds all the way.

Denary to Binary. In Fig. 2(A), seven odometer wheels have been labeled with their ascending powers of two and the corresponding denary numbers. All the wheels display zeros except the one associated with 2^6 or 64 which shows a "1". To read this, you would say to yourself: "The '1' in the 2^6 row means that this row is to be counted as 64; the zeros in all the other rows mean that these are not to be added in. Therefore, 1 0 0 0 0 0 0 signifies the number 64."

Suppose, now, that the odometer operates a while and finally comes to rest as in Fig. 2(B). What number does this arrangement stand for? Since "1" is displayed in the 2^6, 2^1, 2^2 and 2^0 rows, these are to be added while the zeros in the other rows instruct us to disregard those. Thus: 1 0 1 0 1 0 1 is translated into 64 + 16 + 4 + 1 = 85.

Similarly, as shown in Fig. 2(C), a group of wheels all displaying "1" signifies the number 127—obtained by adding all seven of the powers of two. Here again it is evident that if we wish to write the number 128 we shall need another wheel—since 128 is 2^8. This number would then be shown as 1 0 0 0 0 0 0 0.

Using Register Lights. Imagine now that we have a row of incandescent lamps, say ten of them, and a switch for each lamp. Let's say further that a lamp that is *on* signifies the digit 1 and an extinguished lamp represents the digit 0. Above each lamp write the proper power of 2, and write the denary equivalent below each lamp.

Assume that we want to "write" the number 374 in lights. Referring to Fig. 3, we see that 374 is larger than 2^8 (256) and smaller than 2^9(512). Hence, lamp *J* will not be needed and we will start by lighting lamp *I*, which begins the counting process with 256. If we were now to light lamp *H* (2^7 or 128), it would mean that this number was to be added to 256, yielding 256 + 128 = 384. Since 384 is larger than our desired number, we skip *H* and go on to *G*. Adding this to 256, we have 256 + 64 = 320. Progressing down the line, we turn on *F* for a total of 320 + 32 = 352, then *E* for a total of 352 + 16 = 368, skip light *D*—leaving it in the *off* state, turn on light *C* for a total of 368 + 4 = 372, and finally turn on *B* to bring the total to the desired number, 372 + 2 = 374. Light *A* remains off and the final pattern is that shown in Fig. 3.

The fundamental rules for addition, subtraction, multiplication and division of binary numbers are built into computers without difficulty. These processes, even when extremely complex and numerous, are completed in periods of time measured in microseconds or milliseconds with amazing accuracy. So—the mushrooming of digital computer applications has resulted in a corresponding increase in the importance of the binary number system. A little investment of time in practicing the setting up and reading of binaries will be rewarded by a deeper understanding of the operation of digital computers.

By the proper interpretation of numbers in the binary system, the venerable game of "NIM" ceases to be a gamble and becomes a sure thing. To see how binaries are applied to forcing a win at NIM every time, see the article in this issue entitled "Win at NIM with DEBICON." —30—

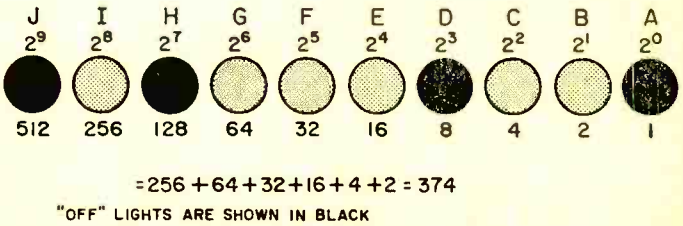


Fig. 3. How to write the number 374 in lights using the binary system.

INTERNATIONAL TELEVISION DX'ING

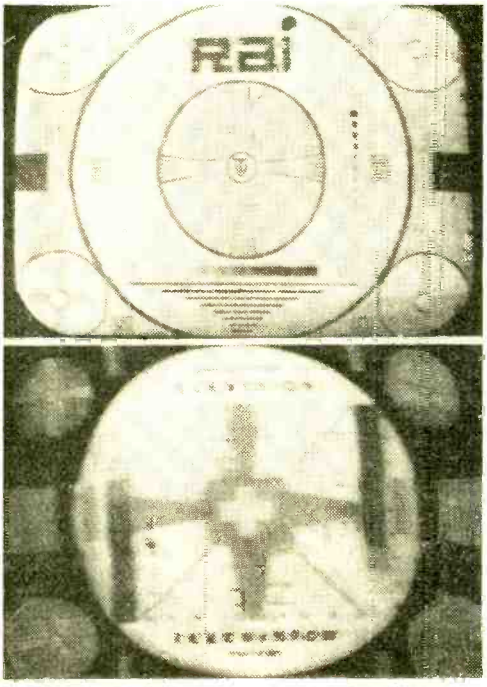
TELEVISION DX'ing, for a long time an American phenomenon, has blossomed into an international occupation, with viewers in many countries sitting before souped-up receivers, waiting for the occasional flash which indicates they're receiving a distant station.

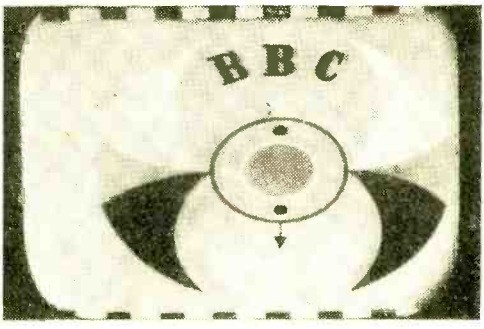
One viewer, George Palmer (above), lives in a suburb of Melbourne, Australia. He has a 90' tower which holds a BBC 41.25-mc. Yagi, vertically polarized, a 10-element Yagi for American channels 2 to 6, and a Finco screen array, fixed on Sydney and Honolulu.

Besides his standard Australian receivers, George uses a Philips 14" variable turret tuning receiver to cover all possible frequency-channel combinations, as well as two RCA 8½" receivers. He has logged the BBC's 41-mc. channel, 10,700 miles away, and a Sydney channel, 450 miles away.

Another avid DX'er is Heinar Tammet of Tallinn, Estonia, 200 miles east of Leningrad, behind the Iron Curtain. Heinar tells us that Estonian viewers first began DX experiments in 1956, in anticipation of the expected high sunspot peak. DX has come in from Holland, Sweden, Switzerland, Germany, Czechoslovakia, France, Italy, England and Denmark, as well as unknown stations.

Heinar took the photos at the bottom of this page. At left is a test pattern from an Italian station, and below it is one from Switzerland. Directly below is a BBC pattern from England. He uses the "common Soviet Union TV receiver," covering the frequency range of 49-66 mc. and has incorporated a two-stage cascade amplifier for weak signals.





According to Heinar, some DX has been strong enough to receive with an indoor antenna, although he uses a five-element Yagi and a "doughnut" more often. The DX usually lasts one to two hours. —30—

Transistor Topics

By LOU GARNER

AND a Happy New Year to you, too! Each year at this time we like to check our batting average on predictions made in past months—and to make a few new ones.

Last January we predicted that a high percentage of the portable receivers offered during the summer would be fully transistorized sets—*check*—such sales hit an all-time high . . . that r.f. transistors would be available at less than a dollar each—*check*—Sylvania's Type 2N233 *n-p-n* r.f. transistor now nets for only 90 cents . . . that power transistors would be available for less than $2 each before the end of the year—*check*—Sylvania's 2N307, a 2-watt transistor, nets for only $1.50 across the counter, and CBS-Hytron's 2N255 and 2N256 were cut to $1.35 and $1.50.

We also "foresaw" that a fully transistorized portable phonograph would be widely available by late summer—*check*—such a phonograph has been advertised by leading department stores . . . that you could expect a sharp drop in the price of *all* transistorized receivers—*check*—commercially built "standard brand" units dropped from the $50-$75 range down to less than $40 . . . that virtually all auto radios with 1958 model cars would be partially or fully transistorized—*check*.

We prophesied that transistors would appear in TV receivers before the end of 1957—*zero*—while several manufacturers have such circuits "in the works," there is none on the market as this is written . . . that there would be a number of transistorized toys available—*check*—and that there would be a rapid swing to "all transistor" computers and aircraft electronics gear—*check*. Out of nine predictions: one wrong, eight right!

Things to Come. In 1958 you can look for . . . *power transistors* netting for less than one dollar . . . "experimenter's" transistors netting for less than fifty cents . . . increased use of transistors in hi-fi equipment and the introduction of commercial *fully transistorized* hi-fi amplifiers . . . a portable transistorized receiver made by a large "standard brand" manufacturer and retailing for less than $20 . . . and commercially available r.f. transistors operating to 1000 mc. and higher.

The new year should also bring power transistors handling loads *up to 100 watts* and power units capable of delivering over a watt at radio frequencies . . . the use of transistors in TV receivers (I *won't* give up on this one) . . . production of a transistorized short-wave receiver . . . transistorized FM receivers . . . and, finally, an increase in the use of transistors in toys and in non-entertainment (controls, computers, etc.) applications.

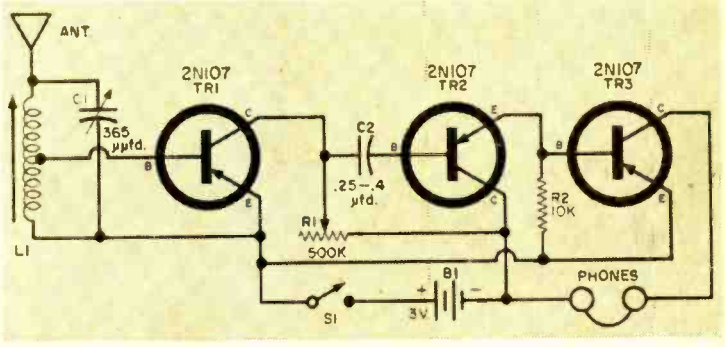
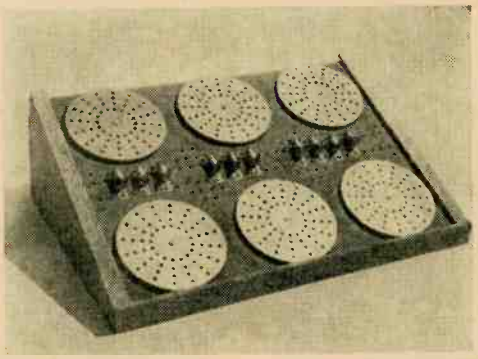


Fig. 1. The three-transistor receiver circuit submitted by Niles Puckett, Jr.

Readers' Circuits. Simple circuits are not only easy to understand and to wire but, since they require relatively few parts, can be assembled with minimum strain on the pocketbook. This month we are featuring a simple three-transistor receiver and an inexpensive wireless microphone. Either project can be assembled and tested in a single evening and has comparatively few components.

Broadcast-Band Receiver. Using one transistor as a detector and two transistors in a direct-coupled audio amplifier, the cir-

Can you think faster than this Machine?



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cuit shown in Fig. 1 was submitted by Niles Puckett, Jr., of 3316 N. 17th Ave., Phoenix, Arizona.

In operation, radio signals picked up by the antenna are selected by the *L1-C1* tuned circuit and coupled to the first transistor, a common-emitter stage operated without base bias so that it serves as a combination detector-amplifier. Next, the audio signal appearing across gain control

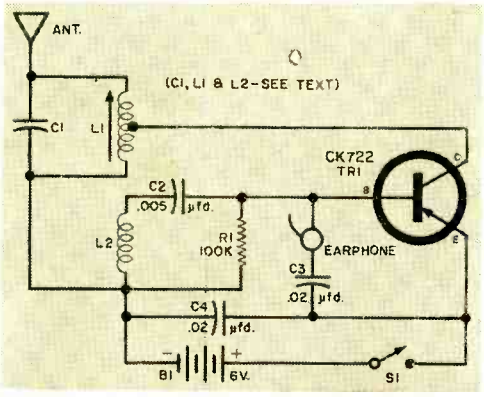

Fig. 2. Reader Ronald O'Neal's wireless microphone.

R1 is coupled through *C2* to a two-stage audio amplifier, consisting of an impedance-matching common-collector stage direct-coupled to a common-emitter amplifier which drives a pair of magnetic headphones. The *p-n-p* type of transistors is used throughout. Power is supplied by a three-volt battery, *B1*, controlled by a s.p.s.t. switch, *S1*.

You can assemble this receiver in a small plastic box or on a metal or fiber chassis. Circuit layout and lead dress are not especially critical. Coil *L1* is a tapped ferrite antenna coil (Lafayette No. MS-299) while tuning capacitor *C1* is a 365-$\mu\mu$fd. solid dielectric unit (Lafayette No. MS-215). The three-volt battery may be made up by connecting two penlite cells in series.

A reasonably long antenna should be used for best results . . . although Niles indicates that he has achieved good reception of nearby local stations using a 3'-length of piano wire as an antenna.

Here's a tip you may find of value, Niles. With some transistors, better results can be obtained if a small bias is applied to the second stage. Just connect a 1-megohm, ½-watt resistor from the base of this transistor to the negative terminal of the battery.

Wireless Microphone. Ronald O'Neal, of 408 Baltimore St., Delhi, La., who submitted the circuit shown in Fig. 2, developed it by modifying the "C.W. Radio Transmitter" circuit described by E. G. Louis in the January 1957 issue of POP'tronics ("More Solar Battery Experiments," page 59). Ronald simply replaced the sun battery used in the original circuit with a dry battery (*B1*) and added an earphone (used as a "mike") and a d.c. blocking capacitor (*C3*).

In operation, the transistor is used as a common-emitter tickler-feedback r.f. oscillator, with its frequency of oscillation determined by tuned circuit *L1-C1*. Coil *L2* provides the feedback necessary to start and sustain oscillation. Base bias is supplied through *R1*.

The oscillator is modulated by an audio signal obtained from a magnetic earphone and applied to the transistor's base-emitter circuit. Blocking capacitor *C3* prevents a short of base bias current. And operating power is supplied by a 4.5- to 6-volt battery (*B1*), controlled by a s.p.s.t. switch (*S1*) and bypassed by *C4*.

In the original article, the circuit was assembled "breadboard" fashion on a perforated Masonite chassis. If you prefer, you can use a small plastic case.

L1 is a tapped antenna coil (Lafayette No. MS-299), while *L2* consists of 10 or 15 turns of enameled wire, tightly wound on top of *L1* . . . you may have to experiment with the connections to this winding to obtain oscillation. *C1* is a fixed ceramic or mica capacitor with a value of from 50 to 300 $\mu\mu$fd., depending on the operating frequency desired and the adjustment of *L1*'s core. Best results are obtained near the middle of the AM broadcast band—from 800 to 1000 kc. The antenna is moderately long.

Use a standard broadcast-band receiver to pick up signals from the completed unit, speaking or singing into the earphone "mike" as you tune the receiver *slowly* over

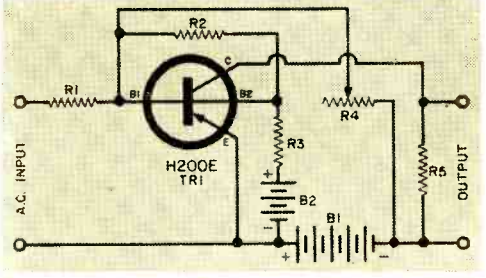

Fig. 3. Basic circuit arrangement for the H200E power tetrode transistor. See page 106 for details.

the band. The receiver and oscillator should be fairly close together for initial tests. If you can't pick up the signal, try reversing the connections to *L2*. If the signal comes in "on top of" a local broadcast

(*Continued on page* 106)

Among the Novice Hams

By **HERB S. BRIER,** W9EGQ

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

ABOUT TWENTY study questions in the General Class section of the License Manual refer to capacitors (condensers) and inductors (chokes and coils), and over half the components in every circuit diagram in the manual are either one or the other. Therefore, it is important to learn something about them in preparing for the General Class amateur examination. So let's talk about capacitors.

Capacitors. Suppose we place two large metal plates close together but not touching, thereby forming a simple *capacitor*. Now connect a source of electromotive

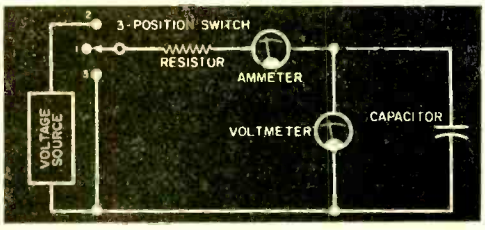

Fig. 1. Theoretical circuit used to illustrate properties of capacitance.

force—such as a battery—a through position switch, a resistor, a voltmeter, and an ammeter to the plates as in Fig. 1.

If we turn the switch from position 1 to position 2 in this theoretical circuit, the ammeter pointer will deflect and then return to zero, indicating a momentary flow of electric current. In the meantime, the voltmeter pointer will swing up, indicate the battery voltage, and stay there—even after we return the switch to position 1 to disconnect the battery. Finally, if we turn the switch to position 3, connecting the resistor and the ammeter across the capacitor, the ammeter will deflect in the direction opposite to its previous deflection and return to zero, while the voltmeter pointer drops to zero.

When the switch was first closed, the positive potential at the terminal of the battery immediately attracted many electrons *from* the capacitor plate to which it was connected. As electrons are negative particles of electricity, the loss of these negative particles left the plate with a positive charge. At the same time, the negative battery terminal placed an equal number of electrons on the other plate, giving it a negative charge. Electrons in motion produce electric current, which was indicated by the ammeter, and the voltmeter measured the difference in charge (potential) across the plates.

