POPULAR ELECTRONICS

SEPTEMBER 1956

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First Transistor Short-Wave Converter

(see page 37)

- Radio Waves From Venus
- How To Be a Tech Writer
- Electrostatic Speakers
- Build 1-Tube Superhet

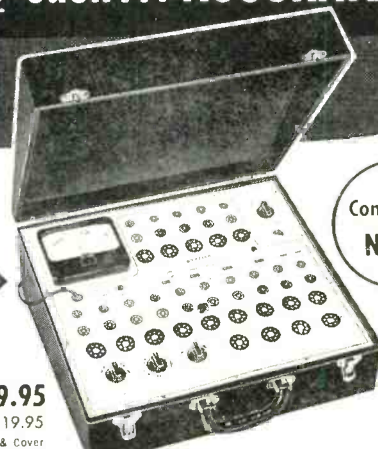
TEST 5 TUBES in 4 SECONDS each... ACCURATELY!

WITH THE NEW ADVANCED ENGINEERED

precise

MODEL 116

Gm. & Em. ULTRAFAST TUBE & TRANSISTOR TESTER



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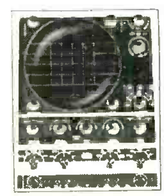

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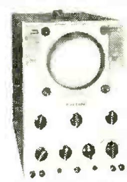

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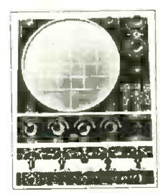

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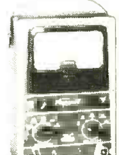

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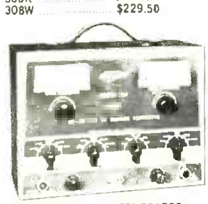

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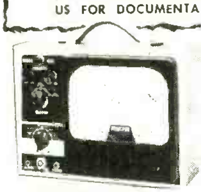

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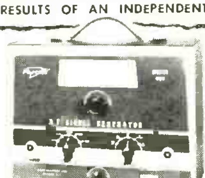

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COMING NEXT MONTH (OCTOBER)

(ON SALE SEPTEMBER 20)

Our second anniversary issue will contain more pages and will be specially devoted to hi-fi with features on tone controls, AM/FM tuners, hi-fi maintenance techniques and compressed speaker enclosures.

There will also be stories on long-wave DX'ing, R/C equipment, home-built test equipment, 21-mc. preselectors and an all-electronic device for measuring relative humidity.

Also look for our regular departments written by Hank Bennett (on SWL'ing), Herb Brier (on Novice ham radio), John Frye (Carl & Jerry), and Lou Garner (Transistor Topics).

IN THIS MONTH'S

RADIO & TELEVISION NEWS

(SEPTEMBER)

Preview of New TV and Radio Sets
Hi-Fi Equipment Cabinets
Experiments with a Series Multivibrator
How to Match Hi-Fi Components
Giant Computer—"Brain" of the SAGE System
An All-Transistor Superhet Tuner

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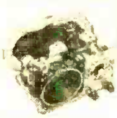
3. TV Cameraman and Studio Technician Course — advanced training for men with Radio or TV training or experience.

C-W Telephone Transmitter

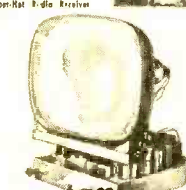
Combination Voltmeter-Ammeter-Ohmmeter

Public Address System

AF-RF Signal Generator



Super-Het Radio Receiver



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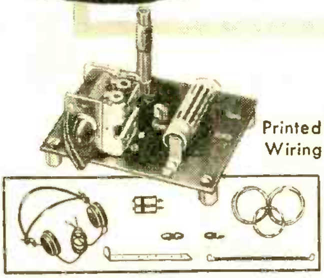

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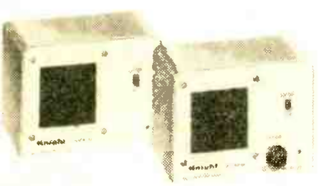

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Model S-265. Net only **$12.65**

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C-100. Antenna Kit for above ... **$1.05**

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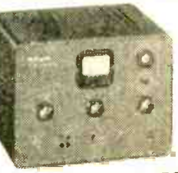

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Model F-125. Net only **$24.95**

F-126. High Voltage Probe **$4.75**
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Model F-140
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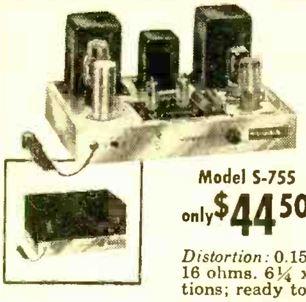

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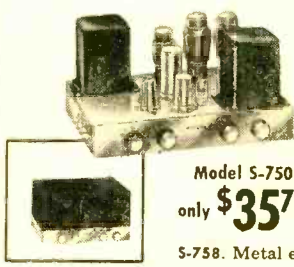

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By JOHN T. FRYE

Electronic Beach Buggy

IT WAS A BLISTERING-HOT last-of-August day, and Carl and Jerry were at the beach, but they were not swimming. Instead, they lolled in the scanty shade of spindly growth on the side of a sand dune and looked disconsolately across the absolutely empty beach at the close-spaced row of large signs sticking in the sand along the edge of the water. The signs read: "DANGER! Water Polluted with Acid. Stay Out!"

A Great Lakes tanker loaded with acid had been in a collision just off shore and lost most of its cargo. This highly concentrated acid, blown in to shore by the wind, had collected on the sand and rocks of the beach. While it was slowly diluting, there was still enough left to cause serious burns to the skin and even more damage to the eyes if it came in contact with them.

"A fine kettle of fish this is," Carl growled. "Here is as hot a day as we've had all summer; there is all of Lake Michigan ready to cool us off; and for all the good it's doing us, we might as well be out in the middle of the Sahara Desert."

"While you're wallowing in self-pity, don't forget that school is coming up like thunder," Jerry added. "In about a week the beach will be O.K. again, but we'll be sweating it out in the brain factory."

BOTH BOYS contemplated this gloomy prospect in silence for a little while, and then Carl said: "Jer, have you dreamed up any ideas yet about how we can raise some money to buy the transistors, special transformers, tiny capacitors, and other parts we'll need for our transistor experiments this winter?"

"Nope, I've not come up with a thing. How about you?"

"Me, neither," Carl replied as he looked across the empty beach, "unless—"

"Unless what?" Jerry demanded, raising himself on an elbow to follow Carl's glance.

"Unless we could do a little beachcombing. You know how packed this place normally is, especially on weekends. There's hardly room to set down a bottle of suntan lotion. Think of all the coins that

Carl & Jerry *(Continued from page 10)*

must have slipped from upside-down pockets into the sand, of all the rings and watches that have been removed to take a plunge and lost, of all the cigarette lighters, bracelets—"

"Okay, okay!" Jerry interrupted. "So what do we do? Sift the sand?"

"A good electronics man like you ought to be ashamed to think of anything so crude and mechanical as that," Carl chided. "We can use our handy-dandy metal locator that we built from the article in the June, 1955, POPULAR ELECTRONICS. You know how we found Farmer Sloan's gold watch out in the cornfield with it; well, most of the valuables here will only be covered with an inch or so of sand, and the metal locator should be able to sniff them out easily. Only one thing's wrong: that treasure-finder is a little heavy to use over a long period of time, and I just know who will be elected to carry it. Lugging that thing around out there in the hot sun does not appeal—"

"HOLD IT! I've got an idea," Jerry broke in. "Suppose we mount that little gasoline washing machine motor of yours on the back of my wagon with the big rubber tires. The motor can drive one of the rear wheels through a couple of jackshafts and combination of speed-reducing V-pulleys so it will make the wagon just creep along. You'll also remember that I've taken all the remote control equipment out of the model tugboat while I'm refinishing the hull; so we can put this into the wagon and remote-control it. A solenoid operating a belt-tightener can serve as a clutch, and we can use one of those fractional-horsepower, reversible electric motors with a speed-reducing, power-amplifying gear train to steer the wagon. We can sit right here in the shade and send that wagon wherever we want to . . . up and down the whole beach."

"Well good, good, goody for us!" Carl said sarcastically; "but what's all that got to do with our locating the loot?"

"I'm coming to that. We'll mount the treasure-locator on the wagon with the search coil out in front, just clearing the surface of the sand. The audio beat-note signal that we hear in the earphones when something metallic appears near the search coil will be amplified, rectified, and the resulting current can be used to operate a sensitive relay which, in turn, will operate the clutch solenoid."

"You're getting through to me!" Carl said, with the enthusiasm boys invariably feel for a really complicated Rube Goldberg device. "When the search coil passes

Carl & Jerry (*Continued from page* 12)

over something metallic like, say, a five-hundred-dollar diamond-studded gold watch, the audio signal produced will trip the relay that will operate the solenoid that will stop the wagon. The gadget will just sit there like a faithful little old bird dog on 'point' until we leisurely stroll down to it, brush away the sand, pick up the watch, and toss it into the pillowcase full of other valuables we have already found."

"Well, let's go!" Jerry said, getting to his feet and brushing the loose sand from his knees and the seat of his trousers.

AND GO they did, just as fast as they could pedal their bicycles home. The heat that had seemed so oppressive when they had nothing to do was entirely forgotten now as they worked out details of mounting the powerful little gasoline motor on the fat-tired coaster wagon. They connected up the remote control receiver and its reed-type actuator so that it could operate the steering mechanism and the simple clutch. Then they arranged the metal locator so that its hoop-shaped search coil was carried well out in front of the wagon two or three inches above the ground. With the motor and the jackshafts mounted behind the wagon and the probe coil sticking away out in front, the resulting ungainly appearance was something like that of an elongated king-sized insect . . . but the contraption worked!

Proof of this was had when Jerry fished a nickel from his pocket and recklessly tossed it out onto the middle of the lawn. They started up the self-powered remote-controlled treasure finder and sent it into action quartering back and forth across the yard. After having first turned up three rusty nails and an old belt buckle, it finally stopped with the search coil directly over the nickel. That was all the "testing" the boys needed. They immediately began coaxing Jerry's mother to drive them and their invention down to the beach in the station wagon, and did not let up until she agreed. Just as they were starting out the drive, Carl suddenly exclaimed: "Wups! Wait a minute. We're forgetting something."

He vaulted over the low fence between the two houses and disappeared into his own house. Almost immediately he came dashing back out waving an empty pillowcase in which to dump their findings.

ONCE at the beach, the boys lost no time in putting their electronic beach buggy into action. The large tires kept the wheels of the wagon from cutting down

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Carl & Jerry (*Continued from page* 14)

into the sand, and the gasoline motor—thanks to the down-gearing—had an easy task propelling the vehicle along. At first the boys could not resist the temptation to send the treasure locator hither and thither along the beach to test out the operation of the remote control; but when it was found that this functioned perfectly, they settled down to directing the movement of the wagon in a regular pattern that eventually would cover the whole area of the beach in sight of what they dubbed their "command post."

The wagon had hardly gone a hundred yards when it came to a halt, and there was nothing leisurely about the way the boys dashed down to where it was sitting quietly put-put-putting away. As Carl eagerly brushed away the sand from beneath the search coil, he uncovered a little slip of tin foil from a stick of chewing gum, and instantly the wagon started chugging ahead, indicating that the bit of tin foil was what it had in mind.

A little disappointed, the boys started back to their command post, but before they reached it, the wagon stopped again. It had found another scrap of tin foil. To cut a long and painful story short, the metal locator found exactly twenty-three bits of tin foil in two hours—and it found nothing else! Actually, the boys were expending more energy running back and forth between their command post and the wagon than they would have used if they had simply carried the metal locator in the first place; but to them, of course, this fact was entirely irrelevant and beside the point.

Finally, Carl knelt in front of the search coil with the twenty-third scrap of tin foil in his hand and addressed it with an impassioned speech: "Now look, Tin-Foil Terry, you don't seem to get the idea. We're not looking for this kind of stuff. We can get all the tin foil we need. We want something like *this*!" He placed some coins in the palm of his hand and held them directly in front of the search coil. "Now will you please, please get off this tin-foil binge you're on and go out there and find some of these pretty little engraved silver discs? Will you please?"

AGAIN the boys trudged back to their command post, and the wagon chugged on down the beach. It did not hesitate until it reached the turn-around point, nor did it stop on the way back until it was almost directly in front of the boys. Then the motor speeded up a little as the solenoid clutch operated to stop the wagon.

"More tin foil," Carl grunted, heaving

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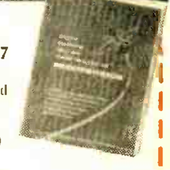

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Carl & Jerry (*Continued from page* 16)

himself to his feet and starting across the hot sand toward the wagon.

"You can't be sure," Jerry said, optimistically, as he followed along. "We can hope, anyway."

And when Carl started brushing away the sand, it began to look as though his pep talk to Tin-Foil Terry had done some good, for no scrap of tin foil appeared, and the wagon stayed put, showing that whatever it was pointing to was still there.

"Dig deeper," Jerry suggested, as he knelt beside his pal.

Carl scooped away the sand to a depth of eight or ten inches, and suddenly his fingers touched a parcel wrapped in moldy, rotting, brown paper. He lifted it out of the hole and discovered that it was a heavy package some four inches wide by seven inches long by an inch thick. The wagon started up when the parcel was removed from beneath the coil, but Jerry stopped it by shorting out the spark plug of the motor.

"What the heck is it?" Jerry asked, with much curiosity.

"You got me, but I guess there's only one way to find out," Carl said, as he started unwrapping the decaying paper. Inside were two rectangular metal plates carefully wrapped separately in soft flannel. He handed one to Jerry to examine while he scrutinized the other.

"It's got a kind of design engraved on one of the flat surfaces," he said slowly, turning it so that the light made the design stand out. "There's a kind of cameo in the middle with a man's head on it, and

. . . The dark man's beady black eyes glinted coldly out of his pasty white face as he held out a demanding hand for the rectangular metal plates . . .

Carl & Jerry *(Continued from page 18)*

there's some printing, too, but it's hard to make out because it's printed backwards."

"Mine's got a picture of some kind of big public building in the middle, and it has both letters and numbers printed on it. Let me see. Say, these must be printing plates for making mo—"

"Never mind what they are," a gruff voice commanded. "Just give them to me. They're mine."

The boys had been so intent on examining their find they had not heard the short dark man approaching in the soft sand. His beady black eyes glinted coldly out of his pasty white face as he held out a demanding hand for the plates.

"HOLD IT, Jake!" still another strange voice interrupted, and three men came running from behind one of the nearby dunes. At first the man they addressed as Jake looked as though he might run for it; but when he saw the guns in the hands of the approaching trio, he stood still.

"Couldn't wait any longer, huh, Jake?" one of the men inquired as he frisked the short dark man for a possible weapon.

"I'm clean," Jake grunted; "and I could have waited until you guys layin' out there in the dunes took root if these brats hadn't forced my hand."

"Hey, can anybody tell us what's going on?" Jerry piped up.

"This is Jake, The Penman," the leader of the trio explained. "He's a well-known counterfeiter just out of prison after doing a stretch. But when the counterfeiting ring was broken up, the plates were never found. We put a tail on Jake as soon as he left prison, hoping he would lead us to where the plates were hidden; and, thanks to you boys and your—your—gadget there, he did. I'm not sure, but I rather think there will be a reward of some sort coming to you for helping to find the plates. But just as a matter of curiosity, would you mind telling us what that thing is? We've been lying out there watching you all afternoon, and none of us can figure it out."

Carl and Jerry, both talking at once, began an explanation of how the electronic beach buggy worked. When they finished, the leader of the three Federal agents shook his head as though to clear it of a bad dream.

"I still don't get it," he confessed; "but right here in my hand is the evidence that it works. Don't be surprised if some of the Treasury people want to examine it after I make my report. We might be able to use it in our business!" —30—

POP'tronics BOOKSHELF

"INDUSTRIAL ELECTRONICS" by Edward J. Bukstein. Published by Frederick Ungar Publishing Co., 105 E. 24th St., New York 10, N. Y. 197 pages. Cloth bound. Price, $3.95.

A well-known and widely read author ("The Magic of Electronics," numerous articles in RADIO & TELEVISION NEWS, etc.) has assembled here hundreds of questions and answers that cover the basic fundamentals of industrial electronics. The first six chapters of the book deal with standard types of equipment that are unique to industrial applications. Resistance welding, photo-electricity, x-rays, thyratrons, counters and scalers, and time delay circuits are included. Chapters 7 and 8 discuss special circuits and applications, such as multivibrators, special power supplies, squaring circuits, integrators, r.f. heating, Geiger counters, etc. Test instruments are taken up in Chapter 9.

Questions and answers that comprise the text are exhaustive, and cover the field as thoroughly as conventional textbook treatment might. A topical index and numerous drawings help clarify the material.

Recommended: as an excellent reference work, as well as an introduction to the subject, for the technician or experimenter who has mastered the fundamentals of basic electronics.

"THE LONG PLAYING RECORD GUIDE" by Warren De Motte. Published by Dell Publishing Co., Inc., 261 Fifth Ave., New York 16, N. Y. 448 pages. Paper bound. Price, 50 cents.

This volume contains a listing of a number of LP records made from 1948 to early 1955. Not every composer, and not every composition is included, but there are enough selections among the 7000 record sides discussed to afford many music lovers and hi-fi enthusiasts plenty to choose from. The over-all plan of the book resembles that of a record catalog such as is available at the counter of any record dealer.

The unique feature of this guide is that it offers brief critical evaluations of the several recordings listed for each composition. As such, it could prove quite helpful. The

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Recommended: as a possible "quickie" guide to LP discs.

"BLOCKING OSCILLATORS" by Alexander Schure. Published by John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y. 72 pages. Paper bound. Price, $1.25.

Blocking oscillators, widely used as starting or triggering circuits in many special applications, are explained and illustrated in this compact volume. Mathematics has been held to a minimum; the text here is for technicians, students, and experimenters whose work demands an understanding of basic concepts. Emphasis, in the explanations, is placed on the role of the transformer used in such circuits.

Recommended: as an introduction to the subject for the beginner, and as a review for the advanced technician.

"TV TROUBLE TRACER" (Vol. 5) by H. G. Cisin. Published by Harry G. Cisin, Amagansett, N. Y. 45 pages. Paper bound. Price, 50 cents.

Forty common picture defects that may develop in a number of 1955-56 television receivers are described in this guide. The cause is explained, and the remedy is suggested. In addition to pictures of the TV screen, with the objectionable characteristics plainly outlined, there are a number of chassis layout diagrams that help locate tubes and other components.

Recommended: as a "short-cut" servicing guide to late model TV sets.

Free Literature Roundup

A brochure on a new 400-kw. generator series is available from Kato Engineering Co., Dept. R-C, Mankato, Minn.

The Berkshire "Labstrobe," Model 18A, is described on "Catalog Sheet No. 18A-1." The instrument is an inexpensive 60-cycle stroboscope, useful for determining motor speeds. Write to Berkshire Laboratories, 898 Bank Village, Greenville, N. C.

Available from Radio Craftsmen, Inc., 4223 W. Jefferson Blvd., Los Angeles 16, Calif., is an attractively printed brochure covering its line of hi-fi components.

A 16-page illustrated brochure describing Philco's microwave communications equipment has been issued by the Philco Corp., Govt. & Industrial Div., 4700 Wissachickon Ave., Philadelphia 44, Pa. —30—

LETTERS FROM OUR READERS

Electronics/Rocket Experimenters

■ Would appreciate your printing the address of the Rocket Experimental Society of Canada in POP'tronics. I believe other readers with a mutual interest in rockets and electronics might want to contact us.

R. W. SCHNEIDER
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More on TV DX

■ I read your article on TV DX in the June issue with very great interest. Let's have lots more about TV.

RONNIE HINES
Opalocka, Fla.

■ Sure enjoyed that article on TV DX, but believe you should have included more data on antennas, boosters, etc.

BOB P. WARD
Riverdale, Mich.

Numerous letters were received commenting favorably on the TV DX story. More information is scheduled to appear within the near future.

Appreciation of Kohler

■ Just finished reading Carl Kohler's "Operation Chaos" in the June issue. It was nothing short of terrific.

By the way, here's a challenge for you to publish a circuit similar to the one Carl described.

JOE CROWTHER
Lincolnwood, Ill.

As in the past, the Editors are not responsible for the brain storms of humorist and UPA animator ("Magoo" cartoons) Kohler. However, Carl's fans should look in POP'tronics next month for "Hi Tide in the Tweeter"—a satire on some particular hi-fi records.

Boost for Our Baffles

■ I varied the "Octahedral" (April, 1956, issue, p. 74) to fit a 10" speaker and am very happy with the results.

I used Celotex lining for the three non-parallel sides, attached the speaker to an old radio receiver, and find that the highs and lows are better now than when the set was new.

IRVING LANG
Bronx, N. Y.

New Twist on the Mark II

■ Just finished the Mark II $3 speaker baffle described in the May issue. I don't think that any enclosure costing more than ten times as much gives better sound reproduction.

I managed to make the Mark II out of a 4' x 6'

sheet of Celotex, so really the Mark II is a $2 baffle for a 12" speaker. Your other readers can do this by cutting the 4' x 6' sheet right across at the 39" line. This half is used for front panel A and back E. The other half is 33" long; cut sides C and D out of it and glue and nail a 1" strip on one end of C and D so they are 34" long. Then there will be enough material left for pieces B, F, G, and H.

MICHAEL SALUSOO
Toronto, Ont.

More on OAB—OAB—

■ I'm just another fellow curious about that so-called "OABT OABT" radio signal on 538 kc.

F. E. HULSMAN, VE1YQ
Yarmouth, N. S.

As mentioned on page 28 of our last issue, the signal OAB— was determined to be an aircraft beacon operated by the USAF at Otis Air Force Base. This information did not prove to be 100% accurate since the transmitter is actually located at North Truro, Mass., near the tip of Cape Cod.

Good L.F. Converter

■ Please mention to your readers that the popular Command receiver known as the BC-453 makes a good low-frequency converter. I have used this receiver as a tunable i.f. and l.f. converter with excellent results. It is still available as a war surplus item for about $10.

WES HAYWARD, W7ZOI
Richland, Wash.

Another Low-Frequency Mystery

■ In the lowest section of the broadcast band, I can hear a continuous transmission of twelve A's and IYT (sent twice). Apparently it is only audible in this territory. What is it?

PAUL ALEXANDER
Conroe, Texas

Anyone for Colombia?

■ I enjoyed my first issue of POP'tronics and think you will have a regular reader in Bogota in the future.

I am interested in exchanging letters with any readers who wish to learn or practice Spanish. It would be fine if correspondents were interested in ham radio or servicing.

GUSTAVO BERNAL, SZA
Radio Clinica
Calle 13-A #17-36
Bogota, Colombia

Yagi Works FB on FM

■ I sure like that FM Yagi antenna on page 58 of the July, 1956, issue. I'm getting some DX on this band and was wondering about possibilities of scatter reception.

GEORGE PETERMAN
Washington, D. C.

We're glad to report, George, that a feature article on scatter reception of FM and TV signals is scheduled later in the fall. The likelihood of scatter FM signals is not too good. As will be pointed

out in our forthcoming article, the scattering effect from the ionosphere stops around 70 mc. The tropospheric scattering effect does not pick up until the frequency is around 500 mc.

OOPS!

■ Did you know that the photo on page 98 of your July, 1956, issue showing the "wire jungle" was upside down?

THE FRAMEMEN
Beacon Office
Richmond, Cal.

Oh well, another reason why most of our editors have snow-white hair. Associate Editor Fantel, Art Editor Reich and the printer will alternate penitence by standing on their heads for one hour each day.

Another OOPS!

■ In your July issue, the four stamps in the upper right-hand corner of page 63 are not German. They are from Switzerland and are war souvenirs.

LOUIS SAMUEL
Shelton, Conn.

■ Those German stamps are really of Swiss origin. The name "Aktivdienst" was the common and official designation for Army Service in Switzerland.

DR. F. KREUZER
Hanover, N. H.

Many thanks to eagle-eyed readers Samuel and Kreuzer. Absolute identification of these stamps was appreciated by all concerned. The stamps were used to solicit money for members of the Funker Kompanie as a sort of PX or company recreation fund.

Miniaturized W/W Control

■ You may be interested to know that I was able to miniaturize the wired-wireless control receiver. This was originally described in your June, 1956, issue on page 63.

I substituted a miniature 7-pin thyratron (known as the 5823) for the OA4-G and a Clarostat "humdinger" potentiometer, combined with a miniature ratchet relay. Then I was able to mount it all in a 1" x 7/8" x 2" plastic case.

The ratchet relay also gives me the advantage of the lock-in feature; the first pulse turns the receptacle "on" and the next pulse turns it "off" again.

E. H. KLINE
Philadelphia, Pa.

Availability of Utah Transformer

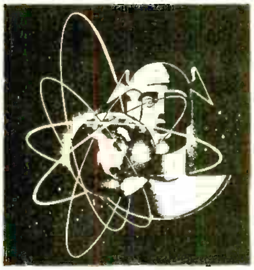
■ I would appreciate your bringing to the attention of your readers that the Utah 1755 transistor transformer is available from Lafayette Radio, 100 Sixth Ave., New York 13, N. Y. I have checked with this company and they report a good stock.

This transformer was required in my article on the miniature tone generator, page 71 of the May, 1956, issue.

FRANK H. TOOKER
Lakehurst, N. J.

Thanks for the information, Frank. We hope that it will be helpful to our readers. —30—

SPACE MAN...



with a Brief Case

Science has a new kind of space man these days. He carries a brief case.

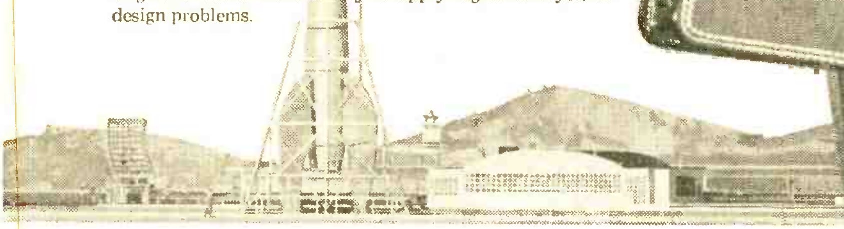
His mission is as new, as exciting and as challenging as a trip to the moon. In many cases you'll find him on the team at Remington Rand Univac®, one of the engineers or technicians who have given UNIVAC the title,

"First in Electronic Computing Systems"

Futures at UNIVAC are as unlimited as the space above. In fact, new facilities and fresh working conditions are being born each day at Remington Rand Univac which means that new members are needed for the Univac team. This is your chance to establish the career every man wants. Write today.

IMMEDIATE OPENINGS FOR:

At South Norwalk we have immediate openings for Mechanical and Electro-Mechanical Engineers with a bachelor's degree in *Engineering*. Extensive mechanical design background may substitute for some college. Men selected will do basic preliminary design and layout of small mechanisms. Work will require the development of original ideas and the ability to apply logical analysis to design problems.



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Attention Mr. A. L. Croble

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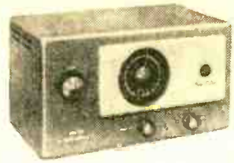
MODEL S-38D
$49.95

COVERAGE: Standard Broadcast from 540-1650 kc plus international reception on 3 Short-Wave Bands covering 1650 kc—32 Mc.

The radioman's idea of radio . . . This famous Hallicrafters' radio, now with smart new styling, amazes even the experts with its superior performance. Featuring the same skillful engineering found in much higher priced communications sets make the S-38D ideal for the Short-Wave listener or new radio amateur.



MODEL S-94 or S-95
$59.95

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

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

for hams • novices • short wave listeners...

MODEL S-53A
$89.95

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

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

MODEL S-85 or S-86
$119.95

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

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

world wide enjoyment is yours with hallicrafters ...at everybody's price!

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

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

TYPE OF SIGNALS: AM-CW-SSB

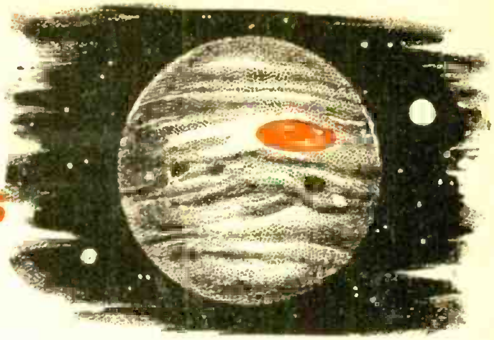
FEATURES: Precision gear drives are used on both main tuning and band spread dials.

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

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

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

Radio Waves Heard from Jupiter and Venus

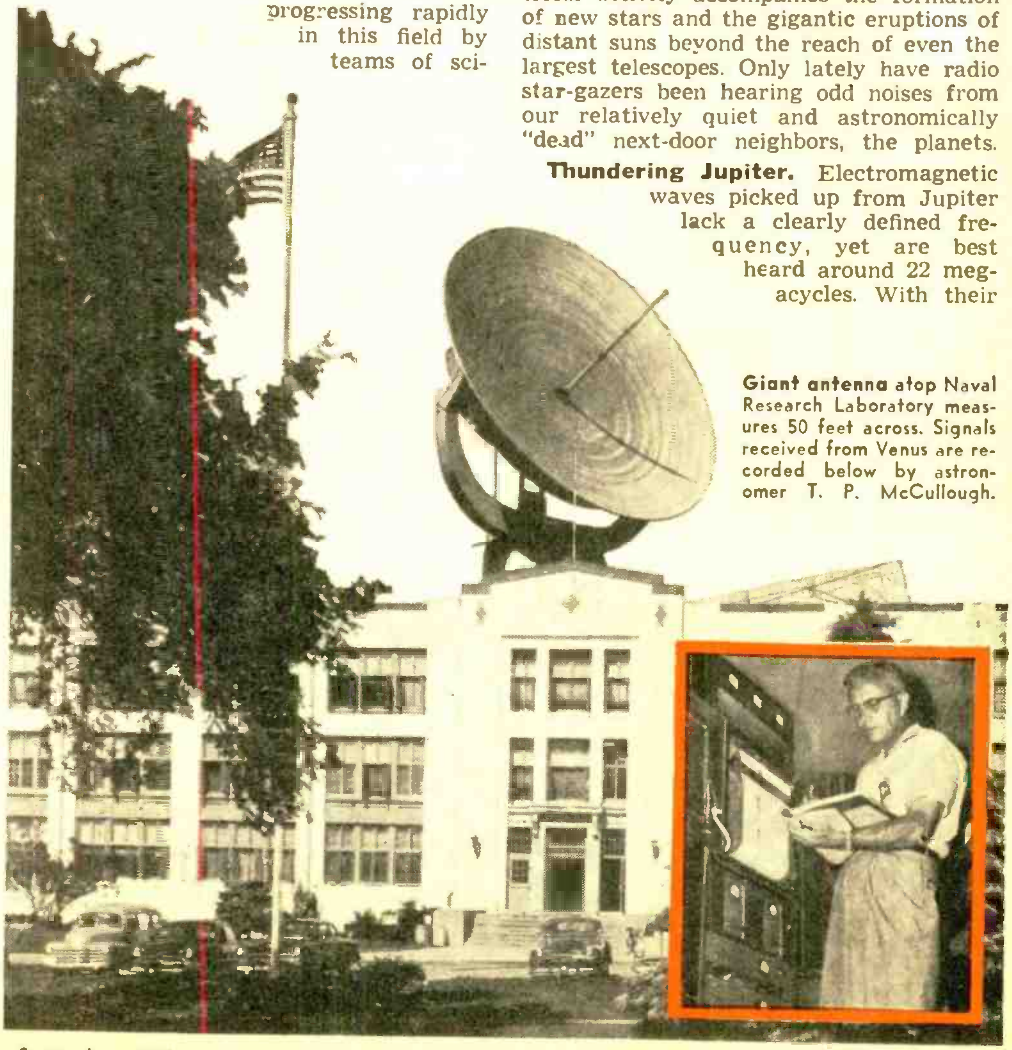


By O. P. FERRELL

RADIO WAVES spanning interplanetary space are now a certainty. The dreams of science fiction writers and the predictions of Nikola Tesla are closer to reality. Positive identification of radio waves generated by means unknown on both Jupiter and Venus has been established. Work is progressing rapidly in this field by teams of scientists in Europe, Australia and the United States, where giant radio telescopes are now in use.

Radio signals from beyond the earth have been known for about twenty years. But these came mostly from turbulent areas of outer space, where intense electrical activity accompanies the formation of new stars and the gigantic eruptions of distant suns beyond the reach of even the largest telescopes. Only lately have radio star-gazers been hearing odd noises from our relatively quiet and astronomically "dead" next-door neighbors, the planets.

Thundering Jupiter. Electromagnetic waves picked up from Jupiter lack a clearly defined frequency, yet are best heard around 22 megacycles. With their



Giant antenna atop Naval Research Laboratory measures 50 feet across. Signals received from Venus are recorded below by astronomer T. P. McCullough.

frequency distribution being random throughout a wide band, the signals sound just like static caused by storms. Since Jupiter, like Earth, is surrounded by a gaseous atmosphere, it is quite possible that the radiation it sends out is a sign of turbulent weather.

Lending probability to this theory is the electrical behavior of the weather-bearing layers in our own terrestrial atmosphere. About 50,000 thunderstorms per day pass over the face of the earth. About 2000 are going strong at any one moment, giving off about 100 lightning flashes every second. Each lightning flash is a 3-millisecond burst of 2000-3000 amperes, reaching peaks around 10,000 amperes. That's a lot of electrical popping for our small planet. To radios on Jupiter, it would probably sound the same way that the waves from Jupiter sound to us.

Hot Venus. Until a few months ago, it seemed that Jupiter was the only planet to radiate electromagnetic waves. Yet earlier this year, Dr. John Kraus of Ohio State University also caught signals from Venus, the planet which is prominent in the sky as the Evening and Morning Star. The Naval Research Laboratory in Washington independently made the same discovery.

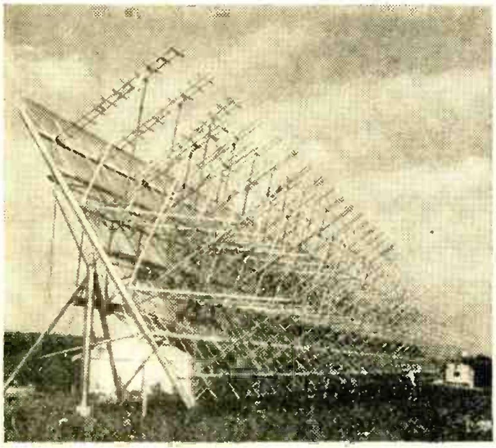
Signals from Venus reported by the Navy differ from those of Jupiter. They are not generated by electric disturbances of the atmosphere, but by the molecular activity of heat. The wavelength of the Venus signals stays fairly constant at 3 cm., which corresponds to a temperature of more than 212° F—the boiling point of water. Any water existing on Venus would therefore be in the form of steam. This makes it unlikely that living organisms as we know them could exist on that planet.

Giant Antennas. No ordinary antenna will catch these faint signals from the stars. Instead, radio astronomers employ huge parabolas or dipole arrays to concentrate the dim stellar mutterings at the receiver input.

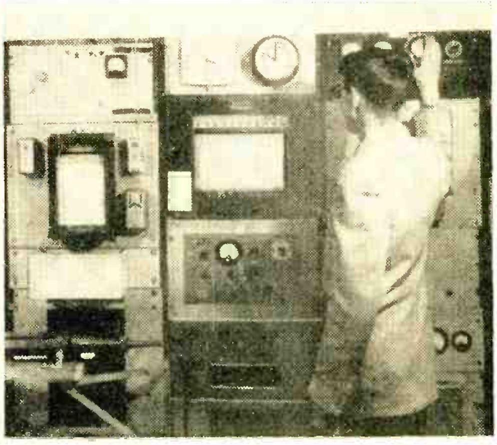
For instance, the giant parabola atop the Naval Research Laboratory Building in Washington acts like the mirror in an ordinary optical reflector telescope. All the energy is focused in a single point at the tip of the central pole, from whence it is funneled to the receiver. The antenna is automatically rotated so as to keep pointing at the same target in space, regardless of the motion of the earth. Signal gain attainable with this antenna is over one million.

The optical refracting telescope, exemplified by ordinary field glasses, also has its electronic equivalent. Helical antennas, looking like vast coil-spring mattresses, bend the incoming radio waves as a deflection coil bends the beam in a TV tube. In this manner, they concentrate the incident energy at the pickup point. By stringing a large number of coil-shaped structures in an array, the gain is multiplied in proportion to the total antenna size. On this principle, Ohio State University built the 96-coil unit, which successfully eavesdropped on Venus.

Whether similar waves will be heard from Mars is still an open question. As Mars draws closer to Earth this year than it has at any time within the past 20 years, the chances of intercepting its radio waves, if any, are greatly increased. Experiments continue as the massive antennas seek out our brother and sister planets in the solar system. —30—

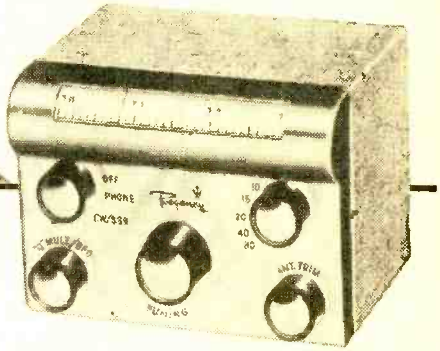


Helical antenna array for the radio telescope at the Ohio State University consists of 96 spiral coil elements to refract the incoming signals.



Ultra-sensitive superhet receivers are checked by technician to assure low internal noise for clearer recognition of marginal signal patterns.

First Transistorized Short-Wave Converter



Our POP'tronics model this month is Diane Pattou. Photographer and secretary, Diane was a "find" of your editors working in another Z-D publication, Popular Photography.

Cover Photo by Maynard Frank Wolfe

THE BOTTLENECK preventing the evolution of transistorized equipment into the short-wave bands has been broken. Appropriately, the first step was taken by Regency—who several years ago introduced the first truly miniature all-transistor radio receiver. Their revolutionary new transistor converter covers all of the short-wave ham bands up to 30 megacycles!

Heart of the converter is the recently announced surface barrier SB-100 transistor.* It is utilized in a special circuit to serve as a high-frequency first detector stage. Credit for the design is due J. F. Towler, V9MNY, ex-W5BYV and W5CEG. Bandspread coverage of the 80, 40, 20, 15 and 10-meter bands results from very careful permeability-tuned coil design. Sensitivity is roughly comparable to mobile ham converters with two or three vacuum tubes.

An additional transistorized circuit (using a 2N172) has been wired into the Regency amateur band converter. This circuit can be made to oscillate, thus enabling reception of either regular c.w. or single-sideband (SSB) signals. When the converter is switched to the phone reception position, the 2N172 circuit becomes a special "Q-multiplier." As pointed out on page 91 of our May, 1956, issue, "Q" multiplication permits increased selectivity or station separation ability. A front panel control is attached to the circuit so that the ham or SWL operator can adjust the degree of selectivity or the amount of c.w. injection voltage.

Called the ATC-1, the Regency converter weighs just about 30 ounces. In size, it measures 4¾" wide, 3¼" high, and 4" deep. Although the converter can be used anywhere with any type of broadcast-band receiver, the manufacturer is making special provisions to bracket-mount it on an automobile steering column.

As in all transistor circuits, the power requirements are almost unbelievably small. Three penlite cells, securely mounted in clips on the back panel of the converter, provide enough power to operate it for at least six months. Batteries are readily accessible without removing the case.

In order to assure maximum protection of the SB-100 surface barrier transistor, a crystal diode (CK706) is employed as a high-intensity signal bypass. Thus, if the converter is used in an automobile, the CK706 will prevent damage to the transistors should another mobile transmitter pull up alongside in another car. Hams will also be interested in knowing that a connection is provided on the rear panel which permits the converter to be disabled during transmissions.

Since the ATC-1 is self-powered and only requires a connection to a broadcast receiver (1200 to 1300 kc.) and an antenna, it will find many uses in homes, cars and field trips of hams and SWL's. —30—

* Practically all transistors in use on the market today are fused junction or alloy types. This is also the first commonly available application of the new surface barrier transistor.

