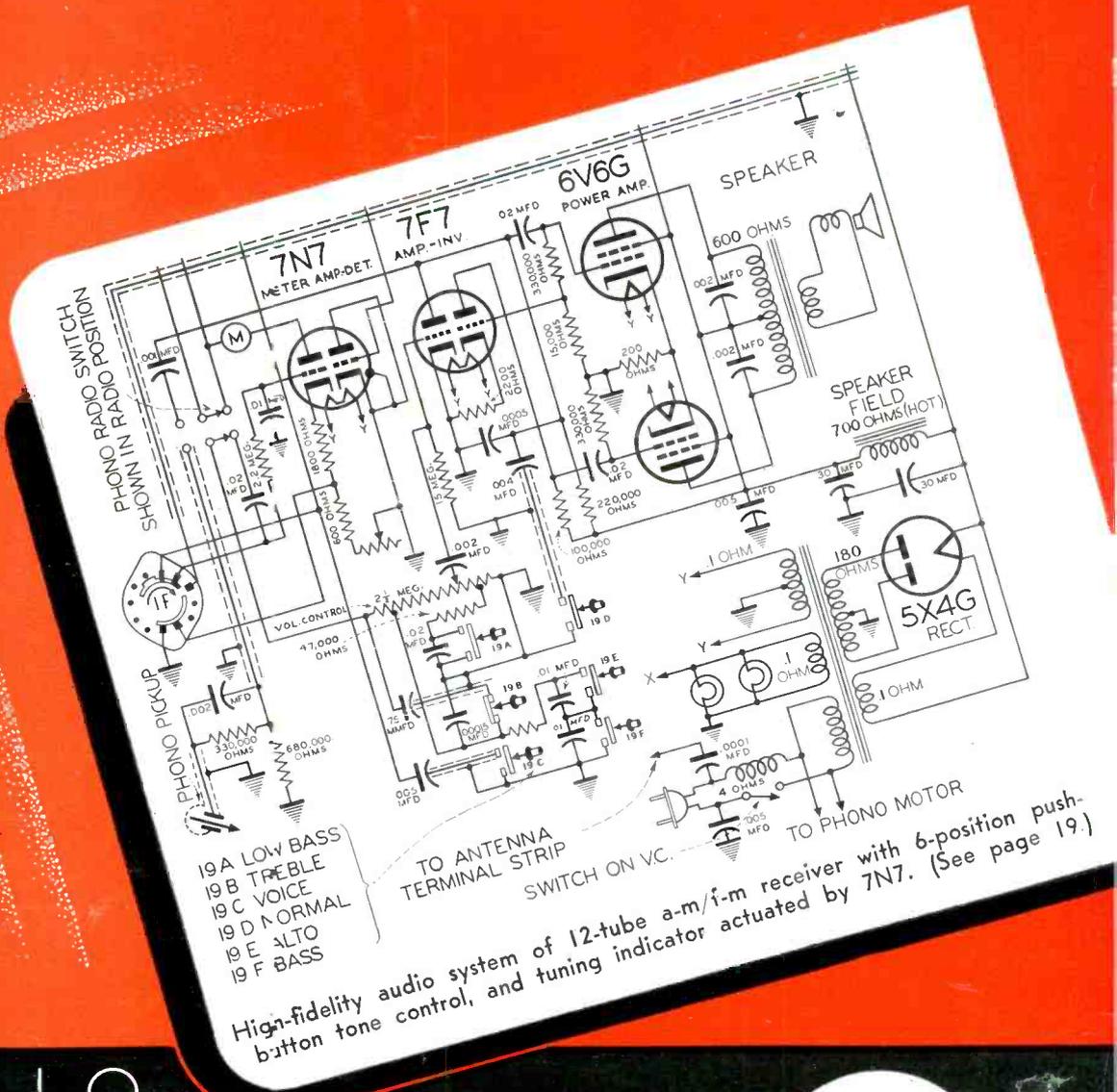


SERVICE

A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE



★ RADIO
★ TELEVISION
★ ELECTRONICS

July
1944



"OH-FOR THE DAY WHEN OUR STAR SALESMAN RETURNS!"