When the switch was opened again, the capacitor remained charged to the battery voltage, because the excess electrons on the negatively charged plate had no path by which they could return to the other plate and equalize the charge between them. This path was provided when the

Ronnie, WN7IYJ, does his best to keep Idaho represented on the Novice bands with his WRL Globe Chief transmitter and Heath AR-3 receiver.

switch was turned to the third position; consequently, the capacitor was discharged.

This whole experiment proves that a capacitor can store electrical energy. A convincing demonstration of this fact occurs every time a service technician bridges

(*Continued on page* 119)

HELP US OBTAIN OUR HAM LICENSES

Prospective amateurs requesting help and encouragement in obtaining their licenses are listed here. To have your name listed, write to Herb S. Brier, W9EGQ, % 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.

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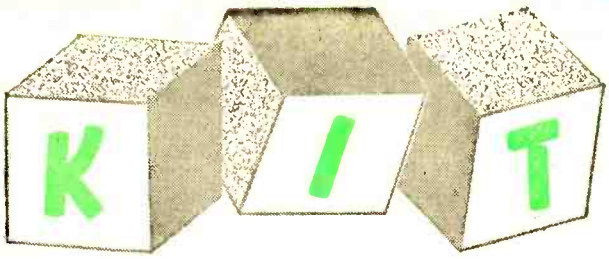
To help prospective amateurs obtain their Novice licenses, the Electronic Industries Association (formerly RETMA) offers a set of code records (recorded at a speed of 33⅓ rpm) and a Novice Theory Course for $10.00, postpaid. The complete course or more information on it is available from EIA, 1721 DeSales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



BUILDER'S KORNER

IF YOU ARE a beginner in the field of electronics, you will soon discover that a voltmeter can show a reading of, say, 12 volts, at a tube terminal, yet the actual voltage will be 150 volts when the voltmeter is removed from the circuit. Later, when you learn the many applications of Ohm's law, you find out why, and how to use the law to take into account the resistances of the circuit and the effect on them when the low-resistance VOM is employed.

Once the need is demonstrated for a voltmeter that presents less load on the circuit under test, you look for an *electronic* type of voltmeter, a VTVM, for your lab or workshop. Many makes are available in ready-built form and in build-it-yourself kits. A new kit, the V-70, has been introduced by Paco Electronics Co., division of Precision Apparatus Co., 70-31 84th St., Glendale, N. Y.

PACO V-70 Vacuum-Tube Voltmeter

Putting It Together. Unlike some kit manufacturers, who prewire portions of their kits, Paco does not—and properly, we think. If all the hard work is done, where's the fun in building a kit? With the Paco V-70, the builder wires from scratch, but if he is able to follow instructions and solder, he will be able to turn out a perfect VTVM. There are plenty of pictorials; the steps are clear and precise, and they follow in logical sequence.

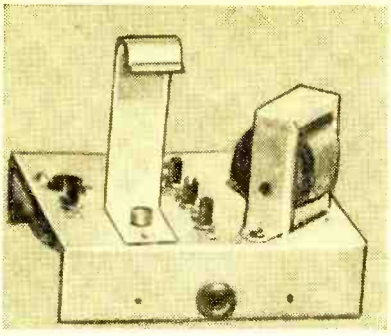
By paying careful attention to the diagram provided when wiring the switches, you should have little trouble here. One tip: use a pencil to mark the switch points with the numbers which have been assigned to them in the diagram.

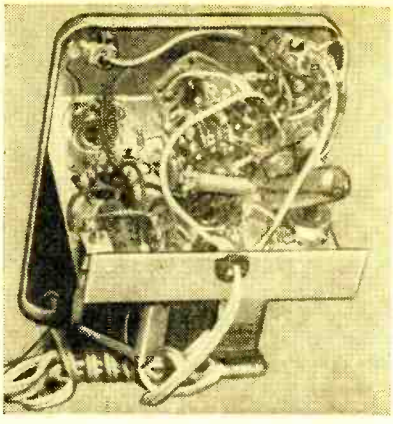
The wiring of the probe is a rather tricky operation. Since the probe assembly is shielded against electrostatic pickup, the preparation of the shielded cable is very precise, even to the soldering. Directions should be followed exactly.

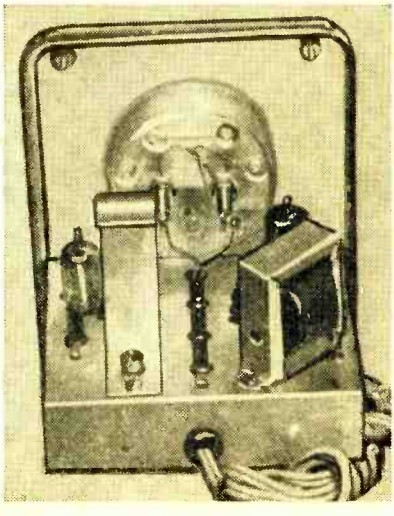
Once the meter has been completed, it will have to be calibrated. This is comparatively simple if you follow Paco's instructions.

Special Features. In operation, the meter is connected to the cathode circuit of a 12AU7 twin triode in a balanced bridge arrangement. The zero-adjust control sets up a balance between the two triodes such that, with no voltage applied to the first grid, the potentials on each cathode are equal, and the meter reads zero. With a voltage applied to the first grid, the balanced condition is upset, causing a difference in the potentials on the two cathodes and consequently across the meter.

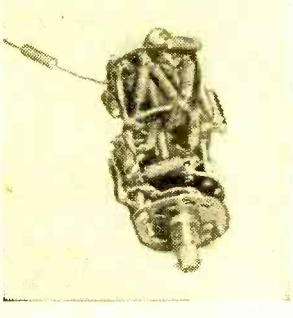
The maximum test voltage which is applied directly to the 12AU7 for full-scale meter deflection is about 1.5 volts. A voltage divider having a total resistance of 10







Various stages in building the VTVM. The partially assembled chassis as viewed from the top (upper left) shows placement of transformer, battery clip and "cal. pot." controls. Above is the wiring of the underside of the chassis, and at left is the completed VTVM before it is put into its case. The completed range switch appears below. While this is a complex wiring job, it can be simplified by marking switch points with numbers assigned in diagram.



meg. divides voltages higher than 1.5 volts. An isolating resistance of 1 meg., located in the test probe, is used in the d.c. position. This makes it possible to take d.c. measurements in circuits carrying r.f. with a minimum disturbance of these circuits.

For a.c. measurements, a 6AL5 duo-diode is used as a rectifier to provide a d.c. voltage proportional to the applied a.c. This voltage is then applied to the 12AU7 as before. The 6AL5 is connected in a half-wave doubler circuit which will respond to the peak-to-peak value of applied a.c. test voltages. And the a.c. scales are calibrated to read in *both* r.m.s. and peak-to-peak values. The "1.5-volt r.m.s. only" scale has been specially calibrated to maintain the accuracy of the meter in this range, where nonlinearity of the rectifier usually reduces accuracy.

In addition to the other scales, the V-70 has a decibel scale, with the operating manual containing a conversion chart for the ranges above 0-5 volts.

Comment. All of the components of the V-70 are of good quality. The meter, a 400-μa. movement, is large and easy to read, despite the large number of scales. Range resistors are 1% precision types. The switches seem rugged and well made, and should last a long time.

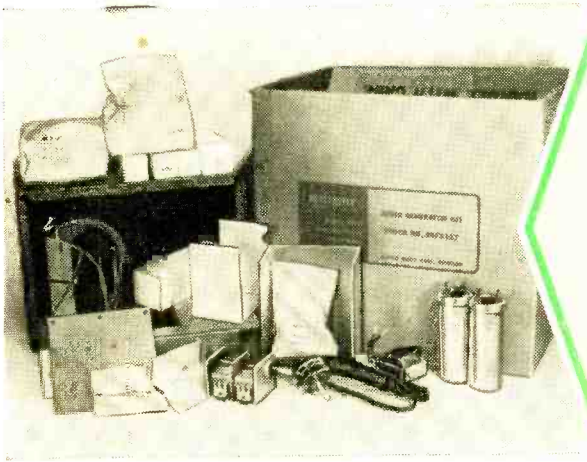
While the range switch has a pointer, the function switch does not. Instead, it has a white index line on the knob—you have to look closely to be sure which position it's on. The probe and the common lead are positioned at the lower left, one above the other. While this may seem to be awkward at first glance, it works out quite well, and makes for better access to the controls. The controls are placed well below the meter and are easy to handle.

IF YOU work with audio equipment—designing circuits, building amplifiers, servicing or installing p.a. or intercommunication systems, or checking out hi-fi gear—you will find an audio generator is essential. It is used alone for many basic tests, such as finding resonant frequency of speakers. And it can be used with either an oscilloscope or a VTVM for amplifier frequency response measurements, or with an audio wattmeter (or VTVM and precision load resistor) for power output tests. You can also use it with an oscilloscope or audio distortion analyzer to make distortion tests, or with either a VTVM or a calibrated oscilloscope to make gain tests.

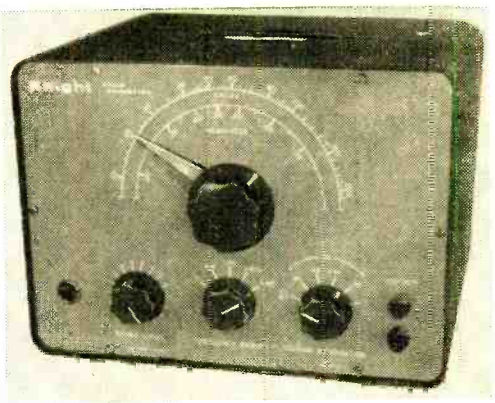
The Knight audio generator includes all the features essential in an instrument of this type. It is available in kit form from Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill., as stock No. 38FX137. With a continuous frequency coverage from 20 cycles to 1 mc. in five ranges, it provides a greater frequency range than is needed for audio work alone. Output signals are available through both audio and ultrasonic frequencies and into the middle of the r.f. AM broadcast band, thus greatly increasing the unit's versatility.

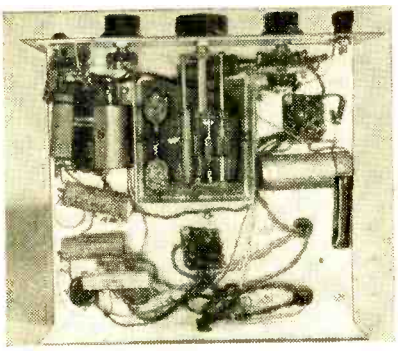
Putting It Together. Using four standard vacuum tubes—a 6CB6 oscillator, a

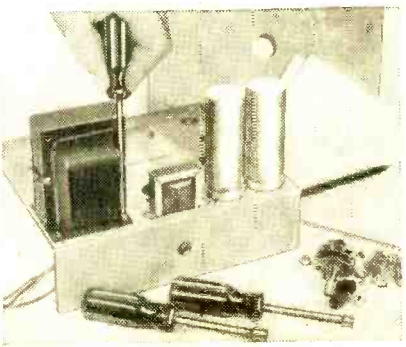
(*Continued on page* 104)



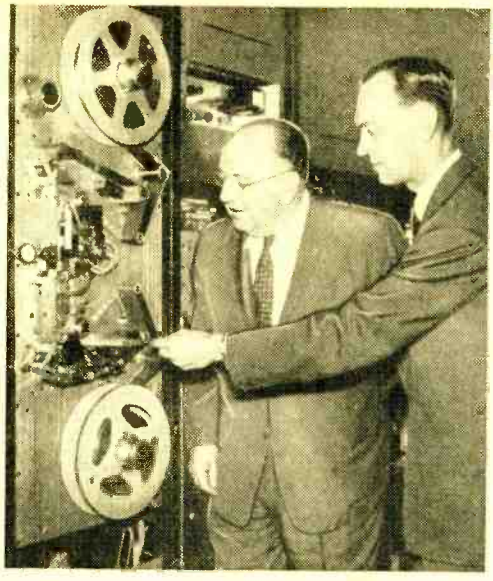
KNIGHT
Audio
Generator







The wiring of the audio generator is shown in the underchassis view directly above. At right, the power transformer is being mounted on the top of the chassis.

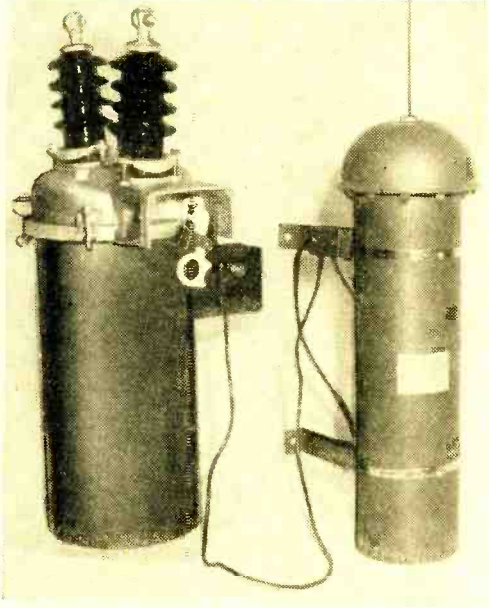


Color Video Taping

Taping of TV programs, just coming into its own (see "They're Putting TV on Tape," November 1957 issue of POPULAR ELECTRONICS, has received an additional boost. RCA announced that it will soon market a color-TV tape recorder. This machine incorporates revolving heads which record a transverse picture signal just as the Ampex black-and-white recorder does, thus cutting tape speed to only 15 ips. The sound track is recorded on the same 2" tape, which will give 64 minutes of programing to a 4800-foot reel. While its basic principle is the same as that of the ordinary home recorder, the RCA color machine (see photo at left) is infinitely more complex. As with all compatible color telecasting, the pictures will appear in black and white on monochrome receivers. The color-TV tape recorder is expected to cut the cost of color programing considerably.

Power Failure Locator

An automatic radio transmitter has been developed which will immediately signal "outage," or power line failure. It operates automatically in response to a tripped recloser, fuse or circuit breaker in a specific section of a power line. A distinctive coded signal, transmitted for very short duration, is picked up automatically by a mobile unit or base station, and serves to identify the section which is closed down. In the photo, the "outage locator," developed by Montrel of Baton Rouge, La., is shown with its transmitting antenna at far right, the recloser (power circuit breaker) and actuator next to it. When the locator is at a height of 35 feet atop a utility pole, it has a range of about 35 miles, usually sufficient for good reception. An FCC change of rules, effective in September, 1957, permits electric utilities to engage in one-way signaling on mobile service frequencies to indicate electric line outage.



Radio Library Aids Blind Electronics Enthusiasts

The South East Amateur Radio Club (SEARC) of Cleveland has formed a Radio Library for the Blind which is expected to fill a gap in the library services to the blind in the United States and Canada. Acting as a clearing house for information on electronics literature in embossed and recorded form, it offers taped readings and Braille copies of literature pertaining to all aspects of electronics at a nominal charge to defray mailing and handling costs. Braille items are in Standard English Braille Grade 2, and tape recordings are normally dual-track, 3.75 ips, 3" to 7" reels. Inquiries are welcomed by the SEARC Library, including requests for information on special devices and instruments which may be used by the blind radio and electronics enthusiast. The library expects to issue the "SRLB High-Fidelity Digest," a counterpart of its radio periodicals digest. Address all inquiries to: Warren Sladky, Librarian, SEARC Radio Library for the Blind, 11519 Parkview Ave., Cleveland 4, Ohio.

By BRADFORD O. VAN NESS

Tune "on the Nose"

Insure optimum fidelity by adding an AM or FM tuning meter to your Heathkit tuner

HIGH-FIDELITY RECEPTION of either AM or FM programs demands exact tuning of the broadcast station's carrier frequency. In the case of most inexpensive tuners, such as the Heathkit BC-1A and FM-3A, the tuning process must be done entirely by ear—an inaccurate method since minor detuning or drift can't be readily detected. The addition of an electronic indicator to your receiver will end such problems by indicating immediately and accurately when you're "on the button."

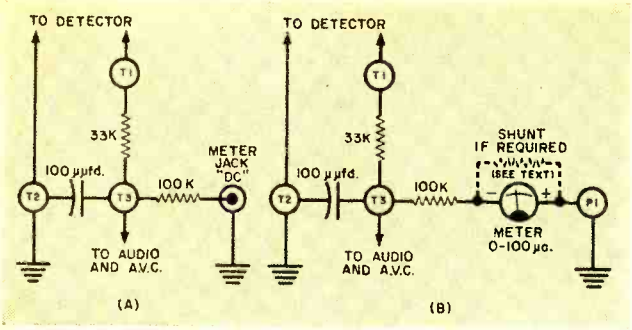
Basically, the choice is between two types of indicators: a "magic eye" cathode-ray tube or a meter. The tuning eye tube, although inexpensive, requires a socket, mounting bracket, and power connections to the receiver filament and plate supply. It will eventually dim out and require replacement, and cannot—because of its length—be easily mounted within a number of the smaller tuner cabinets.

The better choice is one of the inexpensive 1½" meters now available for about six dollars. It can be mounted either outside or within the tuner cabinet as desired—internal mounting requiring the removal of the volume control and a.c. line switch.

With a normal preamplifier-power amplifier system, the volume control is not needed, and the a.c. can be switched through the power switch of the amplifier.

Adding an AM Tuning Meter

The AM tuner meter connection is relatively simple. As shown in top schematic on p. 80, the 100-μa. meter is wired in series with the 100,000-ohm resistor at the detector output. The meter when placed here responds to the Heathkit's a.v.c. voltage which hits maximum at the exact carrier frequency point of the received station. In the case of the Heathkit, as with all "broadband" jobs,



Circuit modifications (at left) for external (A) and internal (B) meter mounting.