Storm Tracking in Your Living Room

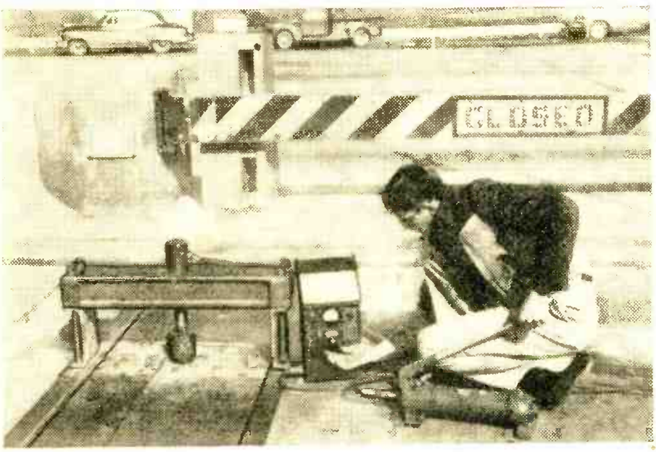
A RADAR DEVICE linked to WLW's regular TV transmitter is the very newest wrinkle in weather reporting. With a specially adapted antenna installed atop the WLW transmitter building overlooking Cincinnati, and a radarscope at the downtown WLW Weather Station in Crosley Square, this new unit can "track" approaching storms within a 125-mile radius of Cincinnati, Ohio.

The only such permanent installation in the world to be operated by a TV station, this radar will provide televiewers with the unique opportunity of actually watching the weather on the radarscope as it moves across Cincinnati's television territory.

Costing $25,000, the device was manufactured by Decca in England. It will be able to forecast with pinpoint accuracy the direction, speed and time of arrival in the WLW television area of any given thunderstorm, tornado, or unusual weather.

Radar-gathered weather news supplements reports from the widely scattered official weather stations to fill in purely local conditions. Radar spots threatening cloud masses that cause sudden freak storms or showers, which otherwise would go unpredicted. According to Jim Fidler, who heads WLW's weather service, the new device will allow as much as six to eight hours speedup in weather forecasting, thus lengthening the forecast span.

Electronic Scales Weigh Trucks on the Run



Dynamic weighing on highway scales is expected to solve many traffic problems. Accuracy of weight measurements is checked at regular intervals by means of a calibration kit (as shown at left). Test loads are applied through the calibrating cell to the scale platform, and weights as recorded in the toll booth are compared with readings on the indicator.

WITH MORE GOODS and more people than ever on the move, America's transportation seems to be heading for some kind of general traffic jam. Until new highways are completed, the main job is to get maximum traffic flow on already existing roads.

On the Pennsylvania and Ohio Turnpikes, trucks no longer need to stop for the scales, thereby holding up traffic and blocking a lane. They are now weighed "on the run" by a new electronic scale. A strain transducer imbedded in the road converts weight to voltage. An indicator in the toll booths adds up the weight for the total number of axles on the truck and identifies overloaded axles. Photoelectric cells provide an automatic count of the number of axles on any given truck.

Besides keeping traffic rolling at a faster rate, the electronic scale, made by Baldwin-Lima-Hamilton Corp. of Philadelphia, offers other advantages. It has no moving parts, responds instantly to load, is hermetically sealed against dust and moisture, stays accurate in any weather, and deflects less than 1/100th of an inch under the heaviest load.

No more fumbling for light switches with the "Touch-o-Matic!" Designed as a lamp base, it can be modified to control on-and-off switching of any electrical device in the home.

The "Soft Touch"

An Electronic Touch-o-Matic Control

By **HARVEY POLLACK**

The last word in convenience and safety, this easy-to-build light and appliance control turns on or off at a mere touch

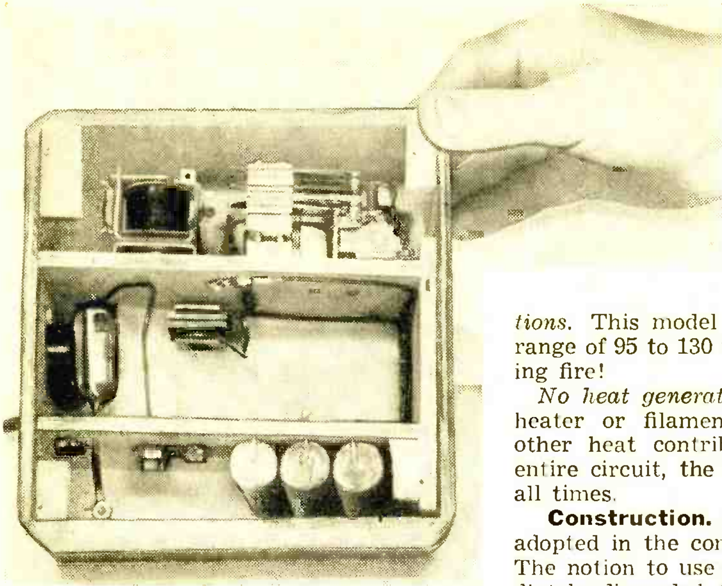
A TOUCH of the fingertips and the lights flash on! Another touch—and off they go! Now, modern electronics brings you a luxurious new type of light and appliance control that ends all fumbling for switches and pull-chains in the dark. Best of all, you can build it easily and inexpensively in a couple of evenings. Once it is put into operation, watch the mystification on the faces of your friends. Note, too, how many orders you get from them for duplicate "Touch-o-Matic" controls.

The unit to be described here was designed as a lamp base, but it may be modified easily to control on-and-off switching of any electrical device in the home. Since it operates when any part of the body bridges the space between two adjacent conductors, it has a multitude of possible applications.

For those suffering from the effects of paralysis, two touch plates may be mounted within one-quarter of an inch of each other on the wall so that the forehead or cheek can conveniently bridge the gap. Immobilization of the fingers due to arthritis or accident presents no problems to the "Touch-o-Matic" control. The back of the hand, the elbow, or the forearm may be used to operate lights or electrical appliances, to make nurse calls, or do any other switching job.

Any electrical device used around the home, particularly within the reach of children, must feature the last word in safety. Here's how the "Touch-o-Matic" control stacks up.

No shock hazard. The touch plates are isolated from each other by an extremely large resistance. The same is true of the a.c. lines and either touch plate. Even on



Double-shelf construction of the wooden chassis makes for easy wiring. Upper side of top shelf holds the 7-pin socket and relays RL1 and RL2; under side, the selenium rectifier SR1 and resistor R1. Upper side of bottom shelf holds resistor R2; under side of bottom shelf, resistors R3 and R4 and capacitors C1 and C2.

a direct short circuit to ground, the maximum current that can flow is of the order of 1/10,000 of an ampere.

No polarized plugs. A standard a.c. plug is used. It may be inserted in the receptacle in any position without affecting the positive action of the "Touch-o-Matic" control.

Negligible idling current. The standby power consumed is so low that the total cost of operation over a period of a year of normal usage is less than 15 cents.

Wide tolerance for line voltage variations. This model has been tested over a range of 95 to 130 volts without once missing fire!

No heat generated. Since there are no heater or filament type tubes, nor any other heat contributing elements in the entire circuit, the system will run cold at all times.

HOW IT WORKS

The 5823 is a cold-cathode thyratron. Although its anode and cathode are directly across the pulsating d.c. supply from the selenium rectifier, the tube does not fire as long as the grid or firing electrode is floating. When the contact plates are bridged by even a very high resistance, the positive line voltage peaks are applied to the grid, causing the tube to fire. The anode potential is applied as a voltage which appears across the 1-μfd. capacitor *C2*, which charges to approximately line voltage through *R2*.

As the 5823 triggers, relay *RL1* in its cathode circuit is pulled in; but as soon as the charge on *C2* drops below the critical voltage, the tube is restored to its non-conducting condition except for a small residual discharge—which keeps *C2* from again taking on sufficient potential to initiate a second large discharge. Hence, the fingers may be held on the contact plates indefinitely without causing repetitive relay action.

As soon as the bridge is removed, however, the grid again floats and even the small residual discharge disappears, permitting *C2* to charge to line voltage once again, readying the control for the next impulse. The 22-ohm resistor, *R1*, serves as a surge protection for the selenium rectifier and also as a fuse if *C1* should become short-circuited.

Relay *RL2* is a locking relay which alternately opens and closes the external circuit with each advance of the cam.

Construction. A unique approach was adopted in the construction of the model. The notion to use a metal box was immediately discarded for two reasons: relays switching inside metal produce objectionable noise, and there is always danger of short circuits and exposure to the line voltage where so much metal is present. Thus, wood was used throughout.

With an eye to easy wiring and the elimination of "tight" spots, a double-shelf construction design was selected as illustrated in the photographs. The small shelves are first cut to size and drilled for the mounting screws. The components are then mounted as follows:

Top shelf, upper side: the 7-pin miniature socket (bottom up), the 2500-ohm relay (*RL1*), and the 120-volt a.c. locking relay (*RL2*).

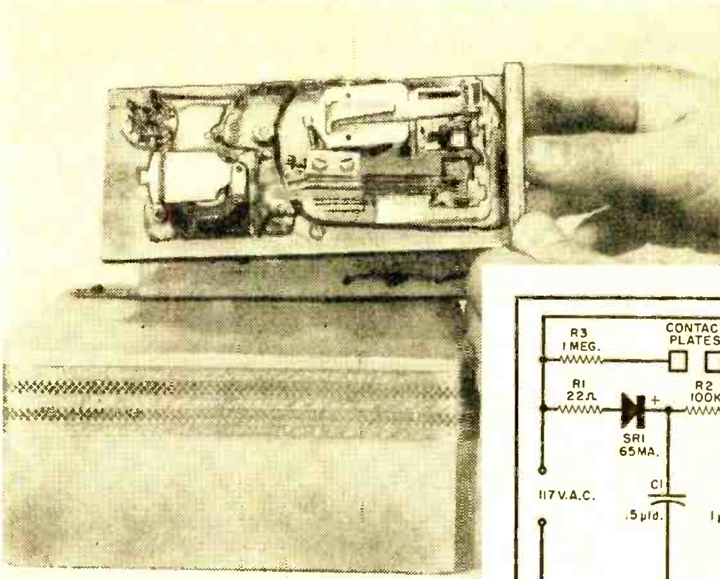
Top shelf, under side: the selenium rectifier and the 22-ohm series resistor (*R1*).

Lower shelf, upper side: resistor *R2*.

Lower shelf, under side: resistors *R3* and *R4* and capacitors *C1* and *C2*.

One ¼" hole is drilled through the upper shelf near the locking relay for the passage of all intershelf wiring. The shelves carry the required solder lugs for the pigtails of the small parts; small holes through which the leads of the capacitors pass support these components adequately. The shelves are glued to the supporting plywood side before wiring by grooving the latter slightly and cementing with a good wood glue such as "Elmer's Glue-All."

Except for the four wires that go to the output socket *SO1* and the contact electrodes, all wiring should be completed and tested before the shelf assembly is slipped into its case. Note that only two of the locking relay contacts are used: one of the moving-blade contacts, and its associated lower contact. This relay is a stock item

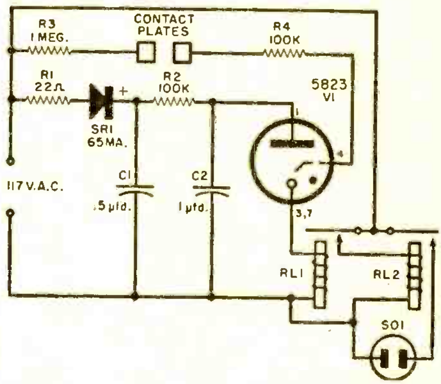


Looking down at the top shelf of the chassis; note position of socket and relays. Brass strapping around the upper rim of the base serves as one contact electrode. A short piece of strapping across the top-rear of the box, on which metallic base of lamp will rest, acts as the other contact electrode.

which, in its least expensive form, comes equipped with double-pole, double-throw contact configuration.

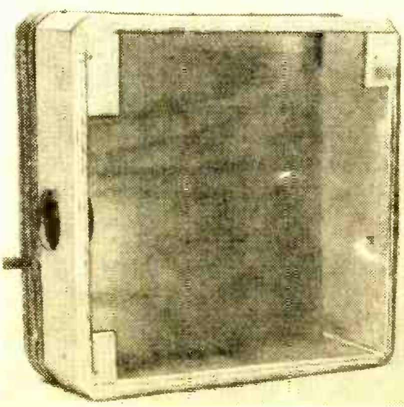
The case is a matter of individual preference. The author's model was constructed entirely of glued three-ply fir with deeply chamfered corners. A strip of ornamental lamp base brass strapping encircles the upper rim of the base to serve as one contact electrode. A short piece of the same material across the top-rear of the box acts as the other electrode. The lamp has a metallic base which rests upon the short length of strapping; hence, bridging the gap between the lamp base and the rim strip operates the relay from almost any position. A chassis type of a.c. receptacle on the side completes the case assembly.

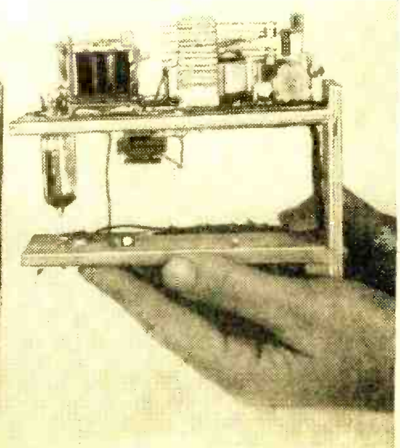
Testing. Before applying a.c. power, use your ohmmeter to make sure you have



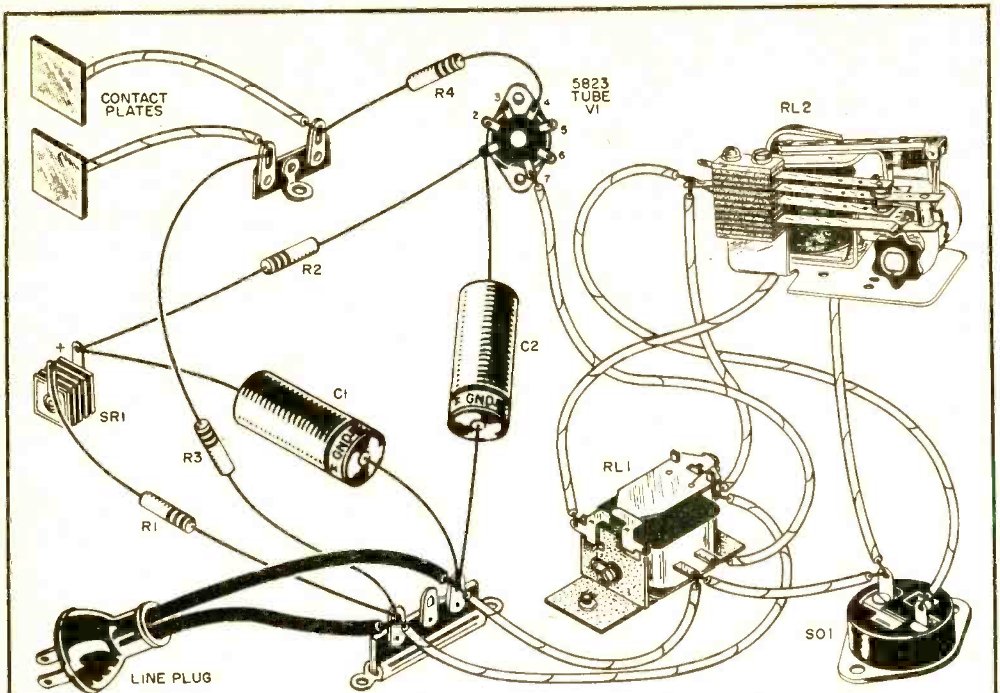
C1—0.5 µfd., 400-volt capacitor
C2—1.0-µfd., 400-volt capacitor (two 0.5-µfd. units used in model to fit space)
R1—22-ohm, ½-watt resistor
R2, R4—100,000-ohm, ½-watt resistor
R3—1-megohm, ½-watt resistor
RL1—2500-ohm, s.p.d.t. relay, upper contact not used (Potter & Brumfield LB-5 or equal)
RL2—110-volt a.c. locking relay (Guardian 1R-RC-100-115 AR)
SO1—A.c. receptacle, chassis-mounting type
SR1—65-ma. selenium rectifier (Sarkes-Tarzian Model 65)
V1—5823 tube
1—Line cord and plug
1—7-pin miniature tube socket
1—Strip of brass strapping for case

Wiring diagram and parts list for the control.





Glue the shelves to the supporting plywood side before wiring by grooving the latter slightly and cementing with a good wood glue. All wiring should be done before shelves are inserted in case. A chassis type of a.c. receptacle on the side completes the case assembly.



Pictorial diagram shows how the parts of the "Touch-o-Matic" are interconnected.

not inadvertently wired in any short circuits. Also check to see that *R3* and *R4* isolate the contact plate terminals from the rest of the system. Note the position of the contacts of relay *RL2* (the locking relay) and plug the line cord into the a.c. receptacle.

Using your fingers, touch both of the contact terminals. The 2500-ohm relay (*RL1*) should pull in and drop out immedately, causing *RL2* to advance to a new position. If the contacts were open, they should now be closed and vice-versa. Remove the fingers and repeat the procedure, allowing about a half-second or so between bridgings. The cam of *RL2* should rotate to an alternate position each time the control is triggered.

If everything operates according to these specifications, the double shelf assembly may now be slipped into the case and the four remaining wires connected: two leads to *SO1* and two leads to the case contact strips.

Trouble-Shooting. Assuming that all wiring is correct, one or more defective parts may occasionally cause troubles to show up. Here is a list of possible troubles that could occur, together with suggestions for cures that will probably prove helpful to you.

Overheating and smoking of R1. This is an indication that *C1* is short-circuited. Test this part with your ohmmeter. It should show several megohms of resistance after taking a charge.

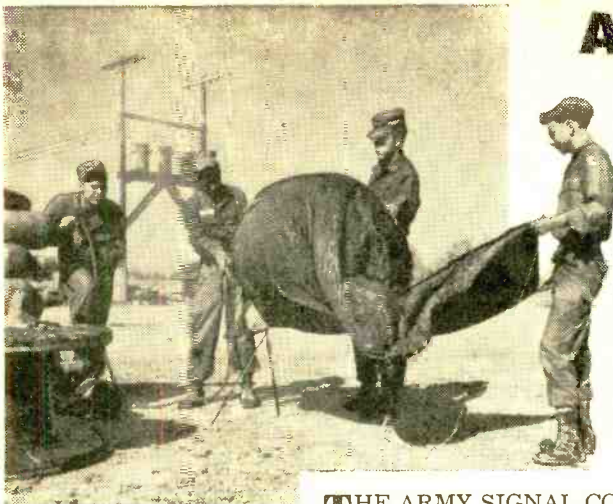
Overheating of the selenium rectifier. C1 may be very leaky. Replace it with a better grade of capacitor.

Relay RL1 does not pull in. Quite a few things may cause this: (a) an open relay coil on relay *RL1*—check with ohmmeter for continuity; (b) defective 5823 tube—test by replacing with another tube of the same type (this tube cannot be checked on a tube tester); (c) leaky or open capacitor *C1* or *C2*—check with capacitor checker or by substitution; (d) either *R3* or *R4* may be open—check with ohmmeter; (e) selenium rectifier could be defective—measure voltage across *C2* with v.t.v.m. (voltage should be 100 volts or over).

Relay RL1 pulls in but does not release upon removal of bridge. The 5823 may be defective—make a replacement check. *C2* may be labeled incorrectly. Too much capacitance here may cause this to happen. Check by replacement.

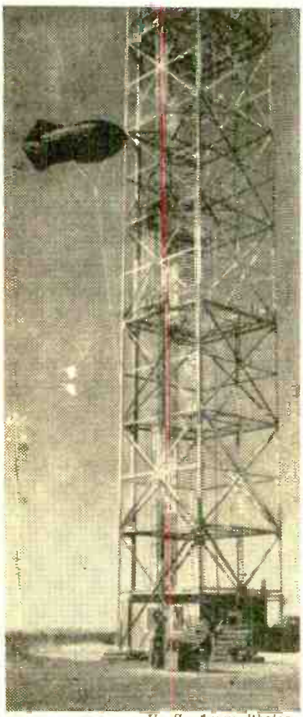
Relay RL1 chatters or hums with bridge in place. R2 may be short-circuited or too small in value—test with ohmmeter.

Relay RL1 works correctly but relay RL2 does not advance. Assuming that the coil of relay *RL2* has been checked previously by tapping it right across the a.c. line, the most likely cause of this trouble is apt to be dirty or oxidized contacts on relay *RL1*. —30—



Army Studies Radio Wave Curvature

Weather tests are being conducted by Army to analyze effects of temperature and humidity changes on microwave transmissions. At left, members of meteorological team prepare "KYTOON"—a helium-filled nylon-covered balloon—for ascent.



U. S. Army Photos

The "KYTOON," carrying a "Wiresonde" which records temperature and humidity, rises in front of 200' tower containing electronic equipment used to measure air conditions (above). This weather balloon can go as high as 1500 feet.

THE ARMY SIGNAL CORPS is carefully watching weather effects on microwaves with an eye towards "seeing" beyond the horizon. Normally, microwaves—used by u.h.f. TV stations—can only travel from transmitting point to the horizon, or within line of sight. However, certain types of weather conditions trap these radio waves and curve them around the horizon.

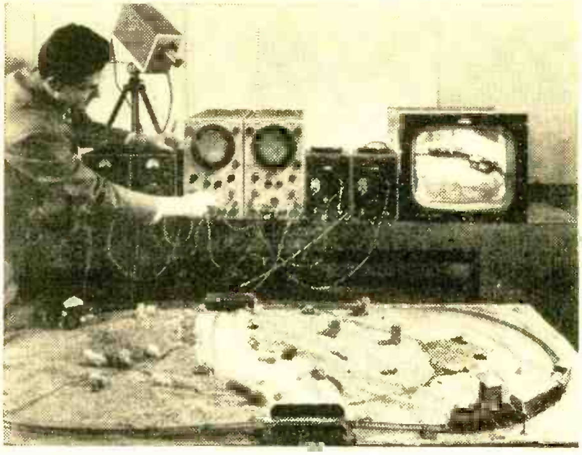
Personnel of the Aviation and Meteorological Dept., Army Electronic Proving Ground, Fort Huachuca, Arizona, are interested in determining the exact constitution of these unusual conditions. Electronic measuring instruments have been developed that will detect minute changes in the temperature and humidity of surrounding air.

Scientists have discovered that a small change in the humidity of the air near the surface has the effect of trapping the radio wave. Microwaves caught by trapping are said to be "ducted"—or passed along as if they were inside of a metallic wave guide. A sudden temperature rise some 50 to 200 feet above the surface appears to have the strongest effect.

The Signal Corps needs to know the extent of these effects to judge whether or not microwave transmissions can be intercepted by an enemy. During World War II ducting was suspected when TV pictures from the Nazi-held transmitter in Paris could be seen across the English Channel—to the military advantage of the British. —30—

Wind direction, velocity and humidity are checked on instruments located in base of tower (right). Testing takes place at Gila Bend, Arizona.

Electronics "Feels Out" Toy Train Track



THIS MODEL RAILROAD is no toy. Its weight, as it presses against the track, its centrifugal force on curves, and all the other factors of its motion are picked up by strain-sensitive transducers, converted into voltages, and automatically recorded and displayed by the instruments arrayed in the back.

The purpose of this elaborate setup is not to increase safety on model railroads but to demonstrate to automation engineers the possibilities of electronic control of manufacturing processes.

Designed by Allen B. Du Mont Laboratories, Inc., the system includes oscilloscopes so sensitive that the minute signals generated by the strain and displacement gauges on the tracks can be displayed without need for preamplifiers.

The railroad is "watched" by the Du Mont "Tel-Eye" closed-circuit industrial TV system. The small camera near the engineer's head "sees" the picture projected on the TV screen at the far right. Together, the visual and telemeter monitors provide complete supervision for almost any industrial process.

Radomes Tested to Assure Radar Accuracy

MILITARY AIRCRAFT carry hundreds of pounds of specialized electronic equipment. Largest and most cumbersome are the antennas for radars. To protect these antennas, they are often hidden behind plastic bubbles—commonly called radomes.

As flight speeds increase, radomes must become sturdier; and as they become sturdier, they are more likely to affect radar waves. To check on the effects of radomes upon radar signals, the U. S. Air Force has established a radome testing range. It is part of the Air Research and Development Command's Wright Air Development Center, Dayton, Ohio, where an elaborate radiation research program has been under way for many years.

Specialized microwave antennas are mounted inside radomes and the amount of radar signal energy absorbed or reflected by the radome measured. In test installations, the radomes can be tilted and rocked around the radar antenna. Beam distortion, false reflections, and bore sight (directional) errors are being studied.

Transmission and reflection of microwaves by the radome seen through glass is recorded in this test monitor station by an Air Force research team at Wright Air Development Center.

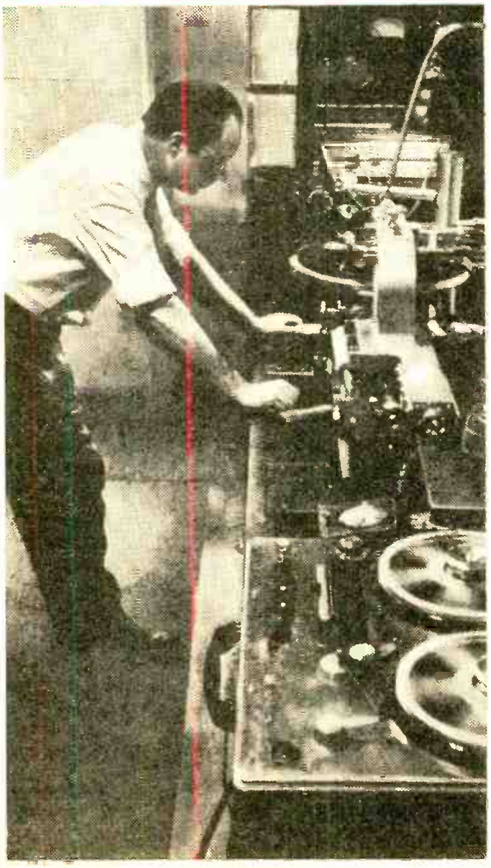
Microwaves are sent through radome inside the building to the receiving antenna being adjusted in foreground. The radome is rotated during the test to permit waves to penetrate all parts.

Hi-Fi Revives Kings of Swing

By ROBERT M. HAWTHORNE

Electronic wizardry brings back unfaded favorites of jazz

Glenn Miller's trombone still casts magic from millions of phonographs with new tonal gloss gained by dubbing process shown below.



EVERY ONCE IN A WHILE, something happens to show up the old pessimist who said that we can't eat our cake *and* have it. Nine times out of ten, lately, that "something" comes out of an electronics laboratory.

This time, the breadboard boys have dared and done the impossible by coaxing the music but not the noise out of aging records to give us back our good old-fashioned cake with fresh hi-fi trimmings. The delicacy they serve up is the Golden Era of Swing—the late 30's; and it's good to savor the smooth blend of this fine old recipe once more.

Benny Goodman, Glenn Miller, Tommy Dorsey—these are names to conjure with. And the conjuring is done by audio engineers who delve into stacks of fuzzy old broadcast transcriptions, put them through the electronic mill and come up with clean, up-to-date sound. If there's magic in the music, some of it must have rubbed off to turn sober engineers into sorcerers. For yesteryear's Kings of Swing are transplanted into the hi-fi age, not dimmed by time but with their tonal luster actually brighter than on the distant day when they faced the microphone.

There was no tape then to offer linear response to the lambent shades of Artie Shaw's warm-molasses clarinet or the mellow swoops of Tommy Dorsey's trombone. Recordings were cut on wax and acetate

Tommy Dorsey

Louis Armstrong

Artie Shaw

discs whose small inner diameters crammed upper frequencies into a tightly packed tonal hash. Part and parcel of the method were the excessive surface noise, the narrow frequency range, and all the other defects we've almost forgotten since the advent of tape, vinylite, and hot-stylus feedback cutters.

Minor surface flaws might crop up in any of the several transfer steps between master and finished record—scratches, "ticks" and "pops" caused by dust particles on one of the many plating surfaces leading up to the final steel stamper. Even obscure causes like needle pinch in the grooves of the springy and therefore dimensionally unstable acetate master contributed their share to the general racket that went hand in hand with the recorded music of the 30's.

The Clean-Up. Just what kind of scalpel does the modern record surgeon use to cut away noise without skinning the music? Let's take a look in the "operating room" and watch the rejuvenation of a record, step by step. This is not a recording session in the usual sense. The familiar bustle is missing; there are no musicians adjusting stands or squawking the first note of the day on dry reeds—no technicians setting up mikes, laying cables, and intoning their monotonous "Testing: one, two, three . . ." There is, in fact, only one recording engineer, one old record, a playback turntable and a tape machine.

The old record might be a "mother," i.e., an inverse copy produced by electroplating from the original master cut. Occasionally it is an unplayed shellac pressing from the company's stock. In more than a few cases, the only recording available is a commercial copy borrowed from a private collection. The only thing we're sure of is that this is not the master, for that was almost always destroyed in the initial transfer.

Before he can take even the first step in the re-recording process, the engineer must fit the record groove with the proper needles. He wants to get out all the sound in the old record, noise included. A needle that rides the walls of the groove or digs into the bottom might miss some of the wiggles. After trying needles of slightly varying radii, he finally gets a perfect fit. He sets the turntable spinning at 78 rpm and lowers the tone arm.

The opening phrases of an old swing classic come to life in the monitor speaker. The wide-range reproducing system grabs up everything—snaps, crackles, pops, surface noise, scratch marks, perhaps some rumble, and—oh, yes—the music. The whole sonic melange is spread out on a tape, racing past the recording head at 30 inches per second for optimum response and easy editing.

Now begins the long, tedious process of noise elimination, with "clicks" and "pops" heading the agenda. To remove these, the tape is played through until a click comes along. Then the tape is stopped and backed up slowly, by hand. At this speed the click sounds like a long growl. It is snipped out, and the cut ends are spliced together. The missing piece of tape, tiny in comparison with the two-and-a-half feet the machine gobbles up every second, does not alter the beat of the music enough for even a musician to notice.

The click-removing process completed,

Benny Goodman

Count Basie

Lionel Hampton

our engineer can now turn to the music itself. He blocks out the higher frequencies of surface noise, running the signal from the original tape through a set of filters onto a second tape. The playback of the second tape shows that he cut out too much: the music is dull and thumpy from the preponderance of lows. Adjusting the equalization to pass slightly higher frequencies, he tries again. This time the life has come back, but so has some of the noise. Nine times out of ten, he winds up "riding the controls" along with the music as the tape reels off.

To catch the shimmering brilliance of a trumpet, he opens the treble wide. He can safely do so, for the blast of the instrument easily overrides the noise admitted with it. But as soon as the player takes the trumpet from his lips, the frequency spectrum passed by the filter must be narrowed again. By suitable adjustment of the filter, he tries to do justice to the various instrumental and vocal solos and passages of ensemble playing while all the time striving for the optimum signal-to-noise ratio. In classical music, the engineer follows the score. But in jazz, where most of the music is improvised, he must often learn the music by heart.

Attempts have been made to design an automatic device to "read" the frequency content and loudness level of the music from the tape and automatically adjust the filter action to suit the program material from one moment to the next. But none of these could match the deft blend of technical skill and artistic judgment that marks a good recording engineer. He regards and handles his dials as musical instruments. In effect, he becomes part of the band. Like a musician, he practices a highly personal art; for in the end he has only his ear and his finely developed taste to tell him whether he has done a good job.

Double Dubbing. At times the engineer will even perform the seemingly impossible in his search for realism. He can, for example, separate out and re-emphasize one of two instruments of *the same range* from a duet. This is not so mysterious as it sounds. Each instrument obtains its characteristic tone, or timbre, not from the basic note it plays, but from its *overtones*. These are a series of fainter tones at fixed, proportional frequencies above the frequency of the basic note, and they

(*Continued on page* 118)

SWING ERA RE-RELEASES WITH IMPROVED SOUND

COLUMBIA:

Benny Goodman	
The Great Benny Goodman (1937, 39)	CL 820
The Vintage Goodman (1931-35)	CL 821
Carnegie Hall Jazz Concert (1938)	CL 814-16

VICTOR:

Count Basie	LPM-1112
Tommy Dorsey	
That Sentimental Gentleman	LPM-6003
Benny Goodman	
Golden Age of Swing	LPT-6703
Golden Age of Benny Goodman	LPM-1099
Glenn Miller	
—Air Force	LPT-6702
—Limited Edition	LPT-6700, 01
Artie Shaw	
Artie Shaw	LPT-6000
Both Feet in the Groove	LPM-1201

DECCA:

Woody Herman	
Woodchopper's Ball (1938-42)	DL 8133

Government by Automation

THE STATE OF CALIFORNIA is trying out "government by automation." This doesn't mean that California is relying on electronic brains to provide the judgment and the know-how it takes to run public affairs. After all, there aren't any machines that can put out wisdom or statecraft. But at California's State Capitol in Sacramento, more than four million dollars worth of electronic equipment is hard at work on a variety of state chores, from maintaining employment records of more than 5,400,000 Californians to identifying hit-and-run drivers.

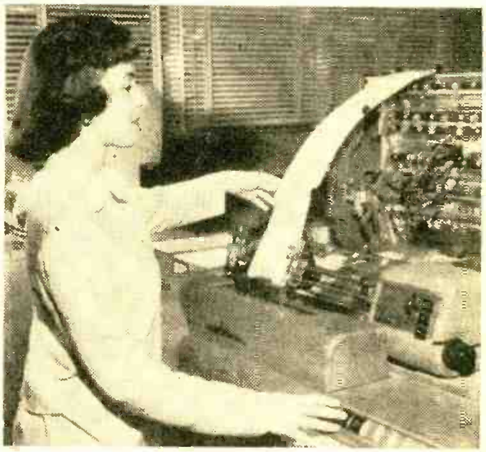
One IBM computer does engineering calculation for highway construction. It figures cut-and-fill requirements at a cost of $50 per mile. When the job was done by an engineer with a desk calculator, it cost $300 per mile. "Even more important than the monetary saving is the saving in engineering manpower," says department director Frank Durkee. "This machine does the paper work and frees engineers for field work."

In the Department of Justice, an IBM computer helps to catch criminals by sorting crimes according to the offender's special methods. For example, a burglar who has a certain way of cutting through windows to enter a home and trusses his victim in a certain manner would be quickly picked out by this machine from a great number of other crime reports. It is precisely criminals with a "professional touch" who make themselves liable to "capture" by the computer. Viewers of "Dragnet" have already seen how the computer helps police work by quickly spotting the likeliest suspects in the whole criminal file for questioning about a specific offense. In addition, IBM electronic sorters keep complete records of every gun registered in the state, and every piece of pawned property. Stolen articles can thus be spotted by machines and returned to their owners.

California completes its "automated government" with electronic payroll and bookkeeping departments. Still another IBM computer checks unemployment insurance claims in millionths of a second.

Thirty other states have already written to Sacramento for information concerning this type of push-button administration. As our population grows, maybe automation of this kind is the answer to the problem of the increasing cost and complexity of government. —30—

Highway engineer above checks electronic "earth mover," which calculates the number of cubic yards of cut-and-fill required for road construction. Automatic accounting machine below issues 16,000 car ownership certificates daily.



Photos Courtesy of International Business Machines Corp.

Accident records are totted up automatically at the rate of 150 lines per minute by this IBM accounting machine. The information is distributed to Highway Patrol Area Commanders to guide them in allocating officers to critical locations.

How to Use a Grid Dipper

By
B. VAN SUTPHIN

With a grid-dip oscillator, you can check circuits, frequency, and realign your receiver

WITHIN the past ten years, the grip-dip oscillator—or GDO, as it is sometimes called—has enjoyed a new surge of popularity. Numerous experimenters now consider the GDO as necessary in the modern ham shack or workshop as the VOM or VTVM. Grid-dip oscillators have been used in electronics laboratories for many years, but recently wide-range units in kit form became available at prices to fit the budget of the average ham or experimenter.

The grid-dip oscillator is really a calibrated, wide-range, low-power r.f. oscillator coupled to an indicating device. An example of a commonly available GDO unit is shown in the photo above. Note the use of plug-in coils so that the wide frequency range—generally from about 2.0 mc. to 250 mc.—can be obtained with minimum r.f. losses, and so that the GDO can be easily coupled to the circuit under test.

When the oscillator grid circuit is coupled to an external resonant circuit and the oscillator is tuned to the frequency of the external circuit, power will be absorbed from the oscillator and the grid current will decrease. The resonant frequency of the external circuit can then be read from the calibrated dial of the grid-dip oscillator. The "sensitivity" control is used to set the initial grid current reading to approximately half-scale on the meter—so that the dip will be sharp and easily recognized, and to allow for differences in oscillator activity on the various ranges. When the instrument is used as an indicating wavemeter, this control limits the current through the meter.

Testing Circuits. There are many uses for a GDO. Suppose that you have just finished winding the coils for a receiver or converter described in POP'tronics and want to be sure they cover the desired frequency range. Merely couple the GDO to each of the coils in turn and look for the dips in the meter reading. By tuning each external circuit over its range and checking for resonance at each end, you can quickly determine whether the coils have the desired tuning range.

Almost any resonant circuit can be checked just as easily. One important point in connection with this type of testing is that it is not necessary to apply power to the circuit under test. The only power required is for operating the GDO.

Here is another example of the kind of tests you can make with the GDO. In a ham transmitter having frequency multiplier stages, you must be sure that the individual stages are tuned to the proper frequencies. Consider the four-stage 2-me-

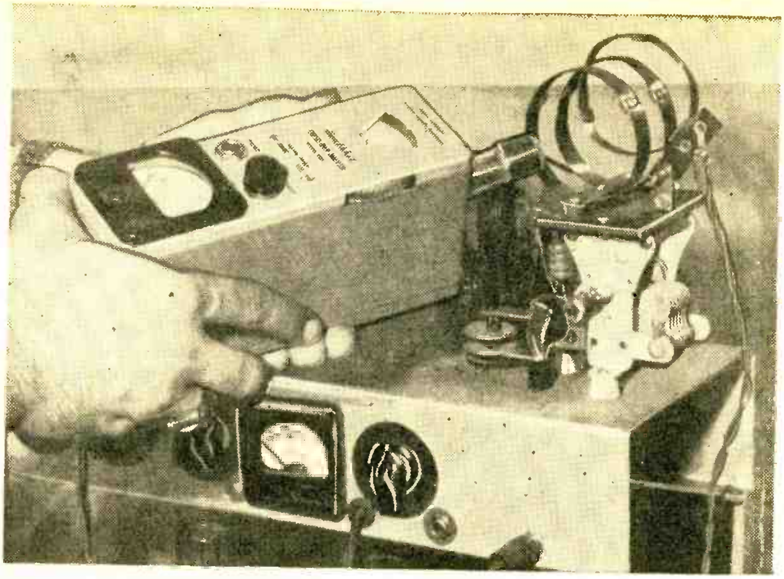


Photo at right illustrates method of coupling the GDO to a coil when making tests. This type of coupling is best both when the instrument is used as a grid-dip oscillator and when it is used as indicating wavemeter.

Method of coupling the GDO to an AM receiver loop during alignment is shown at the left. The individual r.f. and i.f. trimmers should be adjusted for maximum reading. On the opposite page is an alignment table for a typical a.c.-d.c. receiver, adapted for using GDO as a signal generator.

ter transmitter shown in Fig. 1. The plate circuit of the oscillator must be tuned to 16 mc., the plate circuit of the first tripler to 48 mc., the plate circuit of the second tripler to 144 mc., and the plate circuit of the final stage to 144 mc. By setting the GDO to each of these frequencies in turn and trying to tune the particular transmitter circuit so that a dip is obtained, you can tell whether the circuits can be tuned to resonance at the proper frequencies. This type of testing is particularly useful in preventing damage to expensive transmitting tubes in case one of the plate circuits cannot be adjusted to resonance.

This basic testing method can be used in any receiver or transmitter containing a tuned circuit. The ability to reach resonance of the tuning range of the circuit can be checked very quickly. Everyone who displays any interest in radio has had a neighbor or friend come by, at one time or another, dragging his little table-model radio and explaining: "It just stopped suddenly. I took the back off to reach the tubes and saw some loose screws, so I tightened them. One tube was bad and I replaced it—but the set doesn't play now."

Obviously, alignment is in order. Many experimenters hesitate to undertake such a job because they do not have a commercial signal generator. With a GDO, however, they have a signal generator and quickly can realign the receiver, although it is still generally best to obtain complete alignment data beforehand. This is included with the service information which can be purchased from many radio parts jobbers.

Aligning Receivers. An alignment table for typical a.c.-d.c. receivers appears on page 51. This table will be used as an example in the following discussion. Incidentally, this alignment procedure is standard for sets of this type and can be used if it is inconvenient or impossible to buy the service information for a particular brand of receiver.