Oh, for the day when your star salesman can take up his accustomed place behind your counter, and say, "Yes," to those insistent demands for civilian tubes. We'll bet you are just as tired of saying, "No," as we are.

You can be sure that Hytron is doing its darndest to rush to our boys the tubes which will help them to hasten the arrival of that happy day.

Both of us are now doing the best we can with the facilities at our command. Hytron will continue to ship you every MR tube WPB permits. We know you will allocate the tubes to those who need them most. But watch our smoke when the shooting is over—and your star salesman returns!

HYTRON HYLIGHTS
 70,000,000 receiving tubes! In a previous Hylight, Hytron estimated potential 1944 demand for replacement receiving tubes at this staggering figure. Since 1941, Hytron— in compliance with the wishes of the Services— has concentrated its skill upon transmitting and special purpose tubes. For the past six months, however, Hytron gradually has been rescheduling GT Bantam receiving tubes, which it originated. Naturally, the Services still have first call upon these tubes. Hytron's fast expanding productive facilities for receiving tubes—and for the probable postwar favorites, the miniatures—will be ready, though, when the time comes to fill the tremendous pent-up demand for civilian tubes.

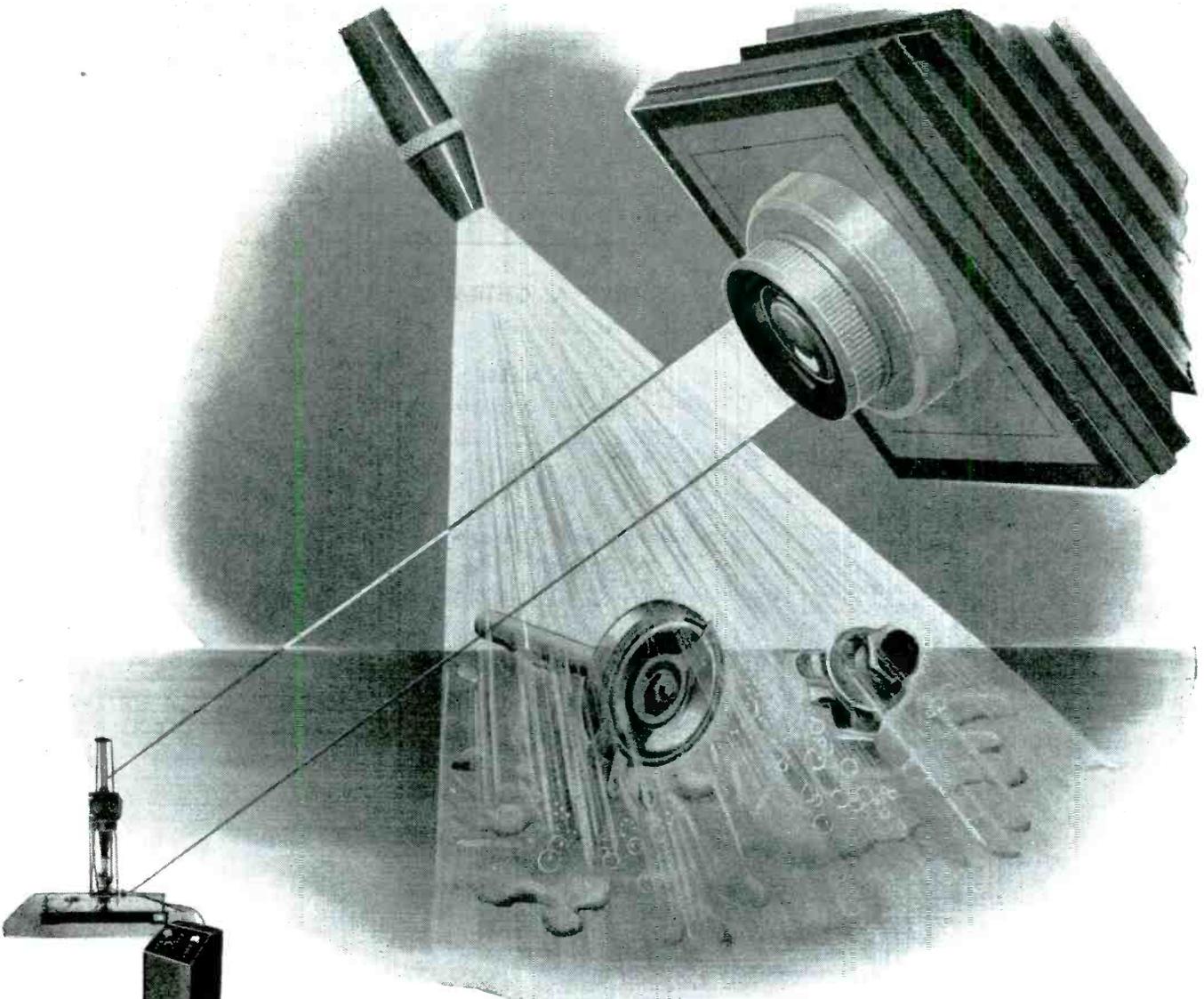


OLDEST EXCLUSIVE MANUFACTURER OF RADIO RECEIVING TUBES

HYTRON CORPORATION ELECTRONIC AND RADIO TUBES