Schematic below shows AM cathode-follower stage rewired without volume control to enable internal mounting of the tuning meter.

there is generally a broad indication on either side of the carrier frequency. The proper place to tune is halfway between the points where the meter begins to "fall off."

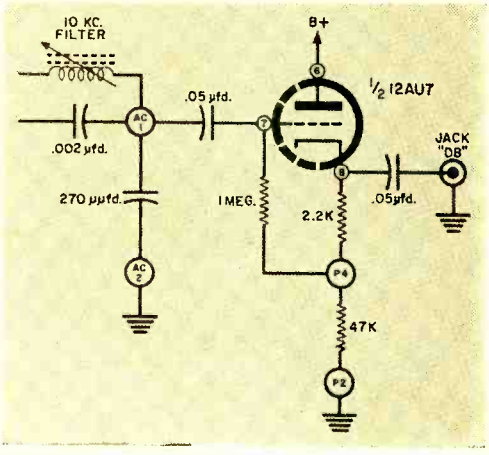
To wire in the meter to your tuner, you'll have to dig out the Heath construction manual because we are going to use their parts code designations. First, disconnect the end of the 100,000-ohm resistor which is soldered to *T2* (a ground point). Splice about six inches of hookup wire to the free end of the resistor. If the tuning meter is to be installed outside the cabinet, the volume control is not removed.

Cut out the 0.05-μfd. capacitor running from jack *DC1* ("fixed output") to *AC1*. Connect the free end of the wire spliced to the 100,000-ohm resistor to *DC1*. The jack *DC* has now become a jack to which the meter can be connected by means of a phono plug and shielded lead. The center conductor of the lead should connect to the negative terminal of the meter, the shield to the positive terminal.

Internal meter mounting requires a different procedure. Do not remove the 0.05-μfd. capacitor. Instead, disconnect and remove the volume control and switch. Remove the twisted leads which went to the switch from *Y2* and *Y3*. Move the a.c. line cord lead from *Y3* to *Y2*. Now the line cord is connected directly to the power transformer primary.

The cathode follower stage (one-half of the 12AU7) should be rewired as shown in schematic above, right. Discard the 0.01-μfd. capacitor running from *CC2* to *E7* (see Fig. 13, Heathkit Manual), and connect the 0.05- μfd. capacitor which originally went to *CC3* to *E7*.

The cabinet should now be altered for the meter installation. First remove the outer front panel from the tuner. Using a 1½"-diameter chassis punch or circle cutter, carefully enlarge the ⅜" volume control hole (see "A" in exploded view). Check to see if the meter will fit properly with its flange *behind* the front panel. Once this hole is of the proper diameter, place the



meter in it and mark the locations for the four flange screws at "B," and drill for a size *4-40* machine screw.

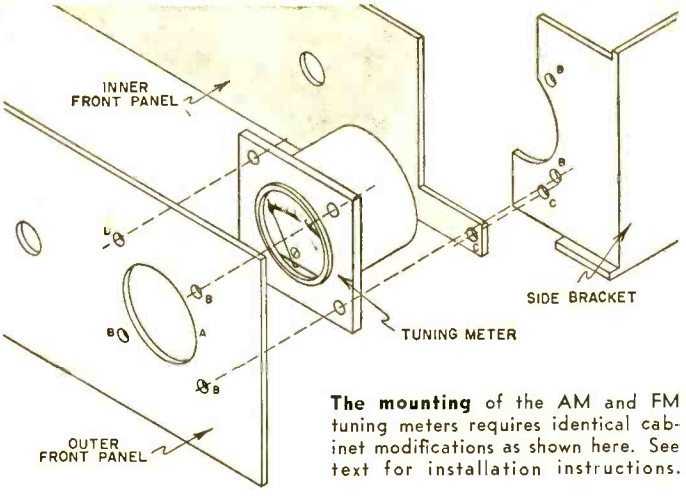
Now remove the pilot light assemblies, dial cord and drive spindle from the black inner front panel and detach the panel.

Remove the aluminum bracket on the right-hand side of the tuner which must be modified to support the right side of *both* front panels. Place the front flange of the bracket in a vise and carefully bend it straight with the main part of the bracket so as not to break it off.

Slide the flange ⅛" further down in the vise and bend it back to the original right angle. This is done to accommodate the thickness of the meter flange. Screw the side bracket back on the chassis and temporarily position the outer front panel at its normal location on the tuner.

With a scribe or sharp pencil, mark the location of the large meter hole "A" and the two right-hand meter flange holes "B" on the rebent front flange of the side bracket. Again remove the side bracket and, using the marked guide lines, cut it so that the body of the meter will be clear. Also drill the two meter flange holes with the same drill used on the front panel.

Be sure to leave a tab on the bottom of



The mounting of the AM and FM tuning meters requires identical cabinet modifications as shown here. See text for installation instructions.

the flange about ⅜" wide to which the inner front panel will attach. Drill a hole "C" for a size *6-32* machine screw in this tab about ¼" from the end. Re-install the side bracket on the tuner and prepare the inner front panel.

Cut the entire end off of this panel, leaving enough of a tab on the bottom to overlap the tab and hole of the side bracket flange. Temporarily place the panel on the tuner; mark and drill the hole "C." Cut a notch in the panel to clear both the meter body and its flange, then fasten it to the tuner using a *6-32* machine screw and nut where the two tabs join. Replace the dial cord drive spindle and the dial cord; and remount the pilot light assemblies.

Place the meter on the outer front panel with its flange to the rear and fasten it lightly in place with two *4-40* machine screws and nuts in the left-hand flange holes. Slip the panel onto the tuner and check to see if the two right-hand flange holes line up with those drilled in the side bracket. If they do, wire in the meter.

The lead spliced to the 100,000-ohm resistor goes to the negative terminal of the meter, and the lead which formerly went to *CC1* now goes to the positive terminal. Using two more *4-40* machine screws, fasten the outer panel, the meter flange, and the side bracket together to complete the mounting of the meter movement.

Now check out the unit. Recheck the rewiring, then plug in the tuner and connect its antenna. After tube warm-up, rotate tuning knob and check for meter deflection as stations are tuned in.

Should the meter read backwards, reverse the leads to its terminals. Should it deflect suddenly high off scale as the tuner warms up, quickly remove power and check to see if the 100,000-ohm resistor is in series with the meter.* If all is well, reassemble the cabinet.

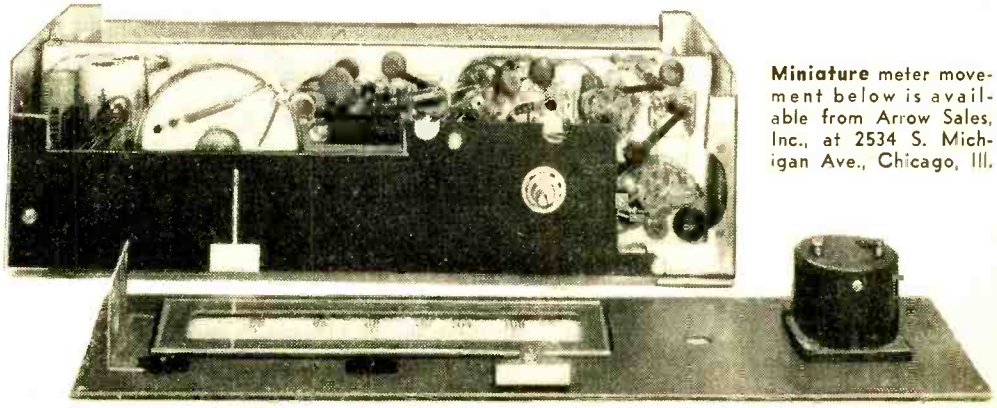
Adding an FM Tuning Meter

FM tuning indication can be accomplished in two ways. Maximum signal strength can be indicated (as with the AM tuner), or the meter can be wired to show the "balance" point of the ratio detector. From the standpoint of fidelity, i.f. stages should be aligned to coincide and produce the maximum signal at this balance point.

This is the best type of indication to use. However, the maximum voltage unbalance of the detector is only about 1½ volts across 1 megohm. As this voltage is far too small for sufficient deflection of most meters, it must be amplified.

Since the audio stage of the tuner is not

* If the tuner is used closer than about a mile from the broadcast station, the meter may swing off scale. This will happen *only* when a strong station is tuned in. Try shunting it with a resistor of about 1000 ohms or less.



Miniature meter movement below is available from Arrow Sales, Inc., at 2534 S. Michigan Ave., Chicago, Ill.

By JOHN T. FRYE

Cupid and the Ions

OUTSIDE, the winter night was fit for neither man nor beast. A roaring wind drove sleet against the windows with a sound like the scratching of tiny claws. Inside, though, Carl and Jerry were warm and cozy and really living it up. They were sitting at a kitchen table drinking Cokes and eating buttered popcorn which was being freshly popped by an attractive girl in a bright blue sweater and dark toreador pants.

The girl was Norma, who lived next door to Jerry. She had asked the boys to see if they could find out what was wrong with her TV set. They had quickly spotted the trouble, a lead-in broken loose by the wind at a lightning arrestor; and after they repaired it, Norma had insisted they come out to her kitchen for popcorn.

Ordinarily Carl and Jerry were pretty girl-shy, but Norma completely disarmed them. In the first place, she was safely ancient by their standards, being in her early twenties; and in the second place, she was such a warm, personable, pleasant sort of person that it was almost impossible to dislike her or even be shy with her.

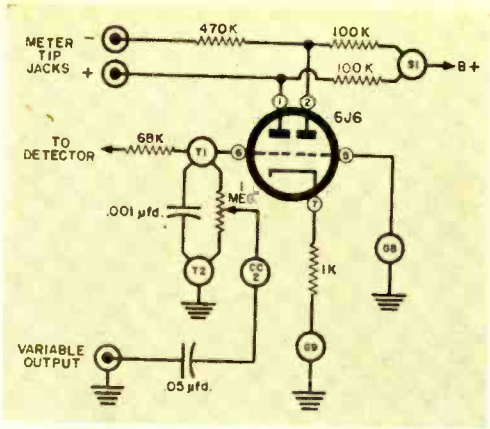
"Guess that'll hold us for a while," she declared, dumping another popper of corn into the huge bowl on the table. "I really appreciate your fixing that TV," she continued. "Tomorrow night my OAO is coming over to watch the fight, and I fascinate him so much that if he found my set wasn't working he'd probably stay home and watch it on his own."

She said this with a self-mocking grin, but the boys detected a little bitterness in her tone.

"Now don't tell us you're having trouble with your love-life again," Carl mumbled with his mouth full of popcorn; "not after Jerry and I got rid of Melvin for you with that supersonic oscillator and nearly deafened poor Bosco doing it."

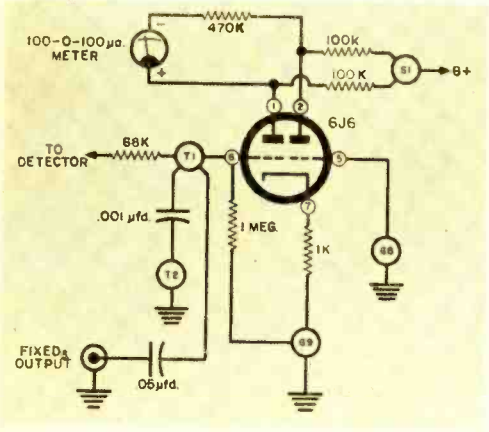
"Yeah," Jerry chimed in. "What's the matter with this 'One-And-Only' of yours? Is he blind? If I liked girls, I'd certainly go —that is—I mean—"

"Why, Jerry, that's the nicest thing anyone has almost said to me in months,"



External mounting of the meter does not require removal of the volume control for proper operation, but jacks are connected as in diagram at left.

Electrical modifications necessary for internal mounting of the FM tuning meter are shown below.



required with most amplifiers, we can convert the 6C4 stage into a meter amplifier using a 6J6 tube. The resulting circuit is a type of vacuum-tube voltmeter having the advantage of response to the *polarity* of the input voltage, and hence will indicate if tuning is "high" or "low." An inexpensive (less than $6.00) 100-0-100 microammeter is used.

To convert the 6C4 to a meter amplifier, remove and discard the 0.05-μfd. capacitor running from jack *DC1* to *G5* (the 6C4 socket) and the 47,000-ohm resistor between *G5* and terminal strip *S1*. Run a short bare wire from *G5* to *G8*, the center post of the socket. Connect one 100,000-ohm, ½-watt, 5% resistor from *G2* to *S1* and another from *G1* to *S1*.

Splice about 6" of wire to one end of a 470,000-ohm, ½-watt, 10% resistor and connect the other end of the resistor to *G2*; connect another wire of the same length directly to *G1*. Remove and discard the 0.01-μfd. capacitor running from *CC2* to *G6*, and connect a wire between *G6* and *T1*.

If the meter is to be placed outside of the cabinet, remove and discard the 1-megohm resistor from *G6* to *G9* (a ground lug). Disconnect one end of the 0.05-μfd. capacitor from *T1* and wire it to *CC2*, splicing on as much wire as needed. Drill two holes adjacent to jack *DC* and install a pair of insulated pin jacks, one red and one black adjacent to jack *DC*.

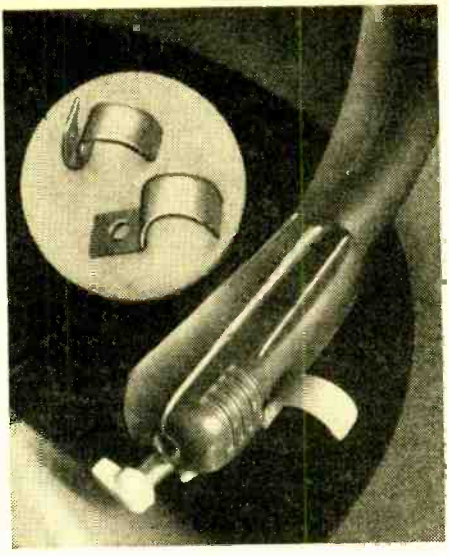
Connect the free end of the wire from *G1* to the red tip jack and the free end to the wire spliced to the 470,000-ohm resistor to the black tip jack. Then connect a length of two-conductor wire to the meter lugs and put a red and black tip plug on the respective leads from the positive and negative terminals. Plug the tips into the jacks and the unit is ready for testing.

Cabinet mounting of the meter requires a different procedure. Remove and discard the volume control and line switch as in the AM conversion. Disconnect the twisted switch wires from terminal strip *AB2* and *AB3*, and transfer the line cord lead from *AB3* to *AB2*. Modify the cabinet for meter mounting as before.

After the meter is installed, connect the free end of the wire spliced to the 470,000-ohm resistor to the negative meter terminal and the end of the wire from *G1* to the positive one. Now remount the front panel.

Testing the conversion is simple. With no antenna connected and a 6J6 in the original 6C4 socket, the meter should read close to the zero-center position. If it does not, adjust the small "zero" setscrew on the face of the meter until it reads exactly zero.

Now connect an antenna and tune to a station. The meter, which reads zero when completely "off station," should read to the left if the dial is set slightly below the station and to the right if slightly above. If the action is backwards, the meter leads should be reversed. The "on tune" position is dead center. If everything checks okay, put it all back together again, and be assured that your hi-fi receiver is tuned "on the nose." —30—

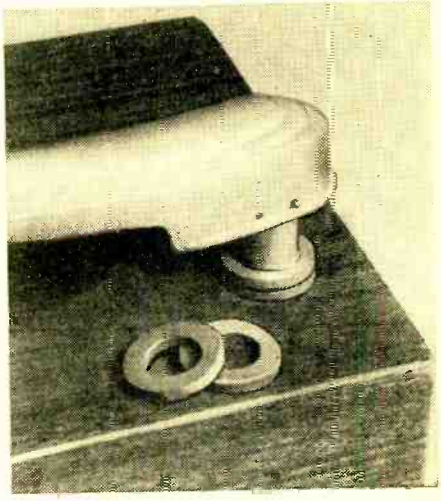


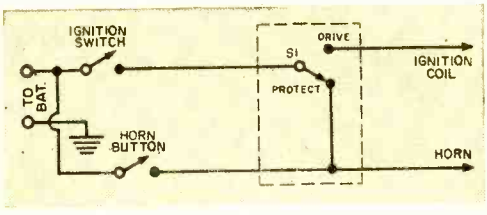
Grip That Arm!

If your low-priced phono arm doesn't have a finger grip, you can put one on easily. Buy a metal cable clamp of the required size (1" is best) and bend it up to form a clip, as shown in the insert in the photo at left. Clip the clamp on the arm, as shown in the photo, using some cement if necessary. Another way would be to cut a strip of the required size from sheet aluminum, file it smooth, and bend into the proper shape—that would be lighter. —*Art Trauffer*

Raise The Pickup!

When replacing turntables, it is sometimes necessary to raise the pickup arm to correspond with the increased height of the new turntable. Rubber washers come in handy for this purpose. As shown at right, you simply slip the washer or washers over the threaded part of the pivot-post of the arm, then fasten the post to the motor mounting board in the usual way. Garden hose washers come in red and black, and in different diameters and thicknesses. —*Carl Dunant*





Protect Your Car!