Since grid dip oscillators do not have a provision for modulating the output signal, some indicating device must be connected to the receiver during alignment. A sensitive d.c. voltmeter (20,000 ohms per volt, on VTVM) connected across the receiver volume control is the method commonly used.

Connect the indicating device to the receiver circuit. Tune the set to the low-frequency end of the dial. Plug the proper coil in the GDO and set the dial to the desired i.f. The preferred method of coupling the GDO to the receiver during alignment is shown on the preceding page.

Adjust the i.f. trimmers for maximum reading of the indicator. Then set the receiver dial to the 1500-kc. point and adjust the oscillator trimmer in the receiver so that a 1500-kc. signal from the GDO gives maximum indication. Finally, adjust the r.f.—or mixer trimmer—on the receiver for maximum indication. (If there is a strong local station operating between 1300 kc. and 1600 kc., you can use the signal from the station in adjusting the oscillator and r.f. trimmers in the receiver. Simply adjust the oscillator trimmer so that the signal comes in at the proper point on the dial and adjust the r.f. trimmer for maximum output from the receiver.)

Aligning home-made receivers and converters is just as easy. Connect an indicating device to the equipment and loosely couple the GDO to the input circuit. Set the GDO to the proper frequency and go on to adjust the various stages. Most grid-dip oscillators have a switch which will convert the instrument to a wide-range indicating wavemeter or simple diode phone monitor with the addition of a pair of headphones.

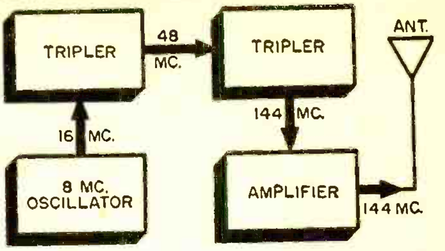


Fig. 1. A four-stage 2-meter transmitter. By setting the GDO to each of the frequencies shown, in turn, and trying to tune the particular transmitter circuit so that a dip is obtained, you can tell whether the circuits can be tuned to resonance at the proper frequencies.

Checking Frequencies. Novice hams are aware that FCC regulations require all ham stations to have some means of checking their frequency other than the calibration of the crystal or VFO used in the transmitter. With the GDO set for use as an indicating wavemeter, it is ideal for frequency checking or "band spotting."

Of course, the calibration of the GDO dial is not accurate enough for use in calibrating a VFO, but it will indicate whether a transmitter is operating in the band. If greater accuracy is desired, the GDO calibration can be checked against a frequency standard of known accuracy and a specially drawn calibration scale can be substituted.

When the GDO is set for use as an indicating wavemeter, it can also be employed as a phone monitor to check the modulation quality of the output signal. Simply plug headphones in the jack on the panel, lightly couple the GDO coil to the transmitter output, and listen while someone else uses the mike. This should provide an accurate check of your ham station phone signal.

Only a few of the many uses for the valuable grid-dip oscillator have been discussed here. You will find others described in the instruction manual accompanying this versatile instrument. —30—

ALIGNMENT INSTRUCTIONS

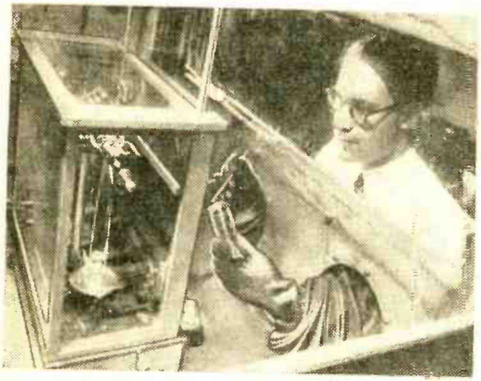
For output indication, connect a sensitive d.c. voltmeter across the second detector load resistor or receiver volume control, the positive meter lead going to the B— side of the control.

Signal Generator Frequency	Receiver Dial Setting	Trimmers to be Adjusted	Remarks
455 kc.	Low-frequency end of dial	All i.f.	If necessary to prevent interference, change setting of receiver dial slightly
1500 kc.	1500 kc.	Oscillator trimmer on smaller section of gang capacitor	See note below
1500 kc.	1500 kc.	Mixer trimmer on larger section of gang capacitor	See note below

Note: A signal from a station operating between 1300 kc. and 1600 kc. can be used in adjusting the oscillator trimmer and the mixer trimmer.

Super Magnet Gets Gas Chamber

LITERALLY TOO HOT to handle, a new material for making what may become the world's strongest magnets must be



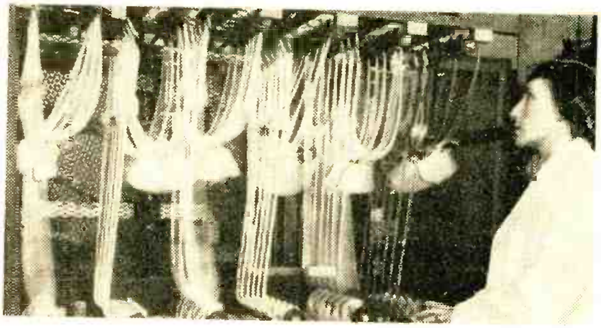
processed by "remote control." The substance is a highly purified manganese-bismuth powder which catches fire spontaneously on exposure to air. Consequently, it must be prepared and processed in the special chamber shown in the photo. The inert atmosphere of helium gas within the chamber prevents the powder from burning itself out of existence before it can be used.

Under advanced study by the Air Research and Development Command of the United States Air Force, the new material can be shaped into a variety of forms. Once processed and sealed into a plastic binder, the powder is orientated in a powerful magnetic field and molded to shape. The result is a magnet material ten times stronger than present-day types. What's more, the material can be shaped readily into a variety of novel forms that suggest a wide number of important uses and applications. Conventional permanent magnets can be made in relatively few different basic shapes.

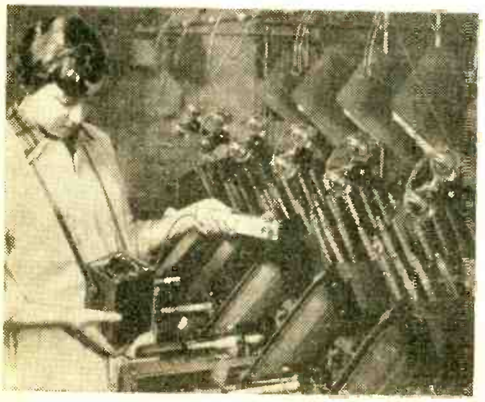
Prior to the ARDC's work with the material, major research on it was carried out by the Westinghouse Electric Corp. under the direction of Dr. Clarence Zener.

Telephone Cords Are Better, Too

EACH of the telephone handset cords shown in the photograph at right is under one pound of tension and is being bent back and forth repeatedly through a 180° arc. Periodically, throughout this test, the cords are checked electrically to determine their conductance.

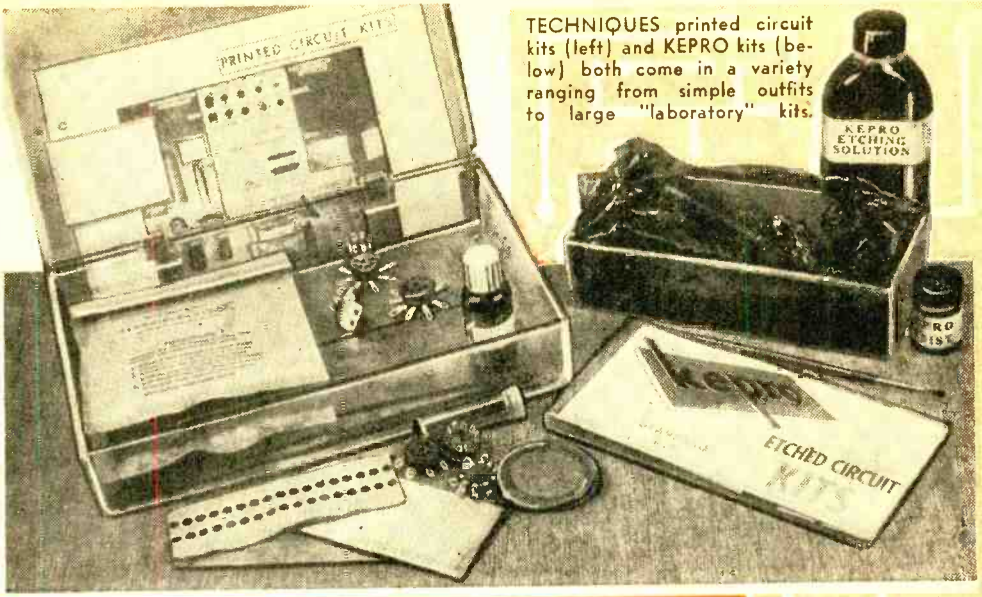


The result of this transmission line torture is, essentially, better phone equipment. Cords, like other telephone components, must keep pace with communications progress. To make sure they do so, engineers and technicians at Bell Telephone Laboratories conduct continuous research and testing. While the concentration is on handset cords, the "Cord Development Group" is also concerned with patch cords, power cords, test cords, and many others. The testing devices used subject the cords to more abuse than they would ever take in the home.



Yarn Without Yawn

AN INSTRUMENT called the "Speedotex," developed in England, measures the speed of yarn as it is fed into a knitting machine. The gadget, demonstrated in the photo by an operator in a textile mill, has been on trial for a year in many British factories. Although designed to measure yarn speed, it also levels up any number of feeds to a large knitting machine, saving over two hours in work preparations, and providing great accuracy of spindle speeds. "Speedotex" is manufactured by Dukes and Briggs Engineering Co., Ltd., Manchester, England.



TECHNIQUES printed circuit kits (left) and KEPRO kits (below) both come in a variety ranging from simple outfits to large "laboratory" kits.

"Printed Wiring" Techniques for the Experimenter

By LOUIS E. GARNER, Jr.

Part 2 of two-part series presents final steps in making your own etched circuit boards, plus other techniques

LAST MONTH we talked about the methods and advantages of substituting printed wiring methods for conventional hand wiring. We also discussed in detail the first four basic steps to follow in making an etched wiring board and assembling a complete circuit: (1) making a layout, (2) preparing the board, (3) transferring layout to board, and (4) applying resist.

Step 5—Etching the Board. A ferric chloride solution ($FeCl_3$) is used for etching the board. This is furnished in either liquid or powdered form in kits. It also may be purchased at engraving supply houses in liquid form, and from some drug stores and chemical supply houses in powdered or lump form. If you use the etchant from a kit, follow the instructions furnished with it.

If you obtain a ferric chloride solution from a photo-engraving supply house, you'll generally find it furnished as "42% Ferric Chloride." This solution is rather thick and may be diluted before use. Add plain water at the ratio of one quart of water to one gallon of solution.

If you obtain the ferric chloride in powdered form, dissolve it in a Pyrex glass or an enameled container. Proper ratio is approximately three ounces of ferric chloride to six ounces of water. The dissolving action is *exothermic* . . . that is, heat is evolved as the ferric chloride goes into solution, so don't worry if the solution heats up slightly.

Caution: Use care when working with the etchant. It will stain clothing. While not especially dangerous, the ferric chloride solution is "bitey" and may irritate sensitive skin. If possible, wear rubber gloves when working with it.

The actual etching is carried out in a small flat tray, similar to those used by photographers. A shallow Pyrex cooking dish makes an excellent tray. Either "hot" or "cold" etching may be employed. The "hot" etching technique is somewhat faster than "cold" etching. With the "hot" etching method, you'll need a small "hot plate" and either a Pyrex dish or tray or an enameled metal tray. If you use the "cold" etching method, a shallow plastic box or tray can serve as the etching container.

To etch the circuit board by means of the "hot" method, pour a sufficient amount

"Hot" method of etching printed circuit board.

With the "cold" method, etching time is longer.

of the etchant into the tray to cover the circuit board to a depth of about ¼ to ⅜ of an inch. The actual amount of etchant used is not critical as long as the board is completely covered. If in doubt, always take a larger quantity. Place the tray on the hot plate and turn on the heat. Drop the circuit board *gently* into the etchant, taking care not to splash the solution. Copper side should be up. Move the board around from time to time during the etching process, using a plastic or glass rod or a pair of plastic tongs.

In general, as the temperature of the etchant is raised, up to the boiling point, the faster the etching action. If it is too hot, however, excessive water evaporation will take place, concentrating the solution and slowing the etching process. An "ideal" etching temperature is between 90° and 130° F. After considerable etching using the "hot" method, a little water may be added to the solution to replace the water lost through evaporation.

To etch the circuit board by means of the "cold" method, pour about a half-inch of etchant into the tray. A plastic tray may be used. Again, drop the board *gently* into the tray, copper side up. Rock the tray slightly during the etching process so that the etchant moves back and forth across the surface of the board.

An average circuit board may be etched with the "hot" method in about two to five minutes, depending on the condition of the etchant, the amount of exposed copper, and the actual etching temperature. With the "cold" method, etching time is around ten to twenty minutes. Regardless of the method used, continue the etching process until all *exposed* copper is removed, leaving only the copper foil protected by the resist.

When the etching is completed, the etchant may be returned to a tightly sealed storage jar or bottle and the circuit board thoroughly rinsed under clear running water. Allow the board to dry.

Step 6—Cleaning the Board. After thorough rinsing and drying, the resist should be removed from the board, leaving the copper foil "printed" circuit.

Ink resist may be removed by rubbing with steel wool, and a final cleaning made using a soft cloth dampened slightly with general-purpose solvent (such as General Cement No. 31-16). Tape resist is simply peeled off.

Step 7—Final Machining. Component mounting and eyelet mounting holes are drilled in the etched board at the points located during Step 3. Normally a size #52 drill is used, but a slightly smaller or larger drill may be employed in some cases. Use a solid backing for the board during drilling to avoid cracking the phenolic. With the drilling completed, mount eyelets (brass or copper) in appropriate holes. Generally, eyelets are mounted wherever connections are likely to be removed and replaced frequently. Where permanent connections are to be made, eyelets are not necessary.

Step 8—Mounting and Soldering. Resistors, capacitors, coils, and similar components are mounted by passing their leads through appropriate holes in the etched circuit board. The customary practice is to mount these components on the "back" (non-etched) side of the board;

when mounted in this position, lead tension tends to hold the foil in place instead of pulling it away from the base. Leave the component leads full length. After passing the leads through the holes and pressing the component tightly against the board, the leads are bent slightly to one side, holding the components in position through natural tension. Circuit crossovers, where necessary, may be made with short lengths of ordinary hookup wire, stripped at both ends.

Either a soldering gun or a pencil-type soldering iron with a small (⅛") tip should be used for soldering the connections. Best results can be obtained with a low-melting-point solder such as General Cement #9131 solder and a special printed-circuit soldering flux such as General Cement #12-2 "Print-Kote Soldering Flux." Do *not* use paste rosin flux nor, under any circumstances, acid-core solder in wiring circuits.

The proper soldering technique is to apply a drop of special flux (if used) to the copper foil where the connection is to be made. Then hold the tip of the soldering iron against the lead slightly above—*but not touching*—the copper foil. Solder is applied to the lead, and allowed to flow down and onto the copper. *Remove the iron as soon as the solder flows onto the copper foil.* A slightly different technique is to accumulate a drop of solder on the tip of the iron and to hold this against the lead, allowing it to flow down and over the copper foil.

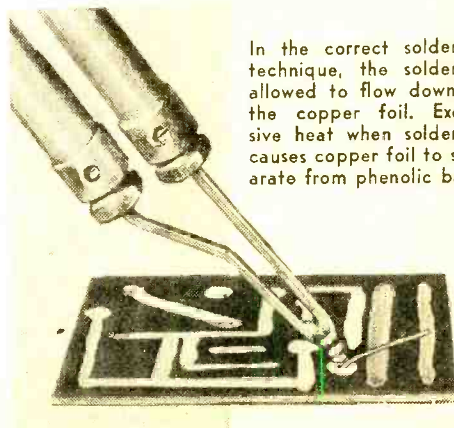
Special pains must be taken to complete all soldering as quickly as possible. Excessive heat will result in a separation of the copper foil and phenolic backing.

When all leads have been soldered in place, projecting wires may be cut off close to the circuit board, using a pair of diagonal cutters. As a final "touch," the completed circuit may be given one or two coats of silicone resin, either sprayed on from a pressure-type can or applied with a small brush. This insulates and protects the completed circuit and reduces the chances of arcing between adjacent conductors under conditions of high humidity. Either type of silicone resin is available from General Cement as Type 14-6 (spray can) or Type 14-2 (liquid).

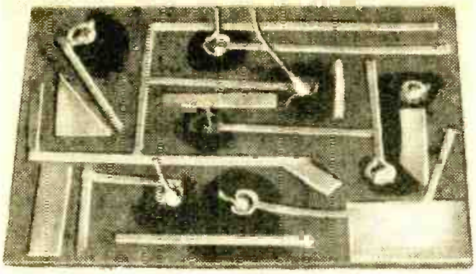
Short Cuts. The technique of making up etched circuit boards, as described, appears long and tedious. Actually, the work moves much more rapidly, for many of the steps take, at the most, a few minutes. In addition, as skill is gained in making up printed wiring layouts, you'll find you can combine several of the steps. For example, the author seldom makes a circuit layout in advance. Instead, he combines Steps 1,

Remove ink resist by rubbing with steel wool, and cleaning with damp soft cloth. Tape resist is simply peeled off.

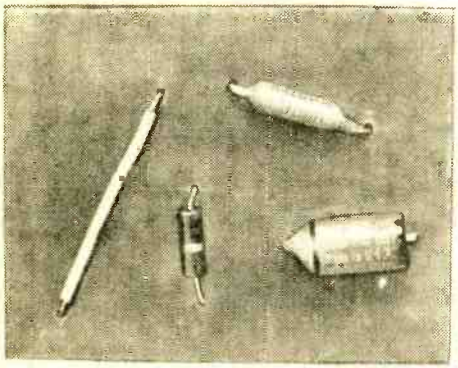
Machining the etched board. When you drill component and eyelet mounting holes in the board, use a solid backing to avoid cracking the phenolic. A drill of the #52 size is generally used, although a slightly larger or smaller drill may be employed sometimes.



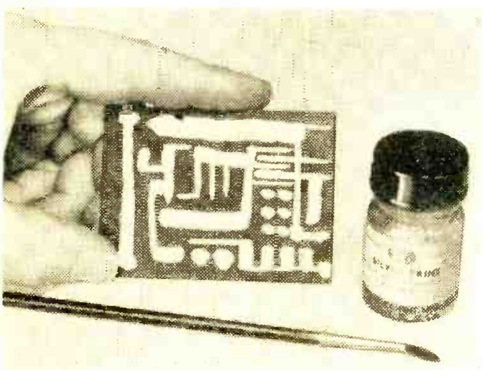
In the correct soldering technique, the solder is allowed to flow down to the copper foil. Excessive heat when soldering causes copper foil to separate from phenolic base.



"Front" view of completed circuit board, with component leads not yet clipped. Dark stains are caused by liquid flux in soldering the connections.



"Back" (non-etched) view of completed board shows parts in position. A piece of hookup wire, stripped at both ends, serves as circuit crossover.



"Painted" circuit board made up by applying metallic "Silver Print" on Bakelite base. Eyelets must be used for all connections in painted circuits.

3 and 4, and, using a tape resist, makes up the layout directly on the copper-clad board. Results obtained by working in this manner are quite satisfactory.

More time may be saved by avoiding components requiring large or odd-shaped holes, and by choosing a layout to fit on standard sizes of phenolic board as furnished by the kit manufacturers.

MAKING PAINTED CIRCUITS. A less popular—but still practical—method of making up a printed wiring board is to "paint" the circuit in place, using a metallic conducting ink on an insulated base. Almost any heat-resistant insulating material will serve as a base as long as it has high insulation resistance and does not tend to absorb moisture. Suitable materials are Bakelite and natural phenolic boards. A suitable metallic paint is General Cement's No. 21-1 "Silver Print."

As in the case of the etched circuit board, you make a scale layout first. Then transfer it to the insulating base material. Here the similarity in the two techniques changes. Instead of applying a "resist," the circuit is now "painted" on the board, using a small brush or pen. Since the conductor is a relatively thin layer of metallic deposit, "minimum" width of an individual conductor should be about 1/8" instead of 1/32" . . . and, in some cases, it even may be necessary to apply two coats of metallic ink.

Drill holes in the board for mounting components, as in the first technique; but since the thin metal deposit will not support a soldered joint, *eyelets* must be used for all connections. In addition, after you mount the components and solder them in position, it may be necessary to "retouch" around each eyelet to insure a good electrical connection.

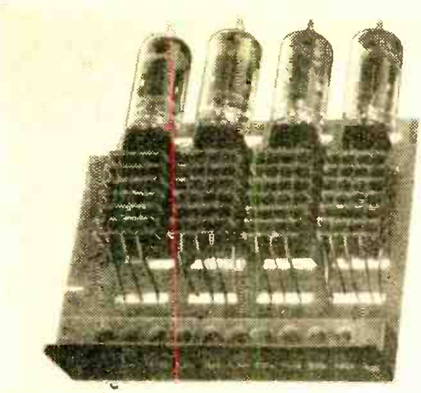
Of the two techniques for making "printed" wiring boards, the etched circuit board method is preferred for the average home experimenter. It is by far the least critical of the two methods and, although it requires a few more steps, can be carried out with less practice.

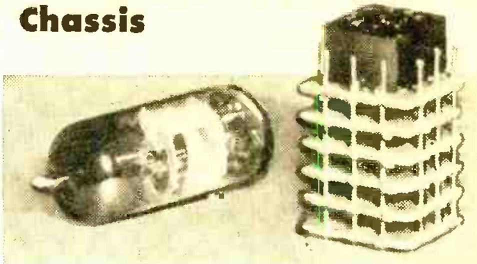
ADVANCED TECHNIQUES. There are two additional techniques for making up etched circuit boards which have not been discussed. Both of these are simple enough to be practical for use in a home workshop or laboratory, but are better suited for the production of several identical circuit boards than for a "single-shot" circuit.

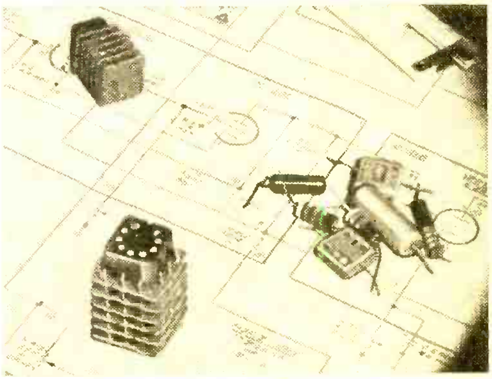
One of these techniques is the "silk-screen" method, in which a silk-screen stencil is first made up and used in applying an ink or paint resist to the copper-clad phenolic. The second technique is the "photographic" process, which involves a light-sensitive copper-clad board. The photographic technique is the one most often used in large-scale commercial work.

If there is sufficient interest on the part of POP'tronics readers in these more advanced techniques, they may be discussed in a future issue . . . let us know if you'd like to see such an article. —30—

Tinkertoy Design Simplifies Chassis







Stacked modules perform all passive circuit functions, replacing conventional components shown on schematic above. Hardly bigger than a miniature tube (top), modules are arrayed in miniature chassis like the counter unit shown at top, left.

THE DAY is surely gone when a piece of electronic equipment was a mess of wires with capacitors and resistors sticking out at odd angles. The flat printed circuit eliminated the traditional wire maze, and the "resistor board" with its neatly arrayed components has given a "new look" to electronic design.

Stacking up layers of printed circuits atop one another is the latest trend. Each circuit forms a thin wafer, and a small stack of such wafers—looking like a miniature skyscraper—makes up a complete equipment stage. The tube or transistor operating the stage usually sits on top of the stack.

Each wafer in the stack is called a module and the entire method of construction is therefore called *modular design*. It was first developed by the National Bureau of Standards for the purpose of cramming the greatest possible number of components into the smallest possible space. Because of the way the modules are connected, this development was nicknamed "Project Tinkertoy."

Commercial development of the Tinkertoy idea has been taken over by ACF Electronics, a division of ACF Industries at Alexandria, Virginia. Their aim has been to make the Tinkertoy modules electronically stable and sufficiently resistant to heat and mechanical shock for use in rocket-propelled missiles. Small size and light weight fit modules for such use.

Junior Ham Wins Jackpot

TO HAUL IN $100,000 in a TV quiz based on solid information rather than trick questions would be quite a feather in anyone's cap. Golden eggs this size are rarely laid by a goose. In this case, the winner was 10-year old Leonard Ross, who stumped NBC's "The Big Surprise" show by his expert knowledge of stock market operations.

Lenny's precocious intelligence also helped him get his ham Novice license at the age of seven and his Technician and General licenses at the age of eight. This makes him probably the youngest ham ever licensed by the FCC. Lenny's brother, Daniel, 17, got Lenny interested in radio and also steered quite a few other boys in his neighborhood onto the subject.

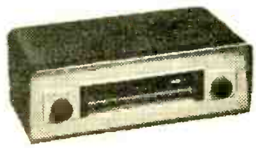
Our picture shows Lenny, W6SJR, Tujunga, Calif., answering questions on the stock market presented to him by Quizmaster Mike Wallace.

what's new in hi-fi

FAIRCHILD RECORDING EQUIPMENT CO.
154th St. & Powells Cove Blvd.
Whitestone, N. Y.

Turntable features flexible, endless-belt drive and stepped idler coupling. Designated as Model 411 "Turromatic," this 3-speed unit is sound-proofed and uses double-shock-mounts for the motor. It is recommended as a professional quality component for custom installations. Net price, with induction motor, $99.50; with hysteresis motor, $144.50.

HARMAN-KARDON, INC.
520 Main St.
Westbury, Long Island, N. Y.

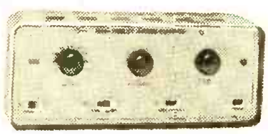


FM-AM tuner incorporates full Armstrong FM circuitry, tuned r.f. stage on FM, automatic frequency control. The "Overture" Model T-10 features compact "pancake" design, may be used with any external amplifier having audio controls. Retail price of $79.50 includes mounting cage.

AUDIOGERSH CORP.
23 Park Place
New York 7, N. Y.

"Miratwin" cartridge consists of 2 variable reluctance phono pickups assembled back-to-back. Unit is a turnover type with separate styli for standard and microgroove records. Response within 2 db at 33⅓ rpm is rated at 30 to 18,500 cps. Cartridge may be mounted in most standard tone arms. Model MST-2D (sapphire stylus for 78 rpm and diamond for LP's), $45.00 net; Model MST-2A (two sapphire styli), $22.50. Replacement styli available.

EICO
84 Withers St.
Brooklyn 11, N. Y.



Preamplifier has full control and equalization facilities, accepts all types of program input signals. Output may be fed to power amplifier and tape recorder. Response is rated within 1 db from 8 to 100,000 cps. Model HF61 (with power supply) sells for $29.95 as kit; factory-wired, $44.95. Model HF61A (without power supply) is $24.95 as kit; factory-wired, $37.95.

UNITED AUDIO PRODUCTS
202-4 East 19th St.
New York 3, N. Y.

Loudspeaker (Wigo, Model ERD 12) is 12" single-cone unit with rated frequency response from 25 to 15,000 cycles. Cone is molded with concentric rings to improve compliance for bass; impregnated cloth suspension is said to aid mid-range; rubberized apex of voice coil support helps dispersion of highs. Magnet weight is 3¾ pounds; power rating, 30 watts. For added high-frequency response, the manufacturer recommends using Wigo tweeter TW500 and crossover at 4000 cycles.

HEATH COMPANY
Benton Harbor 5, Mich.

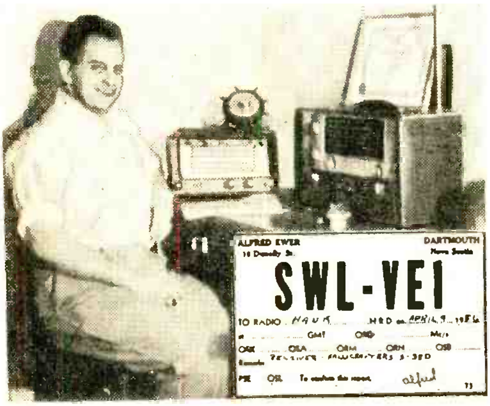
Enclosure is part of multiple speaker system available in kit form. Model SS-1 (not shown here) is miniature resonator with two drivers, covering range from 50 to 12,000 cycles. Model SS-1B (shown) includes larger cabinet, 15" woofer, and additional tweeter for extending range down to 35 and up to 16,000 cycles. Crossover network, with high-frequency level control, is furnished with SS-1B. Power rating is 35 watts; nominal impedance, 16 ohms.

Tuning the Short-Wave Bands

with Hank Bennett

THE FEATURED DX'er for this issue is Alfred Ewer, of 28 Lakefront Rd., Apartment 9, Dartmouth, Nova Scotia. He is married, 25 years old (he'll be 26 on August 30th), and has one daughter. Alfred is with the Canadian Navy.

Our September DX'er uses a Hall receiver, a Hallicrafters S-38D, and an RCA Victor "Transworld Portable" to pull in his DX stations. Before he moved recently. Alfred used an outdoor antenna. 40' long



Meet Alfred Ewer, of Dartmouth, Nova Scotia, accompanied by two receivers and his SWL card.

and 15' high. When last we heard, he was using a 10' piece of wire "laying on the deck," and reported that *Radio Japan* was coming through very well.

There is no equipment in the Ewer listening post besides the three receivers. Judging from his impressive array of verifications from 34 countries in less than two years, it is evident that Alfred is having a good bit of success with these receivers. He started his DX'ing in 1954 and sent his first station report out in 1955. Since that time, he has been quite active and has reported to this s.w. section with regularity.

PROGRAM SCHEDULES

A monthly program schedule can be obtained from Radio Canada by writing to the CBC International Service, P. O. Box 6000, Montreal, Quebec. Radio Pakistan is issuing copies of "Pakistan Calling"; write to Nazir Press, McLeod Road, Karachi, Pakistan, for your copy.

Alfred told your Editor that he prizes his QSL from Delhi, India, above all others. When we asked him about his favorites, he mentioned that *Radio Australia* was the s.w. station he liked most, 25 meters his choice of the DX bands. His best DX came about when he logged *Radio Thailand.*

In addition to being one of POP'tronics' top reporters, Alfred belongs to the Newark News Radio Club, the American Radio Relay League, and the Dartmouth Amateur Radio Club. He likes to write to foreign SWL's and his great ambition is to receive verifications from 100 countries.

Club Notes. The World Shortwave Club is now located at 740 Dana St., Redlands,

Listening post of Ralph Kuhnert, Springfield, Mass.

Calif. Anyone interested in joining should write to this address, in care of Mr. Rolan Riker.

The Newark News Radio Club will hold its Annual Convention on Saturday, September 8, at the Shady Rest Picnic Grounds, Route 33, just east of Freehold, N. J. Although it is mainly for the members of the club, anyone interested in the NNRC or in SWL'ing is invited to attend.

(*Continued on page* 110)

Fool Your Friends with an

By JOHN P. SHIELDS

No knobs to turn, no buttons to push—when you have the "key," you can open it in an instant

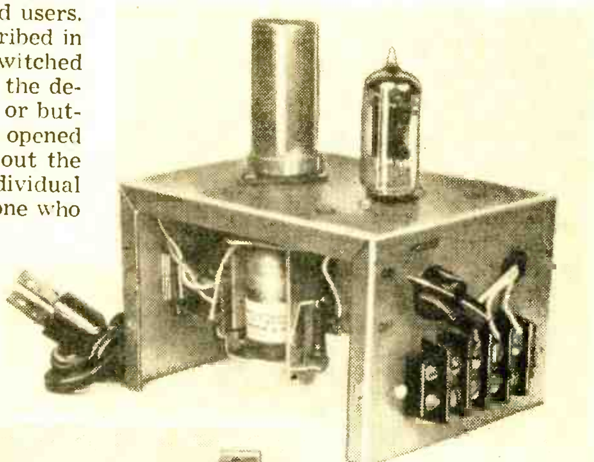
IN RECENT YEARS a number of electronic locks have been devised. Such locks generally contain an electromagnetically controlled latch. When a simple switch is used to control the current through the solenoid, the lock is little more than a holding device—because it is virtually impossible to conceal the switch well enough to foil an intruder and at the same time keep it accessible to authorized users.

The versatile electronic lock described in this article eliminates the faults of switched locks. It is mounted entirely inside the device it locks, with no knobs to turn or buttons to push. Yet, it can be instantly opened by the possessor of its "key." Without the "key," it would probably take an individual several hours to open it, even someone who knew the secret of its operation.

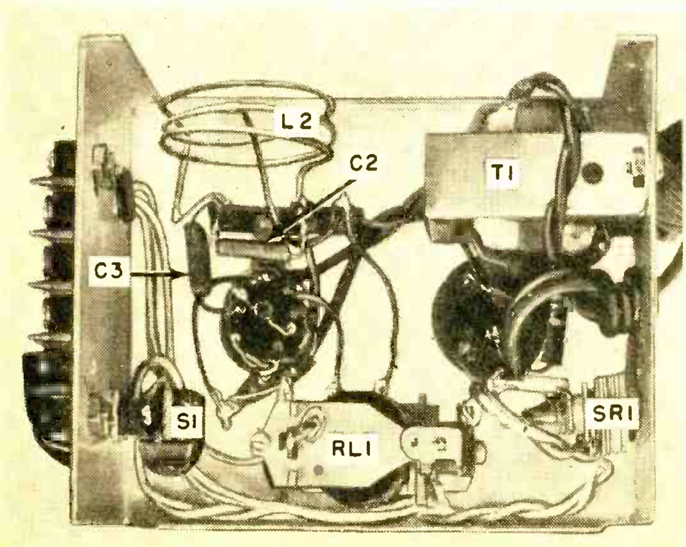
Parts requirements of the electronic lock and its "key" are shown in the diagrams. In laying out parts for the lock, only the position of coil *L2* is at all critical. Mount it on a 2-terminal insulated tie strip, so that it is parallel to one side of the chassis box and about ⅛" from its edge. Then, cut a 2" hole in the cover opposite the coil so that the metal will not shield *L2* from the "key." The hole may be round or square, whichever is the more convenient to cut, and it may be covered with a thin piece of Bakelite, plastic, or other insulating material.

The oscillating frequency is determined by *L2* and *C2* and may be almost any frequency. The values shown produce a frequency of approximately 3000 kc.

As can be seen in the photos, *L2* is self-supporting, but it is advisable to wind the "key" coil on a form for permanence under handling. Choose a form about 2½" long, wind *L1* close to one end of the form, and mount *C1* inside the form. The extra



Completed electronic lock (above) is neat and attractive in appearance. Concealed on the opposite side of the unit is the cutout in the box which makes L2 accessible to the operating "key."



In underchassis view, mounting positions of all components in the lock control unit may be clearly seen. The position of coil L2 is the only one which is at all critical.

Electronic Lock

length of the form will serve as a handle—holding the "key" in your fingers might detune it. Give *L1* a coating of coil dope after it is wound to hold the turns in place.

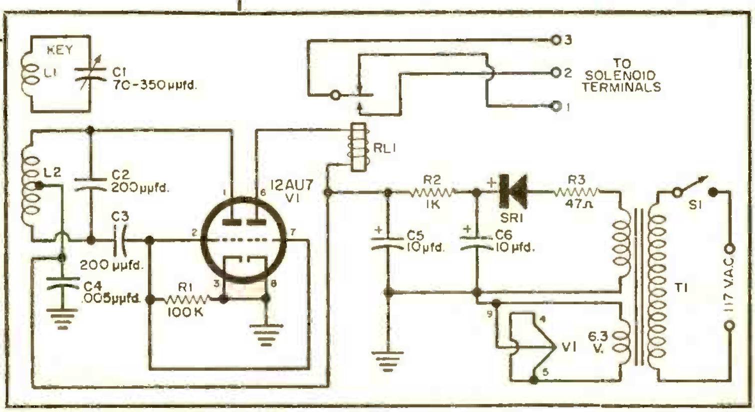
Adjustment. If available, a v.t.v.m. or a 20,000-ohm-per-volt voltmeter is convenient for tuning the lock. Connect one terminal to the chassis and the other one to the oscillator grid (pin 2 of the socket). The meter should show a negative voltage of 10 to 15 volts.

Bring the "key" within ½" of *L2* and parallel to it. Hold the "key" in this position and carefully adjust *C1* while watching the meter pointer. At one setting of the capacitor, the pointer should dip sharply. Move the "key" away from *L2* until there is only a slight dip in the meter reading as *C1* is tuned. Adjust *C1* to the position that causes the sharpest and deepest dip in the meter reading. Put the "key" aside and adjust the relay spring tension so that the relay armature just remains open when power is applied to the unit. Bringing the "key" near *L2* should then cause the relay armature to pull in, and removing the "key" should permit the armature to drop out.

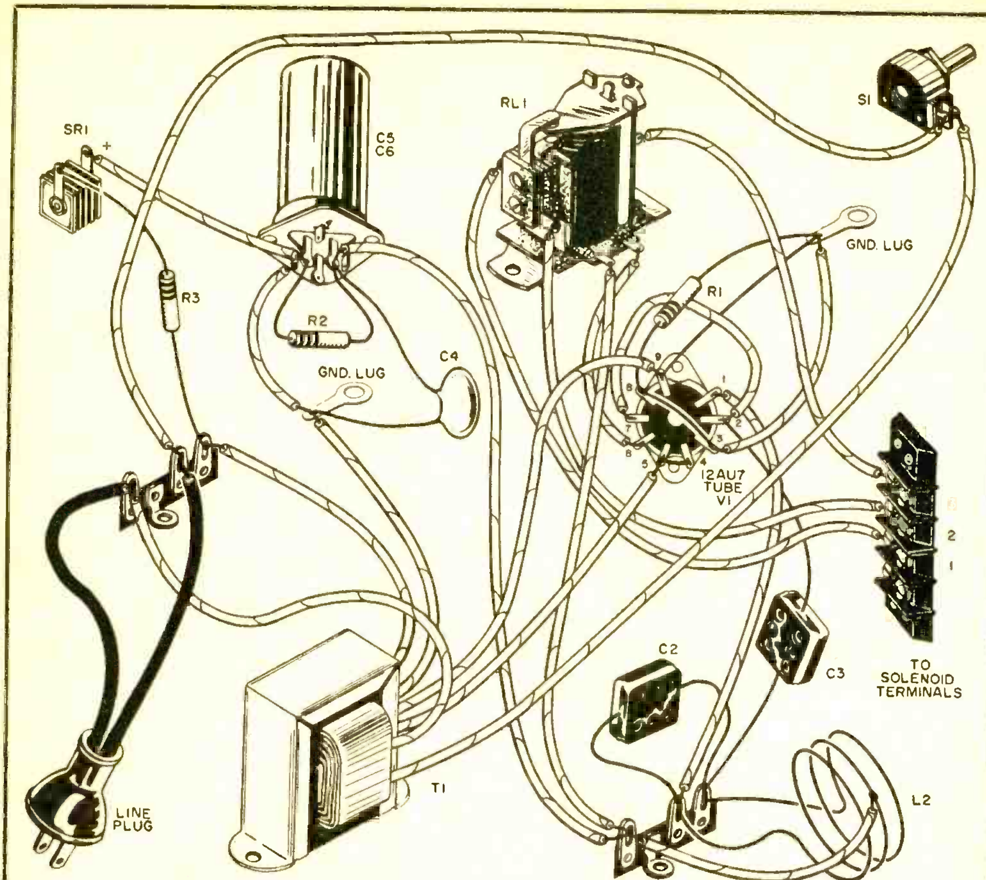
If a high-resistance voltmeter is not available, proceed in the following manner. First, adjust relay spring tension so that the armature just *does not* pull in with power applied to the unit. Then, short pin 2 of the 12AU7 socket to the chassis momentarily with a screwdriver. The relay should close and open again when short is removed. Adjust relay until it performs

PARTS LIST

C1—70-350-μμfd. variable mica capacitor
C2—200-μμfd. silver-mica capacitor, 5% accuracy
C3—200-μμfd. mica capacitor
C4—.005-μfd. disc ceramic capacitor (not used in model but may improve stability of operation)
C5, C6—Dual 10-μfd., 150-volt electrolytic capacitor
L1—4 turns of No. 16 wire, 1½-dia., wound on a coil form
L2—Wire having the same dimensions as L1, spaced about double the wire diameter between turns, with center tap.
R1—100,000-ohm, ½-watt resistor
R2—47-ohm, 1-watt resistor
R3—1000-ohm, 1-watt resistor
RL1—S.p.d.t. relay, 5000-ohm coil (Potter & Brumfield LM5-5000 or equivalent)
S1—S.p.s.t. switch
SR1—65-ma. selenium rectifier
T1—Power transformer, 125 volts @ 15 ma., and 6.3 volts @ 0.6 amp. (Stancor PS-8415, or equivalent)
V1, V2—12AU7 tube
1—3" x 4" x 5" aluminum box



Schematic wiring diagram and parts list solve the "mystery" of the electronic lock.