 SALEM AND NEWBURYPORT, MASS.



BUY ANOTHER WAR BOND



how to photograph salt eating its dinner

Salt, from the sea and air, has a tremendous appetite for many metals—eating them away unless they're protected. The exact effect of its gluttony and the success of the means used in preventing this costly damage are measured accurately by Utah's salt-spray test. One of the stages in Utah's *complete* circuit of radio and electronic tests.

Immediately after the parts have been subjected to the salt spray, microphoto-

graphs are taken and developed in the especially equipped Utah dark room. Thus, it is possible to make a microscopic inspection of the actual condition of the metal *before* other atmospheric changes take effect. Since metal surfaces exposed to salt-spray tests change rapidly *after tests are completed*, it is necessary and possible, by this photographic method, to determine and *accurately* record corrosion in metals.

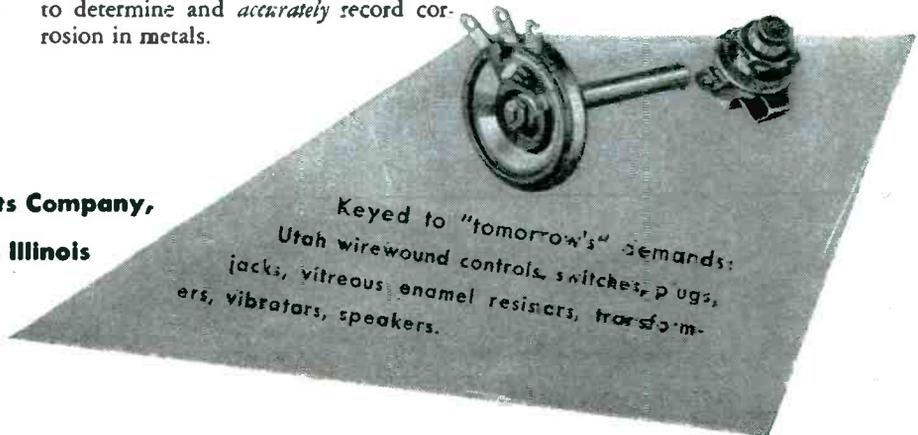
As a result of this and other Utah tests, efficient performance of Utah parts is assured under any and all conditions normally encountered—the failures due to inadequate, inaccurate testing are avoided. ★ ★ ★

Every Product Made for the Trade, by Utah, Is Thoroughly Tested and Approved

Utah

Radio Products Company,

816 Orleans Street, Chicago 10, Illinois



Keyed to "tomorrow's" demands:
Utah wirewound controls, switches, plugs,
jacks, vitreous enamel resistors, trans-
formers, vibrators, speakers.