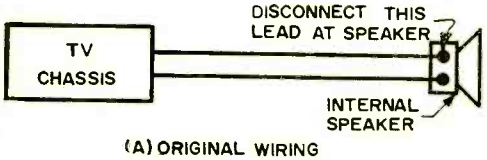
Every year thousands of cars are stolen by thieves who put a "jumper" across the ignition switch. To frustrate a potential thief, hide a "protect" switch under the dash, wired as per the schematic above. When you leave the car, flip it on *"protect."* If someone tries to short out the ignition switch, it will blow the horn and the car won't start. When you come back, just put it on *"drive,"* and your car will start as usual. Switch *S1* is a s.p.d.t. Cutler-Hammer 7582-K6 or equivalent. The circuit change within the dashed lines is the only addition to the electrical system necessary. —*R. Wayne Crawford*

Better Tone from Your TV

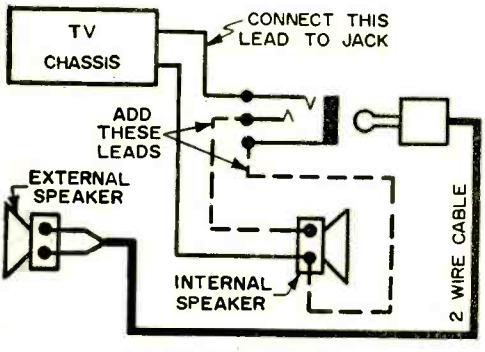
The audio quality of many television receivers can be "souped up" substantially by using an external loudspeaker. It's the compact cabinet of your table model TV that limits both speaker size and sound quality.

Since most television receivers will provide a clean watt or two of audio power, it is definitely worth your while to replace the internal speaker with a larger, better quality job, mounted in an appropriate baffle. The new speaker-baffle combination should be installed close to the TV set in order to keep the sound source near the picture.

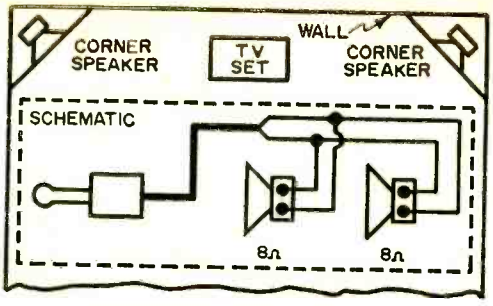
Connecting an external speaker is a snap. All you have to do is remove the back from the TV set and trace the two leads from the speaker to the chassis—see (A) in diagram below. Install a standard, closed-circuit phone jack, wired as in (B), on a mounting bracket attached to the cabinet. The two-wire cable to the external speaker is connected to a matching plug.



(A) ORIGINAL WIRING



(B) MODIFIED WIRING



USING TWO EXTERNAL SPEAKERS

When the phone plug is inserted in the jack, the speaker inside the TV set is disconnected and the external speaker connected to the receiver output. If the receiver used is of the "a.c./d.c." type with one side of the line connected to chassis, it is a good idea to polarize the line plug to prevent chance of shock from the extension speaker leads.

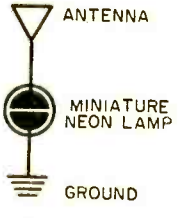
Since the output transformer in your set is probably designed for a speaker of about 4 ohms, a 4-8 ohm speaker will match nicely. Don't worry about mismatch—the only result will probably be a slight loss in efficiency. You have a wide choice as to loudspeakers and baffles. As the "pitchman" says: "You pays your money and you takes your choice."

A more elaborate system can be set up (diagram above) by installing two external speakers, one in each corner of the room and the TV set in the middle. With both speakers operating, the sound will appear to be coming from between them. Two 8-ohm speakers connected in parallel can be used. Special triangular baffles cut from a sheet of Celotex would be ideal for corner mounting. —*Leo Sands*

Use a Neon Lamp to "Detect" Lightning

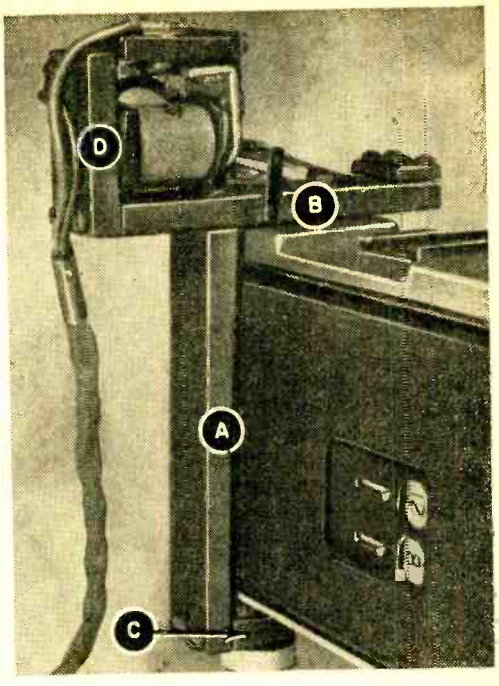
With a dazzling, pink-white brilliance, the lightning flashes outside your home. You flinch, because *that* was a close one! But do you know that the "close one" will register a sizable potential on your antenna? And that the potential can be demonstrated easily and inexpensively with the aid of a small neon lamp connected between antenna and ground?

The voltage on the antenna is induced through magnetic coupling with the lightning stroke or by building up a charge electrostatically—the antenna and the ground acting as two plates of a capacitor. The lamp will flash whenever the voltage on the antenna equals or exceeds the lamp's "breakdown" potential. About 60 volts will cause ionization.



Using an ordinary 100′ antenna, a water-pipe ground, and a NE-2 neon lamp (as in the schematic), you can see neon flashes with almost every stroke of lightning. For best results, put a shield around the bulb to cut outside light. A cardboard tube with a cutaway section will do nicely. —*Frank H. Tooker*

Build an Electric Shutter Release



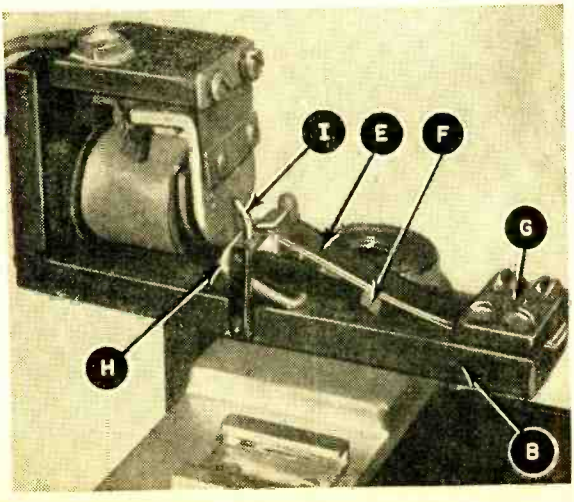
THERE COMES A TIME in every photographer's life when he'd give anything to have a remote electric shutter release. This is especially true in taking snaps of children or during nature shots—when the idea is to get as far away as possible from the subject.

Here is an inexpensive tripper that you can put together in a few hours. It's intended for cameras with a body release button. As the frame should be built to fit the camera, dimensions are not given.

The framework is made of ¾" x ¼" Reynold's aluminum strips. A clamp to fit the camera is formed by strips *A*, *B* and *C*. Strip *D* is mounted at right angles to *B*. All are held by ⅛" screws in tapped holes. One strip (*B*) has a hole drilled to receive the release button. The opposite strip (*C*) clears the camera by ¼" to allow the frame to slip over the release. Drill and tap it to take the knurled screw which holds the assembly in place. Shim with rubber to make it tight and prevent marring the camera.

Almost any relay can be adapted to operate the release. In this case a 6-volt d.c. type was used, mounted as shown. Note that the armature should move freely. The spring (*E*) is made of two lengths of stiff clock spring, with the end of the lower one heated, then bent around the upper. To it is fastened a stud (*F*) to depress the camera release when the spring snaps. The spring is clamped beneath piece *G*.

The movable support for the free end of the spring must be high enough to let the shutter reset when the spring is raised. This support is rectangular and consists of two brass strips spaced by two heavy wires. The bottom wire fits loosely through a hole drilled in strip *B*. A similar wire at the top supports the end of the spring. Backstop *H* is made of wire and soldered to the side of the support frame, at such an angle that the support is slightly off perpendicular, toward the base of the spring, but not so far that the solenoid won't be able to pull it.



Solder the trip bar (*I*) to the relay armature so that it engages the backstop. Then hook any length of lamp cord, up to 100 feet, in series with a 6-volt battery and push button. Install the battery in a small case, mounting the button on the outside, if you wish. You can then attach the wires to the coil lugs. It is best to tape or clamp the wires to strip *D* to prevent them from being pulled off.

Painting the remote release assembly with crackle paint to match your camera will complete the job and make it look attractive.

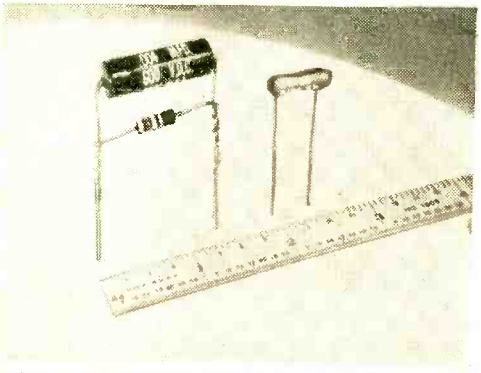
In operation, the device works as follows. The end of the spring is put on the support. Pushing the button energizes the relay coil, pulling the armature, causing the trip bar to pull the support far enough to release the spring. The spring drops, and the stud depresses the body release, which in turn operates the shutter and takes the picture. You'll have to reset the spring each time you use it, as well as the shutter, and advance the film.

—A. J. Lowe

TOOLS and GADGETS

MINIATURE RESISTOR/CAPACITORS

Two new sizes of Tube-R-Cap, a resistor-capacitor unit that requires only the space of a tubular capacitor alone, have been developed by Centralab. Each is a tubular ceramic capacitor incorporating a resistor in parallel. Both are 500-volt units. The CC20 has maximum dimensions of .503" in length and .200" in diameter; its standard capacity range is 400 μμfd. to



2150 μμfd., and its resistance tolerance is ± 20% below 1 megohm. The CC25 has maximum dimensions of .790" in length and .260" in diameter; the standard capacity range is 970 μμfd. to 5000 μμfd., and resistance is ± 20% below 1 megohm and ± 30% above 1 megohm. (*Centralab*, Div. of *Globe-Union Inc.*, 900 E. Keefe Ave., Milwaukee 1, Wis.)

TUBE SOCKET ADAPTERS

You can modernize your present test equipment with these simple cathode-ray tube socket adapters. No rewiring is necessary—you just plug them in. They may

be used for testing the new narrow-neck 110° tubes, for life-testing and aging. Model 110-R has a .600 pin-circle diameter, Model 110-S a .820 pin-circle diameter. (*Pomona Electronics Co., Inc.*, 1126 W. Fifth Ave., Pomona, Calif.)

HOBBY CHEST

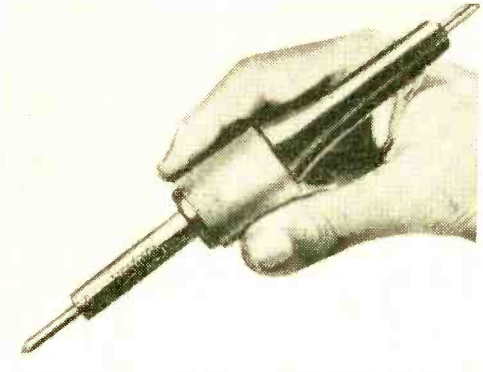
The X-acto #88 hobby chest carries a full line of cutting knives and blades as well as a hand drill, vise, block plane, sand-

er, spokeshave, hammer and many other precision hobby tools. The blonde wood chest measuring 14" x 10" x 3½", comes with carrying handle plus a 96-page book of hobby projects. Price, $33.00. (*X-acto, Inc.*, 48-41 Van Dam St., Long Island City 1, N. Y.)

50-WATT SOLDERING PENCIL

Shown in the photo is a 50-watt soldering pencil with a ¼" coated copper tip. Capable of doing the work of 100-watt soldering irons, it weighs but two ounces. A new stainless steel alloy for the element housing plus a unique design in ventilation is said to insure a very cool, comfortable handle and maximum soldering efficiency.

Both element and tip give exceptionally



long life, reducing maintenance and replacement costs. Each is a separate part and replaceable independently. Designed for constant-duty, the pencil will operate on a.c. or d.c., any cycle. Ask for Catalog No. 24S. (*Hexacon Electric Company*, 569 W. Clay Ave., Roselle Park, N. J.) —30—

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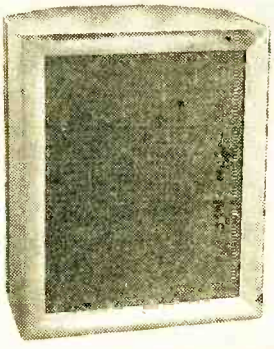
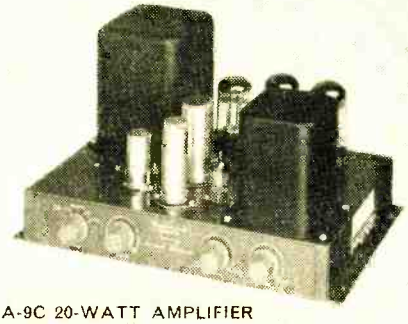
"BASIC" SPEAKER SYSTEM



RANGE EXTENDER



A-9C 20-WATT AMPLIFIER

HEATHKIT "BASIC RANGE" HIGH FIDELITY SPEAKER SYSTEM KIT

This amazing speaker system can fulfill your present needs and still provide for future expansion. Fine hi-fi performance the result of using high quality speakers in an enclosure especially designed for them. Features two Jensen speakers to cover 50 to 12,000 CPS within ± 5 db. Power rating is 25 watts, and impedance is 16 ohms. Enclosure constructed of veneer-surfaced plywood, ½" thick, and measures 11½" H x 23" W x 11¼" D. Precut and predrilled for quick assembly.

Model SS-1
$39.95

Shpg. Wt. 30 Lbs.

HEATHKIT RANGE EXTENDING HIGH FIDELITY SPEAKER SYSTEM KIT

Designed especially for use with SS-1 "Basic" system. Contains 15" woofer and compression-type super tweeter. Extends basic unit to 35—16,000 CPS, ±5.db. Impedance 16 ohms. Measures 29" H x 23" W x 17½" D, and is constructed of ¾" veneer-surfaced plywood.

Model SS-1B
$99.95

Shpg. Wt. 80 lbs.

HEATHKIT A-9C HIGH FIDELITY AMPLIFIER KIT

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

Model A-9C
$35.50

Shpg. Wt. 23 lbs.

HEATHKIT HIGH FIDELITY FM TUNER KIT

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

Model FM-3A
$25.95
(with cabinet)

Shpg. Wt. 8 lbs.

HEATHKIT BROADBAND AM TUNER KIT

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

Model BC-1A
$25.95
(with cabinet)

Shpg. Wt. 8 lbs.

HEATHKIT "MASTER CONTROL" HI-FI PREAMPLIFIER KIT

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

Model WA-P2
$19.75
(with cabinet)

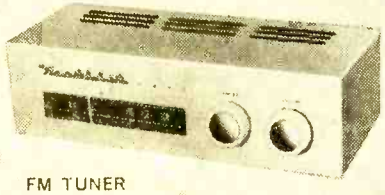
Shpg. Wt. 7 lbs.

HEATHKIT 25-WATT HIGH FIDELITY AMPLIFIER KIT

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

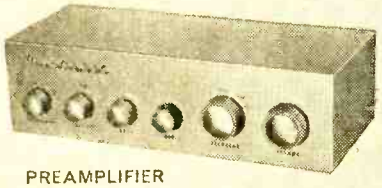
Model W-5M
$59.75

Shpg. Wt. 31 lbs.

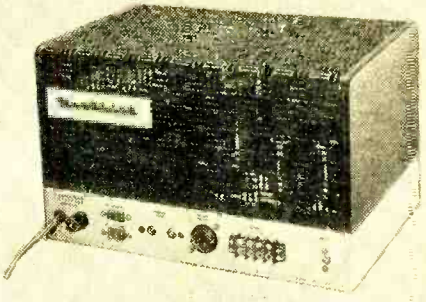


FM TUNER

AM TUNER



PREAMPLIFIER



W-5M 25-WATT AMPLIFIER

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

TRANSISTOR PORTABLE RADIO

HEATHKIT TRANSISTOR PORTABLE RADIO KIT

A new concept in radio reception! Now you can forget about external electrical connections and have fine radio performance anywhere! Low-drain circuit using regular flashlight cells makes battery operation cheaper than power-line operation of table model sets. Tunes 550 to 1600 kc and features a 4" x 6" speaker for "big-set" tone, six Texas Instrument transistors for fine sensitivity and selectivity, built-in rod-type antenna, and unbreakable molded plastic cabinet in "Holiday" gray. Measures 9" L x 8" H x 3¾" D. Appearance and performance are unmatched at this price level. Easy to build! Shpg. Wt. 4 lbs.

Model XR-1

$34.95

(with cabinet less batteries)

HEATHKIT BROADCAST BAND RADIO KIT

Covers 550 to 1600 kc with good sensitivity and selectivity. Has 5½" PM speaker for good tone quality. Features transformer power supply and built-in antenna. Signal generator recommended for alignment. Cabinet, as shown, available separately. Shpg. Wt. 10 lbs.