Components of the electronic lock should be hooked up as shown in this pictorial diagram.

in this manner. The "key" is tuned by holding it close to *L2* and adjusting *C1* until the relay closes. When properly adjusted, bringing the "key" within ½" or ¾" of *L2* should suffice to operate the relay.

After these adjustments have been completed, put the cover on the box with the cutout opposite *L2*. The unit is ready to be installed in its permanent position. It may be mounted with the cutout against a wall or door and controlled by the "key" right through the mounting surface—assuming, of course, that the separation between the key and *L2* is not too great. The "key" will work through wood, plaster, or other insulating materials as well as through air. However, even a thin layer of metal over *L2* will prevent it from functioning.

A suitable electromagnetic latch to be used in conjunction with this control unit can be constructed from a solenoid, such as the Guardian Type 4C 117-volt a.c. solenoid, which has a plunger movement of 1⅛" and is designed for continuous duty. The lock mechanism to be controlled by the solenoid can easily be constructed from a standard door lock, available at any hardware counter. Use a brass or other non-magnetic material to join the solenoid plunger to the movable lock "tongue." —30—

HOW IT WORKS

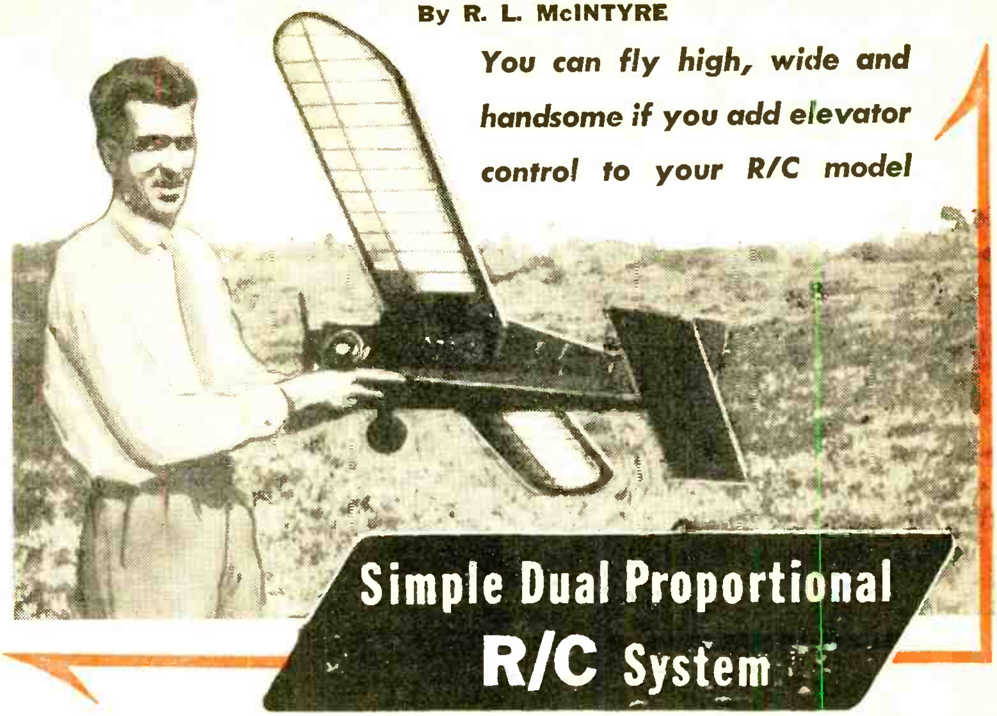
One-half of the 12AU7 oscillates at a frequency determined by the constants of *C2* and *L2*. This energy circulates back and forth between *C2* and *L2*, generating a r.f. field around the coil. Grid current flows through resistor *R1* on the positive halves of the excitation cycles, developing a voltage drop across the resistor, with negative polarity at the grid end. This negative bias voltage, being also applied to the grid of the second half of the tube, reduces the plate current through the relay coil to a low value.

When the "key," which is a simple tuned circuit resonating at the oscillating frequency, is brought near *L2*, it extracts power from the field around it. This reduces the energy fed back to the grid of the tube and decreases the negative bias voltage. Consequently, increased current flows through the relay coil causing its armature to pull in, closing the relay contacts, and thereby applying power to the external circuit. The oscillator is powered from the a.c. line through a selenium rectifier (*SR1*) and a resistance-capacitance filter.

NOTE: Failure of the power source *will not* unlock the door or the device to which this is attached.

By R. L. McINTYRE

You can fly high, wide and handsome if you add elevator control to your R/C model



Simple Dual Proportional R/C System

IF YOU HAVE WANTED to enjoy the added thrill of elevator control along with rudder control on that favorite R/C model, but can't afford the cost or weight of a tone control system, this article is for you. The system described here offers two proportional controls on one channel, and it uses a standard transmitter and receiver as building blocks.

When flying with this dual proportional system, the flyer has two controls: the rudder control which varies the pulse width, and the elevator control which varies the pulse repetition rate. Continuous control is always available by merely regulating the resistance of potentiometers *R8* and *R10*. Thus, it is easy to develop the feel of flying with this system.

The heart of the system is the pulser. This is the unit which does the actual controlling of the model; so it is necessary to observe a few precautions during its construction.

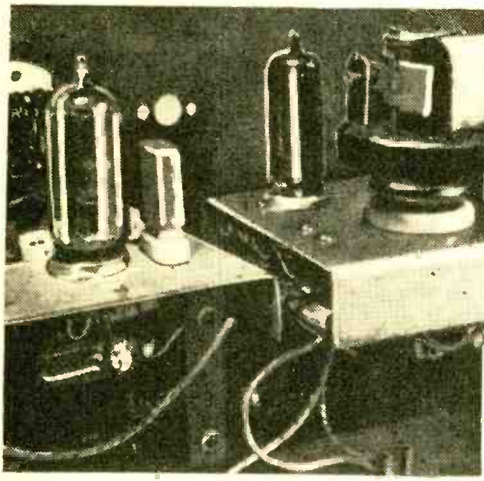
Pulser Construction. Layout of the pulser is not critical, but I prefer to keep the control box as a separate unit as it allows greater freedom of movement. You can build the pulser as a complete unit if you wish. If you follow my design, be sure that the control box is small enough to be held in your hand comfortably, and yet large enough to contain the two potentiometers. The cable used to connect the control box to the pulser should be of the shielded two-conductor type. Ground the shield to the arm of *R8* (rudder) and to the pulser chassis to avoid hand capacity changes.

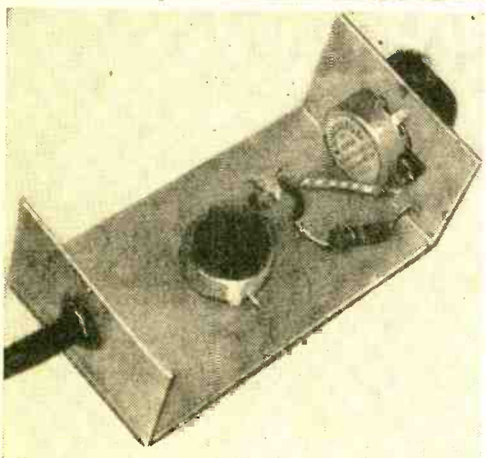
Any plate-type relay may be substituted for the Sigma 4F (*RL3*) as long as you change the value of *R5* so that its resistance—plus that of the relay you substitute—adds up to 12,000 ohms. A common connection between A-plus and B-minus is necessary to stabilize the neutral rudder at all elevator positions. As the 3A5 tube (*V3*) has a high-filament drain, the A battery should be fairly large.

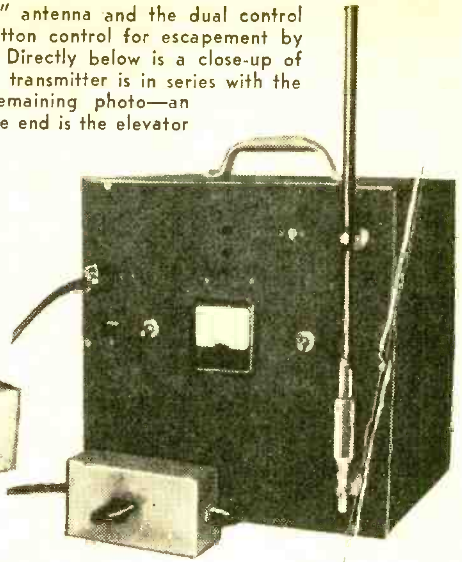
One word of warning! If you are now flying proportional rudder and the pulse stops at full rudder positions, the elevator will be in the full-up position. If your pulser does stop in this manner, increase values of resistors *R6* and *R7* in the grid circuits. If you wish to reset the pulse rates—the lowest rate is set by increasing the values of *C5* and *C6*, and the highest rate is set by reducing the value of resistor *R9* in series with *R10*.

For those who have proportional rudder control installed and want to add the elevator section to a receiver, I have included a diagram of the base I used as shown in the photographs of the elevator control. The receiver should have a plate current drop of approximately 1 ma. on receipt of signal. If it meets this requirement, then mount the 3V4 tube, relay and other components on the base as shown, keeping the lead from the original receiver to *C4* as short as possible. Refer to the complete

At right is a front view of the transmitter with its 24" antenna and the dual control box; this transmitter can be used with simple push-button control for escapement by plugging another cord in unused plug on front panel. Directly below is a close-up of the pulser and transmitter; pilot lamp shown just under transmitter is in series with the crystal to protect it from excess current. In the remaining photo—an internal view of the pulser control box—the control at the end is the elevator control and the one at the top is the rudder control.







receiver construction for details on building and tuning the elevator control.

Receiver Construction. First lay out the base and drill all holes in a piece of 1/16 linen base Bakelite. The tube sockets are mounted about ½" below the base on eyelets or spacers. With the sockets in place, mount *L1*, *C1* and *L2* permanently in place, in the positions shown. Check to see if the relays fit, but do not keep them on the base as they may be damaged by solder.

Work one lead of *RFC1* between the socket for *V1* and *L2* so that it reaches its terminal on *L2*. Shape the other lead to reach the front terminal of the padder *C1*, but do not solder. Connect a piece of solid tinned wire from the back terminal of *C1* to *L2* and solder at *C1* only.

Connect *C2* from *L2* to pin 3 of *V1*. Solder at *L2*, then connect *R1* from pin 3 to pin 5 and solder at pin 3.

Take another piece of wire and connect it from pin 2 to pin 4 of *V1* and then to the outside terminal of *L1*. You can now solder all three points. Connect the other terminal of *L1* (see schematic) to the front terminal of *C1* and up to *L2*. Solder these points.

Attach C3 from *L2* to pin 5, with the marked end of *C3* closest to the pin. *RFC3* is connected from pin 5 of *V1* to pin 5 of *V2*. Solder at *V2*. Connect *RFC2* from pin 1 of *V1* to pin 1 of *V2*, and *C4* from pin 6 of *V2* to *L2*—leaving the lead on *C4* long enough to reach the relay. Solder at *L2*.

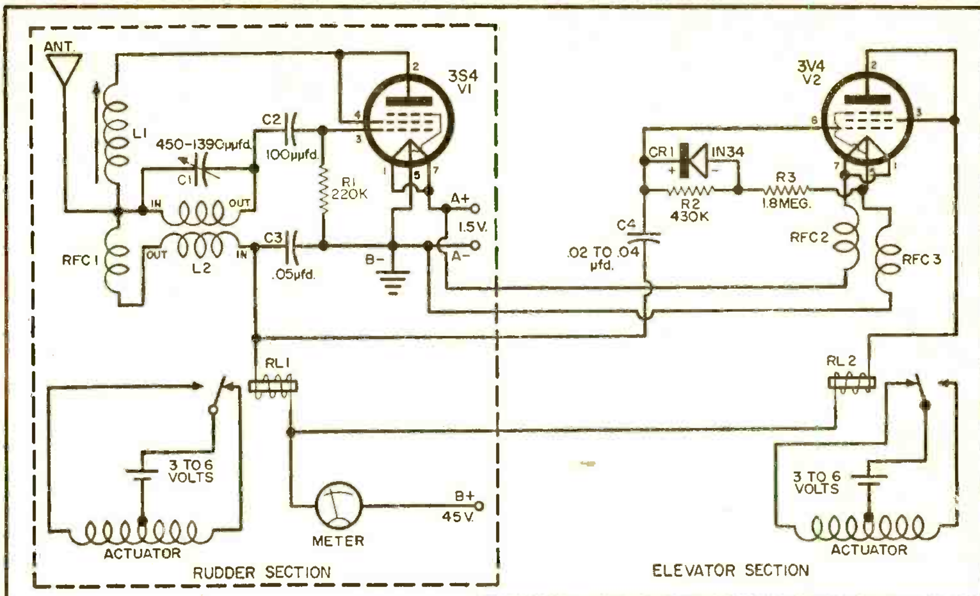
Connect *R2* and *CR1* from pin 6 to pin 4 of *V2*. Solder pin 6, then solder in *R3* from pin 4 to 5 of *V2*. Using solid wire, solder leads from pin 2 and pin 3 of *V2* long enough to reach relay. Connect A and B battery leads to pin 5 of *V1*, then solder.

You can now mount both relays. Connect the leads from *L2*, and pins 2 and 3 of *V2* to the elevator relay and solder. Connect the B-plus lead to the unused end of each relay, the A-plus lead to pin 1 of *V1*, and solder all connections.

Carefully check the finished unit against the schematic, then connect the batteries and check the voltages on the tube sockets. You should have 45 volts from pin 5 to pin 2 and 1.5 volts from pin 5 to pin 1 on both tube sockets.

Tuning. The procedure for tuning the receiver should be followed closely. Insert the 3S4 only, and connect the filament batteries. Then connect a 25,000-ohm potentiometer in series with the 45-volt B-plus lead through a milliammeter to the set as shown in the schematic.

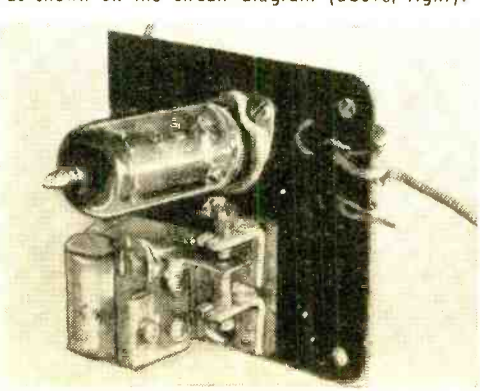
Adjust the external series potentiometer

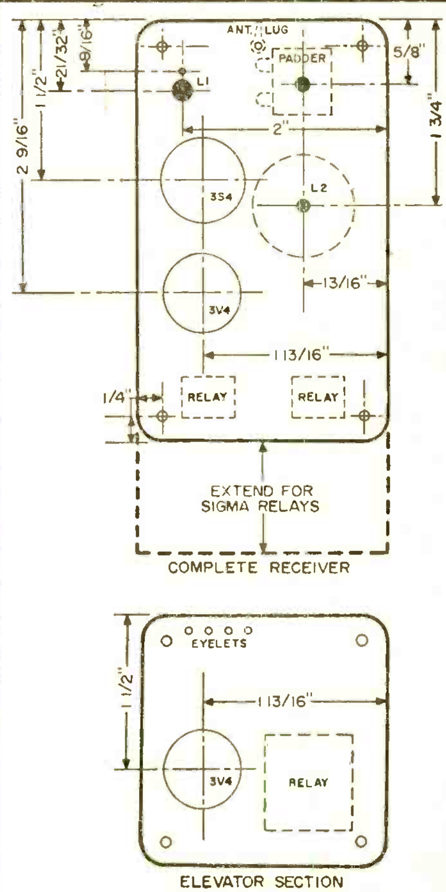


Schematic diagram and parts list for receiver.

C1—450-1390 μμfd. capacitor (Arco Padder #308m)
C2—100-μμfd. ceramic capacitor
C3—0.05-μfd., 200-volt capacitor
C4—0.02-0.04 μfd., 200-volt capacitor (see text)
CR1—1N34 crystal diode
L1—18 turns of wire on 1/4" iron core slug form
L2—National OSR or Miller 313 coil
R1—220,000-ohm, 1/2-watt resistor
R2—430,000-ohm, 1/2-watt resistor
R3—1.8-megohm, 1/2-watt resistor
RFC1, RFC2, RFC3—69 turns of #34 wire on 1/4" form
RL1—2000-ohm Sigma 4F or 5000-ohm Neomatic relay
RL2—2000-ohm Sigma 4F or 7250-ohm Neomatic relay
V1—3S4 tube
V2—3V4 tube

Top view of the elevator unit showing the relay and tube. Note that although a 3S4 tube appears in this photo, the correct tube to use is a 3V4 as shown on the circuit diagram (above, right).

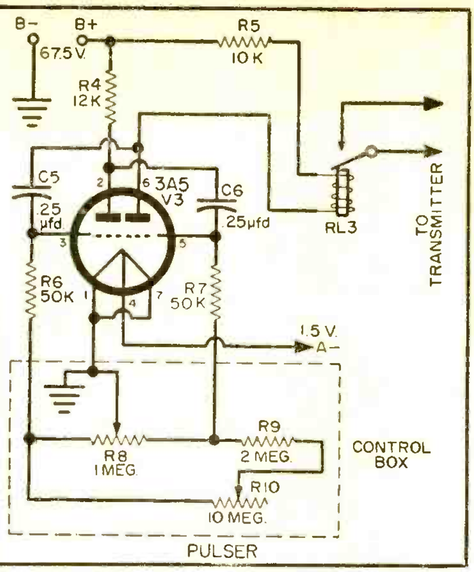




Dimensional drawings of the complete receiver (at top) and the elevator section (at bottom).

Schematic diagram of the pulser unit appears at right; parts list for pulser is given below.

C5—0.25-µfd., 200-volt paper capacitor
C6—0.25-µfd., 200-volt paper capacitor
R4—12,000-ohm resistor
R5—10,000-ohm resistor
R6, R7—50,000-ohm resistor
R8—1-megohm linear taper potentiometer
R9—2-megohm, ½-watt resistor
R10—10-megohm linear taper potentiometer
RL3—2000-ohm Sigma 4F relay
V3—3A5 tube



to allow 1.7 ma. of current to flow, then set the rudder relay to pull in. Readjust to give 1.5 ma. and set the relay to drop out.

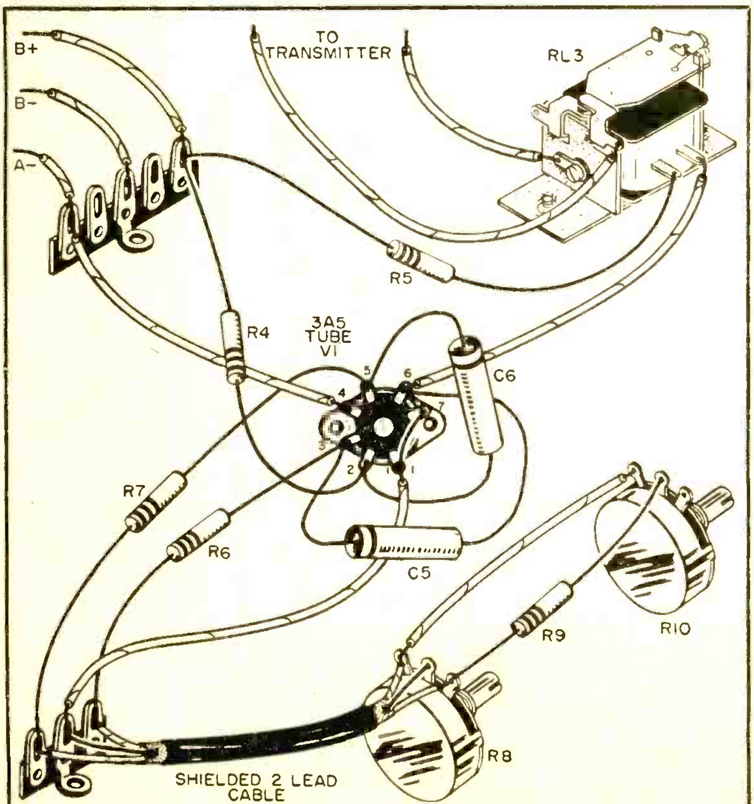
To adjust the elevator relay, insert the 3V4 and set the series potentiometer. The current is now the total of rudder current and elevator current, so subtract the rudder current to get the correct reading.

Remove the 3V4 and tune the receiver to 27,255 mc. by watching for a dip in receiver plate current as you key the transmitter. This dip should be 1 ma. It can be adjusted by turning the padder capacitor to the left until the current drops off and then giving it one-half turn to the right.

Replace the 3V4 and key the transmitter. The rudder relay should drop out and stay out as long as the key is closed. The elevator relay should drop out momentarily and close again almost immediately. Should the elevator relay stay open, check the wiring. If the wiring is correct, reduce *C4* from 0.04 µfd. to 0.03 µfd. and try again. This capacitor should be as large as possible and not cause the elevator to follow the rudder.

The unit is now ready to install with any activator. I used the one put out by Southwestern Electronics, Houston, Texas, although another unit could have been employed.

All of the parts may be obtained at most radio supply houses. The Miller #313 coil can be used in place of the National OSR with about 1 ma. more plate current being the only difference in operation. Any slug-tuned coil that will tune to 27,255 mc. may be used for *L1,* and the 1N34 can be replaced by nearly any germanium diode. —30—



Pictorial diagram of pulser unit shows interconnection of parts.

Oil Bath Increases Rectifier Rating

By
H. J. CARTER

Rebuilt rectifier is mounted in a jar of cooling oil, with rectifier at least one inch below surface. Use a jar or can with a tight lid, and pierce a tiny hole in top so jar can breathe. Cooling the rectifier in any light oil will increase its normal current rating up to 9 or 10 times.

DON'T DISCARD a burned-out selenium rectifier; it probably has some good plates that you can re-assemble into an inexpensive, high-current, low-voltage rectifier for battery charging, electroplating, or for supplying d.c. filament power.

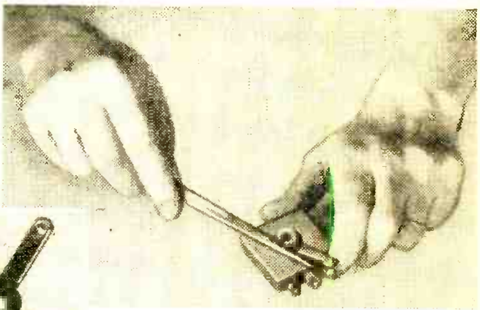
Since filament rectifiers and battery chargers usually supply amperes, you may wonder how a radio-type rectifier rated in milliamperes could be used in these applications. The answer is simply to cool it! By immersing the rebuilt rectifier in a bath of light oil, you can safely increase its current rating to nine or ten times normal values.

Choose a rectifier suitable for rebuilding by first estimating the current required in your application. If you want to charge a 2-volt wet cell battery of the type used in portable radios, your rectifier should handle 1 ampere; if your application is trickle-charging a 6-volt automobile battery, the rectifier must handle about 3 amperes.

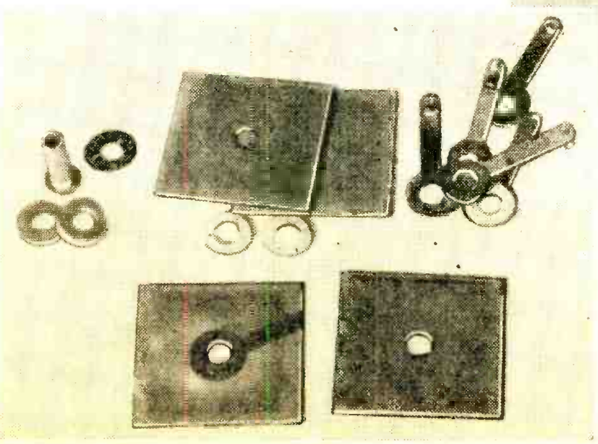
Divide the current estimated for your application by 10. The quotient is the rating (in amperes) of the rectifier you select for rebuilding. Of course, you can use any rectifier rated at a higher current if it is available. *Caution:* do not parallel two rebuilt rectifiers to increase the current-handling capacity.

Like most selenium rectifiers available to the experimenter, the Federal No. 1016 is assembled with a brass eyelet. To disassemble the selenium stack, hold the rectifier against a solid surface and file off the end of the eyelet. Be careful not to injure the rectifier plates.

When the stack feels loose, carefully pull the plates apart. If any discs stick to the plates, apply a little paint remover before pulling them apart. Wipe off the paint remover with a damp rag. Do not try to force the plates apart with a knife or screwdriver. Save all the small parts except the



To disassemble the selenium stack of a burned-out rectifier, hold rectifier against solid surface and gently file off end of eyelet. When the stack feels loose, carefully pull the plates apart.



Parts from bridge stack are shown at left. In reassembling rectifier, be sure to choose a plate which shows no signs of damage or discoloration. Save all small parts except eyelet for re-use.

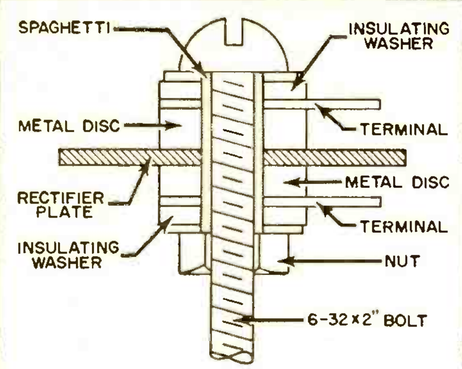


Fig. 1. Mechanical assembly of rectifier built around plate taken from burned-out unit. Center bolt should be at least 2" long, and plastic spaghetti is best for insulating plate from bolt. Washers are placed under screw head and nut.

eyelet so that you can use them again in the rebuilt rectifier.

Examine the plates for evidence of burning or shorting, and select a plate that has no dark spots or discoloration. Assemble the selected plate with the parts shown in Fig. 1, using a center bolt at least two inches long. Plastic spaghetti which slips over the bolt easily is preferred for insulating the plate from the bolt. Sandpaper the contacting surfaces of the metal discs and terminal lugs to remove any minute projections which might injure the selenium barrier layer. Wipe all contacting surfaces carefully to remove dust and grit before assembling the parts.

Tighten the assembly by holding the nut in a wrench and using a screwdriver. Do not tighten excessively, and do not clamp the plate in a vise while tightening.

The coolant oil may be held in any container with a capacity of at least eight fluid-ounces. Since oil can be messy if spilled, a jar or can with a tight lid is best. Pierce a tiny hole with an icepick so that the container can "breathe."

You can use almost any light oil, even cooking oils, but a mineral oil such as "Nujol" is preferred since it will not smoke or deteriorate at the temperatures encountered under full load (up to 180° F).

Test the rectifier polarity and mark the terminals before using it. A simple way to test the polarity is to connect the rectifier in series with a flashlight cell and a 2-volt lamp. If the lamp glows, the rectifier terminal connected to the positive battery terminal is the *anode;* if the lamp does not glow, it is the *cathode.* (The plus sign marked on selenium rectifiers denotes the cathode.)

Sample circuits are shown in Fig. 2. The battery-charging circuit requires a transformer rated at approximately twice the battery voltage. If you use this circuit for charging a 2-volt wet cell battery, the transformer should be rated at 5 volts.

In the electroplating circuit, a primary resistor, *R1,* is used to vary the plating current. The transformer delivers current at a voltage sufficient to overcome the rectifier drop in most applications.

The filament supply is controlled by choosing the capacitance of *C1* to give the desired filament voltage when loaded. You should not operate this circuit unloaded since the voltage rating of *C1* would probably be exceeded. —30—

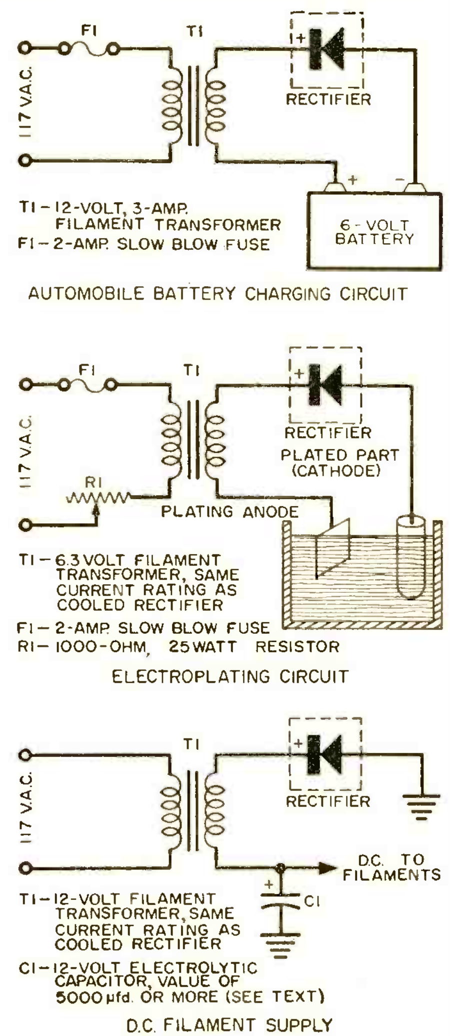
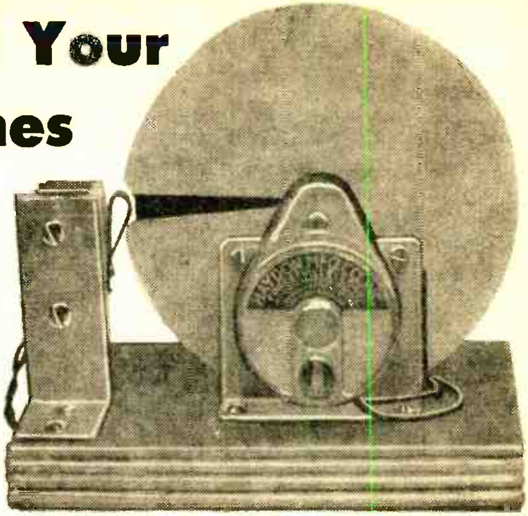


Fig. 2. Circuits showing how rebuilt rectifier may be used for battery charging, electroplating, or supplying d.c. filament power. If you want to charge a 2-volt wet cell battery, just substitute a 5-volt transformer in the circuit shown.

Custom-Design Your Time Switches

By
WM. B. RASMUSSEN

There's no limit to what you can do with timing motor and cam-Microswitch combinations



A FASCINATING ARRAY of timing mechanisms (or, if you please, *gadgets*) for controlling electrical circuits at predetermined intervals can easily be constructed from inexpensive timing motors and Microswitches. You can make controls which will automatically defrost the refrigerator, or turn yard and out-building lights on and off. Radios, ventilating fans, kitchen appliances and, in fact, anything electrical can be turned on or off at will by a timing motor and cam-Microswitch combination.

There is nothing very complicated about timing mechanisms. The mechanics and wiring are simple. An electrical circuit is turned "on" or "off" by the Microswitch, which is actuated by a cam, which is turned by the timing motor. The design of the cam determines how many switching operations take place during one revolution of the cam. Naturally, the speed of the timing motor determines the number of revolutions made by the cam during a given time interval. Of the timing motors currently available to the experimenter, two types are most practical: those operating at one revolution per minute and those operating at one revolution per day, both 117 volts a.c.

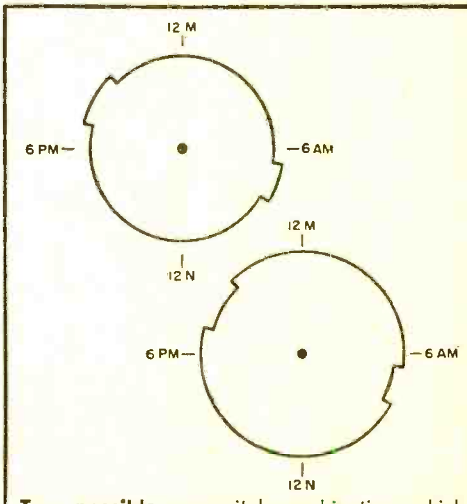
Microswitches, or snap-action switches, are so called because of the small amount of plunger travel needed to actuate the contacts. Switches with leaf actuators are most suitable for cam operation. Electrically, there are three basic types of Microswitches:

(A) Single-pole, single-throw, normally open (s.p.s.t., NO). Actuating the switch closes one circuit.

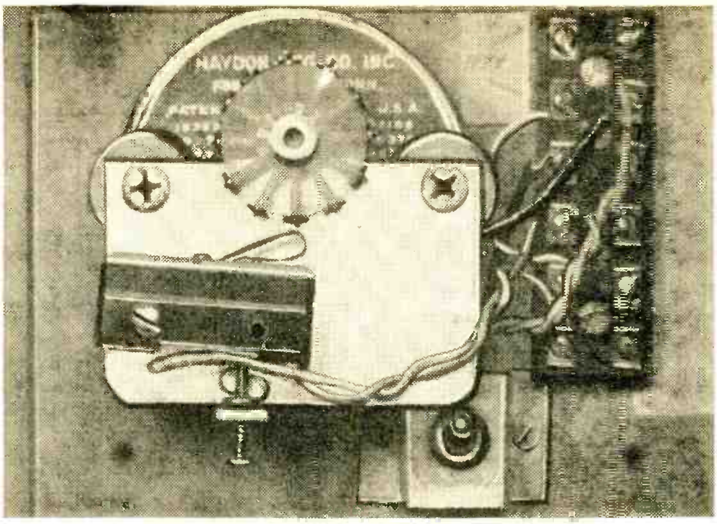
(B) Single-pole, single-throw, normally closed (s.p.s.t., NC). Actuating the switch opens one circuit.

(C) Single-pole, double-throw (s.p.d.t.). This type has one input and two output terminals. In the normal or "at rest" position, one of the output terminals is "off." Actuating the switch reverses this condition. Thus, although only one circuit is controlled, the output can be switched into either of two channels as desired. Consequently, a s.p.d.t. switch can also be utilized as either "s.p.s.t., NO" or "s.p.s.t., NC."

Composition of the cams is a matter of personal preference. For convenience in fabricating, the material should be easy to work (aluminum, plastic, Masonite). Some provision should be made for turning the cam on the motor shaft to facilitate synchronization. This is most easily done by making the cam fit quite snugly on the



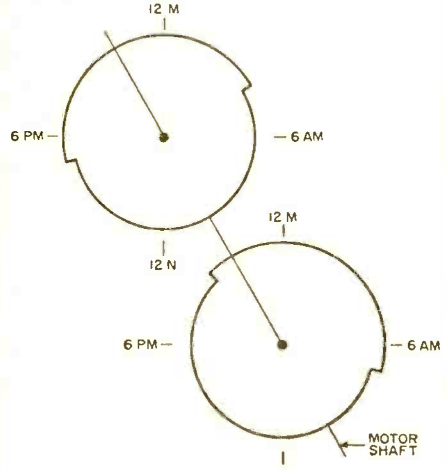
Two possible cam-switch combinations which permit playing a radio from 7 to 9 p.m. and from 6:30 to 8 a.m. Top cam is cut for "s.p.s.t., NO" operation, bottom cam for "s.p.s.t., NC."



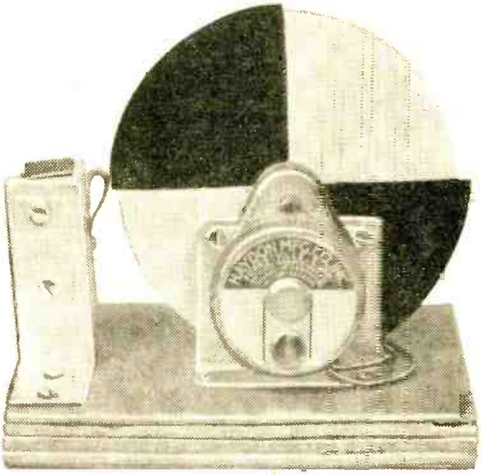
Multiple cam control with "s.p.s.t., NO" switch turns on a household ventilating fan for ten minutes every two hours. These cams consist of pointed machine screws threaded into a plastic disc; by turning them in or out, the duration of each interval can be shortened or lengthened as desired.

shaft. As the load offered by the Microswitch is negligible, there is no danger of the cam slipping during operation.

The simplest timing combination is that of a single cam driven by a 1-rpd motor and switch. A "s.p.s.t., NO" switch has the most potential uses. On page 69 (top) is the application for defrosting a refrigerator. The black control segment of the cam represents a 30-minute interval (7½° of the circle). During the time (23½ hours) that the white area of the cam is in contact with the leaf actuator of the switch, the circuit is closed. When the black area reaches the actuator, the load is removed and the switch opens, turning off the refrigerator which then defrosts for half an hour. If a "s.p.s.t.,



Exploded view of a variable cam set to turn on a yard light from 5 p.m. to 7 a.m. Variable cams, composed of two or more cams clamped together, permit control periods to be adjusted.



"On" and "off" interval is 15 seconds in this simple traffic signal system. When the s.p.d.t. switch is actuated, the lower light is illuminated, the North-South ports show red and the East-West ones green. During the following 15 seconds, after the switch returns to its normal position, the upper lamp is "on" and the colors are reversed.

NC" switch were used for this same application, the black area would have to extend beyond the periphery of the disc instead of below. Then, when contacted by the cam, the switch would be actuated and the circuit opened.

Heart of these control systems is the cam. By using a protractor and keeping in mind that 1 hour equals 15°, accurate intervals of any desired duration can be laid out. The amount of material which has to be cut away from the periphery of the disc is really much less than the illustrations indicate. In the example above, controlling the "off"

(*Continued on page* 121)

THE TRANSMITTING TOWER

Herb S. Brier, W9EGQ

NEW AMATEURS, probably without exception, and most old-timers, too, do not believe that a first contact with another station is complete until QSL cards have been exchanged. QSL cards get their name from the international Q signal: QSL—"I acknowledge receipt of—." They confirm the fact that a successful two-way radio contact has actually taken place.

It is almost like making the contact over again when a QSL card arrives in the mail. This is especially true when a long-awaited card from a rare country or a new state arrives. Later, after time has dimmed the memory of the original contacts, browsing through a stack of old QSL cards enables you to recall interesting and amusing details which had been almost forgotten. In addition, there is probably not a single piece of equipment in a ham shack that interests a visitor as much as its collection of QSL cards.

Sending QSL Cards. Besides the personal satisfaction they bring, QSL cards are also required to obtain the various certificates for achievements, such as WAS (Worked All States), WAC (Worked All Continents), and DXCC (DX Century Club —for working 100 different countries) issued by the American Radio Relay League, and similar certificates issued by other amateur organizations throughout the world. All of them have one requirement in common. Written proof of all claimed contacts must be presented before a certificate will be issued.

A good QSL card should contain the following information:

1. The call sign and location of the sending station
2. Name and address of the operator
3. Call sign of the station worked
4. Signal report—readability, strength, tone (quality on phone)
5. Date and time of the contact
6. Frequency band used
7. Mode of emission used (code, voice, etc.)

In addition to this indispensable information, most QSL cards also contain a brief description of the station equipment and a line or two for remarks about conditions, signals, and similar subjects. It is also ap-

Station call letters are prominently displayed on the typical batch of QSL cards shown above.

propriate to include information on the awards earned by your station or yourself, such as WAS, Code Proficiency Certificate, A-1 Operator, and the like.

A simple postal card or a letter containing the information listed above will serve the fundamental purpose of a QSL card. Nevertheless, most amateurs prefer something a bit fancier. The illustration on page 71 indicates some of the forms their fancies take.

Typically, a QSL card is the size of a standard postal card (3¼" x 5½"), with the station call letters prominently displayed across its face. The operator's name and

Gerhard Sam Plessinger, KN5DNQ, Lindale, Texas.

address are also usually on the face of the card in smaller type. Depending upon individual preference, the remaining information may appear on the face of the card, or it may appear upon the back.

In general, a card with all writing on the back looks a bit neater than one with writing on its face. On the other hand, when a QSL card is mounted in an album or on a wall for display, information written on the back cannot be seen. Also, cards printed on one side only are somewhat less expensive than cards printed on both sides.