EDITORIAL

An unusual prediction on tube prospects for the fall has come from a most reliable source . . . NAB, (National Association of Broadcasters). They say that there will be a substantial increase in the available supply of tubes to the consumer during the third and fourth quarters. NAB experts have arrived at this conclusion after studying manufacturing facilities, the needs of civilians, and the vast stocks of military tubes already produced. NAB states, too, that they were not concerned with either cutbacks or contemplated cutbacks in the backlog of military tubes when they arrived at this prediction.

Maybe we'll have tubes after all!

THE OPA and WPB black market tax is again being wielded and with many heavy blows. A score of "assemblers" have been rounded up for flagrant violations. These "assemblers" have been found to be making receivers and selling them where they can, for what they can. Others have been getting WPB approval but ignoring OPA price ceilings. Still others, with WPB approval, have pretended to obey OPA but have not kept to the price control ceilings.

Tube price violators are also being investigated. Many have already been apprehended for price gouging and illegal practices.

Long prison terms and heavy fines await the violators. WPB and OPA mean business. Keep out of the black market!

THE results of a most interesting survey among receiver owners have just been released by the publishers of a popular women's magazine. The survey reveals that in the homes investigated, 54% of the receivers in use were table models, 30% were consoles, 10% were radio phonograph combinations, and 6% were battery portables. Sixty-five per cent planned to buy a radio after the war; 57% of this group chose the radio-phonograph combination, 22% chose a table model, 21% a console, and 3% selected television. The new set owners selected tone as the most important requisite. Of the 35% who said they were familiar with f-m, 84% indicated a postwar preference for the f-m set.

STANDARDIZED symbols recently adopted by the American Standards Association, appear in some of the drawings in this issue. As will be noted all but one of the symbols are identical to our customary format. The change is in the fixed capacitor, where adjacent straight and curved lines are used in place of two parallel lines. Two parallel lines now indicate an open contact of a relay. These *standard* symbols will be used in all drawings hereafter.