Model BR-2

$18.95

(less cabinet)

HEATHKIT CRYSTAL RADIO KIT

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

Model CR-1

$7.95

HEATHKIT ENLARGER TIMER KIT

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

Model ET-1

$11.50

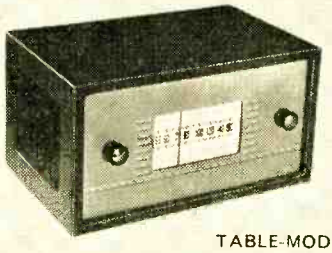
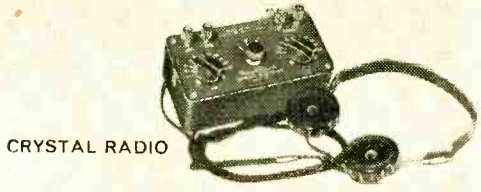


TABLE-MODEL RADIO



CRYSTAL RADIO

ENLARGER TIMER

HEATHKIT FUEL VAPOR DETECTOR KIT

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

6-volt FD-1-6, 12-vt. FD-1-12

$35.95 each

HEATHKIT RF POWER METER KIT

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

Model PM-1

$14.95

HEATHKIT TRANSISTOR RADIO DIRECTION-FINDER KIT

The Heathkit Transistor Radio Direction-Finder model DF-1 is a self-contained, self-powered, 6-transistor super heterodyne broadcast radio receiver incorporating a directional loop antenna, indicating meter, and integral speaker. It is designed to serve primarily as an aid to navigation when out of sight of familiar landmarks. It can be used not only aboard yachts, fishing craft, tugs, and other vessels which navigate either out of sight of land or at night, but also for the hunter, hiker, camper, fisherman, aviator, etc. It is powered by a 9-volt battery. (A spare battery is also included with the kit.) The frequency range covers the broadcast band from 540 to 1600 kc and will double as a portable radio. A directional high-Q ferrite antenna is incorporated which is rotated from the front panel to obtain a fix on a station and a 1 ma meter serves as the null and tuning indicator. The controls consist of: tuning, volume and power (on-off), sensitivity, heading indicator (compass rose) and bearing indicator (antenna index). Overall dimensions are 7½" W x 5⅞" H x 5⅜" D. Supplied with slip-in-place mounting brackets, which allow easy removal from ship bulkheads or other similar places. Shpg. Wt. 4 lbs.

Model DF-1

$49.95

(Available after November 15)

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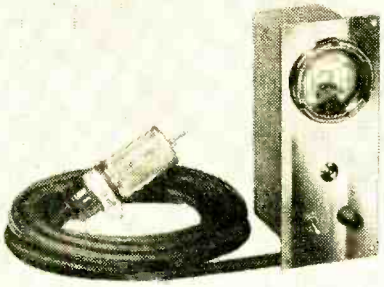
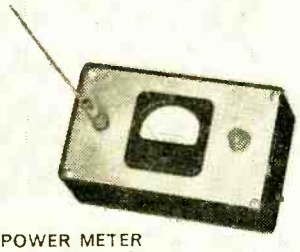


FUEL VAPOR DETECTOR

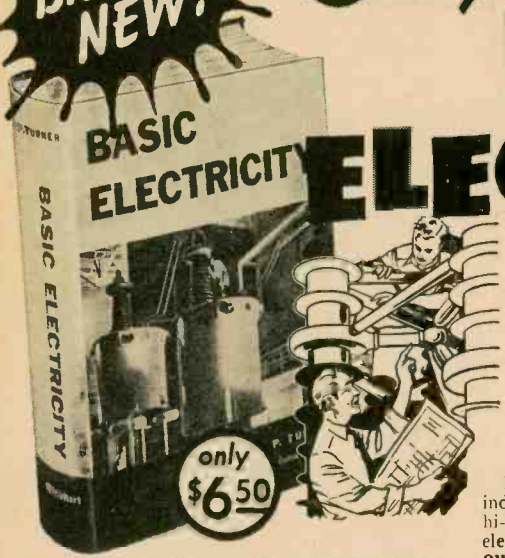


POWER METER

RADIO DIRECTION-FINDER

BRAND NEW!

Complete training in BASIC ELECTRICITY



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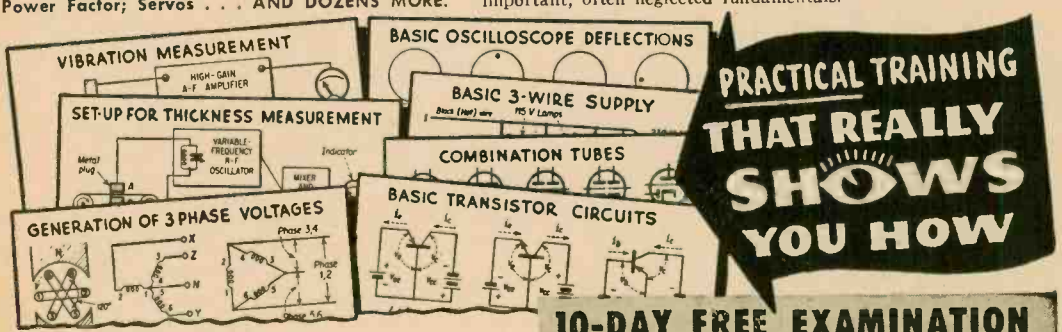

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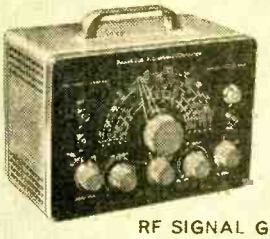
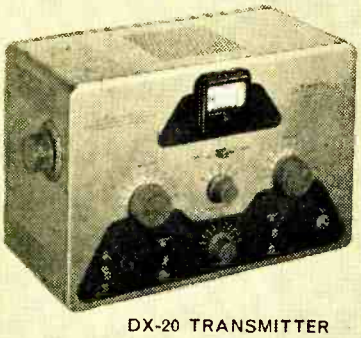


RF SIGNAL GENERATOR



DX-20 TRANSMITTER

GRID DIP METER

HANDITESTER

HEATHKIT DX-20 CW TRANSMITTER KIT

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

Model DX-20

Shpg. Wt. 18 lbs. **$35.95**

HEATHKIT GRID DIP METER KIT

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

Model GD-18

Shpg. Wt. 4 lbs. **$19.95**

HEATHKIT RF SIGNAL GENERATOR KIT

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

Model SG-8

Shpg. Wt. 8 lbs. **$19.50**

HEATHKIT HANDITESTER KIT

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

Model M-1

Shpg. Wt. 3 lbs. **$14.50**

HEATHKIT ETCHED-CIRCUIT VTVM KIT

Sensitivity and reliability are combined in the V-7A. It features 1% precision resistors, large 4½" panel meter, and etched circuit board. AC (RMS) and DC voltage ranges are 0—1.5, 5, 15, 50, 150, 500, and 1500. Peak-to-peak AC ranges are 0—4, 14, 40, 140, 400, 1400 and 4000 volts. X1, X10, X100, X10k, X100k, and X1 megohm.

Model V-7A

Shpg. Wt. 7 lbs. **$24.50**

HEATHKIT ALL-BAND RADIO KIT

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

Model AR-3

Shpg. Wt. 12 lbs. **$29.95**

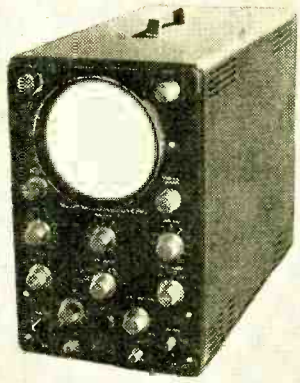
(less cabinet)

HEATHKIT "GENERAL PURPOSE" 5" OSCILLOSCOPE KIT

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

Model OM-2

Shpg. Wt. 21 lbs. **$42.50**



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VACUUM TUBE VOLTMETER

ALL-BAND RADIO

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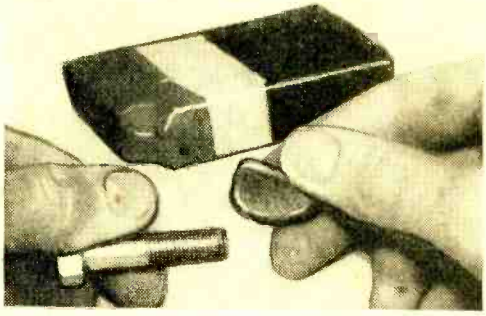
Tips and Techniques

(*Continued from page* 30)

this. After replacing the tip, heat it and immediately rub the area right behind the point with a rubber heel or eraser. The break usually occurs at the thin portion just below the tip. By spreading a ring of "foreign matter" (in this case, rubber) in that area, oxidation is slowed down and tip life can be extended by 50%. —*D.L.S.*

CLAY CLEANS BOLT THREADS

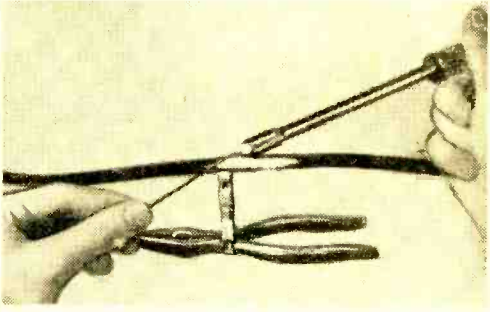
To clean the threads of a bolt or screw, use modeling clay. Press a blob of the clay firmly against the threads, and particles of



dirt and filings deep in the thread flutes will adhere to it. One small piece of clay will last a long time if it is kneaded with the fingers after using. —*J.A.C.*

TWIN-CLIPS AS SOLDERING VISE

Need a "vise" to hold wires or other small parts while you solder them? Twin-clips (Mueller #22) are ideal for this purpose. One end can be clamped to a pair of pliers or other heavy tool as a base, and



the opposite jaws used to hold the parts being soldered. If a ready-made twin clip isn't handy, two ordinary clips can be fastened together by snipping off the wire supports, removing the screws, and using one to screw the clips together. —*J.A.C.*

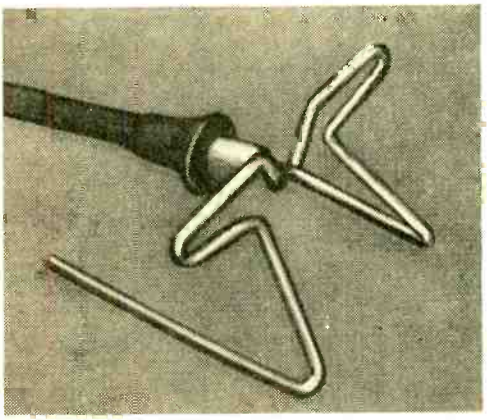
TAPE "HOLD-DOWN" KNOBS

Do you ever have occasion to operate your tape recorder in a vertical position? You can cope with the problems of tape spillage and falling reels by means of a

simple trick. Try pushing removable pencil erasers over the ends of your tape spindles. You'll find that they hold the tape reels firmly in place and can be easily removed when desired. —*R.W.L.*

ALUMINUM WIRE SOLDERING STAND

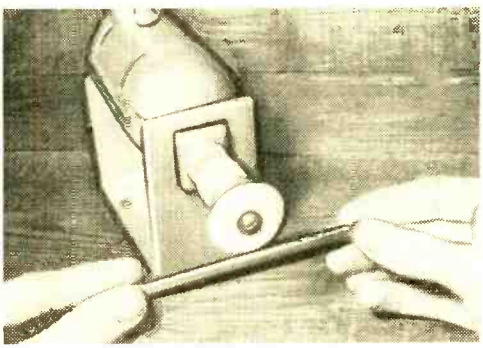
You can make a neat little stand for your soldering iron from aluminum wire. Such a stand is not only convenient, but it



will help keep the iron tip cooler and hence minimize the need for frequent re-tinning. A piece of bare 26"-long aluminum wire, about size number eight, should be bent as shown. It can be bent into almost any fancy shape. The object is not to "streamline" but to aid heat radiation. —*C.A.C.*

ERASER IS POLISHING WHEEL

Need a polishing wheel for your electric drill or hand power tool? A circular typewriter eraser mounted on a machine screw or mandrel makes a handy polishing wheel for brightening up pieces of metal. It will clean and brighten corroded or dirty insulators, electrical plugs, connectors, con-



tacts and tools. The mild abrasive of the eraser may even be used to polish chrome microphone stands without danger of scratching the bright metal. But don't use too much pressure. —*J.A.C.*

Float-Phase Amplifier

(*Continued from page* 49)

burned-out parts that could have been saved if a sensible approach had been used. Be safe, rather than sorry, and use a couple of simple tests like these.

First: Without plugging the amplifier in, check the resistance between the screen-grid (pin 4) of either *V2* or *V3* and chassis with your ohmmeter. This resistance should be more than 30,000 ohms. If it is much less than this value, a short circuit exists somewhere and the wiring should be checked.

Second: Install the tubes in their sockets, apply power, and watch for overheating of resistors and the tube elements. If everything seems okay, plug in the speaker and phono player, and you are ready for the listening test.

Any speaker in a good enclosure should provide fine perfomance when used with this little amplifier. With a standard crytal phono-cartridge or an FM tuner as the signal source, the amplifier can easily drive a de luxe three-way system. —30—

INFRARED—Jack of All Trades

(*Continued from page* 56)

are therefore slightly warmer than surrounding tissue.

You may call for an IR camera the next time you buy a house. By "photographing" each outside wall, you can tell where there are voids in the insulation or other costly heat-leaks.

Other IR Applications. Once an unwelcome condition is spotted with the IR camera, an infrared pyrometer can monitor the spot's temperature against time.

Riding the nation's railroads, you may chance to see small containers shaped like a wedge of white cheese on each side of the tracks. These are "hotbox" detectors, made by Servo Corp. of America, New Hyde Park, N. Y. They can instantly spot a dangerously hot journal bearing box in a car's undercarriage before a wheel is sheared off and lives lost. The switchman in a nearby tower can glance at a chart on his recorder and immediately tell which bearing on which car of a passing train is hot. Ten of these $20,000 systems are now working successfully.

Infrared detectors can also be used to measure dimensions with ease. In dozens of steel mills, pairs of detectors are measuring the width of 100"-wide hot steel strip to hold it to an accuracy of one-eighth of an inch as it squirts out of the rolling mill.

There are many other interesting appli-

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5V6GT
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5Y4G
6AB4
6AC7
6AG5
6AF4
6AH4GT
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6AM8
6AN4
6N8
6AQ5
6AQ7GT
6AS5
6AS7G
6AT6
6AU4GT
6AU5GT
6AU6
6BV5GT
6AV6
A6X4GT
6BA6
6AX5GT
6BC5
6BC7
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6J6
6K6GT
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6N7GT
6S4
6S7G
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6SB7Y
6SC7
6SF5
6SF7
6SG7
6SH7
6SJ7GT
6SK7GT
6SL7GT
6SN7GT
6SQ7
6SV7
6SS7
6T8
6U4GT
6U7G
6U8
6V3
6V6GT
6W4GT
6W6GT
6X4
6X5GT
6X8
6Y6G
7A5
7A7
7B5
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7C5
7C6
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cations of infrared equipment, and new ones are being developed every day. Infrared is already changing your life in many unseen ways and will change it even more in the near future. —30—

Winter Hi-Fi Season

(*Continued from page* 63)

arm length and tracking angle ("offset" of the cartridge holder).

It is good news for loyal partisans of the GENERAL ELECTRIC cartridge that its famous design has been brought up to date in the new VR-11 model. Clean, peak-free response made the old G.E. cartridge a favorite for nearly a decade. This characteristic smoothness of sound has been retained in the new model, and the drawbacks of the old design are eliminated. The frequency response has been extended to 20,000 cps, and by increasing the mechanical compliance of the stylus assembly, the tracking weight reduced to about 4 grams. This puts the G.E. VR-11 on par with current design standards and enables the new cartridge to continue the reputation of its predecessor as a low-priced short-cut to top-notch sound.

Among loudspeakers, the EICO-HEGEMAN had its first public showing. Its spike-shaped omnidirectional tweeter and the unusual slot-loaded bass horn astounded both eye and ear.

Tape and Stereo. A spate of new tape recorders made its debut. BOGEN and LAFAYETTE aim their new models at the advanced amateur, who wants nearly professional quality at a tolerable price. Of course, a good tape recorder is necessarily a piece

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See Other Side for More Information to Better Pay

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of painstaking precision mechanics, which never comes cheap.

Compactness is the keynote of several extremely well designed foreign entries in the tape recorder field. NORELCO and TANDBERG offer neatly packaged, small portable machines which are nevertheless capable of distinctly hi-fi performance. Stereo is optional on both models.

With stereo gaining ground among serious hi-fi'ers, and with the growing number of stereo tapes now available, there has been much interest in stereo playback decks. These look like tape recorders, but are intended only for playback of stereo tapes. Lacking the recording section, they represent the least expensive method for adding a stereo program source. BELL, VIKING, and PENTRON are among the low-priced stereo favorites.

One way to beat the relatively high cost of stereo is by kit building. Several new kit lines, notably LAFAYETTE, TELE-MATIC and ARKAY, now offer two-channel amplifiers and control units. With monaural hi-fi tending toward "packaged" and ready-made components, stereo now presents a new challenge to fellows with a keen ear and a hot soldering iron. —30—

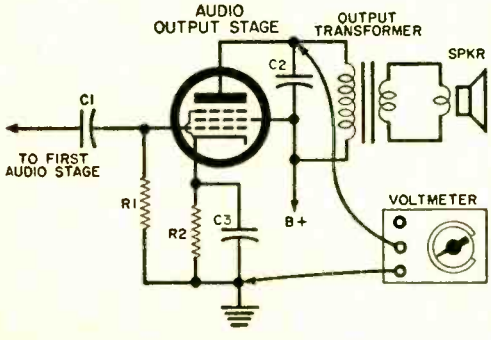
Pocket Size Test Instruments

(*Continued from page* 46)

tained from the center tap and the ground side of the combination.

To use this instrument to measure d.c. voltages, connect to the "COM." and "DC" terminals. Adjust *R1* until the neon bulb just lights, then read the applied voltage on the dial. The polarity of the applied voltage can be identified by noting which of the two electrodes (in the neon bulb) lights—this is always the *negative* electrode.