Commercially printed QSL cards cost from about $2.00 per hundred for a simple card printed in a single color on a fair grade of card stock to several times this amount for a fancy, multi-colored card on high-grade card stock. The number of cards ordered at a time also affects their cost; the cost per card goes down as larger quantities are ordered.

Sample cards can be obtained from QSL printers upon request. (See classified columns of *QST* or *CQ* for addresses.) Some of them charge a small fee for samples, but not all of them do.

Some amateurs prefer to make their own cards, either for economy's sake or to express their own ideas. Usually, the more attractive of these are the cards that stress simplicity of design. Avoid odd sizes. They are hard to display and file along with standard-sized cards. Oversized ones get battered in the mails, and non-standard size cards cost a cent more to mail.

Suitable cards can be printed directly on stamped postal cards by cutting an appropriate stencil for use on a duplicating machine or by having a rubber stamp made to your design. Hams who are photographers can also make extremely attractive QSL cards.

Getting Maximum Returns. Many amateurs complain that they QSL 100% themselves, but they get only a small percentage of cards in return. To be honest about it, the only way to get 100% return from cards sent is to wait for the other fellow to QSL first. In fact, some amateurs have developed this idea to the point where they get ten cards for every one they send.

Two disadvantages of this idea are that it makes you look cheap and it reduces the number of cards you receive. There are quite a few members of the You-QSL-First club. It is better to resign yourself to the fact that you are not going to get an answer to every card you send. The average return is about 65%. However, by sending out your cards with careful attention to detail, you can improve this percentage quite a bit.

The important things are to make your card so valuable and attractive to the other fellow that he will want to answer it with one of his own. To do this, send your card as promptly as possible, so that the contact is still fresh in the recipient's memory, and fill it in accurately and completely.

Start by being sure that you write his call correctly. It does not help your case to write a "W" for a "K" or vice versa in a call or to put your own call letters in the space where the other call letters are supposed to go.

Always show on what band a contact was made and whether the contact was on phone or code. To you, this information may be of little importance, but to an operator who is striving for a special record,

(*Continued on page* 123)

Free Radio Course

The Queens Evening Trade School, 47th Ave. and 37th St., Long Island City 1, N. Y., will offer free courses in radio and television service this fall, according to Mr. Milton Wendroff, of the school's Radio-Television Department. Registration for all classes will be held at the school on September 10 and 11, from 7:00 to 9:00 p.m.

What About TECH WRITING?

By JOHN A. NORMAN

Photo Courtesy of Bell Telephone Laboratories

TECH writer trne (electronic) expd Radar/electronics; EE or evng studt. $80-120. Lawrence Agcy. 120 W 42.

TECHNICAL WRITERS, SR & JR Federal Electric Corp, Rte 17, Lodi, N J

TECHL EDITOR Military handbks; must know military spcs, bk layout. Gotham Agcy. 55 W 42

ARE YOU QUALIFIED to fill any of these jobs? They are samples of recent openings in "technical writing"—a new, promising, and not too widely understood field.

Although much of industry leans heavily on tech writers, it is safe to say that the greatest number are employed in electronics. The first ad, for instance, and the "JR" part of the second ad call for men who have some electronic training but no definite experience in tech writing. The third ad, on the other hand, requires a man with perhaps limited electronic training but a fairly specific kind of tech manual background.

What Is a Tech Writer? In the broadest sense, the technical writer translates the work or products of a specialized group into language that can be understood by the non-specialized group. A man preparing an instruction folder telling housewives how to use a new electric mixer is doing a job of technical writing. Similarly, a team of men preparing volumes on the use and maintenance of a radar system is engaged in technical writing. An assistant to a top scientist, writing a report on recent experiments to be presented to a Board of Directors, or a POP'tronics reader sending in an item for the "Tips and Techniques" department is, in effect, doing tech writing.

In each example, it is presumed that the writer possesses two important qualities. He must understand the subject he is writing about. And he must be able to express this understanding in the language, style, vocabulary, and diagramatic symbols common to his field and which he knows will be grasped readily by his readers.

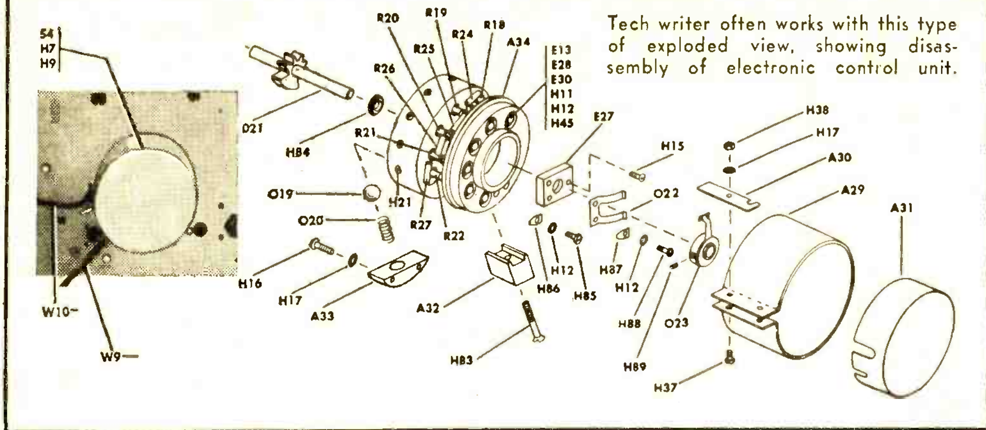
Often, this part of the job is quite knotty. A sonar engineer may talk to the tech writer about a sweep circuit—but how does the writer explain this to others who may never have heard of sweep circuits?

Similarly, a product engineer may explain to the writer the correct use of a wafer switch and a potentiometer with linear taper. But how does the tech writer translate these operating instructions to a lay consumer who thinks of a "wafer" as something you dip into a cup of tea, and to whom "linear taper" is a meaningless cryptogram?

Part of his work, then, involves a constant search for verbal expressions and graphic symbols that can be grasped by his readers and still provide enough correct instruction for them to do the right thing at the right time with the equipment in question.

What is a tech writer? Ask one in the business. He'll tell you he's a combination of many things, including analyzer of equipment and processes, student of human nature, teacher, and—of course—fast and prolific writer of clear, concise prose.

Engineers as Writers. Often the demands of a particular technical post require that a man—engaged primarily in



Tech writer often works with this type of exploded view, showing disassembly of electronic control unit.

research or production—submit a report or other form of verbal communication regarding his work. A project engineer may have to explain how a new product works so that the advertising department can understand enough about it to write intelligent sales copy. Or a government agency—buying 5000 units—may require a handbook of instructions to accompany the product. In this case, a professional technical writer would probably be assigned to do the book, but his basic information would have to come from the project engineer.

Consequently, the engineer or scientist responsible for a product or new development becomes a primary source of information about it. Communication at this level is critical to the further development of the product, its manufacture, use, and eventual maintenance in the field. One wrong—or misunderstood—phrase at this stage can produce a "snafu" at some point within the plant as well as for users of the equipment miles away and years later.

In many situations, the requirements of good, clear communication are so great that a professional writer may be hired whose chief task is to prevent misunderstandings between engineers and executives. Diagrams, specifications, and instructions to personnel must be prepared so that their meaning is unmistakable.

Whether or not the professional tech writer is used in such situations, most firms in recent years have demanded that the men they hire as engineers and technicians have at least the ability to express themselves clearly regarding their work. The need has become so great that universities have instituted special writing courses for students working toward science and engineering degrees. As Profes-

(*Continued on page* 108)

ADMIN ASST
TO CHIEF ENGR

$8-10,000

FEE REPAID IN 6 MONTHS

SMALL PRODUCT LINES

This firmly established leader in the field of testing offers a fine opportunity for the man capable of absorbing the entire non-technical load of the chief engineer.

The successful applicant will be between 30-42. He will have at least 5 years of administrative background with not less than 3 years of supervisory experience.

A degree in engineering or business administration is preferred. Ability to organize projects, budgets and reports is a prime qualification.

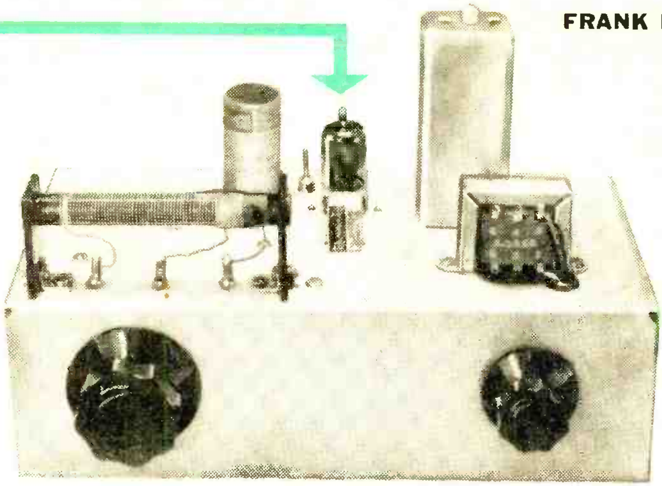
Experience in office management, correspondence and liaison is desirable.

This ad is from a recent listing made by Suburban Employment, a New York agency specializing in electronics and engineering. Many would consider it a "dream job" in terms of salary and promise of interesting, stimulating work. It is a type of job not too far afield from the main area of interest of a technical writer.

Agency director David L. Golan indicates that the title of "Administrative Assistant" could readily apply to an experienced tech writer who has managed, in the course of his job experience, to pick up various related skills in administration and budgeting. In this particular case, Golan points out: "All the non-engineering load of the chief engineer would be established by one applicant hired. Evaluating reports, preparing technical summaries, and handling correspondence would comprise about 60% of the job load." And, adds Golan, there are "many higher priced opportunities in the technical field open to tech writers with appropriate additional background."

Naturally, jobs like this are not for beginners—but they represent the kind of openings that often develop for experienced men.

By
FRANK H. TOOKER



Build a "Minidyne"

The Miniature Superheterodyne

SINGLE-TUBE radio receivers are always in the novelty class. Still, with a careful selection of parts and attention to detail in the layout and construction, such a receiver can be made to perform amazingly well. The little one-tuber described in this article uses a type 6U8 combination pentode-triode tube, and takes advantage of the superheterodyne principle to obtain high gain, excellent selectivity, adequate sensitivity, and enough audio power to enable many stations to be heard through a loudspeaker.

Thanks to an unusual circuit, this little reflex receiver is perfectly stable without neutralization and without the use of any device which seeks to obtain stability at the price of gain, selectivity, or sensitivity. The author has dubbed it the "Minidyne," because it is undoubtedly the *minimum* superheter*odyne*.

Construction. Tuning capacitor *C2-C3* is a two-section superhet type having a 365-$\mu\mu$fd. mixer section and a cut-plate oscillator section. A capacitor with the oscillator section at the back and the mixer section in front is preferred since this arrangement provides for the best layout and shortest leads.

If you have to use the more conventional-type tuning capacitor, a somewhat different layout of the parts will be in order, and longer leads may be necessary. In this case, use an arrangement which provides the shortest, most direct leads in the i.f. amplifier. Above all, avoid crossing "hot" grid and plate leads. If these leads are too long, or if they are laid out in close proximity to each other, uncontrollable instability is almost certain to result.

The transistor-type antenna coil, *L1*, can be seen in front-view photo above. As purchased, this coil is supplied with a waxed fiber mounting bracket. The author preferred a more substantial mount, so he removed the fiber bracket and replaced it with two Bakelite end plates secured to the chassis with small metal L-brackets. Insulated connections (from *L1*) through the chassis are made with solder lugs, 6-32 screws, and flat and extruded fiber washers. Capacitor *C1*, a small mica compression-type trimmer, is mounted below deck as close as possible to the appropriate feed-thru connection to *L1*.

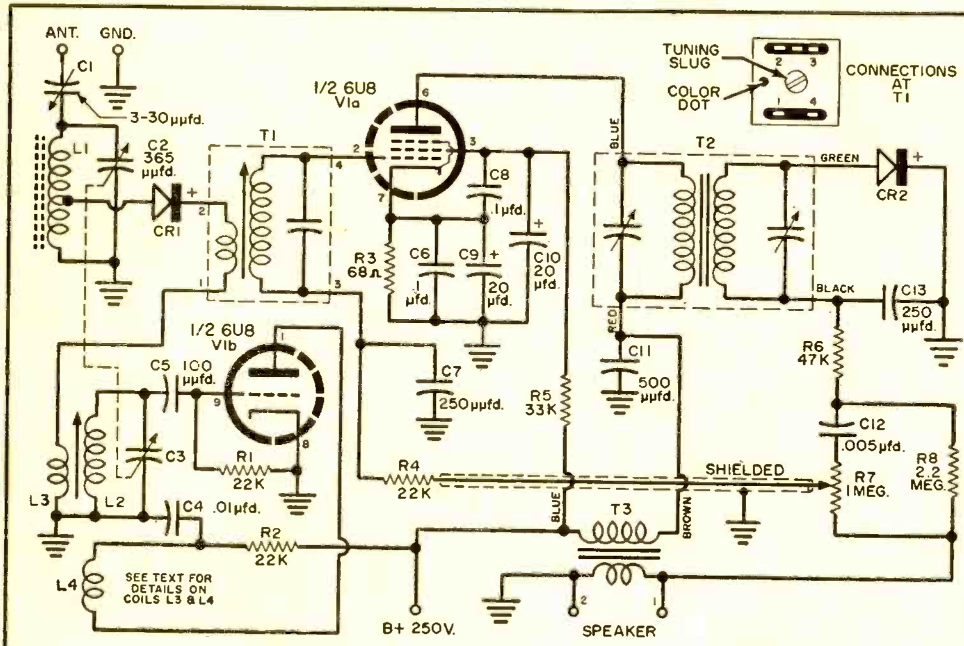
Coil *L2* is a conventional Grayburne "Vari-Loopstick." The range of adjustment of its inductance is sufficient to en-

> **This receiver requires an external power supply capable of delivering about 250 volts d.c. and 6.3 volts a.c. The supply shown on page 74 of the July, 1956, issue would be satisfactory. Also, an r.f. signal generator with built-in 400-cycle modulation is required to align the receiver properly.**
> **The Editors**

able it to be used as an oscillator coil when it is connected across *C3*. It is mounted near the tube, so the connections can be made as short as possible.

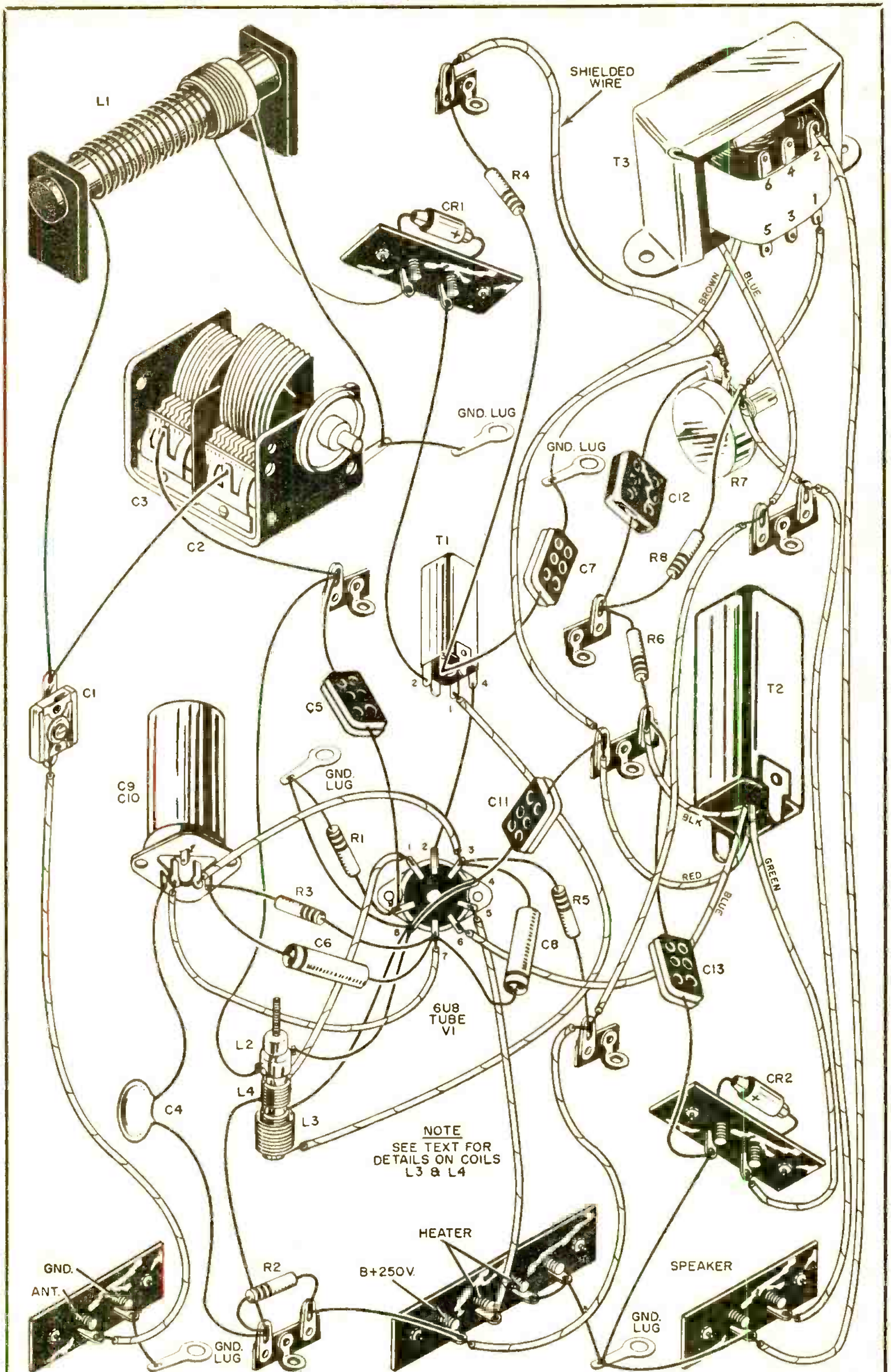
Coil *L4* is the feedback winding. It is wound on the "Loopstick" right below *L2*, and consists of eight turns of No. 28 enameled wire. The turns are close-spaced and are wound on the form in the same direction as the turns of *L2*. When this method of winding is used, the lead of *L4* that is nearest *L2* is the one connected to bypass capacitor *C4* and one end of resistor *R2*. Both *C4* and *R2* should be located as close to the feedback winding as possible.

The coupling between the oscillator and the mixer diode, *CR1*, is important. In any oscillator of this type, the cleanest waveform is always developed across the grid coil. Thus, in the "Minidyne," inductive coupling between *L2* and *CR1* is employed. The coupling coil, *L3*, is wound directly upon the sleeve which the manufacturer has cemented over *L2*. It consists of 15 turns of No. 28 enameled wire, close-

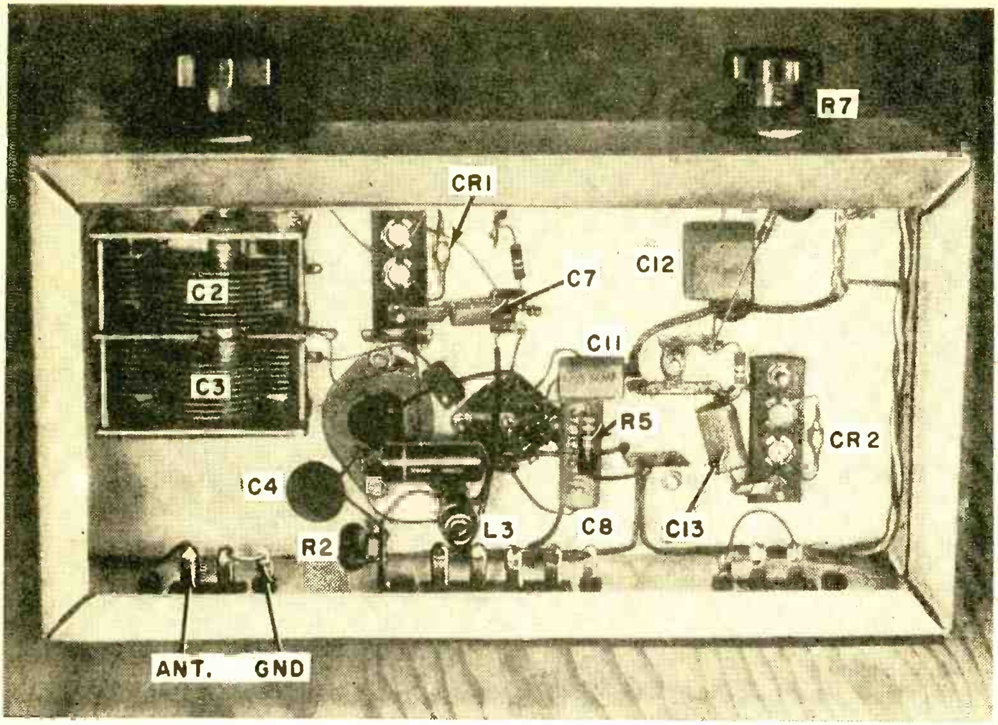


Schematic wiring diagram and parts list for the "Minidyne" one-tube reflex receiver.

C1—3-30 μμfd. mica compression trimmer capacitor
C2-C3—Dual superhet-type variable capacitor, 365-μμfd. mixer section, cut-plate oscillator section
C4—0.01-μfd. ceramic capacitor
C5—100-μμfd. mica capacitor
C6—0.1-μfd., 200-volt paper bypass capacitor
C7, C13—250-μμfd. mica capacitor
C8—0.1-μfd., 400-volt, 455-kc. series resonant capacitor (Sprague Type 72P52 or equal)
C9, C10—20-20 μfd., 25/300 volt, dual electrolytic capacitor (Sprague Type TVL-2555 or equal)
C11—500-μμfd. mica capacitor
C12—0.005-μfd. mica or ceramic capacitor
CR1, CR2—Type 1N54A germanium crystal diode
L1—Transistor loop antenna, fixed inductance, tunes 540-1650 kc. with 365-μμfd. variable capacitor, tapped to match 600-ohm input (similar to Lafayette Radio MS-166)
L2—Ferrite antenna coil (Grayburne "Vari-Loopstick" or equal)
L3—Coupling coil, 15 turns No. 28 enameled wire (see text)
L4—Feedback coil, 8 turns No. 28 enameled wire (see text)
R1, R4—22,000-ohm, ½-watt composition resistor
R2—22,000-ohm, 2-watt composition resistor
R3—68-ohm, ½-watt composition resistor
R5—33,000-ohm, 1-watt composition resistor
R6—47,000-ohm, ½-watt composition resistor
R7—1-megohm volume control potentiometer
R8—2.2-megohm, ½-watt composition resistor
T1—Transistor i.f. transformer with 600-ohm secondary used as primary (Miller Type 2041 or equal)—see text
T2—Iron-core diode output i.f. transformer (Miller 612-C4 or equal)
T3—Universal output transformer (Stancor A-3856 or equal)
V1—Type 6U8 tube
SPEAKER—Quam 52A21
1—10" x 5" x 3" chassis
1—9-pin miniature tube socket
4—2-terminal screw-type terminal strips
1—4-terminal screw-type terminal strip
1—Cabinet for speaker (ICA Type 3988 or equal)
2—Knobs
Misc. hardware, shielded grid wire, grommets, solder lugs, extruded and flat fiber washers, etc.



Pictorial diagram shows how the various components of the receiver are interconnected.



Many of the components of the "Minidyne" are identified in this under-chassis view.

HOW IT WORKS

All of the gain in the "Minidyne" is obtained in the pentode portion of the 6U8 (*V1a*) which operates in a reflex circuit to provide amplification at both intermediate radio and audio frequencies. The triode portion (*V1b*) is used as an r.f. oscillator. 1N54A germanium crystal diodes serve as mixer and second detector. The tuned mixer coil, *L1*, is a transistor "loop" antenna tapped at 600 ohms. The first i.f. transformer, *T1*, is a transistor i.f. transformer with the 600-ohm secondary winding used as the primary in this circuit.

The signal picked up by the antenna is delivered to the tuned circuit, *L1-C2*. A portion of the signal is taken off at the tap on *L1* and fed to the germanium crystal diode, *CR1*. At the same time, a steady r.f. signal having a frequency 455 kc. higher than the signal received in the antenna circuit is being generated in the tuned circuit composed of coil *L2* and variable capacitor *C3*. A portion of this signal is coupled through coil *L3* and fed to the primary of *T1*. The antenna signal and the local oscillator signal mix in *CR1* to produce the 455-kc. i.f. The secondary of *T1* is tuned to 455 kc. and steps up the voltage induced in it by the primary due to the resonant nature of the circuit.

Then, the i.f. signal is fed to the control grid of *V1a*, the 6U8 pentode. It is amplified by *V1a* as an r.f. voltage and applied to the primary of *T2*, a diode output transformer. This signal is detected by *CR2*. The resulting audio signal is developed across the diode load resistor, *R8*. Capacitor *C13* and resistor *R6* comprise an r.f. filter to help keep unwanted i.f. energy out of the audio circuit. Capacitor *C12* couples the audio signal to the volume control, *R7*, and—simultaneously—blocks out the d.c. component of detection, forcing it to flow to ground through *R8*.

The audio signal from volume control *R7* is fed through a second r.f. filter, *R4* and *C7*, and back through the secondary of *T1* to the control grid of *V1a*. After undergoing a.f. amplification in *V1a*, the audio signal passes through the primary of *T2* without effect and is impressed across the primary of *T3*, the audio output transformer. The secondary of *T3* feeds the loudspeaker. Capacitor *C11* shunts the i.f. signal to ground, thereby helping to keep this signal from entering the audio output transformer.

wound, and is held in place by a small band of insulating tape.

Because of the many currents of many different frequencies which flow in close proximity in a receiver of this type, it is highly desirable that all exposed r.f. leads and all audio grid leads be kept as short as possible. Belden 8885 shielded grid lead is used between the volume control, *R7*, and the r.f. filter resistor, *R4*. Capacitor *C7* and resistor *R4* should be located as closely as possible to transformer *T1*. The same is true of *C13, R6* and *C11* in respect to *T2*.

Transformer *T3* is a universal audio output transformer designed to couple a single plate or push-pull plates to the voice coil of a speaker. The red center-tap lead will not be used. If a howl develops in the speaker when volume control *R7* is turned toward its minimum setting, reverse the primary connections to *T3*.

Alignment. When the "Minidyne" has been completely assembled and the wiring thoroughly rechecked, connect it to a speaker and a power supply. Temporarily short-circuit the plates of the oscillator tuning capacitor *C3*, and hook up an r.f. signal generator to the antenna and ground terminals of the receiver. Set the

(*Continued on page* 131)

AFTER CLASS

SUBATOMIC FOOTPRINTS

AT THIS VERY MOMENT—as you read this—you are being riddled by submicroscopic bullets, sprayed and permeated by potential death rays, and assailed from every side by wild energies of which you are not even aware. Were it not for our sensitive scientific instruments, we should still be unconcernedly going through life, blithely unconscious of the invisible "energy-world" around us.

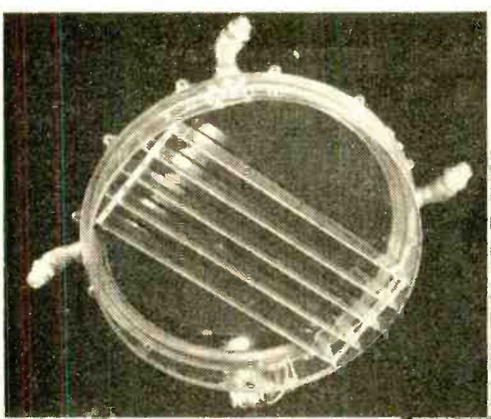
Cosmic rays, radio waves, high-energy electrons, and a host of other energy packages buzz into us and through us as if we didn't exist. Our radios, television, and radar receivers tell us about the variety of waves that surround us, but what of the dozen or so subatomic particles which do not advertise themselves quite as loudly?

The existence of these tiny elemental bits of matter had been suspected for many years before the first "viewing" device was even conceived. As a matter of fact, they announced their presence to Henri Becquerel in 1896 by leaving their "footprints" behind them as they flashed through the emulsion of a piece of photographic film inadvertently left in a drawer near some uranium. Becquerel simply remarked in his notes that radioactive emanations from the uranium had fogged the film, not realizing that he had "invented" the first subatomic particle detector.

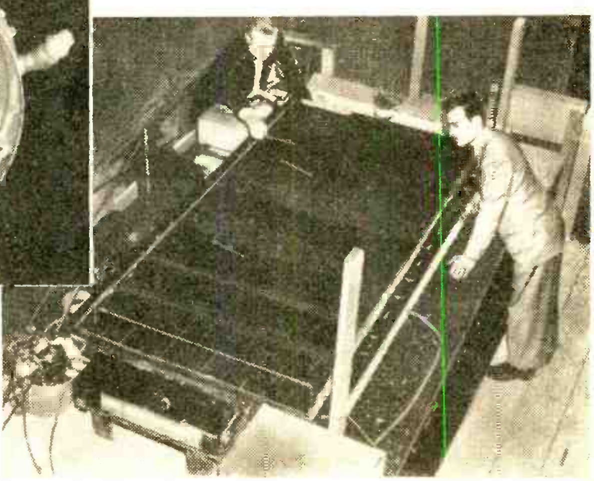
Vapor Trails. Although we cannot see these particles, we can at least see where they have been. One of the methods used to study them involves special photographic emulsions; another is the cloud chamber, invented by the English physicist C. T. R. Wilson in 1911.

In the cloud chamber, the space within a hollow chamber is super-saturated with water vapor. Electrically charged particles have the ability to serve as condensation nuclei, i.e., they encourage water vapor in their immediate vicinity to change to liquid water droplets. So—as a subatomic particle of the charged variety strays into the chamber, it causes condensation of vapor all along its path—leaving a trail behind it much like the vapor trails that appear behind a speeding jet plane. The trail is substantially thicker than the particle itself; hence it becomes visible and may be studied.

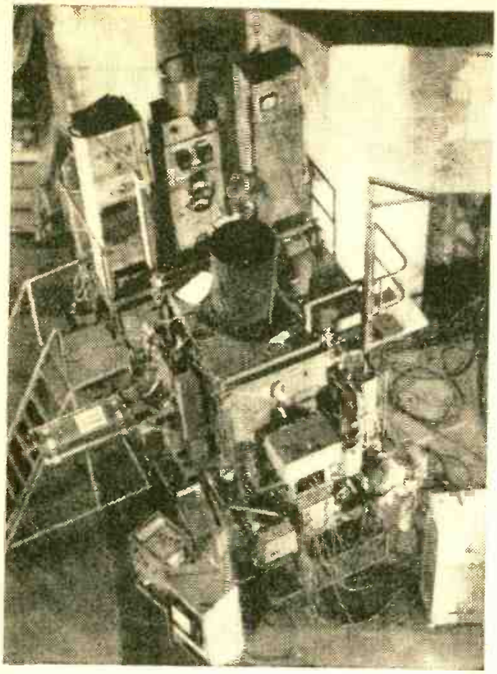
There are two basic types of cloud chambers. The Wilson cloud chamber is an expansion type in which saturated water vapor is brought to the super-saturated state by a sudden expansion of the volume of



Modern research expansion-type cloud chamber (above), known as the "Pantograph," has 22" diameter and is $3\frac{1}{2}$" high.



World's largest cloud chamber (right), originally designed for study of cosmic ray air showers, is now in use at the "Bevatron" at U. C. Radiation Laboratory.



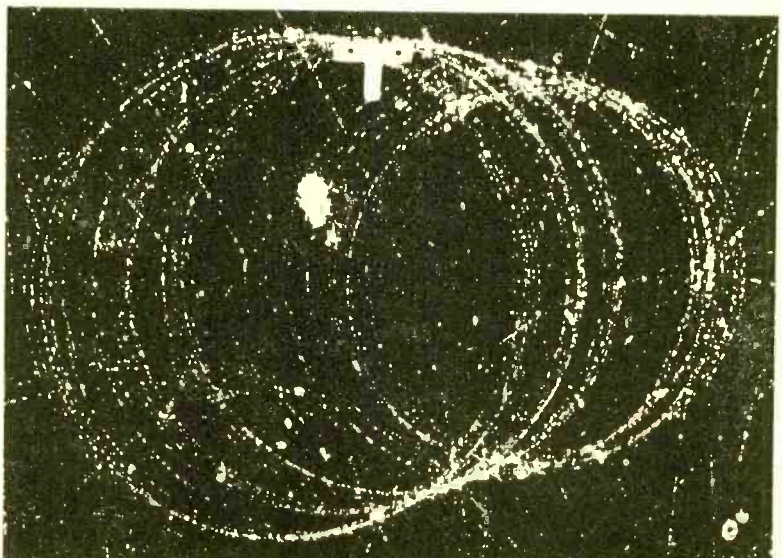
Experimental setup for use with cloud chamber. In the background, you can see the concrete shielding of the 184" cyclotron at the U. C. Radiation Laboratory.

the chamber. The subatomic footprints which form in this instrument are very fleeting, lasting for about 1/30 second. Later, in 1939, Langsdorf at the University of California invented a cloud chamber in which the conditions required for track formation are maintained continuously; after many years of research, the Langsdorf chamber was perfected to the point where it could be used as a research instrument.

Cosmic Rays. When no source of radiation is placed in or near the cloud chamber, almost all the tracks seen will be caused by those mysterious vagrants from outer space, the cosmic rays. Although cosmic rays in themselves are incapable of leaving tracks, their energy is so high, particularly in the upper atmosphere, that they smash into and disrupt atoms of any elements that happen to be present, releasing a shower of all kinds of charged (and uncharged) particles.

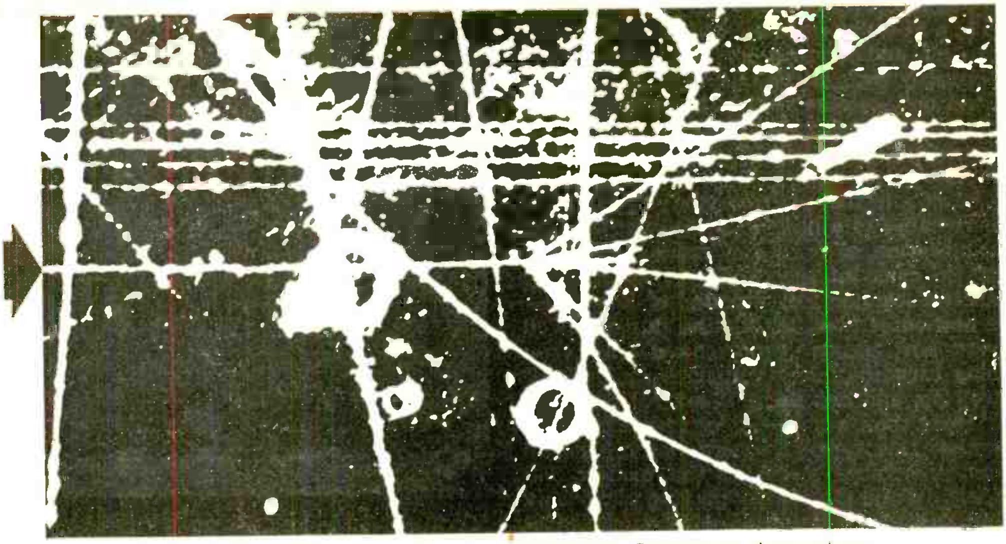
These particles include the now familiar electrons, protons, and neutrons as well as numerous other recently discovered atomic debris—such as nine different kinds of mesons, positrons, antiprotons, lambda particles, sigma particles, and cascade particles. Most of them, with the notable exception of the neutron, two types of mesons, and the neutrino, leave characteristic vapor trails which make it possible to identify the causative agents. For instance, electrons make much fainter and thinner tracks than the heavier positive bodies.

An alpha particle is a helium atom which has been stripped of its orbital electrons so that only the nucleus remains; the neucleus contains two protons and two neutrons, is quite massive, and is heavily ionizing. Alpha particles radiate from the gas radon which is always present in the air in small quantities. At first an alpha track is sharply defined, but then suddenly billows out as if it were exploding into a puff of smoke.



The signature of a high-energy electron as it travels through the cloud chamber under the influence of a magnetic field.

All Photos Courtesy of University of California Radiation Laboratory



A five-billion-volt meson from the world-famous Bevatron is shown above striking a hydrogen atom in a diffusion cloud chamber, thus producing six charged particles. This is an outstanding example of the phenomenon known as multiple meson production. (The meson enters the picture from the left, as indicated by the arrow, and the collision occurs at the photo's exact center.)

Neutrons and other neutral particles do not leave their signatures behind them because they have no electric charge and cannot act as nuclei for condensation. There is, however, ample evidence of their very real existence. Neutrons smash into atoms and liberate other charged particles that can be identified in the cloud chamber; for instance, a fast neutron charging through the vapor may collide head-on with a hydrogen atom, tear away the latter's lone electron, and cause the proton in the hydrogen nucleus to make a track that tells the story of the atomic catastrophe.

Cloud Chambers. Of all the scientific devices used for research in the first half of the 20th century, the cloud chamber is probably responsible for the making of more Nobel prize winners in physics than any other.

C. T. R. Wilson was awarded the Nobel prize in 1927 for the invention of the chamber itself and some of the discoveries he made with it. The positron—a particle which is the counterpart of the familiar negative electron in all respects except for the fact that it carries a positive charge—was discovered by the American, C. D. Anderson, during an investigation of cosmic rays by the use of a cloud chamber.

It was also in a cloud chamber that the elusive dream of the ancient alchemists was first observed actually occurring: transmutation of one element into another. P. M. S. Blackett, Nobel prize winner in 1948, filled a cloud chamber with nitrogen and bombarded this gas with high-energy alpha particles. The alpha particles smashed into nitrogen nuclei, set up a complex series of nuclear changes from which a proton and an oxygen atom then emerged; thus, nitrogen was transmuted to oxygen.

As recently as September, 1953, a new discovery of the first rank was made with a cloud chamber. At Brookhaven National Laboratory, research workers bombarded hydrogen gas in a cloud chamber with very high energy pi mesons coming from the now-famous Cosmotron accelerator. They observed the first artificially produced V-particles. Naturally occurring V-particles from cosmic rays had been studied previously with the aid of cloud chambers.

The life history of a cosmic particle from space that generates its track in a cloud chamber and then comes to rest is something to capture the imagination. It may be the nucleus of a helium, iron, or nickel atom torn from its electrons millions of years ago in the very heart of an immense star thousands of times more massive than our own sun. Blown out of the star by the unimaginable energy of billions of exploding atoms . . . accelerated through the vastness of interstellar space by ever-present magnetic and electric fields . . . escaping collision with cosmic dust for millions of years . . . it finally stumbles into our atmosphere and—in a single split second—loses all the energy stored in it since birth! —30—

Do You Really Have Hi-Fi?

Hi-fi specialty records test a sound system, demonstrate its quality . . . first of series

RECORDS that "show off" or "show up" a hi-fi system have become best sellers among audiophiles. At least one record company reports that its "test and demonstration" release far outsells any other single disc, including all the topnotch performances of some of the world's greatest music.

Visit a hi-fi'er at home and you're apt to be treated to a broadside of drum thumps, a pulsation of frequency tones, a barrage of tin cans interspersed with the roar of ancient cannon, or—wonder of wonders—a session of absolute silence, during which your host stands proudly besides his spinning turntable, with volume turned all the way up, and breathes: "See? No rumble!"

More than a curiosity or mere sonic exercise, this type of record has a rightful and inevitable place on the modern LP shelf. While a constant playing of nothing but such discs may gain you complete isolation from the rest of the world, it is safe to say that no record collection is complete without at least two such records: one, the kind that tests the performance of a hi-fi system for response, distortion, tracking, etc., and the other, the kind that shows off a hi-fi system to best advantage, celebrating the pure joy of the sonic miracles achieved in recent years by recording engineers.

Often, there is no sharp difference between the two types of discs. A record that has a frequency tone run of, say, 40 to 15,000 cps, is not only a test of your system's response but—if your rig does reproduce the entire range—it becomes a means of showing off the system. Such a record is both a "show-off" and a "show-up" type. Pickups, amplifiers, and speakers which clear the sonic hurdles incorporated on such records can rightfully be called "hi-fi."

Similarly, records which are largely musical in content may be regarded as mainly the "show-off" kind . . . yet, if you know in advance what to listen for (it is usually stated in the printed literature accompanying the record), you are in a position to judge the kind of sound your system is—or should be—putting out.