A similar technique is used for a.c. voltage measurements and when the instru-



Correct method of connecting the volt-output meter to the last audio stage of an amplifier in order to obtain output indications. See text.

Carl & Jerry (*Continued from page 8*)

Norma declared with a beaming smile. "No, I don't think Mike is immune to feminine charm; he's just cagey. He takes care of the accounting machines in our office, and we've been dating for three or four months now. I just happen to know he's dating two other girls about as often as he dates me. He's good-looking, a good dresser, polite, free with his money, intelligent—and just too darned cool, calm, and uninterested!"

"I suppose you've tried the usual feminine wiles," Jerry said solemnly.

"All of 'em! I've tried the poor-little-helpless-me-and-big-strong-smart-you routine. I've practically drenched myself with everything from 'Chanel Number Five' to 'Sweet Surrender.' I prepared and fed him a steak dinner that cost me half a week's salary for groceries. I've even taken up his hobby of bowling, which I despise. And I've tried being 'busy' when he asked for a date—you know, the old hard-to-get business. I've not missed a trick, but there's nothing."

"Your trouble," Carl offered, "is that you're trying to make *him* like *you*. You ought to be making him like himself when he's *with* you. Guys are dumb. When this happens to them, they think it's the girl they like."

Norma gave him an astonished, wide-eyed look as she said: "Hey, you're not supposed to know that! What do you think I was doing with that clinging-vine stuff?"

"That's too old and easy to see through. This character sounds like a smart cookie, and we need something more subtle. If we just had some way to make him feel better when he's with you than he does at any other time, he wouldn't be able to stay away from you."

"That's a pretty big 'if,'" Norma sighed.

"HM-M-M-M," Jerry said, with a wrinkled brow; "I'm beginning to get an idea. I was reading a theory the other day that there's a definite relationship between the ionization of the atmosphere and the moods of people. Now if we could just surround him with a favorable ionization when he's in your presence—" his voice trailed off as the far-away "inventing" look came into his eyes.

"What's the normal ionization of the atmosphere?" Carl asked.

"The ionosphere has a positive charge and the earth a negative one. Ordinarily a steady stream of positive ions flows down through the atmosphere to the earth. The current represented by this rain of ions averages about 3.7 microamperes per

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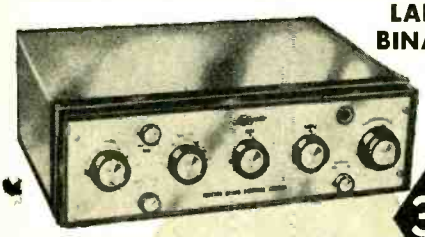

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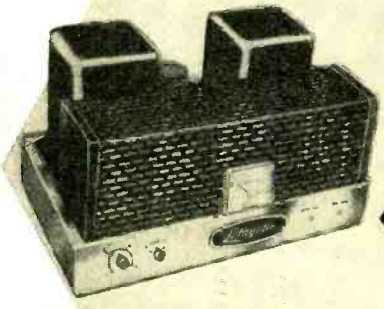

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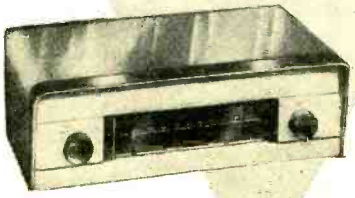

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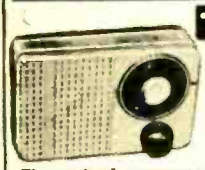
MS-279—Sensitive matching earphone ..... Net 2.39

3 TRANSISTOR SUPERHET POCKET RADIO KIT



- A TRUE POCKET SUPERHET RECEIVER-NO EXTERNAL ANTENNA!
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A remarkable sensitive, super-selective pocket superhet receiver with astonishing performance over the complete broadcast band. Uses 2 high-frequency and one audio transistor plus efficient diode detector and features 2 specially matched IF transformers for maximum power transfer. The components are housed in a professional looking beige plastic case. The receiver's appearance enhanced by attractive maroon and silver station dial. Sensitive built-in ferrite antenna eliminates need for external antenna. A designer's dream in a true pocket superhet receiver! Complete with all parts, transistors battery, case, dial and easy to follow step-by-step instructions. 4⅛" x 2⅝" x 1-1/16". Shpg. wt., 1 lb.

KT-116—Complete Kit, less earphone ..... Net 16.95
MS-260—Super Power Dynamic Earphone ..... Net 3.95

LAFAYETTE SIGNAL GENERATOR

COMPLETELY WIRED AND TESTED! ACCURACY AND QUALITY GUARANTEED!

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- **FREQUENCY 120KC to 260MC!**
- **120KC to 120MC ON FUNDAMENTALS!**
- **30 DAY TRIAL PERIOD! FULL REFUND IF YOU ARE NOT SATISFIED FOR ANY REASON**

Completely wired and tested instrument. Do not confuse with kits sold in the same price range. Has the quality and accuracy of instruments selling for 3 to 4 times as much. Six overlapping ranges — 120KC to 320KC, 320KC to 1000KC, 1MC to 3.2MC, 3.2MC to 11MC, 11MC to 38MC, 37MC to 130MC — all on fundamentals — calibrated harmonics from 120MC to 260MC. Switch between internal modulation at 400 cps or any external source at other frequencies. 400 cps signal can be used separately. Outputs are unmodulated RF, modulated RF and 400 cps audio. RF output is in excess of 100,000 micro volts. Jacks are provided for high or low RF output.

Highly stable special circuit design. Fine adjust RF control. AF output 2-3 volts, input 4 volts, across 1 megohm. 5 inch etched dial plate — protected by clear plastic bezel. Common AF terminals for EXT-MOD input and INT-AF output eliminates need for special connectors. Gray metal case — carrying handle — complete with leads, line cord and plug. For 105-125V. 50-60 cycle A.C. Shpg. wt., 8 lbs.

LSG-10 — Signal Generator 22.50

NEW "DYNA-SLIM" MICROPHONE

- **HIGH IMPEDANCE — 50,000 OHMS**
- **ON-OFF SWITCH**
- **"QUICK-SLIP" ADAPTER**

New dynamic, high output microphone with all the features of "mikes" costing 3 times Lafayette's price! Output level —55 db. Smooth response from 60 to 10,000 cycles. Omnidirectional head. External on-off switch. Slips on or off stand adapter in a wink. Standard ⅝" — 27 adapter permits tilting mike for multi-angle use. Satin black and chrome finish. Complete with detachable cable and connector. 8" long, 1⅛" max. dia. tapered panel. Shpg. wt., 2 lbs. Imported

PA-43 ..... Net 6.95

20,000 OHM PER VOLT MULTITESTER SEMI KIT

- **20,000 OHMS PER VOLT DC—5,000 OHMS PER VOLT AC**
- **40 MICROAMPERE 3" D'ARSONVAL METER MOVEMENT**
- **HIGH INPUT RESISTANCE ON ALL DC AND AC RANGES**

A new kind of kit—the difficult work is already done—you wire in only a few multipliers and mount the battery holder to complete the unit. A fine high sensitivity (20,000 ohms per volt DC —5000 ohms per volt AC) instrument employing a 3" 40 microamp movement. Has 4 DC voltage, 4 AC voltage, 2 DC current, 3 resistance and 2 db ranges. Complete with test leads and detailed instructions. Size 3⅝" x 4⅝" x 1⅝". Shpg. wt., 3 lbs.

TK-20—Kit ..... Net 11.95

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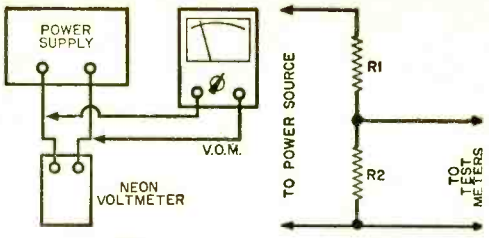

Voltmeter calibration procedure using (A) variable power supply and (B) a voltage divider.

ment serves as an output meter, except that connections are made to the "COM." and "AC" terminals. *Both* electrodes light on a.c. —30—

Audio Generator Kit

(*Continued from page* 77)

6CL6 cathode follower buffer, a 6CL6 cathode follower output, and a 5Y3 rectifier —the Knight audio generator is designed for operation from a standard 50-60 cycle, 117-volt a.c. line. Only 8½"x11"x7½" overall, it weighs approximately 15-16 pounds. With its sturdy metal case, small size, and comparatively light weight, it is suitable for field as well as laboratory applications.

After the kit has been carefully unpacked and checked for missing or damaged parts, basic hardware and larger components are mounted, using machine screws and hex nuts.

The assembly steps, as outlined in the easy-to-understand instruction manual, are broken down into convenient stages. This makes the job easier if you like an occasional coffee break. The stages are: mounting the parts on the chassis; mounting the front panel; installing the a.c. wiring; and building and mounting the tuning capacitor assembly. The range or band switch is assembled separately and installed after most of the circuit wiring is complete.

With the wiring completed and double-checked for possible errors or accidental shorts, the tubes are installed and the instrument turned on. After adequate warm-up time (at least 15 minutes), two adjustments are made—one to set the output level and one to establish proper frequency calibration. A VTVM or high-impedance multimeter may be used for both of these adjustments, but an oscilloscope (if available) is preferred for the final frequency adjustment.

Special Features. Both continuously variable output level and step-type voltage attenuation output controls are provided,

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7. Instructions on how to go into business.
8. Continuous consultation and help.
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permitting the signal level to be adjusted smoothly from 0 to 10 volts (r.m.s.) into a 600-ohm load. The output is flat within 1 db over the entire operating range. The output signal is a sine wave, of course, with very little inherent distortion. Harmonic distortion is less than 0.25% from 100 cps to 20 kc., and less than 0.3% over the entire tuning range. When driving a 600-ohm load to maximum output, the distortion is less than 0.5%.

The audio generator includes one feature useful to beginner and advanced worker alike. All resistors are mounted on cardboard strips and identified (*R1, R2, R3,* etc.). You don't have to search through a pile of components to locate a particular resistor.

Circuit-wise, the audio generator features the NBS-developed Sulzer bridged-T *RC* audio oscillator circuit, an arrangement noted for its stability, low distortion, and constant output. In addition, the use of cascaded cathode-follower stages permits a high degree of isolation between load and oscillator, insuring consistent performance with varying loads.

Comment. Your reviewer had no trouble assembling and checking out the test model. No errors in the instructions were noted, and all components mounted without "fitting" difficulties. The completed instrument operated when first plugged in.

Assembly time will vary with the individual worker, of course, but you can plan on spending a couple of evenings on assembly and wiring—or a single day on a weekend. It is somewhat easier to assemble than the average hi-fi preamplifier.

It's a good idea to recheck the adjustments at periodic intervals—say every two to four months of operation. Tube replacement, aging, or other factors might make small readjustments necessary if peak performance is to be maintained. —30—

Transistor Topics

(*Continued from page* 72)

station, readjust *L1*'s core until the signal is picked up at a "dead" point on the receiver's dial.

The maximum transmitting range will vary with the sensitivity of your receiver and the length of antenna used but, in general, will fall somewhere between 15 and 20 feet.

Power Tetrode Transistor. In past columns we have discussed both high-frequency *tetrode* transistors and *"high power"* triode transistors. Now, Minneap-

GIANT EXPANSION SALE!

OUR LARGER QUARTERS ALLOW US TO BRING YOU THE ADVANTAGES OF TRUE VOLUME BUYING! TONS OF RADIO PARTS BOUGHT FOR THIS SALE! NOWHERE ELSE CAN YOU GET SO MUCH VALUE FOR YOUR DOLLAR!

FAMOUS KIT KING® DOLLARBUYS!

70 COILS & CHOKES. RF, IF, ANT., Large variety, incl. slug-tuned. Wt. 2 lbs. Reg. $15.

3 LBS. HARDWARE. Reg. $8. Approx. 2000 pcs. asstd. screws, brackets, etc.

40 MOLDED CONDENSERS, Black Beauties, porcelain, etc. Reg. $8. .0001 to .1 mf to 1000 V. Oils incl. Wt. 1 lb.

40 PRINTED CIRCUIT PARTS. Diodes; carbon, precision resistors; chokes; molded, ceramic cond.; boards. Reg. $15.

150 RESISTORS! ½, 1 W. 40 values: 5 ohms to 10 megs. 5%, too. Reg. $15.

2 TRANSISTOR TRANSFORMERS. UTC "bouncer" type. Reg. $10. Interstage: 1 x ¾ x ¾". Imp. ratios unknown. Color-coded leads.

WORLD'S SMALLEST RADIO KIT. 2½ x 1¾ x ¾" w/permeability tuner, diode, all parts, directions. Reg. $3.50.

SEVEN 25-ft. ROLLS WIRE. Reg. $3.75. Asstd. colors, stranding, insulation. #18 to 24. Wt. 2 lbs.

80 CARBON RESISTORS. Insulated; IRC, A-B, etc. Many 1 & 5%. ½, 1 w. 10 ohms to 10 megs. 30 values. Reg. $15.

2 SUB-MINI SOLENOIDS. 1 x ⅝ x ⅝". Change elec. energy to mech. 12 VDC @ 300 ma. actuates plunger. Wt. 2 oz. Reg. $5.

70 TUBULAR CONDENSERS. Reg. $12. Paper, molded, oil. .0002 to .25 mf to 2000V. Wt. 2 lbs.

40 TUBE SOCKETS. Reg. $8. 4 to 14 prong. Bakelite, ceramic, mica. Shield types, too! Wt. 2 lbs.

40 SUB-MINI RESISTORS. Only ¼" long. 20 values: 15 ohms to 10 megs. Color-coded. Reg. $6.

4 OUTPUT TRANSFORMERS. 50LA, 35L6, 6V6, 50B4 to 3-4 ohm v.c. Wt. 1 lb. Reg. $8.50.

8-PC. NUTDRIVER SET. Plastic handle. 3/16, 7/32, ¼, 5/16, 11/32, ⅜, 7/16" steel socket wrenches in plastic case. Wt. 1 lb. $3 value.

15-PC TWIST DRILL SET. 1/16 thru ¼" x 64ths; in graduated plastic holders. Reg. $4.

40 PRECISION RESISTORS. Carbofilm, Wilkors, etc. ½ to 1 W asstd. Wt. ½ lb. Reg. $18.

100 RADIO PARTS — surprise asstmt. Reg. value over $15! Wt. 3 lbs.

60 TERMINAL STRIPS & BOARDS. wide variety solder lug, binding, etc. Wt. 1 lb.

30 DISC CONDENSERS. Transistor & printed circuit types. Reg. $8.

50 PLUGS & RECEPTACLES. Audio, power, chassis, panel & spkr. types. Wt. 2 lbs.

80 MICA CONDENSERS. Silver. 5% incl. 30 values: .00001 to .01 mf. To 1000V. Wt. 1 lb. Reg. $5.

40 POWER RESISTORS. WW, candohm, vitreous, sand-coated. 15 values: 5 to 50W, 35 to 11000 ohms. Wt. 2 lbs.

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10 "POLY" BOXES. Clear plastic, hinged, w/snap locks. Asstd. sizes. Reg. $2.50.

60 ASSORTED KNOBS. Bakelite, plastic; including set-screw types. Wt. 2 lbs. Reg. $9.

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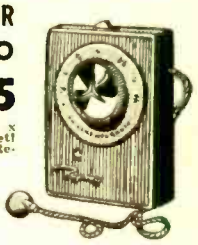

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POCKET MULTI-TESTER

3½ x 2 x 1½" bakelite case, 100 ohms/V. Zero adj. 0/15/150/1000 AC & DC V; 0/150 ma; 0/100,000 ohms. w/test leads and battery ... in orig. pack. $13 value! **$6.99**

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LEKTRON

131-133 EVERETT AVE. CHELSEA 50, MASS.

olis-Honeywell (Semiconductor Products Division, 2753 Fourth Ave., Minneapolis 8, Minn.) has announced the pilot production of a *power tetrode* transistor. We'll try to keep you informed on its progress as time goes on.

Compared to power triodes, this new transistor, Type No. H200E, offers the advantages of lower distortion, higher efficiency, better stability, and improved frequency response—about 50% better than triodes. Potential applications include special control circuits, servo amplifiers, and —of special interest to POP'tronics readers —hi-fi audio amplifiers.

A typical circuit for this new transistor is shown in Fig. 3. Parts values are omitted since these will depend on the final characteristics of the transistors, on the operating voltages used, and on the type of operation desired. However, the bias voltages and load arrangements are similar to those for a corresponding triode transistor, except for the connections to the second base ($_{B2}$), which is operated with a *reverse* bias, as with low-power tetrodes.

Product News. Quite a number of price cuts have been announced in recent months. Motorola introduced a 15% across-the-board reduction in the prices of their auto radio power transistors. Philco Micro-Alloy transistors have come down 33%. And G.E.'s high-frequency tetrodes have been cut in price from 42% to as much as 75% below former prices.

Jim Sweeney, manager of marketing for G.E.'s Semiconductor Division, recently predicted that semiconductor sales would reach one billion dollars annually within the next ten years.

Wireless loudspeakers are being used in a drive-in movie in New Jersey. Each loudspeaker is actually a transistorized receiver, picking up a signal sent out by a low-power transmitter, modulated by the audio signal from the picture's sound-track.

A *new* transistor manufacturer is now in production in the United States—Industro Transistor Corp., 649 Broadway, New York 12, N. Y. They have a valuable Transistor Specifications & Interchangeability Guide available. Ask them for a copy if you would like to have one.

Transistor circuit booklets can be obtained either free or at nominal cost (usually 25¢ to 50¢) from almost all transistor manufacturers who sell through local and mail order jobber outlets. Check with your favorite parts distributor concerning availability and price. You'll want a "full library" of current booklets.

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

Lou

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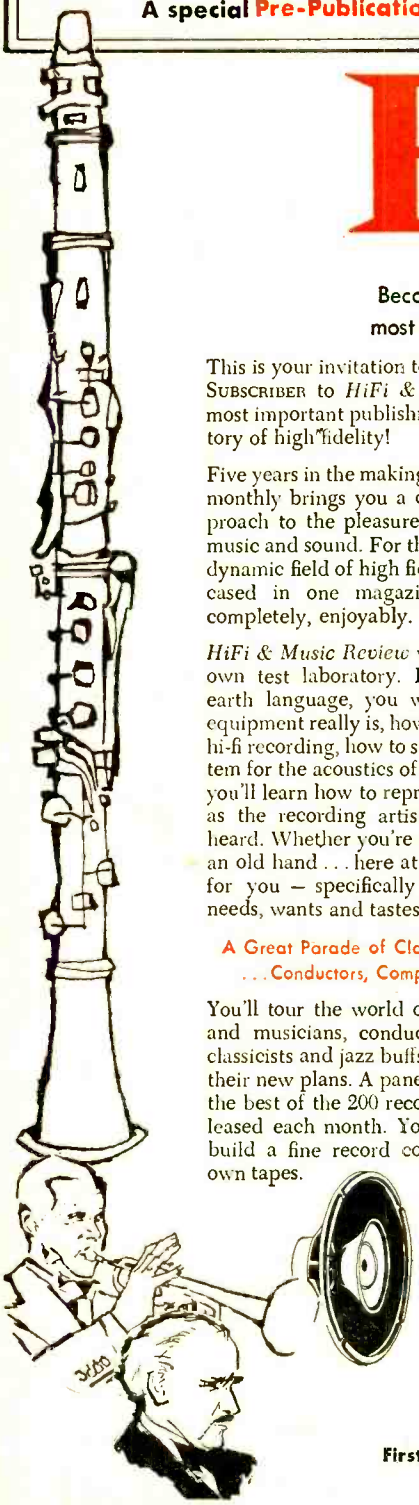

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Short-Wave Report

(*Continued from page* 64)

The following is a resume of the current reports. If your report doesn't appear, please bear in mind that we receive much more material than we can include in the space allotted to us. All times shown are Eastern Standard and the 24-hour system is employed.

Afghanistan—A rare country finally operating on an audible frequency, Kabul has been noted recently on 18,640 kc. at 1000-1130 with English news at 1030. *(100)*

Argentina—*Radio Belgrano*, LRY1, Buenos Aires, 9760 kc., can be tuned from 0445 to 2315 and is best around 1930. All Spanish with music, no Eng. noted. *(286)*

Australia—The "Australian DX'ers Program" can now be heard as follows: to Pacific Isles on Saturdays at 1700 on 17,790 kc.; to Africa on Sundays at 0030 on 21,590 or 21,680 kc.; to British Isles, Europe, and South Pacific on Sundays at 0345 on 11,710 kc.; to Asian listeners on Sundays at 1100 on 11,710, 9580, and 7220 kc.; to Eastern N.A. on Sundays at 0830 and to Western N.A. on Sundays at 1100, both on 11,810 kc. *(KB, GW, HZ, 61)*

Austria—*Osterreicher Rundfunk*, Vienna, now carries Eng. on 7245 kc. at 0430-0530 at good level. *(11)*

Brazil—A new outlet in Brazil has been noted with news at 1900 and seems to give location as Rio de Janeiro. Some sources claim this to be *Radio Guaiba*, 11,785 kc., Porto Alegre. Another new one is on 9730 kc., noted around 2130, and may be *Radio Sociedad Farroupilha*, Porto Alegre. *(AN)* (Editor's Note: The latter very likely is the new one also reported by *CH* as unidentified.)

ZYC26, *R. Globo*, Rio de Janeiro, 6035 kc., has been found at 1845-2000 with L.A. music on records, Portuguese anmts, and frequent ID. *(61)*

ZYW28, *R. Clube de Goiania*, is using 1 kw. on 11,735 kc. Reports for this one go to Rua Dois #5, Caixa Postal 62, Goiania, Estado de Goias, Brazil. *(7)*

British Guiana—*Radio Demerara*, ZFY, Georgetown, is on 5981 and 3255 kc. with 2000 watts power as follows: Sundays at 0445-2145; Fridays at 0415-2145; Saturdays from 0415 to 2245. *(GC)*

British Honduras—BHBS, Belize, 3300 kc., is usually very good at 1900-2200 with Eng. and some Spanish. *(DR)*

Dahomey—*R. Cotonou* has moved from 4868 to 4900 kc. and is heard from 1553 with instrumentals. The ID is in French. S/off is at 1530 weekdays, 1600 Sundays. *(166)*

Egypt—Cairo, 9795 kc., has been noted in Arabic to 1830, in Portuguese at 1830-1900, in Spanish at 1900-1930 (to South America), in Arabic at 1930-2000 (to N.A.). *(44, 61)*

The 17,915-kc. outlet is tuned with native music to 0815, Eng. news from 0815, and language at 0830 and again at 1135. Another Eng. period, to Europe, is aired at 1400-1520, with Eng. news being broadcast at 1500. *(23, 26, 59, 61, 82, 226)*

England—London is now operating on a new frequency of 25,650 kc. at 0445-0900 in

Arabic, 1900-1200 European languages. *(100)*

Ethiopia—*Radio Addis Ababa,* 9620 and 15,345 kc., now has English at 0500-0600 and 1315-1900, according to a letter from the station. *(JC)*

French Equatorial Africa—Brazzaville operates at 1330-1800 on 11,972 kc. in parallel with a new 11,931-kc. station. *(100)*

French Sudan—*Radio Soudan,* Bamako, is a new station noted on 4835 kc. from 1554 with variety music. Schedule is 1400-1600 daily (Saturdays and Sundays to 1700). Closing is with playing of "La Marseillaise." *(166)*

French Togo—Lome is now audible on 5038 kc. from 1600 with news in French, closing at 1629. This may be difficult to log. *(166)*

Germany—*The Voice of Germany,* Cologne, has begun a course in German for English listeners on Sundays and Wednesdays at 2330 on 9640 and 11,795 kc. *(DK, PM, WR)*

Ghana—The Ghana B/C System, Accra, is being heard on 4915 kc. at excellent level from 1615 to 1715/close, dual to 3366 kc. Programs are largely made up of information on the country of Ghana. *(208)*

Greenland—*Radio OZL,* Angmagssalik, 7570 kc., operates at 0900-0950 with 2 kw. Other frequencies are 500 and 2500 kc. for c.w. service. The basic task is collecting data from Greenlandic weather stations. *(286)*

Haiti—4VBS, *La Voix de Sud,* Cayes, 5750 kc. (new), is strong afternoons and evenings. There is an occasional Eng. ID. 4VGC, *R. Liberte,* is again on the air on 6135 kc. after being off for several months and is scheduled

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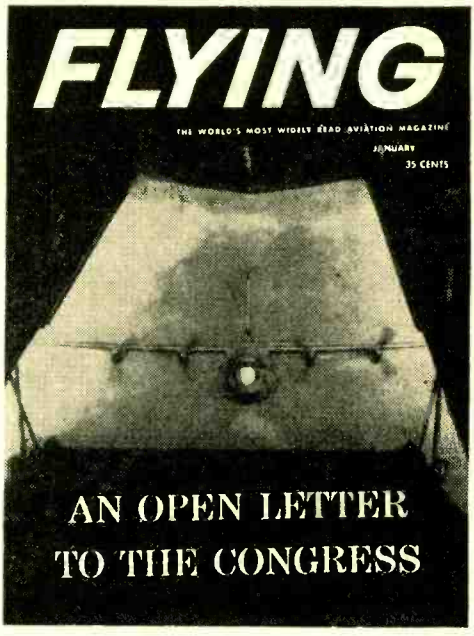

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at 0600-0900 and 1200-1300. 4VES, *La Voix de St. Marc*, St. Marc (new), is noted on 6175 kc. at 0630-0830 and 1700-1800; it is usually QRM'ed out after 1800. 4VCP, *La Voix de Nord*, Cap Haitien, 6220 kc., is back on the air after an absence of more than a year. The power is 300 watts and it is in parallel to 4VEA, 1430 kc. Schedule: weekdays at 0700-1000 and 1600-2030; Sundays at 1200-1800. *(4)*

Honduras—HRMT, *Radio Molino Rojo*, San Pedro Sula, 6185 kc., is a new station replacing HRSU, *Radio Progresso*. *(100)*

Iceland—A new schedule for TFJ, Reykjavik, 12,175 kc., is 0700-0815 and 1500-1600 daily. The 1600-1700 xmsn which was to have been aired daily has been dropped; the 1500-1600 xmsn which was for Sundays only is now daily; and the morning xmsn is an entirely new one. *(61)*

SHORT-WAVE ABBREVIATIONS

A—Approximate frequenc.
anmt—Announcement
c.w.—Morse code
Eng.—English
ID—Identification
kc.—Kilocycles
kw.—Kilowatts (power)
L.A.—Latin America(n)
N.A.—North America(n)
QRM—Station interference
R.—Radio
s/off—Sign-off
s/on—Sign-on
xmsn—Transmission from statio
xmtr—Transmitter used by station

India—Bombay has a new 100-kw. xmtr on 11,950 kc.; it is being heard well at 0700 s/on in Hindi, followed by entertainment. *(100)*

Delhi can be noted on 17,895 and 17,830 kc., the former at 0850-0900 and the latter from 2130, both in English. *(EK, 59)*

Ivory Coast—*Radio Abidjan*, 4940 kc., is heard until 1730 at strong level and is usually noted from 1630 with music and most anmts in French. *(208)*

Liberia—ELWA, Monrovia, has been noted on 15,197 kc. (dual to 21,535 kc.) at 1815-1942, on 9655 kc. at 2000-2130, and on 4770 kc. (formerly 4760 kc.) at 1630, with mostly English religious programs and signals at excellent levels. *(59, 61, 166, 313)*

Luxembourg—Reports on *Radio Luxembourg*, 6090 kc., should be sent to new address: *Radio Luxembourg*, 38 Hertferd St., London, W1, England. This station is widely reported late afternoons with English programs beamed to England. *(11)*

Mexico—XELUU, *R. Universidad*, Chihuahua, is a new station on 15,300 kc. It is being noted in the western states at 1300-1600 and 1700-2000 with all-Spanish anmts, and American and L.A. music. They seem to have xmtr trouble at times. *(7, 61)*

Monaco—3AM3, Monte Carlo, 6035 kc., has Billy Graham's program on Mondays at 1705-1735. They are said to have a new outlet on 9733 kc. *(JC)*

The new outlet on 9733 kc. has been noted at times from 1400 to 1600. The call is not known but it may be *3AM5*. English has been noted at 1530-1600. *(JM, 11)*

Mozambique—*Radio Clube of Mozambique*, Lourenco Marques, 15,080 kc., is heard from

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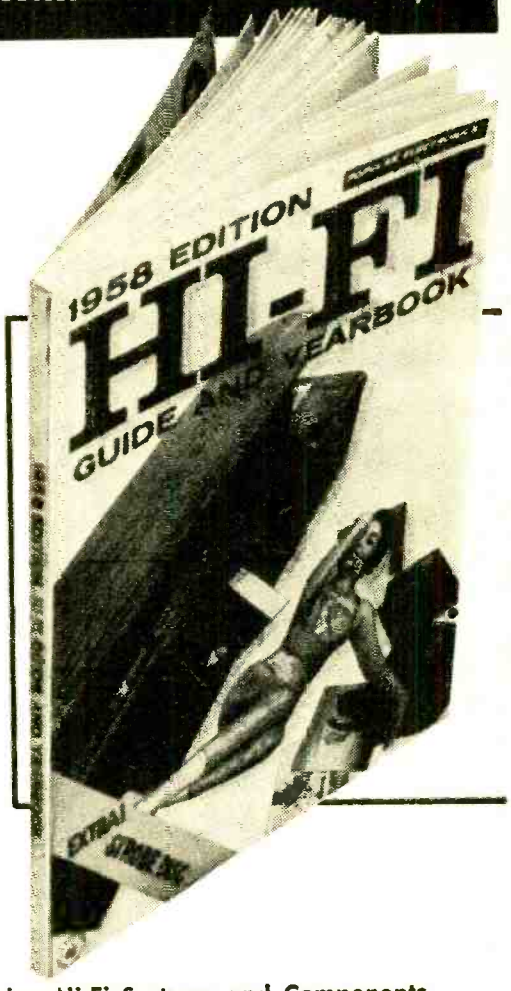

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1430 to 1515 s/off and again at 0000-0100 with many good recorded music shows and all-Portuguese anmts. Frequent ID follows a four-note gong. The 0000-0100 session is very well received. *(44, 61)*

Nicaragua—YNBX, *Radio Oriental*, Granada, has moved to 7675 kc. with a power of 100 watts. *(JB)*

North Vietnam—*The Voice of Vietnam* is still being heard at 0430-0500 in Eng., followed by Oriental. Those of you who have been unable to verify this station might send your reports in an envelope addressed to the station, but placed in another envelope addressed to *Radio Moscow*, with instructions to the latter to forward your report. An International Reply Coupon should be enclosed in both envelopes. *(208)*

Pakistan—Karachi is being noted on 15,335 and 11,885 kc. at 1930-2015 with Eng. news from 2000. This program, beamed to Southeast Asia, is heard daily except Sundays. *(28, 44, 59, 65, 226)*

Poland—Warsaw has been found on a new channel of 11,755 kc. from 1930 with news in English. This may be a shift from 11,740 kc. to avoid QRM from Moscow. *(AN)*

Portugal—Lisbon is using 15,150 kc., a new outlet, at 0700-1000, relaying the Home Service. *(100)*

Solomon Islands—According to *Radio Australia*, plans are in preparation for an increase in power and coverage of the stations in the Solomon Islands. A program is planned for Europe, possibly in English. No further details at this time. *(318)*

Booklets Available

The Swiss Shortwave Service is offering SWL's its program guide, "Switzerland Calling," on a regular basis at no charge. The address is: Neuengasse 23, Berne, Switzerland.

Write to *Radio Nederland*, P. O. Box 137, Hilversum, Netherlands, for a free antenna booklet.

Radio Sweden (Stockholm 7, Sweden) sends a DX Bulletin to anyone who requests it. This bulletin is issued monthly and is free for the asking.

South Korea—HLKA, Seoul, is now noted in the Home Service at 0230-0500, with all programs in Korean. Address for reports: No. 3, Duksoo Palace, Seoul. *(208)*

Spain—*Radio Nacional Emissora*, Madrid, has moved from 9363 kc. to 9585 kc. for the N.A. xmsns at 2215-2245, 2315-2345, and 0015-0045, parallel to 6130 kc. *(JA, 23, 240, 304)*

A new outlet is noted on 15,420 kc. in Spanish, at 1800. *(AN)*

Madrid is also found on 9610 kc. afternoons around 1500 in Spanish. *(59)*

Switzerland—Berne has dropped HER6, 15,305 kc., and replaced it with HEU3, 9665 kc., in the N.A. xmsn at 2030-2215. It parallels with HER4, 9535 kc., HER3, 6165 kc., and HER5, 11,865 kc. The second xmsn, at 2315-0000, is on the same channels with the exception of 6165 kc. HEU3 is also noted at 1430-1530 to the United Kingdom but the signal is usually poor. The "DX Program" is

broadcast at 2050-2115 and 2335-0000 on the first Monday of each month. *(59, 82, 100, 156, 312, JR, JW)*

Tangier—One of the many *Voice of America* stations in this country can be noted on 11,820 kc. with music until 0100, news to 0115, then back to music. Many of these programs are in European languages with only English ID. *(AF)*

Turkey—TAU, Ankara, 15,160 kc., is heard at 1300-1315 in Bulgarian, at 1330-1400 in language with native music, at 1415-1430 in Polish, at 1430-1500 in Italian, at 1515-1600 in French, and at 1600-1645 in English with news and music. All xmsns are beamed to Europe. Each Sunday there is a "Mailbag" during the Eng. segment. *(44, 61)*

Uganda—Kampala, 5026 kc., is noted in Eng. at 1630-1715. There is heavy QRM and this may be rough to get into your log. *(11)*

Uruguay—A letter from *Radio Sarandi*, Montevideo, advises that they have been testing on 9515, 11,885, and 15,385 kc. Reports go to *Radio Sarandi*, Montevideo, and confirmation is made with a letter and a triangular pennant. Another Uruguayan outlet has been noted on 6125 kc. at 1930-2000 in Spanish with L.A. music. The schedule for *R. Sarandi* appears to be Tuesdays and Fridays at 2030-2130. *(CG, EL, AN, 44, 59, 61, 226)*

Venezuela—*Radio Mil Cinquenta*, Caracas, 5055A kc., a fairly new station, now has s/off at 2226 after ID with six gongs (going down scale) and an orchestral number. Listeners in the Gulf States might try for the outlet on 1500 kc. *(152)*

—30—

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Among the Novice Hams

(*Continued from page* 73)

a filter capacitor across the d.c. power supply terminals of a humming receiver to determine if the hum is caused by insufficient filter capacitance. When he removes his test capacitor from the circuit, he short-circuits its leads to dissipate the charge and produces a husky spark in the process. If he neglects this precaution, the voltage in the capacitor can give him quite a shock.