"Testing . . . 1, 2, 3, 4 . . ." Hi-fi recording has given us more than lifelike sound. Thanks to the ingenuity of recording engineers, discs are available that provide home tests of phono systems previously considered possible only in the laboratory. Designed strictly for checking how well your hi-fi system is doing its job, this type of record has no program material—but what is recorded onto the grooves is something that should excite all audiophiles.

One such pressing, Dubbings' *The Measure of Your Phonograph's Performance* (D-100), tests—without the need for meters—stylus pressure, frequency response, crossover points of multiple speaker systems, turntable rumble, wow and flutter, and the tracking and compliance of your pickup. Using this record is simplicity itself. You simply follow the instructions on the record jacket.

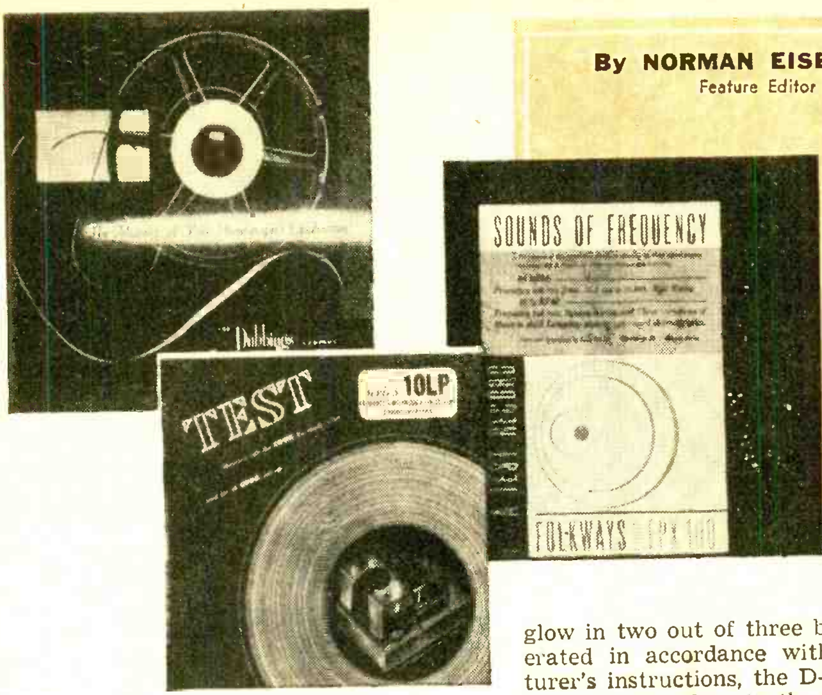
Some of the tests are marvels of economy and cleverness. The tracking test, for instance, is a 400-cycle tone repeated with increasing intensity level. The fourth run of this frequency is intended literally to kick the stylus up over the record grooves—and this it will do, except to the most advanced professional equipment.

Beyond these performance characteristics, the record fancier is often concerned about proper equalization. To assist hi-fi'ers in this area, Dubbings issued its D-101, *The Measure of Your Phonograph's Equalization*. It contains four frequency tone runs, each from 30 cps to 12,000 cps, and is cut according to the AES, NARTB, LP, and new ORTHO (RIAA) curves.

This pressing has a two-fold use: first, it enables you to check the accuracy of your equalizing circuit and switch controls; second, you can use the disc to obtain approximate equalization settings (if you have no equalizer) by correct adjustment of bass and treble controls.

D-101 is best used with an a.c. voltmeter hooked across the speaker terminals. A

By **NORMAN EISENBERG**
Feature Editor



typical reading, at the standard reference frequency of 1000 cycles, might be 0.4 volt. Without equalization, readings at frequencies above and below 1000 cycles will vary considerably. The idea is to adjust treble control (for tones above 1000 cps) and the bass control (for tones below 1000 cps) so that all a.c. voltage readings are as close to the 1000-cps reading as possible.

The tones are heard long enough to permit adjustment while you watch the a.c. voltmeter needle swing back and forth until you get it just where you want it—in this case, as near as possible to the original 0.4 reading. When you have finished taking readings for the tones in one curve, you can mark the approximate roll-off and turnover settings on your treble and bass controls respectively—and this will be an approximate equalization for records cut to that curve.

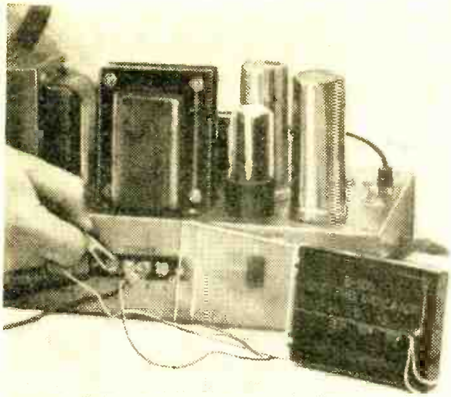
Anticipating that many record collectors will not be inclined to fuss with an a.c. voltmeter, Dubbings has developed a simple and cheap substitute for this application. Known as the *Test Level Indicator* (D-500), this gadget consists of three low-voltage bulbs sitting in a neat plastic box. The bulbs are so arranged as to light up at 3-decibel intervals when connected across the leads to the loudspeaker. The right-hand bulb indicates a 3-db rise; the left-hand bulb a 3-db cut.

In using the D-500, you adjust your amplifier controls for the correct amount of glow in two out of three bulbs. When operated in accordance with the manufacturer's instructions, the D-500 can provide results fairly close to those obtained with an a.c. voltmeter.

Beams and 'Scope Traces. Also providing the nontechnical audiophile with something easy to do is the "N-A Beam" test for intermodulation distortion, recorded by Emery Cook as his *Series 50*. The theory behind this record is involved, but what it comes to for the listener is simply this: if you hear a "dot-dash" (coded "A"), your system is all right; if you hear a "dash-dot" (coded "N"), it isn't.

Wider ground is covered by Cook's *Series 10* test records. There are two versions of this pressing, one recorded at 33⅓ rpm for "greatest convenience," and the other at 78 rpm for "highest accuracy." The 78-rpm pressing is intended for playback using a microgroove stylus. The advantage claimed for the combination of 78-rpm speed and .001 groove is greater fidelity in the very high frequency regions. Both of these discs permit frequency and distortion measurements, determination of arm resonance, tracking error, etc. The *Series 10* is best used with at least an a.c. voltmeter and preferably additional measuring equipment such as a distortion analyzer. In this respect, it is more of a professional's test record, although the advanced home hi-fi'er can use it to advantage.

Somewhat similar to the Cook test releases is Folkway's *Sounds of Frequency* (FPX-100). Made by Peter Bartok, son of the late composer, Bela Bartok, this disc is intended for use with an oscilloscope



Substitute for a.c. voltmeter in signal voltage measurements is Dubbings "Test Level Indicator." Two leads connect across speaker output terminals on amplifier. Device is intended for use with Dubbings test record. Relative intensities of glow in bulbs are interpreted as signal measurements.

and volume indicator. Its range is somewhat awesome, containing tones from 15.6 cycles up to 22.5 kc. Included are square waves (ever hear one?), demonstrations of high-frequency loss and increased distortion on the inner grooves of a record, equalization characteristics, and a few other test runs of impressive quality.

Accompanying the latter release is a booklet containing an excellent series of photos of oscilloscope traces, showing how certain bands should look, regardless of how they sound. The philosophy behind this is, apparently, that although you may not hear a frequency of 22,000 cycles you might want to see what it looks like.

The Sound and the Fury. Back in the 1920's, there was a ferment in the art world which involved experimenting with lines, color, form, etc. The general idea was not to paint pictures that looked like anything or anybody, but rather to generate "interesting design patterns." If nobody knew what you were talking about when your canvas was finished, who cared? Scornful of such work, the more literal-minded members of the public and the critical press labeled this movement "art for art's sake."

Today, in the field of sound reproduction, we are going through pretty much the same kind of thing. It could be called the "sound for sound's sake" movement. A succession of earthquake rumbles, train whistles, clucking hens, buzzing flies, and shrieks from outer space has been recorded and launched with an intensity and ferocity and fidelity like nothing since the invention of the phonograph. The records containing these sounds are strictly non-musical—in fact, they're anti-musical—but there they are, and look at 'em sell!

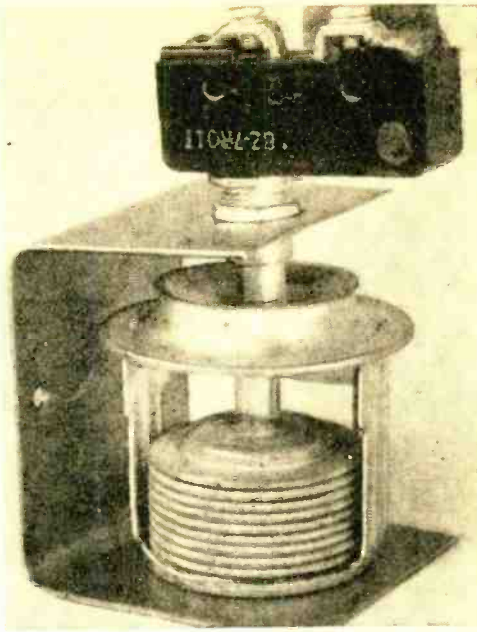
Chief exponent of the trend toward tonal terror is, of course, Mr. Emory Cook, head of the recording laboratories in Stamford, Conn., which bear his name and which produce the test records discussed above. Something of a maverick, something of a leg-puller, and something of a genius, Mr. Cook has managed—in these records—to combine the sound enthusiast's interest in audiology with the thrill-seeker's bent for the unusual, the different, the outlandish.

Releases of this sort are not to be taken too literally as "test" records; often they

(*Continued on page* 106)

All manner of sound is recorded by Emory Cook, shown here "on location," as he tapes special outdoor sequence. Recording is later transferred to master disc for record manufacture. In addition to unusual sounds, Cook has recorded a series of excellent audio test records. Startling realism and high technical standards characterize his work, which has taken him to many far-off places, including—by means of sensitive microphones—the reaches of outer space. (Photo by Walter Bursten).

D.C.-Operated Fire Alarm



THIS FIRE ALARM is really an assembly job built around a simple sheet steel frame about 1/32" thick and bent on a garage vise to a U-shape. The dimensions of the U-form rigidly hold an automobile thermostat measuring 1½" in diameter and 1¾" thick (at 75° F ambient temperature).

The thermostat is inserted in the open end of the U after the Microswitch has been temporarily fastened in position. Clearance between the thermostat and the Microswitch is then adjusted so that the Microswitch is electrically "open" at 75° and definitely "closed" at 150°.

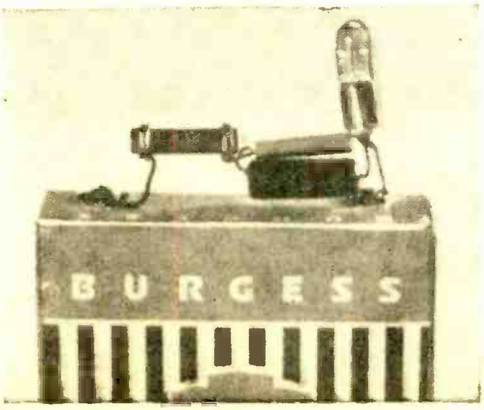
These adjustments are made by completing the wiring from the switch (using flexible wires) through alarm bell to a 6-volt battery, and then placing the unit in the kitchen oven. The oven is heated to 150° and the pressure adjusted between the Microswitch and the thermostat until the contacts close. The Microswitch will probably require a movement of 1/16" before it closes the circuit, so a direct contact with the thermostat—not a clearance—is the proper setting.

Since I mounted the unit in an attic which can reach a temperature of 120° on a hot day, the alarm was adjusted to operate at 150°. This setting has proven to be safe from false alarms and yet has been found to be dependable in case of excessive heat. —*I. C. Chapel*

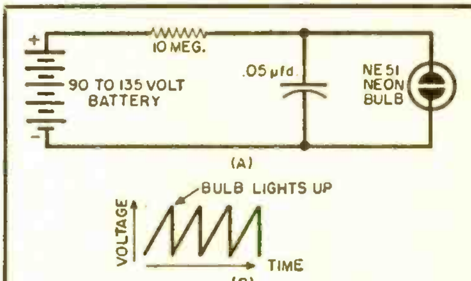
Relaxation Oscillator Makes Perpetual Flasher

HERE IS SOMETHING you can build in a few minutes and that will catch the attention of everyone who sees it. Call it a "Perpetual Flasher." Although its source of power may be an old 90-volt battery, this small blinking light will keep on flashing for years.

Note that the circuit has only three parts and a battery. The principle of operation is very simple. The capacitor charges through the 10-megohm resistor. When it is sufficiently charged, the neon bulb "lights up," effectively shorting the capacitor and simultaneously extinguishing the bulb. The waveform of the voltage across the capacitor is shown at the bottom of the schematic.



The flashing rate is a function of the



Schematic diagram (A) of the perpetual flasher and waveform of voltage (B) across capacitor.

values of *R* and *C*. Decreasing either will increase the frequency (flashing rate), and increasing either will decrease the frequency. The frequency is also a function of voltage. An old 90-volt battery or two old 67½-volt batteries in series will operate the "Perpetual Flasher." Since the power dissipation is a small decimal part of a watt, the device will generally operate throughout the shelf life of the battery. —*Forrest H. Frantz, Sr.*

Transistor Topics

By LOU GARNER

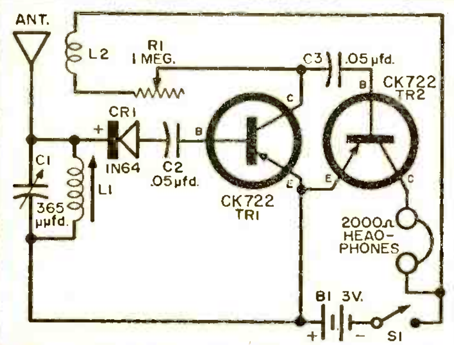
AS THE EXPRESSION GOES, Summer has just about "had it." Sure, there'll be a few more warm—or even hot—days, but the nip of Fall will soon be in the air . . . and experimenters all over the world will start cleaning and tinning their soldering irons, checking their stock of components, ordering new parts, and lining up their pet projects. Summer usually brings a falling off of interest in indoor hobbies—in business, it's called the "Summer Slump." But in the autumn there is a general reawakening of interest—and hobbyists attack their projects with renewed vigor . . . rested after a summer of play and sparked by the cool autumn breezes.

Have you thought about a name for transistor experimenters? I'm still trying to find a good "handle" for them . . . something to compare with *ham* for amateur radio operators and *audiophile* for hi-fi enthusiasts.

Reader's Circuit. Regenerative receiver circuits continue to be popular with home builders and experimenters, so we're featuring another this month, suggested by Vincent E. Henley, Jr., of 806 Atlantic St., S.E., Washington 20, D.C. His circuit features two transistors, a diode, and operation on a 3-volt battery.

Referring to the schematic diagram below, *L1* is a broadcast-band "Vari-Loopstick," *L2* consists of 16 turns of litz wire wound on top of *L1* (after removing the cardboard cover), and *C1* is a miniature 365-μμfd. or 420-μμfd. variable capacitor. The s.p.s.t. "on-off" switch, *S1,* may be mounted on the regeneration control *R1,* or a separate slide or toggle switch used, as preferred by the individual builder. The 3-volt battery may be made up by connecting two penlite cells in series. Moderate-impedance (2000-ohm) magnetic headphones are used. Transistors *TR1* and *TR2* are Raytheon's popular CK722.

You'll find details on the new "Mascot" pocket radio, manufactured by Televex, Inc., on page 120.



Vincent Henley's regenerative receiver which is described above. It features two transistors, a diode, and operation on a 3-volt battery.

Vincent indicates he obtains good reception with a 26" length of hookup wire as an external antenna (ANT.), and *without* using an external ground. His model is assembled in a small plastic box.

In operation, the first stage (*TR1*) serves as a regenerative detector, with the 1N64 diode assisting in the detection action. The feedback necessary to regeneration is obtained through coil *L2*, inductively coupled to the main tuning coil *L1*. The audio output signal is coupled through capacitor *C3* to the second stage, *TR2*, which serves as a simple audio amplifier. The *grounded-emitter* circuit configuration is used in both stages.

To use the receiver, advance the regeneration control (*R1*) until a hiss or similar sound is heard in the headphones. Adjust *C1* to tune in the desired station, readjusting *R1* if necessary for best reception. If no hiss—or other indication of regeneration

—can be obtained, reverse the connections to *L2*.

A few tips, Vincent . . . you may find that replacing *TR1* with Raytheon's new r.f. transistor, Type CK768, will improve gain. And, in some cases, the gain of the second stage will be improved by applying a small bias . . . you can do this by connecting a small resistor from its *base* electrode to the negative side of the battery. Determine the best value experimentally . . . it will probably fall between 220,000 ohms and 1 megohm. A ½-watt resistor is okay.

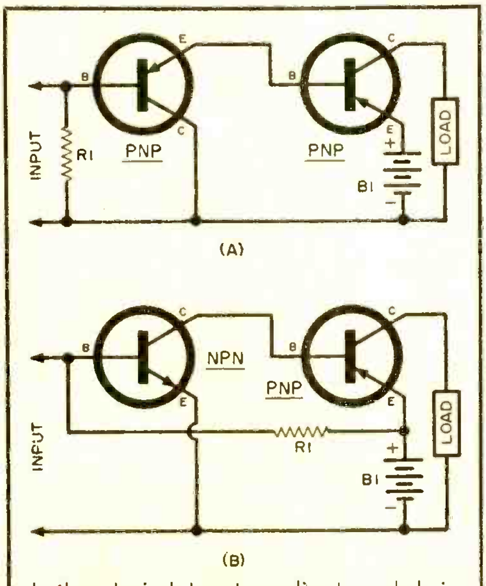
Tickler File. As mentioned last month, we're devoting some space to "tickling" your memories about new items mentioned in previous columns. Here goes:

(1) G.E.'s new 2N170 is an *n-p-n* transistor with a 4-mc. cutoff frequency.

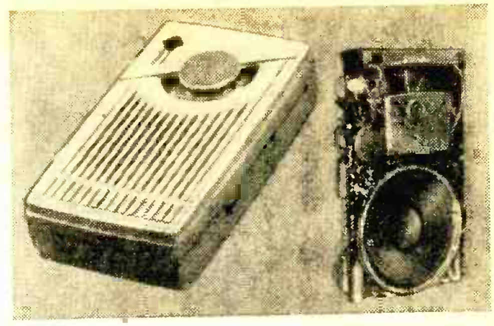
(2) Your columnist's new *Transistor Circuit Handbook* . . . with nearly 200 practical circuits . . . is available from your regular distributor.

(3) *Raytheon's* CK768, a *p-n-p* r.f. transistor, sells for only $1.50.

Tech Talk. Although the majority of published transistor circuits feature either capacitive or transformer interstage coupling, transistors are well suited to *direct coupling*. Direct-coupled circuits are generally simpler than other types because, in such a circuit, there is a d.c. path from the "output" electrode of one stage to the "input" electrode of the second stage. This may be either a direct wire connection or a series current limiting resistor, depending on the circuit and its intended application.



In these typical, two-stage, direct-coupled circuits, (A) features two p-n-p transistors and (B) utilizes the opposite d.c. characteristics of n-p-n and p-n-p transistors. See text.


Exterior and interior views of Telefunken's new transistorized pocket receiver . . . the first all-transistor receiver manufactured in West Germany.

In addition to simpler circuitry, direct-coupled arrangements are less expensive to assemble than other types, since expensive coupling capacitors and interstage transformers are not used. And, from a technical viewpoint, they generally offer a much improved frequency response characteristic, particularly at the "low" end of the frequency spectrum. Properly designed circuits may be made "flat" to *0 cycles per second* (d.c.).

Typical two-stage direct-coupled circuits are shown in the schematic diagram at left. Both of these are suitable for experimental work, and may be used in receivers, amplifiers, or control applications, depending on the nature of the input signal and the type of *load* used. In a receiver or audio amplifier, the load may be a pair of headphones; in an instrument, the load may be a resistor or a meter; and in a control circuit, the load may be an electromagnetic relay.

Circuit (A) features two transistors of the same type and is basically a common-collector amplifier direct-coupled to a common-emitter stage. Bias for the first stage is supplied through *R1*. This circuit is essentially the same as that used in Marvelco's new *Tandem Transistor*. It features a *high* input impedance and a gain which is approximately equal to that of the second stage . . . the first stage serves simply to match impedances and supplies relatively little gain. *N-p-n* transistors may be substituted for the *p-n-p* types shown simply by reversing the battery (*B1*) polarity.

Circuit (B) utilizes the opposite d.c. characteristics of *n-p-n* and *p-n-p* transistors to permit direct coupling from collector to base. Since both stages use the common-emitter configuration, this circuit has a low input impedance, but it provides

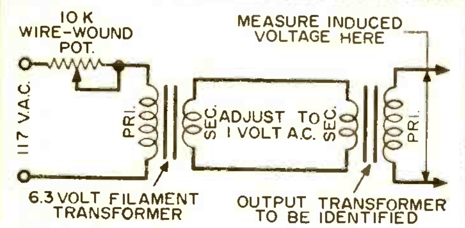
(*Continued on page* 120)

Identifying Salvaged Transformers

EVERY EXPERIMENTER accumulates various and sundry audio output transformers—the type that's used to match a power tube, or tubes, to a loudspeaker. He salvages them from old radio receivers with the idea that one day they'll be useful. Sooner or later our hero finds that he has neglected to tag or otherwise identify the transformers he has stowed away.

The equipment needed to identify a transformer consists of: an a.c. vacuum-tube voltmeter, such as the Heathkit Model AV-2; a small 6.3-volt filament transformer, such as the Triad F-13X (any 1-ampere unit will do as well); a 10,000-ohm wire-wound potentiometer; and a power cord and plug.

Set up the circuit shown in the schematic diagram. If you are unable to tell by inspection which two of the four or five leads coming out of your transformer are the secondary connections, measure the d.c. resistances between the various leads. The two leads (of a 4- or 5-lead output transformer) that have the *lowest* resistance are the secondary leads.



With this circuit, you can determine the impedance ratio of any output transformer.

If you're checking a 4-lead transformer, the two remaining leads are the primary. If you're checking a 5-lead transformer, the two remaining leads that have the *highest* resistance are the two plate leads; the third lead is the center-tap connection. A 4-lead output transformer is made to match a *single tube* to a speaker voice coil. A 5-lead transformer matches *push-pull* tubes to the voice coil.

After you have made the few simple connections, set the potentiometer to where the full 10,000 ohms is in the circuit, and plug the line cord into the 117-volt a.c. socket. Connect your v.t.v.m. across the *secondary* of the output transformer. Then, adjust the potentiometer until your meter reads *exactly 1 volt.*

As soon as this adjustment has been made, set your meter to a higher range (the 100-volt range will usually be the right one), and immediately switch the meter leads to the primary of the output transformer. Measure the voltage across the primary and write it down. Multiply this number by itself, and then multiply the product by the voice-coil impedance of the speaker you want to use. Your final figure is the load impedance into which the plate of your power tube will work when you're using this particular transformer and speaker.

EXAMPLE I: Suppose, after setting the voltage across the secondary of our output transformer very carefully to 1 volt, we read the voltage across the primary and find it to be exactly 39.5 volts. We write this down and multiply it by itself (39.5×39.5) and obtain the product: 1560.25. The voice-coil impedance of the speaker we want to use happens to be 3.2 ohms, so we multiply our 1560.25 by 3.2, and get 4992.8. This is close to 5000, so we'll call it 5000 ohms—the right impedance to match the plate of a 6V6 or a 6AQ5 power tube.

EXAMPLE II: Suppose we have a 5-lead output transformer and, after carefully setting its secondary to 1 volt, we measure the voltage across the two primary plate leads and find it to be 42 volts. We have an 8-ohm speaker, so we multiply $42 \times 42 \times 8$ and get 14,112. Call it 14,000 ohms. This will match a pair of 6F6's, or 6K6GT's, or 6AR5's in push-pull to the voice coil of our 8-ohm speaker.

Proper plate loads at various grid bias and plate potentials for a number of power tubes can be found in the *RCA Receiving Tube Manual,* or the tube section of *The Radio Amateur's Handbook* published by the American Radio Relay League (A. R. R. L.). —*Frank H. Tooker*

HOW IT WORKS

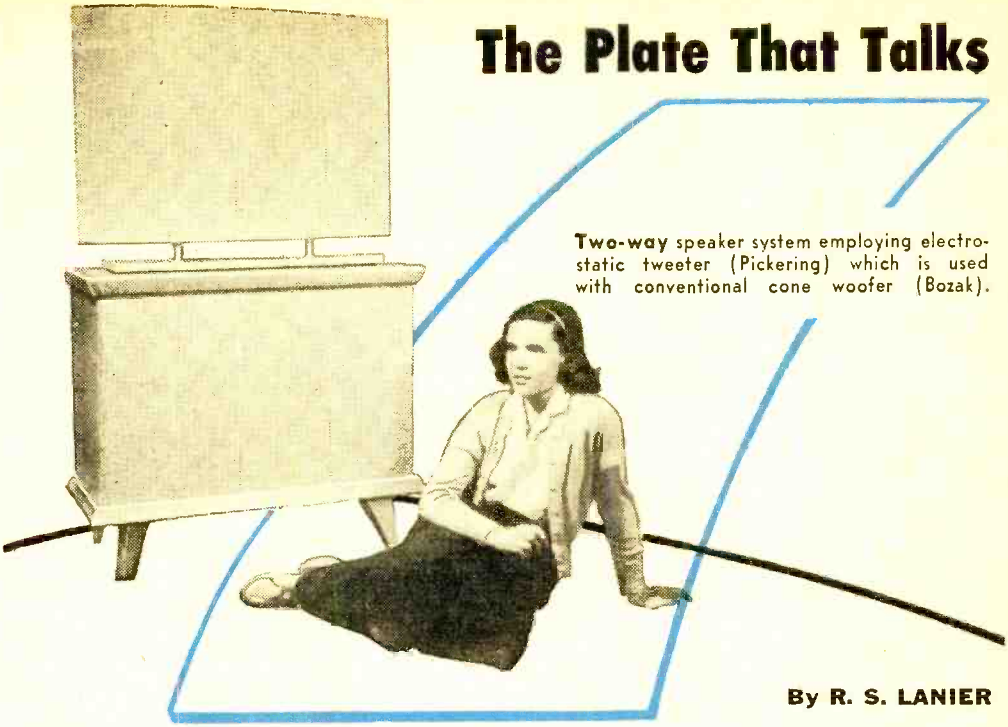
It is easy to identify the impedance ratio of an output transformer by means of two useful iron-core transformer formulas:

$$(Ns/Np)^2 = Zs/Zp \text{ and } Ns/Np = Es/Ep$$

in which Ns represents the number of turns on the secondary of our output transformer; Np, the number of turns on the primary; Zs, the impedance to be placed across the secondary; Zp, the impedance reflected into the primary; Es, a voltage impressed or induced across the secondary; and Ep, the voltage impressed or induced across the primary.

In this circuit, a filament transformer is used to drive the secondary of the unknown transformer. The voltage is carefully adjusted and measured by an a.c. vacuum-tube voltmeter. Once the secondary voltage is known, the v.t.v.m. is used to measure the voltage induced in the primary. Through the formula above, the nominal primary load impedance can be found.

The Plate That Talks



Two-way speaker system employing electrostatic tweeter (Pickering) which is used with conventional cone woofer (Bozak).

By R. S. LANIER

Electrostatic speakers generate sound in a way that has thrilled many hi-fi fans; here's how they do it

LONG AWAITED and much discussed, electrostatic speakers are here—apparently to stay. Although available commercial models cover only the mid-range and high frequencies of the audio spectrum, we may expect that sooner or later full-range electrostatic reproducers will be on the market. Development work, here and abroad, is now under way on such devices.

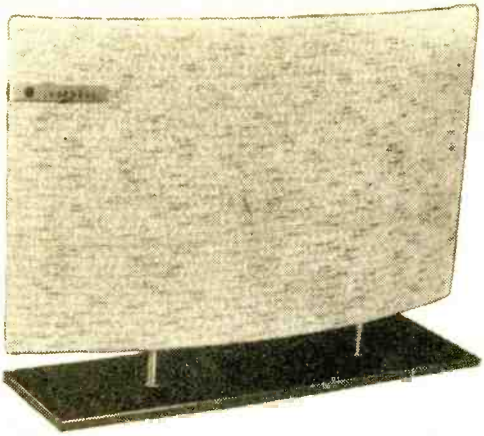
Recent models are, of course, hi-fi news—although their operation is based on tried-and-true electronic principles. If you take apart an electrostatic speaker, you have what is, essentially, an overgrown capacitor. One plate of this capacitor is stationary and can't move; the other is suspended elastically so that it can move. Feed an a.c. signal across these two plates and the movable one will vibrate, creating sound waves. That, in a nutshell, is how the electrostatic speaker works.

But, as in all things electronic, there's more to this story than the insides of a nutshell. The basic principle of electrostatic speakers was known years ago, but audio engineers chose the electromagnetic principle as the big hook on which to hang their speaker designs. There were many good reasons for such a choice. Among them were: cost of construction and operation; over-all smoothness of response; wide frequency band coverage; output level; efficiency.

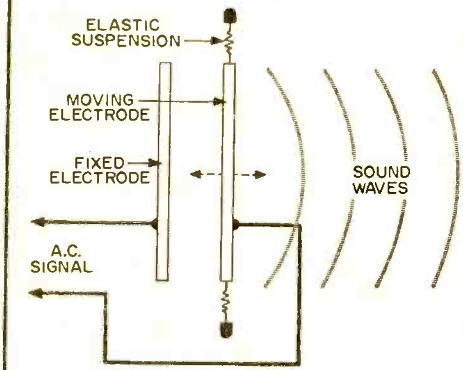
Many experts still feel that these advantages have not been seriously challenged by the electrostatic speaker and never will be. Others point to the highly rated performance of electrostatics at the high frequencies, emphasizing the importance of good reproduction in this area for the ultimate perception of clean overtones that characterizes real hi-fi.

The Moving Plate. In preparation for hi-fi-dom's reception of electrostatic speakers, it's a good idea to understand just how these units operate. As stated above, the basic action is capacitive, depending on the build-up of an electrostatic field between two conductive plates.

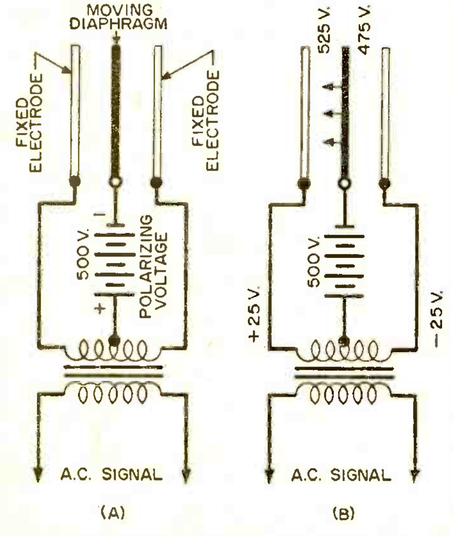
When the charges on the two plates are of the same polarity (both plus or both negative), the static field (or tension, or force) between the two plates tends to push them apart. When the charges are of opposite polarity (one positive and the other negative), the two plates are "attracted" and the force pulls inward between them. Varying the charge—as an



Curved surface of Pickering "Isophase" electrostatic tweeter disperses highs uniformly into room.



Basic action of electrostatic speaker is diagramed above. Simplified version of push-pull electrostatic speaker is shown below: in (A), no signal is applied; in (B), the applied signal of 50 volts creates unbalance between plates and diaphragm vibrates, producing sound.



audio signal voltage can—varies the force and creates a "push-pull" effect across the two plates.

To make a loudspeaker of two such plates, or panels, three things must be done. First, fix one panel so that it can't move. Second, suspend the other in an elastic mounting so that it can move a very short distance with respect to the first plate. Finally, feed across the two panels a signal voltage that represents speech or music (see drawing at left).

The movable panel will be pushed and pulled with respect to the fixed panel with a force that is proportional to the signal voltage. The resultant vibrations will move the surrounding air to create sound.

This arrangement makes possible a reproducer diaphragm that moves as an integral unit. The force of any point on the surface equals that at every other point, thus eliminating "break-up"—long a bugaboo of conventional speakers. Break-up occurs when some parts of the speaker diaphragm do not move in step with the voice coil.

At middle and high frequencies, for example, the flexible cone of a conventional speaker is pushed at one area only, near its attachment to the voice coil. Some distortion may result. In the better speakers, this difficulty has been controlled so that distortion is fairly low. Well-designed horn tweeters reduce it to a minimum. But, it appears that the electrostatic speaker has no such problem at all. This would indicate a high degree of purity in the propagation of high frequencies.

Practical Problems. There were two big obstacles that stood in the way of electrostatic speakers clearing the high-frequency hurdles. One was the spacing of the two plates.

The diaphragm, or moving plate, must be very close to the fixed plate for any usable electrostatic force to be developed. The closer together the two plates, the stronger the sound available. But the plates can't get close enough to touch each other during the movement of the diaphragm; this would, naturally, short out the audio signal and defeat the purpose of the whole setup.

In the past, experimenters attempted to solve this problem by stretching a thin metal foil tightly in front of a plate. Another method was to mount the foil on a layer of rubber. Neither method worked very well. The foil could not be made both lightweight and strong enough to do the job. Thus, the spacing problem be-

Four panels, at various angles for dispersal of highs, characterize the Janszen electrostatic tweeter, a push-pull unit handling 1000 cps and up.

came, effectively, a problem of finding and using the right material for the diaphragm.

The second problem involved a basic law of physics: the mechanical force between two charges varies inversely as the square of the distance between them. For example, if two charges attract each other with a certain force when they are one inch apart, the same two charges will attract each other with only one-fourth that force when they are two inches apart.

This square-law relationship between distance and force means that when the diaphragm moves well away from the fixed plate the resultant force will not be in strict proportion to the applied signal voltage. Harmonic and intermodulation distortion will result; the speaker will not be linear in response.

The "Push-Pull" Speaker. To solve the distance-force problem, both American manufacturers of electrostatic speakers (Pickering and Janszen) use a push-pull system which is said to be completely linear (see drawing on page 92). The force applied to the diaphragm is proportional to the applied signal voltage no matter where the diaphragm is at any time during its vibrations.

The push-pull system uses two fixed electrodes; the moving diaphragm is suspended between them. A fixed d.c. voltage (the "polarizing" or "bias" voltage) is applied to the speaker by means of the transformer center-tap, creating an initial electrostatic force between the diaphragm and each electrode. With no a.c. signal, the force is balanced; the diaphragm is pulled equally in both directions and so stays in the middle. No sound is generated.

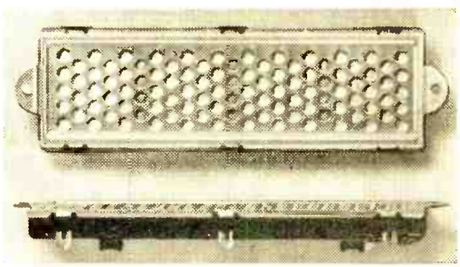
When a signal is applied to the transformer, the voltage varies. In effect, the polarizing d.c. voltage is "modulated" by the a.c. signal. This action pulls the diaphragm first toward one electrode, then toward the other. Resultant vibrations generate the sound.

Diaphragm and Suspension. The problem of choosing a suitable material for the diaphragm is solved in both the Pickering and Janszen units by the use of a very thin, lightweight, strong plastic which is made into an electrode by depositing on it a microscopic layer of metal. The suspension of the diaphragm, however, is quite different in each make.

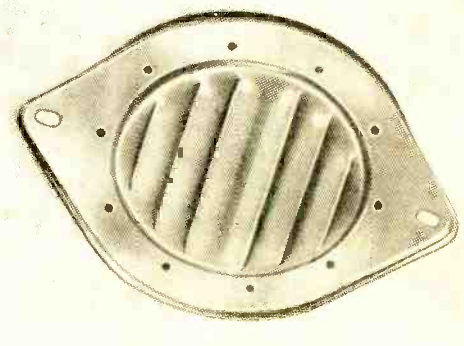
In the Pickering speaker (see drawing on page 92), the diaphragm is not stretched and held at its edges. Instead, the "inert diaphragm" method is used, with the plastic supported by a number of small spring elements across its surface, between it and the two outer electrodes. This entire "sandwich" (consisting of the outer electrodes and the diaphragm) is curved in the horizontal plane, which helps in the even distribution of highs throughout the listening area. In addition, the outer electrodes have numerous openings to allow both the front and the back waves to emerge from the unit.

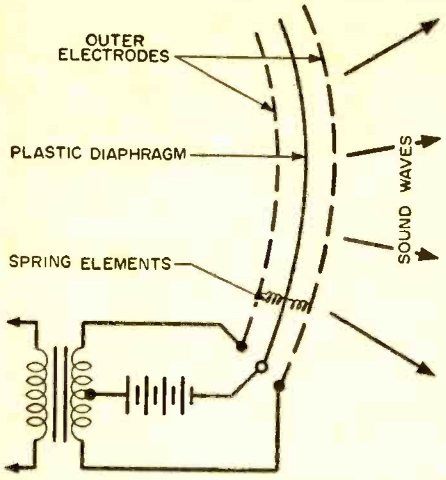
Two models of the Pickering speaker are currently sold: the larger (2′ by 3′) is designed to cover the frequency range from 400 cps up. The smaller (12″ by 18″) handles the range from 1000 cps up. Obviously, the lower the frequency range handled by the electrostatic method, the larger—and costlier—must be the unit.

Both units are free-standing and self-contained. They can be placed anywhere near the woofer and its enclosure. Each

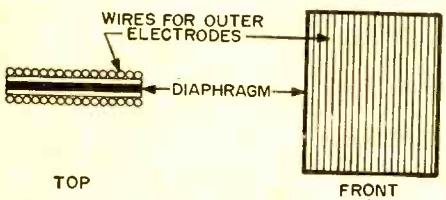


Examples of single-ended electrostatic tweeters are the Arnhold "Isophon" (above) and the Lorenz SKL-100. Both units are small, fairly inexpensive, and simple to connect. Isophon handles range from 7000 cycles and up; Lorenz, 5000 cycles and up.





Construction of Pickering speaker is shown in drawing above; diaphragm is suspended by spring elements between outer plates and openings in plates permit sound to emerge. Below, in drawing of panel used in Janszen speaker, diaphragm is stretched across panel; outer electrodes are formed by special layers of wire.



speaker is used with an adapter unit which serves as a crossover network, supplies the polarizing voltage, and matches the speaker to the amplifier. The rig can be used with any standard hi-fi amplifier. A typical hookup is shown in the photo on page 89.

The Janszen speaker (see drawing above) consists of a series of four flat panels, each about six inches square. The plastic diaphragm is stretched across the frame of each panel. On each side of the diaphragm, in each panel, is a network of parallel wires which forms the outer electrodes of the push-pull circuit. This unit is intended to cover the frequency range from 1000 cps and up. It is furnished with a high-pass filter for crossover, and a polarizing voltage supply. Like the Pickering, it is free-standing and self-contained. (For further information on these units, contact Pickering and Co., Inc., Oceanside, N. Y., and Janszen Laboratory, Inc., 69 Harvey St., Cambridge, Mass.)

Single-Ended Electrostatics. In addition to the push-pull speakers, there are a few small, single-ended electrostatics such as the Isophon (Arnold Ceramics, Inc., 1 East 57 St., New York, N. Y.), and the Lorenz (Kingdom Products, Ltd., 23 Park Place, New York 7, N. Y.).

Designed to handle only the very upper range (the Isophon takes off at 7000 cps, the Lorenz at 5000 cps), these tweeters serve as "top" reproducers in three-way systems or as high-frequency aids to wide-range cone speakers where relatively high crossover points can be used. The distortion inherent in their single-ended construction is minimized by permitting the diaphragm to move only thousandths of an inch, or less. At that, such microscopic motion is enough to produce sizable sound levels at high frequencies.

How Do They Sound? Most listeners agree that, properly connected and matched to suitable woofers, electrostatic speakers make excellent mid-range and tweeter units. Of course, in the last analysis every listener must decide for himself. Listen, if you can, to "A-B" tests in which the highs are played first through a horn or cone tweeter and then through an electrostatic unit.

Advocates of the electrostatic devices urge you to listen for two main things. First, the over-all response is said to be very smooth with no audible peaks and no "break-up." Transient response is claimed to be excellent. Intermodulation and harmonic distortion have been measured at less than 1% at full output.