Capacitance. The ability of a capacitor to accept an electrical charge is called its *capacitance* and is measured in *farads*. But a farad is too large a unit for practical use; therefore, the *microfarad* (millionth of a farad), abbreviated μfd., and the *micro-microfarad* (millionth of a millionth of a farad), abbreviated μμfd., are used.

Basically, capacitance is determined by the size, spacing and the number of plates in a capacitor; many plates, closely spaced, mean high capacitance. But the type of insulating material between the plates, called *dielectric,* also affects capacitance.

Commonly used dielectric materials besides air are wax- or oil-impregnated paper, mica, glass, oil, and ceramics. Air has the lowest loss, but has a *dielectric constant* of

only 1, while the other materials have dielectric constants several times greater. This means that substituting one of the other materials for air as a dielectric in a capacitor will increase the capacitance several times. The capacitor will also usually withstand much higher voltages.

One of the duties of the designer of electronic equipment is to choose the proper type of capacitor from the many available.

Time Constant. The speed with which a capacitor can be charged or discharged depends on the *time constant* of the circuit. This, in turn, is determined by the amounts of resistance and capacitance in the circuit. Theoretically, the capacitor never becomes completely charged or discharged;* therefore, the time constant of the circuit (Fig. 1) is defined as the time it takes to charge the capacitor to 63% of the charging e.m.f. (voltage) or to discharge it to 37% of its original value.

The time constant of a resistance-capacitance circuit is calculated as: $T = CR$, where T = time in seconds to charge the capacitor to 63% of the charging voltage or to discharge it to 37% of its original voltage, C = capacitance in farads, and R = resistance in ohms. This formula is also true when capacitance is expressed in microfarads and the resistance is expressed in megohms. It is manipulated exactly like Ohm's law.

Questions about the time constants of capacitive-resistive circuits in the General Class examination may require you to identify the formula ($T = CR$) or to determine the time constant of a specified resistance and capacitance connected in series. For example, if resistance is given as 5 megohms and capacitance as 2 μfd., your answer would be 10 seconds.

Alternating Current. Now assume that, in Fig. 1, the battery is replaced by an a.c. generator. At the beginning of a cycle, the voltage from the generator will start increasing, and a heavy current will flow into the capacitor. As the voltage from the generator gradually increases, the current flowing into the capacitor gradually decreases, as the capacitor becomes partially charged. This process continues until the generator voltage reaches its peak value at exactly the same instant that the capacitor voltage becomes equal to the generator voltage.

As there is now no difference between the two voltages, the current flow becomes zero. Immediately, however, the generator voltage starts decreasing. Consequently,

*After the first unit of time, the capacitor will be 50% charged or discharged. After the second unit of time, it will be 75% charged or discharged, with the percentages increasing to 87.5%, 93.75%, etc., at the end of additional periods of time, never quite reaching 100%.

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Carl & Jerry (*Continued from page* 10)

square kilometer of the earth's surface, and this totals up to some 1800 amperes. A potential of around 300,000 volts between the ionosphere and the earth is required to force this current through the high resistance of the atmosphere."

"What produces the current?" Carl asked.

"No one is sure. There are several theories. One is that thunderstorms keep the ionospheric battery charged. At any rate, during thunderstorms the comparatively stable ionization of the atmosphere is upset. Franklin was getting both positive and negative charges from his kite flying in the storm. But have you ever noticed that during a thunderstorm and right after it many people seem to feel a mood of happiness and exhilaration?"

"I certainly have," Norma chimed in. "Children show it especially, probably because they're less inhibited. You know, they laugh and shout and run up and down through the water that flows in the gutters after a summer shower."

"Exactly! Now it just *could* be that they feel this way because the lightning has rendered the atmosphere negative—or at least less positive. I was thinking that we might use the high-voltage power supply out of an old projection TV set we have over in our lab so as to change the ionization in a small area. We could connect the positive side to ground and the negative side to a device with a lot of sharp points on it that would shove the negative electrons out into the air and neutralize the charge of the positive ions. Anyone in the vicinity would be in a negatively charged atmosphere—and might react accordingly."

"What say, Norma?" Carl asked.

"What have I got to lose?" Norma said recklessly. "How do we go about it?"

"WELL, suppose we install the gadget in your living room tomorrow and give it a try tomorrow night," Jerry suggested. "I suppose you and Mike will sit on that couch across from the TV set. We'll mount the de-ionizer close to the couch."

"Okay," Norma agreed; "but I think it'd be a pity if you two couldn't see how this experiment works out. I'll leave the shades up, and you can watch developments from Jerry's dining room right across from my living room. Really, though, you should be able to *hear* what's going on, too. Can't you geniuses manage that?"

"Easily, since you're agreeable," Jerry said. "We'll just put the pickup unit of an intercom set behind the couch and run leads across to a receiver unit in my house;

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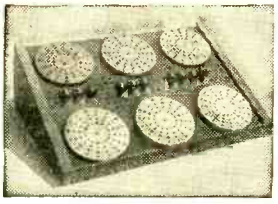

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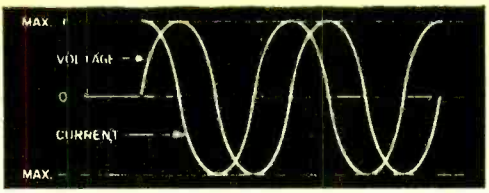

Fig. 2. Behavior of alternating current and voltage in a capacitor. The current always leads the voltage by one-quarter cycle or 90 degrees.

current starts flowing out of the capacitor *into* the generator, reaching its maximum value at the end of the first half cycle, when the voltage in the circuit is again zero.

The generator voltage now starts building up in the opposite (negative) direction, and the whole action of the current and voltage during this half cycle is a mirror image of the previous half cycle, with the entire pattern repeating itself over and over as long as alternating current is fed into the circuit. This action is illustrated graphically in Fig. 2, which shows that the current in a capacitor always leads the voltage by one-quarter cycle or 90 degrees.

Although a.c. does not actually flow through the insulating material between the plates of a capacitor, it appears very much as if it did. Nevertheless, if the capacitor is short-circuited, the current in the circuit will increase, showing that capacitance does offer opposition to the a.c. flow.

Capacitive Reactance. The opposition that a capacitor presents to the flow of alternating current is called *capacitive reactance*. It is equal to: $X_c = 1/(2 \pi FC)$; where X_c = the capacitive reactance in ohms, π (*pi*) = 3.14, F = frequency in cycles per second, and C = capacitance in farads. If capacitance is expressed in microfarads (μfd.), the formula becomes a bit easier to manipulate if written as: $X_c = 1{,}000{,}000/(2 \pi FC)$; where C = capacitance in microfarads, and the other symbols have the same meanings as before.

Solving the formula for a couple of typical problems will show you how to handle it. Question: What is the capacitive reactance of a 2-μfd. capacitor at 60 cycles per second? Answer: $X_c = 1{,}000{,}000/(2 \times 3.14 \times 2 \times 60) = 1{,}000{,}000/753.6 = 1326$ ohms, approx. Question: What is the capacitive reactance of an 0.0005-μfd. capacitor at 4 mc. (4,000,000 cycles)? Answer: $X_c = 1{,}000{,}000/(2 \times 3.14 \times 4{,}000{,}000 \times 0.0005) = 1{,}000{,}000/12{,}560 = 80$ ohms, approx.

News and Views

Barrie, W7DCK, offers to schedule anyone needing Arizona on weekends, and he will be glad to help prospective amateurs get their licenses. Barrie has been a ham for a year and a half—a full year as a Novice—and now

has his Conditional Class license. He operates a Heathkit DX-35 transmitter and a National NC-57B receiver, which replaces the Heathkit AR-2 he used as a Novice. Barrie's states-worked total is 39, all confirmed. . . . **Peter, KN1ADJ,** who some months ago offered to tell anyone interested how to substitute a 6146 for an 807 in a transmitter, has finally answered all the cards and letters he received on the subject, and now repeats his offer. Pete's Novice license expired in mid-October, but he has been having a bit of trouble with General Class theory and could use some help with it. Code is no problem. He has a 25-wpm code-proficiency certificate. As a Novice, Pete worked 43 states and many DX stations, running 75 watts to a 6146.

Bruce, WN2RHE, works 80 meters with a Heathkit AT-1 transmitter, a 250′ antenna, and a Hallicrafters S-38D receiver. He also works on 2 meters, but did not mention what kind of equipment he uses there. . . . **Mike, KN5MLG,** has had his ticket for about three weeks and made over 50 contacts in spite of his antenna being surrounded by 75′ pine trees. KN5MLG uses a WRL Globe Scout 680 transmitter and a Hallicrafters SX-99 receiver. . . . **Mickey, K9BBO,** got some well-deserved publicity in the Gary, Indiana *Post Tribune* for being one of the first hams in the midwest to hear the radio signals from the Russian "Sputnik I" and tape-record them on October 5 and 6. Since he received his General license, Mickey has built a final amplifier using a pair of 805 tubes, which he drives with his Johnson Adventurer transmitter.

George, KØCYP, Operation Manager at World Radio Labs., Council Bluffs, Iowa, reports that there were 81 enrolled in the last WRL Novice class. If you live in that vicin-

FOR BEGINNING AMATEURS

I recommend the *Novice And Technician Handbook* by William I. Orr, W6SAI, and Donald Stoner, W6TNS, to all beginning amateurs, no matter what class of license they hold, primarily because of its many easy-to-follow construction articles. Among them are four on transmitters rated from 10 to 60 watts input for the amateur bands between 3.5 and 148 mc. Others give data on converting war-surplus "Command" transmitters for Novice and General Class use, a screen modulator, power supplies, and antenna tuners. Among the receiving equipment described is: a preselector for improving the sensitivity of inexpensive short-wave receivers; a 20- to 6-meter converter which will improve the high-frequency performance of almost any short-wave receiver as well as add 6-meter coverage to it; a transistorized Q-multiplier; and two 6- and 2-meter converters. You'll need some knowledge of elementary electronic theory and the ability to read schematic diagrams to get the greatest amount of good from this handbook. It can be obtained either from the publisher, Radio Publications, Wilton, Conn., for $2.85 plus 15 cents postage, or from most amateur supply houses.

ity, check with George (George Hladik, Jr.) for the date on which the next Novice class will start. He works 6 meters and reports that it is truly amazing how 6-meter activity has increased recently. Not only are the Technicians getting on the band, but many Generals are operating on it to escape the interference on the lower frequency bands. . . . **Ronald, K2SST,** is proud of becoming a ham. To prove it, he presented a 3' x 4' QSL card to Walter Muller, his instructor at the Jersey City, N. J., Department of Parks Radio School. (Free classes are held nightly from 7 to 10 p.m. on Monday, Wednesday, and Friday at 15 Cole St., and on Tuesday and Thursday at Roosevelt Stadium, Jersey City.)

To extend the tuning range of his Allied Spanner receiver beyond the broadcast band and the 6- to 19-mc. short-wave band, **Earl Tiley, K8CFJ,** replaced its original short-wave coil with a set of ICA #1741 plug-in coils. To make a similar change, disconnect the original coil from the bandswitch, carefully noting where each connection was made. Remove the coil and mount a 4-prong socket on the chassis. Wire the socket to the switch, so that when the new coils are plugged into the socket they will be connected to the switch in the same way that the original coil was connected. After the change, Earl reports, the receiver works as before, except that the entire short-wave spectrum up to 30 mc. can be covered by plugging in different coils. Earl also replaced the original 400-$\mu\mu$fd. tuning capacitor with a 140-$\mu\mu$fd. one (Bud 1876). This makes tuning the short-wave bands less critical than with the original capacitor, but it prevents tuning the lower portion of the broadcast band. Earl admits that although the Space Spanner doesn't do everything an expensive superhet receiver will do, he is very pleased with it.

With six weeks to go as a Novice, **Ron, KN4LWZ,** has worked 41 states and nine countries. He worked most of the states, and also Hawaii, on 40 meters with a 11-watt, home-built transmitter. His present transmitter is a Heathkit DX-20. Ron is another one who has suggested a monthly Novice DX honor roll in this column. . . . **Noel E. Donawa,** 22 Prizger Road, San Juan, Trinidad, British West Indies, would like help in radio theory and code. In return, he might be able to tell you something about life on a tropical island.

Contributors to News and Views: **Barrie Schwartz, W7DCK,** (16), 1533 Avenida Sirio, Tucson, Ariz.; **Peter Guber, KN1ADJ,** 407 Ward St., Newton Centre, Mass.; **Bruce Bouvier, WN2RHE,** Box 217, Oakland, N. J.; **H. M. "Mike" Grimes, KN5MLG,** (15), P. O. Box 992, Gladewater, Texas; **Mickey Hall, K9BBO,** (17), 213 Cleveland St., Gary, Ind.; **Ronald Parham, K2SST,** (22), 127 Terrace Ave., Jersey City, N. J.; **Earl E. Tiley, K8CFJ,** 405 East Main St., Blanchester, Ohio; **Ron Hines, KN4LWZ,** 14300 NW 16 Court, Miami 47, Fla.

Keep your letters and reports coming. Next month we plan to review the Johnson "Navigator" de luxe c.w. transmitter kit. I'm sure you'll like it! 73,

Herb, W9EGQ

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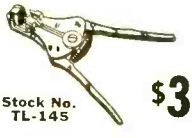

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1S4	.78	6AG7	.97	6S4	.59	12SK7	.69
1S5	.68	6AH4	.89	6SA7	.79	12SN7	.69
1T4	.69	6AH6	.95	6SH7	.69	12SQ7	.69
1U5	.59	6AK5	.69	6SJ7	.69	14A7	.69
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955	4/$1	6AX4	.79	6U8	.89	35Z5	.59
957	.30	6BA6	.59	6V6	.59	50A5	.69
1619	4/$1	6BC5	.59	6W6	.79	50B5	.79
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1626	5/$1	6BF5	.79	7A8	.79	50L6	.69
1629	4/$1	6BG6	1.49	7C5	.79	75	1.00
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Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance or interest charges added. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

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- ☐ Model 76 . . . . . Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.
- ☐ Model TD-55 . . Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.
- ☐ Model TV-50 . . . . Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.
- ☐ Model TV-40 . . . . . Total Price $15.85 $3.85 within 10 days. Balance $4.00 monthly for 3 months.
- ☐ Model 670-A . . . . . Total Price $28.40 $7.40 within 10 days. Balance $3.50 monthly for 6 months.
- ☐ Model 70 . . . . . Total Price $15.85 $3.85 within 10 days. Balance $4.00 monthly for 3 months.
- ☐ Model TV-12 . . . . Total Price $72.50 $22.50 within 10 days. Balance $10.00 monthly for 5 months.

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Address .....

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

All prices net, F.O.B., N. Y. C.

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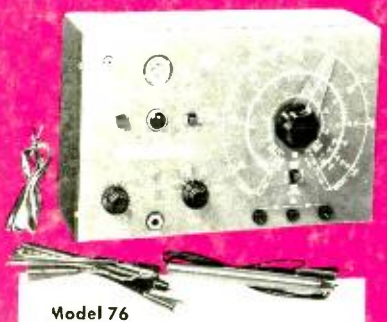
NO MONEY WITH ORDER

NO C.O.D.



Model 76

Terms: $6.95 after 10 day trial then $5.00 per month for 4 months.

Superior's New Model **76**

IT'S A **CONDENSER BRIDGE**

IT'S A **RESISTANCE BRIDGE**

IT'S A **SIGNAL TESTER**

IT'S A **TV ANTENNA TESTER**

Specifications

CAPACITY BRIDGE SECTION

4 Ranges: .00001 Microfarad to .005 Microfarad; .001 Microfarad to .5 Microfarad, .1 Microfarad to 50 Microfarads; 20 Microfarads to 1000 Microfarads. Will also measure the power factor of all condensers from .1 to 1000 Microfarads.

RESISTANCE BRIDGE SECTION

2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms.

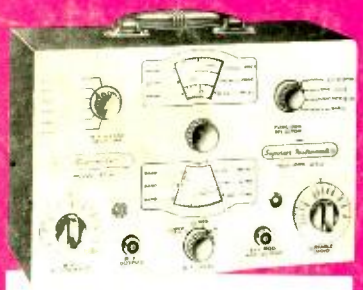
SIGNAL TRACER SECTION

With the use of the R.F. and A.F. Probes included with the Model 76, you can make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc.

TV ANTENNA TESTER SECTION

Loss of sync., snow and instability are only a few of the faults which may be due to a break in the antenna, so why not check the TV antenna first? Locates a break in any TV antenna and measures the location of the break in feet from the set terminals.

Complete with R.F. and A.F. probes and test leads **$26.95 Net**



Model TV-50

Terms: $11.50 after 10 day trial then $6.00 per month for 6 months.

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**
- **Marker Generator**
- **Bar Generator**
- **Color Dot Pattern Generator**
- **Cross Hatch Generator**

R. F. SIGNAL GENERATOR: 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: Provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

MARKER GENERATOR: The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency.)

BAR GENERATOR: Pattern consists of 4 to 16 horizontal bars or 7 to 20 vertical bars.

DOT PATTERN GENERATOR (FOR COLOR TV): The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence.

CROSS HATCH GENERATOR: The pattern consists of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

Complete with shielded leads **$47.50 Net**

TRY FOR 10 DAYS

BEFORE you buy! ***THEN*** if satisfactory pay in easy, interest free, monthly payments. See coupon inside.

We invite you to try before you buy any of the models described on this and the preceding pages. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate. (See other side for time payment schedule details.)

NO INTEREST OR FINANCE CHARGES ADDED!

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

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