Second, the point-source effect, or "sound coming from a hole in a box" is eliminated. The wide radiating surface spreads the sound over a large area so that it "just seems to be there." While the highs may not come at you with the impact of a pile-driver, they are all present and perhaps in a more natural-sounding way.

What About Bass? Practical use of electrostatic speakers, at least so far, involves a two-way speaker system in which the bass is handled by a cone woofer while the mid-range and highs are sounded by the electrostatic unit. The crossover point depends on the particular electrostatic speaker used; some take over at about 500 cps, others at 1000 cps. In any case, the electrostatic reproducer must be fairly well balanced with whatever woofer is used. Power ratings and relative efficiencies must be watched lest the sound output is unbalanced in favor of highs or lows.

One of the big problems faced in developing electrostatic speakers for the full audio range, including bass, is the spacing of the electrodes. As frequency is lowered, the diaphragm has to move farther to maintain balanced sound output. At 100

(*Continued on page* 122)

Heathkit vfo KIT

☆ 6AU6 electron-coupled oscillator.

☆ OA2 voltage regulator tube for stability.

☆ Smooth-acting illuminated dial.

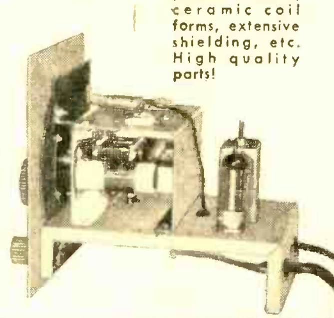
☆ Easy to build and attractively styled.

MODEL VF-1 **$19.50** Shpg. Wt. 7 Lbs.

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

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

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



Heathkit CW amateur transmitter kit

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

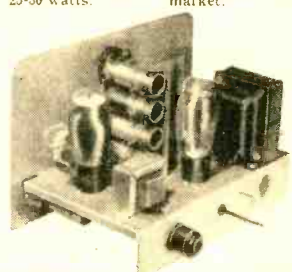
MODEL AT-1 **$29.50** Shpg. Wt. 15 Lbs.

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

Plate power input 25-30 watts.

Panel meter monitors final grid or plate current.

Best dollar-per-watt buy on the market.



SPECIFICATIONS:

RF Amplifier Power Input . . . 25-30 watts
Output Connection . . . . 52 ohms
Band Coverage . . . . 80, 40, 20, 15, 11, 10 Meters

Tube Complement:
5U4G . . . . Rectifier
6AG7 . . . . Oscillator-Multiplier
6L6 . . . . Amplifier-Doubler

Heathkit COMMUNICATIONS TYPE all band receiver kit

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

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

Transformer-operated power supply for safety and high efficiency.

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

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

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

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

SPECIFICATIONS:

Frequency Range . . 550 kc to 30 mc on four bands

Tube Complement . . 1—12BE6 oscillator and mixer
1—12BA6 IF amplifier
1—12AV6 second detector, AVC, first audio amplifier and reflex BFO
1—12A6 beam power output
1—5Y3 fullwave rectifier

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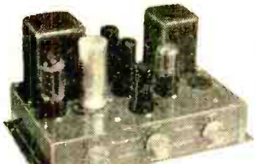
amplifier kit



MODEL A-7D

$16.95 Shpg. Wt.

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

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

Free 52-Page 1956 Catalog

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

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receiver kit

MODEL BR-2

Shpg. Wt. 10 Lbs. $17.50 Less Cabinet

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

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

HEATHKIT HIGH FIDELITY

fm tuner kit

MODEL FM-3

$24.50

Shpg. Wt. 7 Lbs.

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

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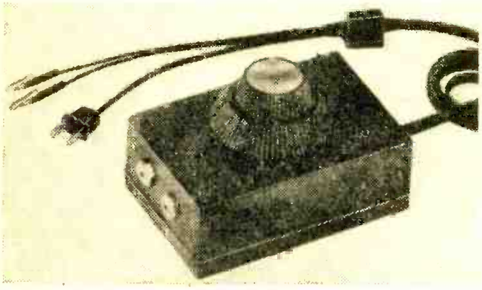
ON PARCEL POST ORDERS insure postage for weight shown.

ORDERS FROM CANADA and APO'S must include full remittance.

TOOLS and GADGETS

REMOTE CONTROL FOR YOUR SET

You can turn your present TV, radio or hi-fi into a remote control set in a few seconds by connecting the "Remote LAZY-TROL" to it. This is said to be the only remote-controller with: (1) on-off switch, (2) volume controller, and (3) earphone plug-in. The "LAZY-TROL" can be used

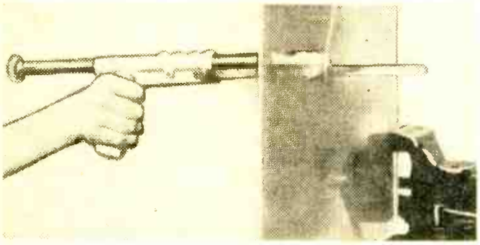


with speaker only, earphones only, or both together.

Whenever the music is too loud or too soft, you can adjust it without moving out of your easy chair. Or if you want to listen to only part of the program, you can turn it on or off at will. It's all done with one knob. List price, $9.95, with 20 feet of wiring. (*Televex, Inc.*, Kew Gardens 15, N. Y.)

VERSATILE HACKSAW

Depth of cut is unlimited with the "Leytool" hacksaw, since the entire frame remains on the operator's side of the material, and inside cuts are also possible. Once the saw cut is blade deep, the nose of the spring-loaded blade support rests against the material being sawed, and only the blade moves back and forth through the

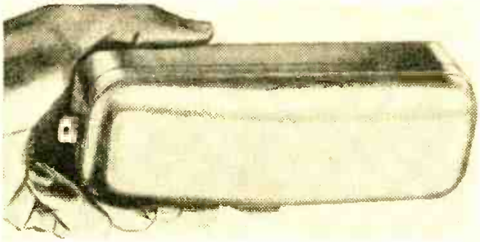


cut. The molded finger rest stays directly above the portion of the blade doing the cutting.

Made of die-cast aluminum and English steel, the "Leytool" saw will take either 10" or 12" standard hacksaw blades. It weighs a little over 1½ pounds, and measures only 5" x 16" x 1½". A pistol grip handle gives the operator complete control. Price, $7.95. (*Hallbee Products Company,* 142 Mill St., Parma, Mich.)

HOME FIRE ALARM

Fires which break out in any part of the home—from basement to attic—can be detected and reported by the "Lert-A-Larm." This extended protection is made possible

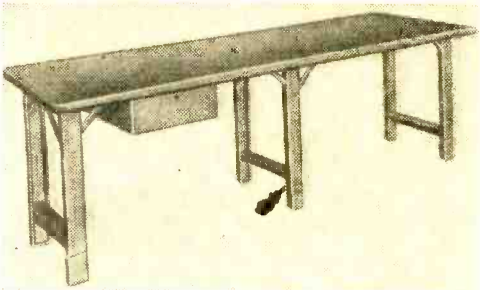


by running a thin wire (non-electrical), interspersed with fusible links, back and forth over the areas to be protected. A temperature of 158° anywhere along the wire will cause one of the links to melt, setting off the alarm in the living quarters.

Not dependent upon household current, "Lert-A-Larm" is powered by self-contained batteries. It can be installed by the home-owner using only simple tools. Model A, with 100 feet of wire and 12 fusible links, is $12.95 postpaid. (*Time Products Co.*, 1350 N. Jackson, Milwaukee 2, Wis.)

NEW LIMBS FOR CRIPPLED TABLES

Metal folding legs make replacing wobbly "fixed" table-legs, or assembling new tables, an inexpensive and simple task. Any table top may be used which is made of plywood, pressed wood or other suitable



material. The only tool necessary to do the job is a screwdriver. Constructed of 1" heavy-gauge steel tubing and equipped with double-action safety locks, these legs can support 1500 pounds.

There are also heavy-duty "fixed" legs for tables which will safely support 5000 pounds (shown in photo). A 2" adjustment in height is possible, enabling you to level the table easily if floor is uneven. (*ABC Metal Products Company,* 115 West 30th St., Dept. 25, New York 1, N. Y.)

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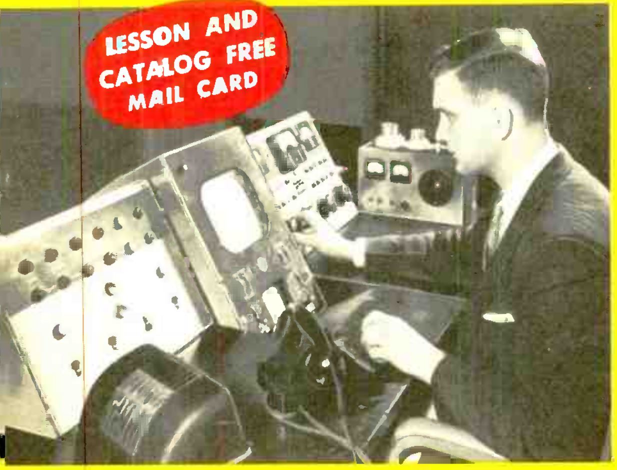

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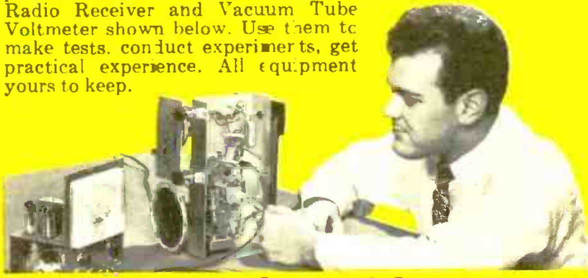

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Quit Job to Start own Business—"I decided to quit my job and do TV work full time. I love my work and am doing all right financially." W. F. KLINE, Cincinnati, Ohio.

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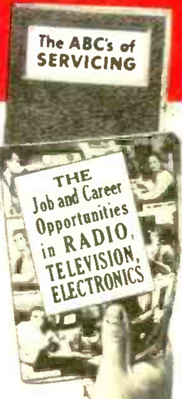

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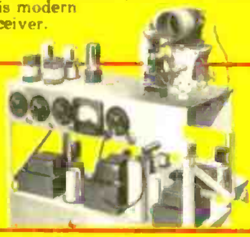

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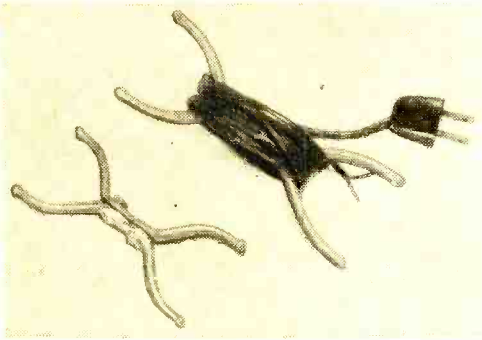
TIPS and TECHNIQUES

LINE CORD HOLDERS

The next time you visit your local hardware store, pick up a handful of clothesline cleats. They are quite inexpensive, and you'll find that a pair, bolted together, makes an excellent and durable holder for extension cords, spare line cords, mike cables, speaker line, or any of the other types of cable or wire you're likely to have around your electronics workshop.



When you use the holder for an extension line cord, unwind only the amount of cord needed, and you'll have a neater—and safer—installation. Remember that a loose cord can trip someone! —*L. E. G.*

JOINING FINE WIRE

Often the experimenter is faced with the problem of joining two ends of fine "hair" wire, such as may be found in a.c. meter coils, solenoids, etc. To solve this problem quickly and effortlessly, simply twist the two ends to be joined into a pigtail splice. Then dip the splice into a small quantity of lighter fluid, and apply a flame. The resulting heat will cause the ends of the fine wires to melt and fuse together into a small ball of copper. This forms, in effect, a permanently welded connection. —*R. L. K.*

COVERING CABINET SCRATCHES

It is almost impossible to avoid scratches on radio, TV and hi-fi cabinets when the units are being repaired. A quick way to cover up such scratches is to rub in a little brown soldering paste and then rub off the excess. A more professional procedure is to use a gadget such as the General Cement "Scratch Stik," which consists of a felt wick fed by a reservoir of stain. There are also penetrating dye stains available in small bottles at radio parts houses for the same purpose. —*E. F. C.*

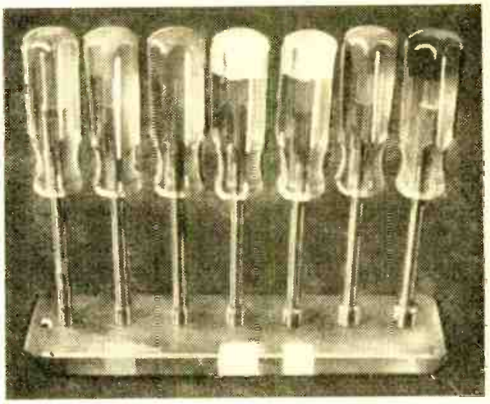
SIMPLE BURR REMOVER

A tool that will remove burrs in a jiffy from around small holes, drilled in a chassis or any other metal part, can be made quickly and easily from a screwdriver—as shown in the sketch. The two sides at the tip of the blade are ground away, as shown by the dotted lines, to form a flat, pointed instrument.

The end of the screwdriver can then be inserted into the drilled hole and rotated once or twice to cut away the burr. An angle of about 90° for the point gives excellent results. Use a good quality, tool-steel screwdriver, and grind slowly and carefully to avoid heating the blade and drawing its temper. —*F. H. T.*

COLORS IDENTIFY SOCKET DRIVERS

Different colors or shades of paint help in identifying various sizes of socket drivers quickly and easily. Simply dip or paint each of the handles of the different-size wrenches a different color. If a base is used, the same code may be applied to it as an aid in returning each driver to its proper place. This system may be readily adapted to other types and sets of tools as a time saver. —*C. A. P.*



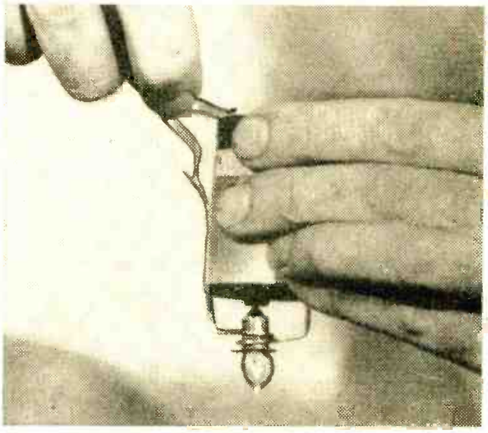
KEEP FILTERS AT HAND

To aid in running down defective filter capacitors which cause hum in radios, amplifiers, tape recorders, etc., keep a test capacitor handy. The test unit may be an 8- or 10-μfd. electrolytic capacitor having a working voltage rating of 350 volts d.c. or better, with insulated alligator clips on its leads. Simply clip the test capacitor across those in the set, maintaining the same polarity, and note whether the hum decreases.

This procedure will not work with shorted or nearly shorted filter capacitors, in which case it is first necessary to disconnect one side of the suspected filter. Shorted or badly leaking units are generally indicated by overheated rectifier tubes or power transformers. Don't forget to short out any filter capacitor momentarily before wiring or unwiring it, as even a weak one may retain enough charge to cause a shock or damage to test equipment. And remember—this precaution also applies to your test capacitor. —*E. F. C.*

IMPROVISED CONTINUITY CHECKER

An improvised continuity checker may be constructed from a flashlight bulb, a piece of fairly stiff bare wire, tape and a flashlight battery. Wrap the wire around the base of the bulb and, while holding the bottom contact of the bulb against the top contact of the battery, bend the wire and bring it down along the sides of the battery, taping it in place. Make sure the bulb is pressed tightly against the top battery contact.



To use this simple tester, touch the end of the wire and the base of the battery to the wires of the appliance to be tested. If the bulb lights, continuity is present; if it does not, there is no continuity. The tester is suitable only for dead circuits of low resistance. —*C. A. P.*

ALIGNING DECAL LETTERING

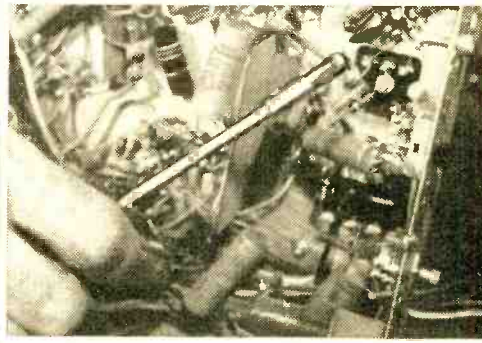
Lining up decal lettering on a panel or chassis is easy when you use a length of thread and a couple of pieces of Scotch tape to hold the lettering in place. Locate the thread where you want the top or bottom of the letters to appear, draw it taut, and then align the decals with it as you put them on. Use black thread on an

unfinished chassis, white on painted panels and other dark-colored objects.

Curved lettering may be made by cutting the words into individual letters and then putting them on in alignment with a length of small-diameter wire bent to the desired shape and held in place with a couple (or more) pieces of Scotch tape. Cut the wire longer than the length of the lettering and put the tape where no letters are to appear. —*F. H. T.*

SCREWDRIVER STARTS SMALL NUTS

Small nuts in hard-to-reach places can be started quite readily by using a gripper-type screwdriver. As shown in the photo,



such a screwdriver is fitted with two small metal springs at the end of its blade. Although primarily designed for grabbing small screws, this tool works very nicely on nuts. —*C. A. P.*

METAL SPACERS

When constructing electronic equipment, there is often a need for a metal spacer of the right size. To assure an adequate supply, buy an assortment of brass telescopic tubing at the nearest model and hobby shop, and make your own. This tubing is usually sold in one-foot lengths. The cost depends on the diameter and will range from 15 to 30 cents per length.

To make the spacer, simply select the correct-size tubing for the screw being used, cut to the proper length with a hacksaw, and dress the ends with a file. A thick-walled spacer can be made by adding the next two or three larger sizes before cutting.

The following table lists the size of tubing required for each of the most-often-used machine screws:

Screw Size	*Tubing Size*
2-56	1/8" OD x .014" wall
4-36 or 4-40	5/32" OD x .014" wall
6-32	3/16" OD x .014" wall
8-32	7/32" OD x .014" wall
10-24 or 10-32	7/32" OD x .014" wall
12-24	1/4" OD x .014" wall
1/4-20	9/32" OD x 0.14" wall

—*J. E. P.*

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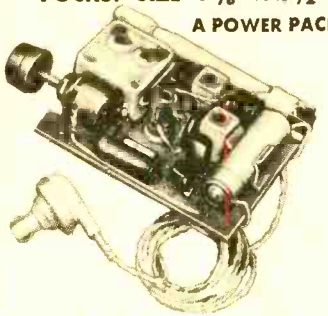
4 TRANSISTOR SUPERHET POCKET RADIO KIT WITH BUILT-IN ANTENNA

POCKET SIZE 1 3/8" x 2 1/2" x 3 3/4" REQUIRES NO EXTERNAL ANTENNA OR GROUND

A POWER PACKED RECEIVER WITH 2 I.F. STAGES AND 2 RC COUPLED AUDIO STAGES



COMPLETE PARTS INCLUDING TRANSISTORS

The exceptional sensitivity characterizing this receiver, making external antenna and ground unnecessary, stems from the use of the new Poly-Vari-Con miniature variable condenser and properly matched loop, oscillator coil and I.F.'s. This circuit performs amazingly over the entire broadcast band. The four transistors (2 high frequency and 2 audio types) plus a germanium diode provide a miniature earpiece with power to spare. Truly miniaturized, the entire set can be mounted on a bakelite board 2 1/2" x 3 3/4" as illustrated, and can be mounted in an inexpensive plastic box.

COMPLETE LIST OF PARTS LESS EARPHONES AND CASE

We supply all the basic electronic components including 3" x 3 3/4" undrilled mounting board and leave cabinet size and layout to your ingenuity. Four G.E. transistors, (1-2N136, 1-2N135, 2-2N107) are included as well as the matched RF and IF components and crystal diode detector. All other parts such as resistors, condensers, brackets, hardware, etc. including miniaturized electrolytic condensers, volume control and battery are provided. Construction aids and schematic diagram included.

CI-101....Complete parts, less earphones and case....Net **19.10**

MS-260....Super powered dynamic earphone ....Net **3.95**

FM-AM TUNER KIT

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

32.50

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

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

SPECIFICATIONS

FREQUENCY RANGE: FM 88-108MC, AM, 530-1650 KC. **ANTENNA INPUT:** FM, 300 ohms, AM Ferrite loopstick and high impedance external antenna. **DISTORTION:** Less than 1% at rated output. **FREQUENCY RESPONSE:** FM, ± .5 db 20 to 20,000 cps, AM ± 3 db 20 to 5000 cps. **SENSITIVITY:** FM, 5 UV for 30 db quieting, AM, Loop sensitivity 80 UV/meter. **SELECTIVITY:** FM, 200 KC bandwidth, 6 db down; 375 KC FM discriminator peak to peak separation, AM, 8 KC bandwith, 6 db down. **IMAGE REJECTION:** 30 db minimum. **HUM LEVEL:** 60 db below 100% modulation: **TUBE COMPLEMENT:** 2-12AT7, 1-6BE6, 1-BA6, 2-6AU6, 1-6AL5 plus selenium rectifier. **SIZE:** 5 1/4" high x 9 5/8" wide x 9 1/2" deep (excluding knobs). **CONSUMPTION:** 30 watts. For 110-120V 60 cycles AC. Attractive etched copper-plated and lacquered finish. Less metal case. Shpg. wt., 9 lbs.

KT-100 .... NET **32.50**

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

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**

2 TRANSISTOR POCKET RADIO KIT

Packed into a 2 1/2"x3 1/2"x1 1/4" plastic case This Two Transistor plus crystal diode radio kit offers many surprises, utilizing a regenerative detector circuit with transformer coupled audio stage, gives you high gain and excellent selectivity. Pulls in distant stations with ease with more than ample earphone volume. Kit comes complete with two transistors, crystal diode, loopstick, Argonne transistor audio transformer, resistors, condensers, plastic case, etc. Including schematic and instructions.

KT-68A Complete Kit less earphones. Net **11.80**

MS-260 New Super Power Dynamic Earphone, ideal for Transistor Circuit imp. 8000 ohm, D.C. 2000 ohm **3.95**

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

• Completely wired — Not a kit

Accurate VOM with a sensitivity of 2000 ohms per volt on both AC and DC. Single selector switch. 3" 160 amp. meter. Scales: DC Volts: 0-10-50-500-1000; AC Volts: 0-10-50-500-1000; Ohms: 0-10K, 0-1 Meg; DC Current: 500 ua and 500 ma; Decibel: —20 to +22, +20 to 36; Capacity: 250 mmf to .2 mfd and .005 to 1 mfd. Heavy plastic panel, metal bottom. 4 1/4" x 3 1/2" x 1 5/8". With batteries and test leads. Shpg. wt. 4 lbs.

RW-27A **7.95**

Lafayette Radio DEPT. I-I

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Do You Really Have Hi-Fi?

(*Continued from page* 84)

test little more than your credibility, patience, and tolerance to noise. On the other hand, the fully modulated grooves with the incredible amplitude peaks that Cook manages to squeeze into them do provide a fairly accurate test of any phono's ability to track, comply, and reproduce.

If, for example, your system can get through and survive some of the bands on *The Compleat In Fidelytie* (Cook "Longe Plae" No. 1044), you can be sure it will handle almost any music with the greatest of ease. One side of this utterly unbelievable pressing contains such items as the sounds of jet aircraft, steam locomotives, crying babies, Mexican firecrackers, gas engines, and what is probably the most horrible organ recording in history complete with a high percentage of distortion and climaxed by the buzzing of a fly trapped in the organ—a buzzing which is so annoyingly realistic that you are ready to swat your speaker cabinet, perhaps with "Longe Plae" No. 1044 itself.

In a sense, *The Compleat In Fidelytie* is the gruesome climax to a series of "pure sound" records which Cook has been releasing steadily in recent years. A typical one is *Out of This World* (Cook Long Play No. 5012). Side 1 of this release contains earthquakes and ground tremors. If your turntable rumbles, it may actually help the sound here. Often, the two can't be distinguished. In any case, for those who would rather hear their earthquakes than see them, this disc might prove engaging.

The flip side, containing sounds picked up from outer space, is labeled *Ionospheric Swishes, Whistlers, Tweeks, The Dawn Chorus.* Here, the sounds are interspersed with a running interview in which a Dartmouth professor explains the unearthly sonic phenomena you are hearing. Somehow, we can't help but feel that too often this interview resembles one of Bob and Ray's satiric take-offs; we never quite know whether Mr. Cook is pulling our leg while presumably pulling these weird sounds from the rarefied regions above *terra firma.*

Be that as it may, Mr. Cook may have had his head in the clouds on this one, but the down-to-earth value of such a release is its challenge to the industry to record and press discs containing music that can boast such dynamic range and presence. The extent to which the recording industry is meeting this challenge and supplying the demand for top quality, wide-range recordings is best illustrated by a number of recent "show-off" releases to be discussed next month. —30—

What About Tech Writing?

(*Continued from page* 74)

sor B. B. Gamzue of New York University puts it: "These men are finding that writing is a professional tool as valuable to them as the slide rule. By instituting the technical writing course, the engineering college has fulfilled an obligation to its students and their future employers."

The "How-to-Do-It" Need. Beyond the lab report, the specialized magazine article, the formal specification, and miscellaneous intra-industry communications, is the large area of technical-instruction-writing that is more generally taken to be the domain of the full-time professional tech writer. Such a writer may be employed by the firm producing the items he writes about. Or, he may work for a large publishing house which has a technical writing division. Or, he may be on the staff of a "job-house," which specializes in technical manuals and related literature. Or, he may write courses for a technical school.

Regardless of where they are employed, such writers have one job in common: telling others how to use something or how to do something. To the extent that an understanding of theory is needed for intelligent operation, the writer must also include something of the "how" and "why" behind a piece of equipment or process.

A tech writer's understanding of theory need not be as profound as that of the engineer's—but it must be enough to place the writer on "speaking terms" with his area of interest. A supply of such writers, plus industry's willingness to use them instead of forcing their engineers to "double in brass" is anticipated by many.

Getting Started. The ground rules for getting into tech writing are still flexible; this is a relatively young field. Many start as technicians or engineers with little previous interest in writing. But most beginners with a bent for writing, plus an interest and background or training in things technical, find their way into electronics or other fields of technical and business activity. Either way, the ability to explain—in writing—accompanied by a definite liking for this kind of work are "musts."

Within the area of tech writing itself, there are several specialized jobs known by different titles. A "parts lister," for example, catalogs a large piece of equipment down to its last resistor and solder lug. Painstaking and often tedious, such work has provided many with an avenue of approach to becoming full-fledged technical writers.

Writers themselves are often graded as "senior" and "junior," depending on personal experience and salary earned. The writer prepares the text of a handbook or manual, confers with product engineers, researches the equipment, may run tests on it under plant supervision, and orders art work for illustrating his book. Sometimes he acts as a "project director," supervising the work of a team of writers, parts listers, draftsmen and layout artists all engaged in a series of books.

When the term "editor" is employed in such a situation it can mean practically anything: the "editor" can be anyone from the general manager to a senior tech writer to a nontechnical person who scans every line for grammatical correctness and conformance to handbook requirements. This last item is of great importance, particularly in government-requisitioned manuals. There are government specifications for the manuals as well as for the equipment itself, and a handbook—regardless of how well it's written and how accurate it is technically—will be rejected if it does not present its information in the organized form demanded by the specification.

Many tech writers find these demands too restrictive; when the job is voluminous and complex, the services of an editor who is a specialist at interpreting government specifications may be required.

Pay and Rating. Because it's a fairly new field, salaries in tech writing vary. Generally, the beginner with no experience but some training and aptitude will start as a "trainee" and earn up to $2.00 an hour. As his experience and technical understanding grow, so do job advancement and salary. A senior writer with four or more years on the job may earn from $3.50 to $4.50 an hour. The figures vary with the type of company, the nature of the work, and the demand for and supply of writers at the time.

Invariably, a man seeking a job in tech writing will be given some kind of test at his interview. He may be shown a number of standard circuits and asked to explain them. He may also be handed a poorly written paragraph and asked to rewrite it.

A unique test has been developed by Emil Filepp, a Project Manager in the Technical Writing Service at McGraw-Hill Book Company, New York City. Filepp asks an applicant to write instructions on "How to Fill an Inkwell." The result, according to Filepp, ". . . is graded for spelling, punctuation, use of words, sentence structure, economy of language. In addition, it shows how well the writer can organize written material, and whether the applicant has a good feeling for equipment and an appreciation of detail."

For a home test, Filepp suggests that

you try writing on "How to Tie a Necktie." If someone can do the job successfully, following your written instructions, you may make a successful tech writer.

Once you get your "foot in the door," you may proceed well past the threshold into a promising and lucrative career. Tech writing, itself interesting and well paying, often serves as a stepping stone to better things. —30—

Tuning the Short-Wave Bands

(*Continued from page* 59)

Here we go into the list of reports for this month. All times shown are Eastern Standard, 24-hour system.

Aden—The Aden Broadcasting Station, operating on 6045 kc., is scheduled in Arabic from 1030 to 1230 except for English around 1210. (*WSMC*)

Australia—The *Radio Australia* broadcasts to Eastern North America at 0715-0845 and to Western North America at 1015-1115 are now on 11,740 kc., replacing 9615 kc. The DX tips broadcasts on Sundays remain at 0830 and 1100. (*RL*)

Other transmissions are: to the North Pacific and Northeast Asia at 0330-0845 on 15,210 kc., and at 1715-1930 to the same areas on 15,160 kc.; to South and Southeast Asia from 0900 to 1230 on 11,900, 9580, 7220 kc. and at 1715-1930 on 11,900 and 15,320 kc.; to Europe and the British Isles at 0100-0145 (French) and 0145-0230 (English) on 11,740 and 15,160 kc.; to the Mid-Pacific Areas at 1500-1700 on 17,840 kc. (English). (*BV*)

Belgium—The Brussels transmissions to North America are now at 1200-1245 and at 1615-1800 on 15,335 kc. and at 1815-2000 on 11,850 kc. OTC, Leopoldville, Belgian Congo, continues to relay the 1815-2000 broadcast on 9655 kc. (*RL*)

Bolivia—Try for CP38, La Paz, 9444 kc., around 0700 and 2130. This station is not on the air on Tuesdays. The slogan is *La Cruz del Sur* (*The Southern Cross*). (*BT*)

Brazil—PSF, *Agencia Nacional*, 14,690 kc., can be logged at excellent level around 1730 but often is covered by c.w. QRM. PRL7, 9720 kc., Rio de Janeiro, can be heard at 1715 in Spanish. *R. Mayrinck Viega*, 9575 kc., Rio de Janeiro, is usually good at 1845 with English and Latin-American vocal music. *R. Gaucha*, PRC22, 9675 kc., Porto Alegre, is another that is often heard around 1830. (*FW*)

Radio Globo, Avenida Rio Branco 183, Rio de Janeiro, has begun daily transmissions with its new s.w. outlet on 6035 kc. and can be heard around 1830. (*WRH*)

Chile—*Radio Sociedad Nacional de Agricultura*, operating on 12,000 kc., has extended its German Hour by 30 minutes on Sundays. It is now scheduled from 1730 to 1800 with "Kleine Meisterwerke," and from 1800 to 1900 with national and popular music. The weekday schedule remains unchanged at 1940-2010 (except Monday). (*WRH*)

Colombia—*Radiodifusora Nacional*, 5010

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53 BIGGEST DOLLARBUYS IN U.S.!

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- ☐ **30-TUBE SOCKETS.** 4, 5, 6, 7, 8, 9, 11-prong. Miniatures, octals, wafers, "zip-ins", moldeds. Tube shields, too! Wt. 2 lbs. Reg. $7. **$1**
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- ☐ **12 SWITCHES.** Micro, push, AC, mobile, rotary. Wt. 3 lbs. Reg. $15. **$1**
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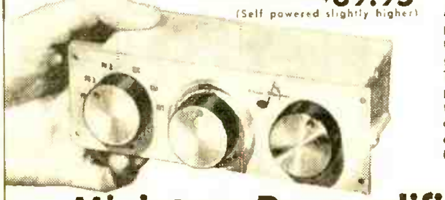

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- SPACE SAVING, SIMPLE TO OPERATE.
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Miniature Preamplifier by Audio ARTISANS, Inc. SEE YOUR DEALER OR WRITE FOR SPECIFICATIONS
394 MILL, HAWTHORNE, NEW YORK

kc., can be tuned with classical music at 2340-0005 s/off, in dual with 6180 kc. They send an attractive monthly program bulletin. (*DX*)

Ecuador—HCJB, Quito, 15,115 kc., is heard at fair to good level at 1645 with "Musical Mailbag." They have a Russian program at 1730 in parallel with 17,890 and 11,915 kc. The "Musical Mailbag" is heard on Thursdays only. (*FW*)

El Salvador—Anyone needing this country should try around 1100-1300 on 11,947 kc., or evenings to 2300 close-down on 9555A kc. (*BT*)

Finland—Helsinki has moved its North America xmsn to 2200-0000. It is heard with fair strength on 15,190 kc. The 17,800-kc. outlet is heard occasionally with fair signals, but their 9555-kc. channel is completely inaudible. (*RL, PR*)

Formosa—The Broadcasting Corp. of China, Taipeh, would like to have listeners write in—they confirm reports with a very pretty card. They are currently carrying English on BED3, 15,225 kc., and BED6, 11,815 kc., both 50 kw., at 2355-0200 to North America. This schedule will be in effect until November 30. (*CM*)

France—RTF, Paris, is noted on a new channel of 21,620 kc., replacing 15,400 kc. at 0800-1000 to the Far East. (*RL*)

NOTE: The widely reported program "Paris Star Time" is not broadcast from Paris, as reported by many, but actually from 4VC, *Radio Commerce*, Port-au-Prince, Haiti, on Sundays at 1830-1900. This all-English program, with French music, precedes the 4VC s/off at 1900.

French Equatorial Africa—*R. Brazzaville* is operating on a new channel of 15,420 kc. at 0500-0720 and 0900-1000, replacing the 15,595-kc. channel. (*RL*)

The outlets on 9625 and 11,970 kc. have English news at 1835-1850, sports to 1855, then a return to the musical program. (*RN*)

Germany—Best reception of the 2030-2330 xmsn to North America of the *Deutsche Welle*, Cologne, using new 100-kw. transmitter, is on 11,795 kc. This broadcast is also on 9640 kc. (replacing 9735 kc.) and 5980 kc. News in English is at 2130. Cologne is using a new frequency of 17,875 kc. at 0500-0800 to the Far East, replacing 17,815 kc., and also a new 15,375-kc. channel at 1700-2000 to Latin America, replacing 15,275 kc. (*RL, CM, KM, RA*)

Gilbert & Ellice Islands—Tarawa, 6050 kc., has English only at 2330 s/on and 0000 on Saturdays only. (*WSWC*)

Gao (Portuguese India)—CR8AB, 9610 kc., has English programs at 0200-0300 and 0400-0800 at fair level. (*WSWC*)

Gold Coast—Gold Coast Broadcasting Service, 6200 and 4915 kc., 5 kw., carries English daily at 0550-1330; Sundays it begins at 0255. A new 20-kw. xmtr is scheduled to go into operation shortly. (*DQ*)

Greece—The Athens broadcast in English is now at 1230-1245 on 15,345 and 17,745 kc., preceded by the French broadcast at 1215-1230. These frequencies can also be heard in Greek at 1400-1500, at 1700-1730 and at 1800-1830. (*RL*)

Guatemala—TGNC, *R. Cultural*, Guatemala City, 11,850 kc., is now heard on Saturday only from 0712 s/on in Spanish. They

have an English lesson for Spanish listeners at 0800. The signal is usually excellent. (*SW*)

India—The 1930 broadcast from *All-India Radio,* Delhi, is in English and beamed to Burma on 17,810 and 15,380 kc. Delhi is heard with excellent strength on 17,780 kc. at 1915-2015 with a broadcast in Tamil, dual to a new channel of 21,700 kc. (*RL*)

Delhi, on 15,210 kc., has English at 0830-0930. (*NS*)

Another English newscast is noted at 2130-2140 on 17,835A kc. (*SW*)

Iran—The Teheran broadcast in English at 1515-1530 is now receivable with fairly good strength on 15,100 kc. (*RL, MI, FW*)

The Sunday Poetry Hour at 1035 has been discontinued. (*MI*)

This station is also heard around 1350 with native music. (*FB*)

Israel—A new *Galei Zahal* outlet is 6175 kc., replacing 6725 kc. (*WRH*)

Italy—The Rome broadcasts to North America at 1730-2210 are heard with excellent signals on 11,905 and 15,325 kc. English programs are at 1915 and 2125. (*RL*)

Japan—*Radio Tokio* broadcasts to Eastern North America at 1800-1830 and 1930-2000 are now on 15,235 and 17,845 kc. Best reception is on 17,845 kc. during the 1930 program. The Western North America broadcast at 2230-2330 is transmitted on 15,235 and 17,825 kc. (*RL, GF*)

Lebanon—A Lebanese Forces station operating on 6500 kc. has been heard with Arabic programs at 0930-1025 close. Further details requested. (*WRH*)

Malaya—The British Far East Broadcasting Service at Singapore, 9690 kc., is heard very well at 0845-0945 with light music and "Radio Newsreel." (*BV*)

Mexico—XETW, Tampico, 100 watts, has English daily to Southern USA at 1930-0100 on 6130A kc. (*DQ*)

XEFT, Vera Cruz, 9545 kc., can be tuned at 2245-0020 with music and advertising. (*WF*)

XESC, *La Mas Espanole del Mundo,* Mexico City, 15,205 kc., is usually strong at 1730-1830 with music and talks. (*DK*)

Monaco—English can be heard from Monaco at 1705-1805 (Wednesday) and at 1705-1735 (Friday) on 6035 and 7349 kc. (*DQ*)

Mozambique—The best reception from Lourenco Marques at present is via CR7BD on 15,080 kc. at 1300-1515 s/off. All programs are in Portuguese. (*RL*)

Netherlands—*Radio Nederland,* Hilversum, is heard well on a new frequency of 15,365 kc. during the 2130-2210 English period to North America, replacing 11,730 kc. The 9590-kc. frequency remains on this transmission. Hilversum is also heard well on 17,775 kc. at 1800-2125 with Dutch and Spanish beamed to Latin America. (*RL*)

New Zealand—Wellington can be noted from ZL10, 15,220 kc., in a program beamed to Australia at 0015-0115 with m.w. relayed programs of light, popular, and classical music. The interval signal used before s/on is the chirping or call of the Bell Bird, a native bird of New Zealand. (*BV*)

ZL19, 11,830 kc., is often heard around 0130 with news reports. (*DK*)

Nicaragua—Two stations currently on the air are: YNRM, Matagalpa, 7590 kc., at 2045-2157 close, in Spanish, which often mentions Managua; and *Tropical Radio* (?) which is being noted in Spanish with the sign/off at 2205. (*GF*)

Northern Rhodesia—The Central African Broadcasting Station, Lusaka, is now broadcasting two programs. Program "A" is on 3914 and 7220 kc. at 0500 (Sunday at 0400) to 1400; there is English for Europeans on Thursday at 1300-1400 and Sunday at 0400-0600 and 1300-1400; broadcasts for Africans are on weekdays except Thursday at 1300-1400 and on Sunday at 0600-1300. Program "B" is broadcast on 4826 kc. daily at 1030-1230 in native languages only. After 1230, 4826 kc. carries the "A" program. (*WRH*)

Norway—Oslo is using 15,175 kc. on the 2000-2100 broadcast to North America, replacing 7210 kc. Other frequencies used are 9610 and 11,735 kc., with best reception on the latter since a Brazilian station usually covers the 9610-kc. transmission. (*RL*)

Pakistan—*Radio Pakistan* is heard on 15,335 kc. at 1945-2015 with English to Southeast Asia. This channel replaces 15,255 kc. (*RL, GF*)

Panama—HP5J, Panama City, 9607 kc., is noted at 1915 in Spanish, ending a musical program. This is usually well heard. (*DX*)

Peru—OBX4C, *Radio El Sol,* Lima, is again active, and is operating on 15,190 kc. Best reception usually is at 2100-2200 during the interval between *Radio Canada* and Helsinki use of 15,190 kc. (*RL*)

Philippine Islands—The Far East Broadcasting Co., P.O. Box 2041, Manila, has English periods at 1845-1900, 0300-0400, and 0900-1100 on DZH7, 9730 kc., DZH8, 11,855 kc., DZH9, 15,300 kc., and DZI6, 17,805 kc. (*DD*)

Pitcairn Island—A letter was recently received from T. C. Christian, Officer in Charge of Station ZBP. There is *no* broadcasting from the Island at present; ZBP operates on 12,110 kc. irregularly on c.w., m.c.w., and teletype with a power of 50 watts. He states further that residents of the Island depend on U.S. *standard broadcast stations* for their radio reception, as they are received perfectly there at night! (*BF*)

Portugal—Lisbon is operating on a new channel of 17,895 kc. at 0530-1945, with best reception after 1700. Their new 21 700-kc. frequency is used at 0530-0830 and at 1200-1515. Sundays at 0530-1515. The 2000-2230 North America xmsn is now on 11,840 kc. and 9775 kc., and the Western North America xmsn is on 9635 kc. at 2045-2230. (*RL, GF*)

Saudi-Arabia—Once in a while, listeners may be able to hear Arabic chants from Djeddah on 6175 kc. around 2300. At times they also use 5975 kc. and/or 11,850 kc. (*BT*)

South Korea—Western DX'ers may hear HLKB, 7235 kc., Seoul, around 0500-0700 in Korean and/or English. (*BT*)

South Vietnam—According to a letter from Mr. J. Varnoux, Saigon, a temporary agreement with the Vietnamese Government makes it possible to radiate a daily 2-hour program in French from Saigon over 9620 kc. (*WRH*)

Confirming this, the station has been heard on 9625A kc. with musical programs and a drama at 0820-0920. Interval signal was 11 notes and the usual slogans were in French. Schedule is presumed to be 0800-1000. (*BF*)

Spain—Madrid has shifted from 15,420 to 15.415 kc. It is heard at 0600-0730 to the Far East and at 0830-0900 in Arabic. (*RL*)

English periods to North America are at 2215-2300, 2315-0000, 0015-0100 on 9363 kc. and 6130 kc. Another English period is at 1540 on 7100 and 6130 kc. (*DD*)

ABBREVIATIONS

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

Sweden—The *Radio Sweden* broadcast to North America at 1900-2130 is now heard well on 11,880 kc. The morning broadcast at 0815-0915 is on 15,155 kc., but is usually covered by *Radio Moscow*. The xmsns for Western North America are at 1100-1145 on 15,155 kc. and at 0500-0600 on 11,705 kc. Stockholm is using a new frequency of 17,800 kc. at 0600-0645, 0930-1045, and 1200-1245, but interference from Rome is severe on this channel. (*RL*)

Switzerland—Berne has increased use of the higher frequencies. The summer and fall schedule, in effect until October 31, is as follows (italicized frequencies indicate new channels in use): to Australia—New Zealand—Far East at 0215-0445 on 11,865, 17,784 and 21,520 kc.; to Southeast Asia and Japan at 0745-0930 on 15,305, 17,784, *21,520* kc.; to India and Pakistan at 0945-1130 on 11,865 and *21,605* kc.; to the Middle East at 1145-1330 on 11,865 and *15,315* kc.; to Great Britain and Ireland at 1345-1530 on 9665 and *11,865* kc.; to Spain and Portugal at 1545-1730 on 9665 and *11,865* kc.; to Latin America at 1800-1945 on 9535, 11,865 and *15,305* kc.; to North America at 2030-2215 on 6165, 9535, 11,865 kc.; to Latin America at 2230-2300 on 9535 and *11,865* kc.; to Western North America at 2315-0000 on 6165, 9535, and 11,865 kc.; to Europe at 0015-0200, 0500-0830, 1030-1730 on 6165 and 9535 kc.; to Africa at 0015-0200 on *17,784* kc., 0500-0730 on 21,520 kc., 0945-1300 on *21,520* kc., and at 1315-1700 on *15,305* kc. (*RL, FW, JM, AK*)

Syria—The Damascus broadcast in English at 1530-1630 is now heard well on a new frequency of 17,865 kc., replacing 9555 kc. The 1900-2100 Arabic xmsn for Latin America is on new frequencies of 15,165 and 17,865 kc., replacing 9555 and 11,915 kc. (*RL, GF, DQ*)

Turkey—*Radio Ankara* is operating on 15,160 kc. at 1400-1645, replacing 7285 kc. The English program is at 1600-1645. The Ankara 17,825-kc. frequency can be heard at 0900-0915, after 0900 s/off of *Radio Norway*. (*RL*)

A station believed to be TAZ, Izmir, was tuned at 1530 with Turkish music to 1550 when light music followed. The s/off at 1600 was blotted out by c.w. signals. (*BB*)

The Istanbul Technical School is now operating on 7143 kc. with a radiated power of 100 watts. The call letters are TAO5. The Istanbul Technical University Radio is now on 7040 kc. (*WRH*)

United States—A report has just been received concerning *The Voice of Maritime Labor*, New York. This is reportedly operating over WFK39, 19,850 kc., WFL65, 15,850 kc., and WFK95, 15,700 kc. The latter frequency is best with news at 1250. This station is on the air on Sundays only. (*HG*)

Venezuela—Recent frequency shifts are: YVKX, Caracas, from 3390 to 3305 kc.; YVMU, Carora, from 2470 to 3340 kc.; and YVRA, Maturin, from 2360 to 3325 kc. (*RL*)

DX Programs

The following stations carry DX programs: Switzerland, over HER3, on 6165 kc., over HER4, 9535 kc., and HER5, 11,865 kc., on the first Thursday of each month at 2045-2115; Denmark, over OZF, Copenhagen, 9520 kc., each Tuesday at 2115-2130; Australia, over VLC9, Sundays at 0830 to Eastern North America; United States, over the *Voice of America* relay in Tangier, on Saturdays, at 1345-1400 on 9500 kc.; Hungary, over Budapest, 9833 kc., on Saturdays at 1620-1630. (*NS*)

YVLK, Caracas, 4970 kc., has English at 1800-1900. The "Supper Club" is heard at 1800-1830 and 1850-1900 with American records and local commercials. (*SF*)

Windward Islands—The Windward Islands Broadcasting Service, Grenada, has shifted to new frequencies of 3390 and 17,800 kc., replacing 3395 and 17,745 kc. Their schedule is 1700-2115 daily except Saturday. (*RL*)

Yugoslavia—Try for English from Belgrade at 1645 on 6100 and 7200 kc. At times they may use 6150 kc. (*BT*) —30—

SHORT-WAVE CONTRIBUTORS

Richard Albright (*RA*), South Gate, Calif.
Floyd Backus (*FB*), Richmond, Va.
John Beaver (*BV*), Pueblo, Colo.
Bernard Brown (*BB*), Derby, England
Grady Ferguson (*GF*), Charlotte, N. C.
Stuart Fidler (*SF*), Jordan, N. Y.
Warren Fisher (*WF*), Miami, Fla.
Bill Flynn (*BF*), Berkeley, Calif.
Harley Grimmer (*HG*), Chamcook, N. B., Canada
Mary Iwai (*MI*), Lombard, Ill.
Allen Kelly (*AK*), DeRidder, La.
David Kimpton (*DK*), Cobourg, Ontario
Roger Legge (*RL*), McLean, Va.
John Mann (*JM*), Montreal, P.Q.
Chuck Maxant (*CM*), Baldwin, N. Y.
Kurt Metzger, Jr. (*KM*), Ortonville, Mich.
Robert Nelson (*RN*), Newburgh, N. Y.
David Quarterson (*DQ*), Farrell, Pa.
Peter Risse (*PR*), Atlanta, Ga.
Norman Styer (*NS*), Elverson, Pa.
Bruce Tuten (*BT*), Savannah, Ga.
Francis Welch (*FW*), Worcester, Mass.
Stewart West (*SW*), Union, N. J.
World Radio Handbook, (*WRH*)
World Shortwave Club, (*WSWC*)

Hi-Fi Revives Kings of Swing

(*Continued from page* 47)

differ for every instrument. Hence the recording engineer can set his filters to pass one set of overtones and block another, bringing out one instrument while suppressing the other. Sometimes this requires "isolation" of one part of the total tonal spectrum on a separate tape, which is later blended by a sort of double-dubbing procedure into the main sound channel feeding the cutter.

As a final touch, the right amount of "liveness" is added to the rather dead-ish studio sound of these old records by the usual echo devices, and the tape is ready for transfer to the new microgroove master.

Swing Back In Focus. Proof of this particular pudding lies in the listening. The net result naturally falls short of present standards. But what has been accomplished is none the less remarkable. Gone is the hiss, the buzz, the scratch, and the muffled ventriloquist aura of yore. Instead, swing shifts into a new focus, crisp and clean with much better balance and articulation. Instruments are recognizable by their tone, rather than by the hopeful guesswork of the old days. There is even considerable expressiveness unearthed in some of the solo passages—fine touches lost before. Though lacking the hi-est of fi, these rejuvenated records are eminently listenable, even on wide-range equipment.

Best of all, these recordings bring back classic performances which epitomize a whole age: Benny Goodman's incomparable *Sing, Sing, Sing,* for example, recorded with a band whose roster reads like a Who's Who in Jazz—Harry James, Ziggy Elman, Gene Krupa, and an arm-long list of big-name *et ceteras.*

Benny's famous Carnegie Hall Concert is here, too. It's a fitting tribute to the King of Swing, who packed the Hall back in 1938, when a jazz concert was a daring innovation. The contents of the set are so numerous and so uniformly good that they can all be recommended with equal enthusiasm. The full-side (LP) free-for-all on Fats Waller's old standard, *Honeysuckle Rose,* is one of the finest anywhere.

If we add to Benny's hot numbers a few of Glenn Miller's smooth, dance-tempo arrangements from the Limited Edition album, the result is a nutshell picture of all that was best in the Swing Era. Although Miller's band almost always played from scores, the tempo favoring the less frantic type of dancing, still his work had a brightness and charm that's enjoyable today. The continuing popularity of some of his old favorites bears this out: *Little*

Brown Jug, for example; or *In the Mood;* or *Tuxedo Junction.*

Artie Shaw's liquid, effortless clarinet is restored to us. The restorations cover his big-band days, with both the phenomenally popular standards like *Frenesi* and *Begin the Beguine,* and a number of less well-known but no less excellent pieces. They show off such Shaw innovations as the full violin section in a swing band. The *Both Feet in the Groove* album contains forgotten gems like the slow-jump *Comin' On,* recorded on the same date (July 24, 1938) as the perennial *Beguine,* which pushed the Shaw organization to the top. For Artie in the slower, smooth-as-butter mood, the record contains a full, tricky arrangement of *What Is This Thing Called Love* that's guaranteed to wake a lot of twenty-year-old memories.

The names go on, too many for detail: Duke Ellington, one of the most original minds in the business; that old Sentimental Gentleman, Tommy Dorsey; Count Basie; Coleman Hawkins; Jess Stacy; and so on. There's enough available by now to whet the most jaded appetite.

"In The Mood." For those of us who grew up under the reign of King Benny, and who spent our adolescence listening to "Music in the Miller Mood" on the "Chesterfield Hour," these records evoke nostalgia for what was perhaps a happier time. The intervening years of hot and cold war added, unfortunately, more to our wisdom than to our joy. Depression or no, the 30's saw us more relaxed than the atom age. These records captured the easy yet intense feeling of the times. That part of their content—the emotion transmuted into their grooves—can't be polished up by engineering, but it certainly takes on a poignant sheen in the perspective of memory. —30—

Transistor Topics

(*Continued from page* 87)

high gain. Bias for the first stage is supplied through resistor *R1*. The positions of the *n-p-n* and *p-n-p* transistors may be interchanged if the battery (*B1*) polarity is reversed. Known as a *complementary amplifier,* circuit (B) is suited to assembly using similar *n-p-n* and *p-n-p* transistors, such as G.E.'s 2N170 (*n-p-n*) and 2N107 (*p-n-p*) or Sylvania's 2N35 (*n-p-n*) and 2N34 (*p-n-p*).

Product News. *Lafayette Radio,* 100 Sixth Ave., New York 13, N. Y., has just introduced a new "Hi-Q-Loopstick" antenna, designed specifically for transistor circuits but also suitable for use with vacuum tubes. The new antenna coil is intended for AM broadcast-band coverage, when used with a standard tuning capacitor, and is provided with a tap to match the comparatively low input impedances of transistor circuits . . . assuring maximum signal transfer and circuit efficiency. Type number is MS-299.

Good news for experimenters . . . more price cuts! G.E. has cut the net price of its new 2N170 *n-p-n* transistor to only $1.45 . . . and the popular 2N107 *p-n-p* unit has been cut to 99 cents! These two transistors are ideal for experiments with *complementary* circuits (see above).

The General Transistor Corporation of Richmond Hill, N. Y., has announced a new *p-n-p* phototransistor, Type GT-66. A three-electrode unit, the GT-66 may be used as either a triode or diode light-sensitive cell. It is especially well suited for equipment employing a *modulated* (varying) light source.

A new "high power" transistor has been announced by CBS-Hytron. This unit, CBS Type 2N155, is designed specifically for use in auto radio receivers and is intended for operation on a 12-volt battery. It is a *p-n-p* transistor. Chances are you'll see some of these used in 1957 car radios.

The "Mascot," a new transistorized pocket radio manufactured by Televex, Inc., Kew Gardens, N. Y., features extremely long battery life (see photo on page 86). This two-transistor receiver, powered by a pair of small penlite cells . . . operated for more than *3000 hours* with a single set of batteries . . . comes complete with a 20′ antenna hank equipped with a miniature clip. Earphones are available as an optional accessory.

Developments Overseas. Although the United States is unquestionably the world leader in transistor development and in commercial applications, other nations are not idle. Your columnist has received word of transistor work in England, Holland, Japan, and in many other free nations. Latest news item is the announcement of a fully transistorized pocket receiver, developed by the world-famous Telefunken Company of Hanover, West Germany. The photo on page 87 shows exterior and interior views of this interesting five-transistor receiver.

Well, fellows, that's it for now . . . see you next month. . . .

—*Lou*

Custom-Design Time Switches

(*Continued from page* 70)

interval was the prime consideration. A child with a bedside radio seldom turns it off before falling asleep. A timer set to control the duration of the "on" interval could save the parent quite a few steps. Cams cut for "s.p.s.t., NO" operation, and "s.p.s.t., NC" operation are shown on page 69 (bottom). Either cam permits playing the radio from 7 to 9 p.m. and from 6:30 to 8 in the morning. Note particularly that for controlling the "on" intervals the cam-switch combinations are reversed from what they were for "off" interval control. Since there are two possible cam-switch combinations, the constructor can select the type of cam easiest to fabricate for either "off" or "on" operation for each particular application.

The single cam and switch type of operation can also be used for controlling yard lights, chicken house lights, etc. Since the periods of daylight and darkness vary during the year, one fixed cam would unnecessarily waste electricity during the long summer days. However, variable cams, composed of two or more individual cams clamped together, permit the control periods to be adjusted whenever necessary. The drawing on page 70 shows an exploded view of a variable cam set to turn on a yard light from 5 p.m. to 7 a.m. By rotating one cam with respect to the other, this interval can be shortened or lengthened. If the load to be controlled exceeds the rating of the Microswitch, a relay with greater power-handling capacity can be operated by the Microswitch.

More than one cam can be driven by the same timing motor. Thus, with a switch actuated by each cam, several circuits can be controlled from one centrally located unit. It follows that for certain operations more than one switch could be operated by the same cam. The cams may be made in various ways. On page 70 (top) is a photo showing a control which turns on a household ventilating fan for ten minutes every two hours. The switch is "s.p.s.t., NO." For greater precision in adjusting the "on" intervals, the cams are pointed machine screws threaded into a plastic disc. By turning the screws in or out, the duration of each interval can be shortened or lengthened.

One-rpm motor-cam systems do not have the everyday practicability of the 1-rpd type, but many interesting gadgets can be devised which utilize them. For instance, a disc with a number of cams on the periphery could be used as a blinker, or a Christmas tree light flasher. By mounting several switches around this same cam, different lights—or strings of lights—could be synchronized so that when one is "on" the others are "off," etc. The cam could well take the form of a music box cylinder with pegs used to actuate the switches; with such an arrangement, a "light organ" could be constructed. There is no limit to what can be done with timing motors, cams and Microswitches. —30—

The Plate That Talks

(*Continued from page* 92)

cps, for example, the diaphragm must move four times as far as it does at 200 cps. But the two outer plates must remain very closely spaced for optimum operation. This spacing gives the suspended diaphragm very little room in which to vibrate. At the middle and high frequencies, where the motion is in thousandths of an inch, it is no problem. But the limits are reached when the diaphragm is forced into the low bass regions.

To an extent, this difficulty is overcome by increasing the size of the diaphragm. The bigger the diaphragm area, the better is its bass performance, and the less it has to move to put out the bass notes. Here, though, lies another problem involving ultimate size and cost and general practicability of a bass-reproducing electrostatic speaker. To date, this problem has been solved in theory only. Reports and rumors tell of experimental models both here and abroad. What will actually be produced remains to be seen. —30—

The Transmitting Tower

(*Continued from page* 72)

such as a single-band WAS, a QSL card which did not contain that information would be useless for his purpose.

Be careful to show the date and time of the contact clearly, so that the recipient will know where to check his log when he makes out your card. This is especially important in cards going to foreign amateurs. They almost always wait for a QSL from a USA station before sending one. Spell out the name of the month in such cards. To us, a date written 6-12-56 means June 12, 1956, but in most foreign countries it would mean 6, December, 1956.

Take enough time to make your card look neat. A carelessly penciled card gives the impression that the sender really did not care much what happened to his card, and the recipient may take the same attitude. A card on which all blanks are carefully filled in with pen or typewriter creates a much more favorable impression.

Insuring Delivery. At least as important as any of the above is to make sure that your card actually reaches its destination. Too many amateurs address their QSL cards "Operator Sam, KN9XXX, Chicago, Illinois," or in some other obviously inadequate manner. With very few exceptions, anyone sending a card with such an address would save money by leaving the stamp off and throwing the card away.

The best thing to do when a complete address is not available is to hold the card until it is obtained. However, if you wish to take a chance with a doubtful address, place the card in an envelope, write in the upper left-hand corner "If not delivered in 5 days, return to (Your Name, Your Address)," affix a 3-cent stamp, and mail. An undelivered card will come back, and you will at least know what happened to it.

The necessity for a complete address on a QSL card to insure its delivery imposes a handicap on newly licensed amateurs. It takes at least one issue of the *Call Book* after they get their licenses before their calls appear in it. Consequently, unless the stations they work happen to be in the *Call Book*, the only way they can get QSL cards at first is to send their addresses to every new station they work. The heavy interference in the amateur bands often makes it impossible to get an address through in either direction. Under these conditions, the wisest thing to do is to hold your card until the station is worked again or a new *Call Book* comes out.

If a QSL card does not arrive in return for yours within a reasonable time, send another one. The first one may have been

HELP US OBTAIN OUR HAM LICENSES

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

K1/W1 CALL AREA

David Duncan, 127 Blue Hill Ave., Milton 87, Mass.

Norman Piette, 91 Pulaski Blvd., Woonsocket, R. I. (Code and theory)

Ernest Godbout, 142 Garden St., Woonsocket, R. I. (Code and theory)

Francis Ascolillo, 119 Cornell St., Roslindale 31, Mass.

Rusty Bulis, 201 Birchwood Rd., Manchester, N. H. Phone: NA-2-8896. (Code)

Bob Gordon, 279 Upham St., Melrose, Mass. (Would like help in obtaining low-priced ham equipment)

George Howard, Jr., (15), Summer St., Franklin, Mass. Phone: 1131-W. (Code and theory)

K2/W2 CALL AREA

Avrum Gittlet (17), 1424 43rd St., Brooklyn 19, N. Y. (Needs help with code; learned theory at Brooklyn Tech; will answer all mail)

Hugh Bruce (13), 2115 Troy Ave., Brooklyn 34, N. Y. (Code)

Harold Cohen (40), 2355 Ocean Ave., Brooklyn 29, N. Y. (Code and theory)

James McDonough (13), 686 East 28th St., Paterson 4, N. J. (Code)

Jay Cleary, 360 Woodward St., Jersey City 4, N. J.

K3/W3 CALL AREA

James Glatt, 709 West Weber Ave., Dubois, Pa. (Would like SWL pen pals; will answer all letters)

Louis Lindenmayer, 3218 N. Fairhill St., Philadelphia 40, Pa. (Help with procedure in obtaining Novice license)

Anthony Glinskas, 9 W. Ogden St., Gerardville, Pa. (Advice on equipment and aerial best suited for valley area)

Leonard Dietrich, Manatawny, Pa. (Code and theory)

James Reynolds, 755 Marietta Ave., Lancaster, Pa. (Needs help for code test and written examination)

K4/W4 CALL AREA

Dwight Harman (13), Rt. #4, Kingston, Tenn. (Code)

Tommy Wright, Rt. 6, Box 167, (Ferry Pass) Pensacola, Fla. (Code)

Larry Benfield, Route #1, Mount Ulla, N. C.

Tommy Moultrie, 1487 Virginia Ave., Macon, Ga. Phone: 2-6858.

Earl W. King, M.O.Q. 2901, Camp Lejeune, N.C. (Theory)

K5/W5 CALL AREA

Bob Wilkins, 906 West Commerce, Honey Grove, Texas. (Has been SWL'ing for three years, now wants to talk back; needs help with code)

Buddy Gilmore, Box 804, Aqua Dulce, Texas. (Code and theory; will answer all letters)

Leonard Clark, 146 Blossom Dr., San Antonio, Texas. (Theory and code)

Allen Kelly, K5-SWL, Rte. #3, DeRidder, La.

K6/W6 CALL AREA

Ronald Malt, U.S.N. 352-72-92, YA-63, C/O F.P.O., San Francisco, Calif. (Home is Tulsa, Okla, but he is stationed in Alameda, Calif.)

Harry D. Jenkins, 2044 Sherman Drive, Concord, Calif. (Traded an oscilloscope for an s.w. receiver, became an avid SWL'er, now wants to become a ham)

Robert Hayden Stormer, 1109 Mound St., Alameda, Calif. (Theory and receiving code)

Earl H. Carder (34), 6148 Aura Ave., Resdea, Calif. (Radio theory)

James Lytthans, 199 E. La Verne Ave., Pomona, Calif. (Code and theory)

K7/W7 CALL AREA

Robert L. McMullen, 414 West 31st St., Cheyenne, Wyo. (Code and theory)

Thomas MacFarland, 807 W. 14th Ave., Spokane 4, Wash.

Rhio Hove, 219 So. 36th Ave., Yakima, Wash. (Code and theory, will answer all letters)

Lynn C. Ratcliffe, 1235 E. 92nd St., Seattle, Wash. Phone: KE-1496. (Advanced theory and code)

K8/W8 CALL AREA

Ron Ruff, 2051 Division Rd., St. Clair, Mich. (Code and theory; would like to hear from hams with "Heathkit" OX35)

Richard J. Copits, 204 East Hamtramck, Mount Vernon, Ohio.

Frank V. Piekarski, 27 Morgantown St., Fairchance, Pa.

John W. Northrup, 39854 Ormsby, Mt. Clemens, Mich. (Code and theory) Phone: HO-8-4763.

Gregory Andracke, W8-SWL, 5940 Chatsworth, Detroit 24, Mich. Phone: TU-2-5323. (Code)

K9/W9 CALL AREA

Thomas Ivas (16), 6844 S. Maplewood, Chicago 28, Ill.

William D. Dragoo, Jr., 305 S. McKinley St., Muncie, Ind. Phone: AT 2-3525. (Code and theory)

Robert Yolton (14), 2915 Colgate Rd., Madison, Wis.

Allen Butkus, KN9BET, 143 E. Walnut St., Oglesby, Ill. (Wants help on General Class theory, also pen pals)

Thomas Iras (16), 6944 S. Maplewood, Chicago, Ill. (Code)

Roger Kimmel, 3808 N. 54 Blvd., Milwaukee 16, Wis. (Code)

KØ/WØ CALL AREA

Ronnie Ettinger, 1864 Hillcrest Ave., St. Paul 16, Minn.

Stanley Sides, Box 332, Malden, Mo. (Help in obtaining license and getting started afterward)

Carl Turnquist, 829 Mapleton, Boulder, Colo.

Duane Brady, P. O. Box 85, De Soto, Mo. (Code and theory, antenna tuning and matching)

Alfred Schott, Route 1, Milford, Iowa. (Theory)

Al Kennedy, KNØDFC, 2856 Texas Ave., St. Louis, Mo. Phone: PR-3-1113. (General Class theory)

VE AND OTHERS

Bill Steinberg (15), 6701 Belard Rd., Cote St. Luc (Montreal), Quebec, Canada.

Graham A. Rife, 536 Frederick St., Preston, Ont., Canada. (Code, theory, Canadian regulations, equipment)

Noel Elliot (14), R.R. #1, Meadowvale, Ontario, Canada. (Code, theory, Canadian regulations; will answer all letters, will travel to Toronto for help)

Bob Wismer, 1676 W. 59 Ave., Vancouver 14, B. C.

To help prospective amateurs obtain their Novice licenses, the Radio-Electronics-Television Manufacturers Association offers a set of code records (recorded at a speed of 33⅓ rpm) and a Novice Theory Course for $10.00, postpaid. The complete course or more information on it is available from RETMA, Suite 800, Wyatt Bldg., 777 Fourteenth St., N. W., Washington 5, D. C.

lost or mislaid. Put the second one in an envelope, and enclose a courteous note, explaining why you need the addressee's card. Mention tactfully—if you actually want a confirmation of a contact, and not just wall paper—that a plain card containing the desired information will satisfy your needs. Use airmail for best results.

Incidentally, if you are one of those who have neglected to answer received-QSL cards because you do not have formal cards of your own, remember that most amateurs would far rather have a simple postal card than to be ignored entirely.

SWL Cards. Many short-wave listeners mail reports to amateur stations they hear and request QSL cards in return. Almost everything said above goes double for SWL cards. Few amateurs value a listener report nearly as much as they do a QSL card; consequently, it is harder to get a reply to one than to a QSL card. However, by following the above suggestions, you can expect about a 50% return from SWL cards. Including return postage improves the percentage somewhat, but the very thought makes some SWL's furious.

Using QSL Bureaus. At the head of each call area listing in the *Call Book* is the address of a DX QSL bureau. In addition, in the United States, an address of a Novice QSL bureau is also given. To receive cards through them, you must furnish a business-size stamped envelope addressed to yourself, with your call letters written in the upper left-hand corner, to your area QSL bureau. In addition, the Novice bureaus accept cards from both U.S. and foreign amateurs for distribution to Novices who have envelopes on file. Few Novices use the Novice QSL bureaus.

The DX QSL bureaus are designed strictly to distribute incoming foreign QSL cards. Most DX cards arrive via this route; therefore, if you work foreign DX, send an envelope or two to your area QSL manager; otherwise, your DX cards will remain in his files. Do not send your outgoing DX cards to him.

News and Views

Dave F. Kovach, KN2RSM, 161 La Grange St., Vestal, N. Y., writes: "I have been on the air two months and have made 75 QSO's (contacts) in 13 states and Canada. I have been using an AR-2 receiver and an AT-1 transmitter feeding a 120′ end-fed antenna. I have just secured enough money to get an S-40A receiver. My biggest gripe is against stations that do not QSL. I QSL 100%, and I get a return of about 80%."

Bill Skidmore, KN8AZQ, 2513 Third St., Cuyahoga Falls, Ohio, says: "It is nice to read about the fellows you have worked in the *Transmitting Tower*. I tried changing the resistor in my AR-3 receiver, as Terry Meyers suggested on page 115 of the June P.E. It works swell. Also, the QF-1 Q-Multiplier you described in the May issue helps a lot."

Jim Williams, W5BPA—W5ISX, P.O. Box, Roswell, New Mexico, writes: "I am planning some antenna experiments at the 1500′ height on the 1610′ tower of KEWS-TV, where I am employed. This will probably be the world's highest amateur antenna. I'll appreciate suggestions as to what kind of antennas and what bands to try. Beams are out, because of their wind resistance. I plan to use 300-ohm ribbon to feed the antennas, because of its light weight and low wind resistance. The transmitter will be a Viking II."

Walker C. Gallman, W4IHA, 105 Woodland Ave., Great Falls, S. C., shows what can be done with low power. "I finally got on the air and with only 11 watts. My rig is the Sandwich Box Transmitter described in POPULAR ELECTRONICS for March. Frankly, I did not expect to get out of the state with it. Imagine my surprise when in five hours of operation I worked K2's, W3's, W4's, and W5's, with 589 'solid copy' reports. My antenna is a 40-meter dipole, 20′ high, and my receiver is an AR-3. I am the first and only ham in my town. I'll be glad to help anyone who is interested."

Jim Rogers, KNØEHG, (17), Box 186, El Dorado, Kans., complains: "I like to rag-chew a little, but many of the stations I work just want to exchange reports, names, and addresses, and then sign off. So, if anyone else likes to rag-chew, look for me on 7184 kc. Even though I think rag-chewing is more fun than DX'ing, I have worked 34 states in nine call areas in about three months on the air. I use a TR-75 transmitter, running 60 watts, a ½-wave doublet antenna, and an S-85 receiver."

Howard Schmidt, K2JYK, 235 White St., Englewood, N. J., wastes no time in saying: "I have been a ham for two years now and have had a lot of fun at it. It seems to me that some of the newer hams are neglecting the privilege of sending messages or radiograms. It may seem difficult, but it isn't, and I am sure that they would enjoy it."

Robert Carraway, WN1HIR, Chester, Mass., reports: "I have only worked eight states, because I stick to 80 meters in the afternoons, when I am lucky to get out of town with my AR-2, AT-1, and AC-1. I'll do better on the DX when I go on 40 meters. What I really want to talk about is the Northeastern Novice Net which Jay Worrell, WN1HUK, R.F.D. #2, Raymond, N. H., and I have organized. We meet on 80 meters, Saturday afternoons and weekday evenings, and invite everyone in the area to join us."

Hugh Edmonds, Jr., KN4GBJ, P.O. Box 277, Anderson, S. C., says: "I work 40 meters only for 24 states, with 21 confirmed. My transmitter is a Viking Adventurer, running 50 watts, and my receiver is a reconditioned SX-17. I would like a schedule with Okla., Mich., or any W1, 7, 9, or Ø."

Fred Beatty, KN8AJX, 5301 Second Ave., Vienna, W. Va., reports: "I have tried about six different hobbies, but have not found any other as satisfying as amateur radio. I got my Novice license in February and hope to have my General by the end of the summer. My rig is an AT-1, and the receiver is an SX-25. I have worked 23 states, of which 17 are confirmed. I'd be happy for guys to write."

From Germany, **Hans Rohrbacher, DJ2NN,** Freiburg i. Br., J. v. Weerthstrasse 5, writes: "I was very lucky to get some old issues of POPULAR ELECTRONICS. Your articles and the letters from Novices in the USA are very helpful in completing the picture we have of the States. Perhaps you are interested in amateur radio here in Germany.

"On 15 meters, I have worked a lot of Novices with great fun. I was able to work 30 states in three months. My only frequency on 21 mc. is 21,120 kc., using a hand-rubbed crystal. I might say that some Novices make their calls too long, and QSB gets them before they finish. On 20-meter c.w., I have worked 250 W's in eight weeks; and on 40 meters, I have worked eight states. In the morning hours, W's are very strong on this band.

"My rig is all self-built, running 100-watts input. Unhappily, I must multiply frequency in the final amplifier for 20 and 15 meters, so my output is low on these bands, but I am planning a new 150-watt rig. At first, I used an indoor folded-dipole antenna. Now, I have an outdoor 40-meter Fuchs antenna, which does much better. My receiver is a 13-tube, two-conversion superheterodyne.

"About myself. I am 21 years old and a student of the Technical High School near Freiburg. There are 120,000 inhabitants here and only 12 hams, and only three of them are QRV for DX. I am alone on 21 mc. Besides amateur radio, I collect stamps, and am always happy to get a new stamp on a letter. Most German boys collect stamps, too; so don't forget this when QSL'ing directly. If you have any questions, I'll try to answer them the quickest way."

John Rudolph, 9 Myrtle Ave., Ridley Park, Pa., forwarded an interesting clipping from the "Stars And Stripes." It seems that W6BGJ, while driving near Rawlings, Wyo., came upon a bad automobile accident. He immediately called for help and an ambulance over his mobile transmitter, raising KH6QU in Hawaii, who relayed the information to W6RUQ in North Hollywood. He, with the aid of the American Legion Traffic Net, tried to raise any ham in Wyoming. This failing, he called the California police, who sent a message on teletype, via Dallas, Denver, and Laramie. Twenty-three minutes after W6BGJ's original call, an ambulance and a highway patrol reached the scene of the accident.

Paul DeVivo, K2PGP, 198-21 49th Ave., Flushing 65, N. Y., writes: "I want to congratulate W8VVD for his 'Hart-25' transmitter, described in the April, 1955, POPULAR ELECTRONICS. Since I got my General license and put a v.f.o. in front of it, it has really been working. With it, a dipole antenna, and an SX-25 receiver, I have worked Canada, Cuba, Puerto Rico, Virgin Islands, Guantanamo Bay, Guatemala, Brazil, Hawaii, England, Wales, Germany, Sweden, Switzerland, and Yugoslavia on 40 meters."

That's all our space for this month. Keep writing. 73,

Herb, W9EGQ

POPULAR ELECTRONICS BARGAIN BASEMENT

SAVE ON THESE SPECIAL BUYS OF THE MONTH

There's no better place for reaching so many electronics hobbyists and experimenters than on the pages of this magazine! Ask about **POPULAR ELECTRONICS'** "Bargain Basement" column rates and circulation figures by contacting **POPULAR ELECTRONICS, 366 Madison Avenue, New York 17, N. Y.**

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Classified

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

Build a "Minidyne"

(*Continued from page* 78)

signal generator to 455 kc. and switch on the 400-cycle modulator. Now, turn the receiver volume control to maximum.

Adjust the trimmers at the top of *T2* and the slug available through the underside of *T1* for maximum tone output from the speaker. Keep the volume control of the receiver at maximum, but back off the r.f. output from the signal generator as the i.f. circuits are brought into alignment. The most critical adjustment of the trimmers can be made when the tone from the speaker is just barely audible.

When the i.f. circuits are aligned, remove the temporary short circuit connected across the plates of *C3* and turn the plates of the tuning capacitor to where they are completely meshed. Set the r.f. signal generator at 550 kc., and adjust the slug in *L2* until the 400-cycle tone is again heard coming from the speaker. The length of the threaded brass adjusting screw on *L2* should be extending about ½" when the adjustment is properly made.

Now, turn the plates of the tuning capacitor full out, and set the signal generator at 1700 kc. Adjust the trimmer on *C3* until the tone is heard coming from the speaker. Retune the receiver and the signal generator to 550 kc. and readjust the slug in *L2*. Then recheck the 1700 setting and, if necessary, retrim *C3*. This completes the alignment.

Operation. In the design of the "Minidyne," all stress has been laid on gain. Thus, it is not a high-fidelity receiver. With a 20′ length of wire used as an antenna, it provides room volume when receiving stations are 50 miles away. However, the maximum audio output is limited. Severe distortion results from overloading the tube, so the length of the antenna should be limited to that which provides best over-all performance. Those constructors living in large cities which have strong broadcast transmitters will need a fairly short antenna. In some localities, enough signal may be picked up by *L1* alone, without any antenna.

Those of you who live at some distance from a powerful station, however, will need an antenna. For most efficient reception of a single station of your choice, back out the trimmer on *C2* until its capacitance is too low to be effective. Tune the "Minidyne" to the desired station and adjust *C1* for loudest and best performance. To receive several stations moderately well, juggle the adjustments of *C1* and the trimmer on *C2* until the reception is the best that can be obtained. —30—

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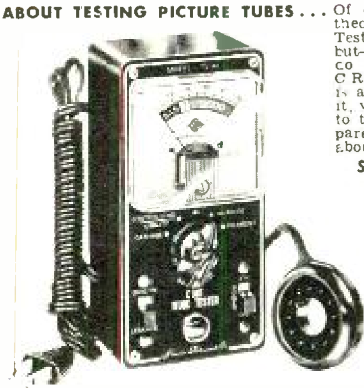
ELEMENTAL SWITCHES ARE NUMBERED IN STRICT ACCORDANCE WITH R.M.A. SPECIFICATION.
One of the most important improvements, we believe, is the fact that the 4 position fast-action snap switches are all numbered in exact accordance with the standard R.M.A. numbering system. Thus, if the element terminating in pin No. 7 of a tube is under test, button No. 7 is used for that test.

The Model TC-55 comes complete with operating instructions and charts. Use it on the bench—use it for field calls. A streamlined carrying case, included at no extra charge, accommodates the tester and book of instructions.

26.95

ABOUT TESTING PICTURE TUBES . . . Of course you can buy an "adapter" which theoretically will convert your standard Tube Tester into a picture-tube tester. Sounds fine—but—it simply doesn't work out that way! We do not make nor do we recommend use of C.R.T. adapters because a Cathode Ray Tube is a very complex device and to properly test it, you need an instrument designed exclusively to test C.R. Tubes and nothing else. As compared to a make-shift adapter, which sells for about five dollars, our Model TV-40 C.R.T. Tube Tester sells for $15.85. But, if you believe that Television is here to stay, then you must agree that the difference in price is more than justified by the many years of valuable service you will get out of this indispensable instrument. Incidentally, the Model TV-40 is the ONLY low-priced C.R.T. Tube Tester, which includes a real meter. Neons are fine for gadgets and electro-line testers, but there is no substitute for a meter with an honest-to-goodness emission reading scale.



Superior's New Model TV-40

PICTURE TUBE TESTER

Tests ALL magnetically deflected tubes . . . in the set . . . out of the set . . . in the carton!!

- Tests all magnetically deflected picture tubes from 7 inch to 30 inch types.
- Tests for quality by the well established emission method. All readings on "Good-Bad" scale.
- Tests for inter-element shorts and leakages up to 5 megohms.
- Test for open elements.

EASY TO USE: Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube base (Ion trap need not be on tube). Throw switch up for quality test . . . read direct on Good-Bad scale, switch down for all leakage tests.

Model TV-40 Picture Tube Tester comes absolutely complete — nothing else to buy. Housed in round cornered, molded bakelite case. Only

15.85

SHIPPED ON APPROVAL

NO MONEY WITH ORDER – NO C.O.D.

We invite you to try before you buy any of the models described on this and the following page. 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.

SEE OTHER SIDE

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MOSS ELECTRONIC DIST. CO., INC.
3849 TENTH AVENUE
NEW YORK 34, N.Y.

Superior's new Model TV-11 STANDARD PROFESSIONAL

TUBE TESTER

★ Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyratron Miniatures, Sub-miniatures, Novals, Sub-minars, Proximity fuse types, etc.

★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because **all elements are numbered according to pin-number in the RMA base numbering system**, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with Model TV-11 as any of the pins may be placed in the neutral position when necessary.

★ The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. **Thus it is impossible to damage a tube by inserting it in the wrong socket.**

★ Free-moving built-in roll chart provides complete data for all tubes.

★ Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.

★ NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRA SERVICE — The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

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

47.50

Superior's New Model TV-12 TRANS-CONDUCTANCE

TUBE TESTER

TESTING TUBES

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

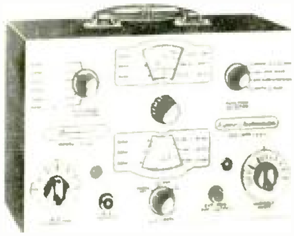
ALSO TESTS TRANSISTORS!

TESTING TRANSISTORS

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

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

72.50



Superior's new Model TV-50

GENOMETER

7 Signal Generators in One!

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

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

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

BAR GENERATOR: The Model TV-50 projects an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars.

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

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

MARKER GENERATOR: The Model TV-50 includes all the most frequently needed marker points. The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc. (3579 Kc. is the color burst frequency.)

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

47.50

SHIPPED ON APPROVAL

NO MONEY WITH ORDER — NO C.O.D.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-257, 3849 Tenth Avenue, New York 34, N. Y.

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

- ☐ **Model TV-11 . . . 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 TC-55 . . . Total Price $26.95** $6.95 within 10 days. Balance $5.00 monthly for 4 months.
- ☐ **Model 670-A . . . Total Price $28.40** $7.40 within 10 days. Balance $3.50 monthly for 6 months.
- ☐ **Model TV-50 . . . Total Price $47.50** $11.50 within 10 days. Balance $6.00 monthly for 6 months.
- ☐ **Model TV-12 . . . Total Price $72.50** $22.50 within 10 days. Balance $10.00 monthly for 5 months.

Name ____________________

Address ____________________

City ____________ Zone ______ State ____________

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

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

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◄SEE OTHER SIDE

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