SERVICE

A Monthly Digest of Radio and Allied Maintenance

Vol. 13. No. 7

July, 1944

ALFRED A. GHIRARDI

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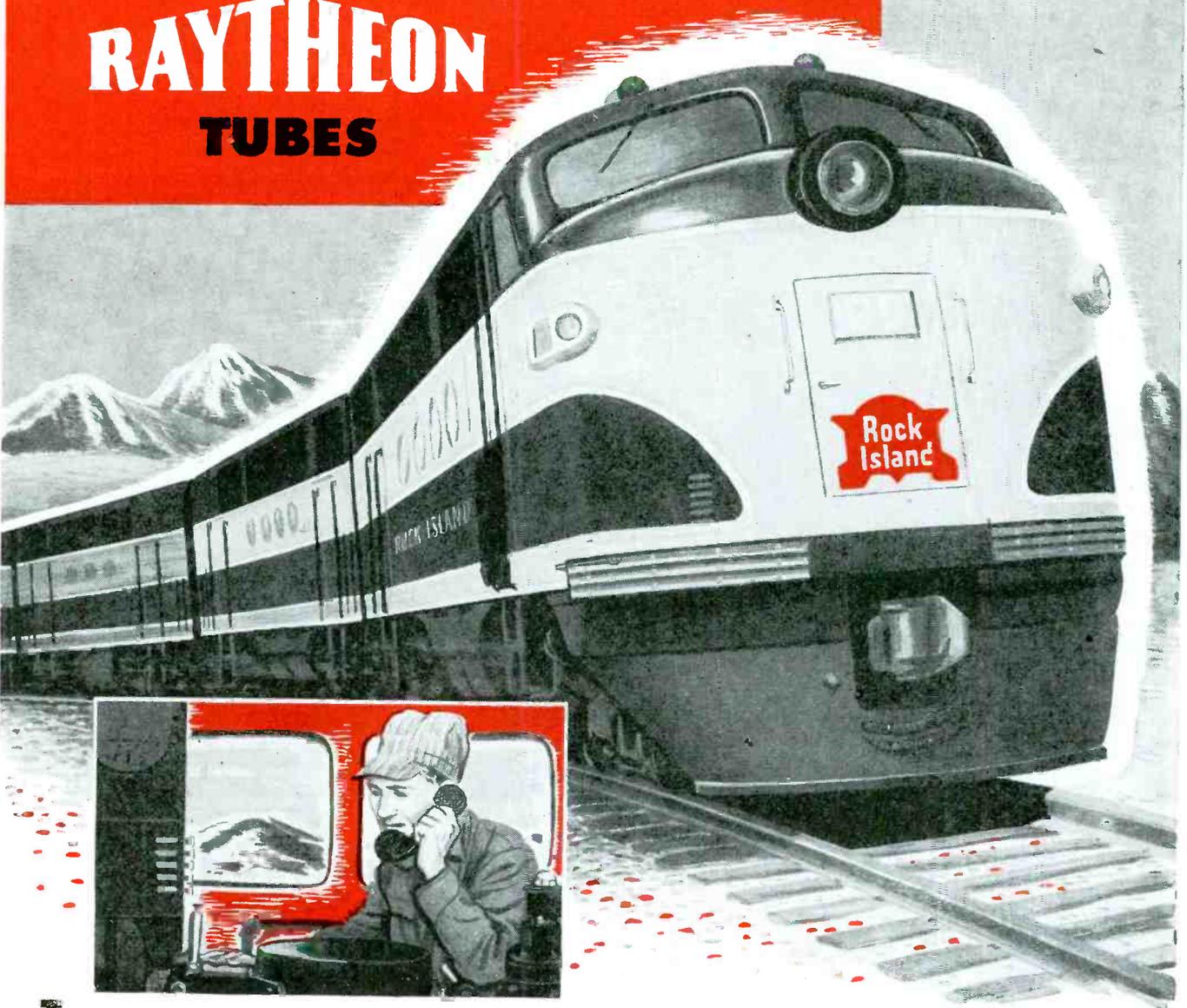
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**MAKING RAILROAD HISTORY...
THEY RELY ON**

**RAYTHEON
TUBES**



Taking a giant step forward in railroad history, paving the way for greater efficiency and added safety in railroad operation, THE ROCK ISLAND LINES, recognizing the importance and value of an electronic communications system have installed two-way radio in their trains ... and, because they want the best equipment, delivering peak performance at all times, THE ROCK ISLAND LINES are using RAYTHEON Tubes.

Because of its unique wartime experience, Raytheon will be in a better position than ever before to supply

electronic tubes to radio manufacturers and industrial equipment users for the most exacting applications. Into RAYTHEON Tubes is built the finest engineering, as well as all the "Plus-Extra" performance qualities that have been synonymous with the name of Raytheon throughout the years.

Raytheon Manufacturing Company

RADIO RECEIVING TUBE DIVISION

Newton, Massachusetts • Los Angeles • New York • Chicago • Atlanta



All Four Raytheon Divisions Have Been Awarded Army-Navy "E" Plus Stars

RAYTHEON

High Fidelity

RADIO AND ELECTRONIC TUBES



DEVOTED TO RESEARCH AND MANUFACTURE OF TUBES FOR THE NEW ERA OF ELECTRONICS



History of Communications Number Five of a Series

NIGHT COMMUNICATIONS ON THE HIGH SEAS



MODEL T-30-S
THROAT MICROPHONE

In those early days when our Navy was first organized night communication was made by lantern from the masthead. This was the only communication between ships at sea during through which many times news from home was transmitted.

Today, through the use of Universal Microphones and voice communication components, vital communications of War are speedily transmitted equally as well from small sea-craft and battle cruiser to home port.

Many new types of Universal microphones shall be developed from the experience obtained from the production of military units, for the private citizens in the marine pleasure-craft in the days after Victory is ours.

< Model T-30-S, illustrated at left, is but one of several military type microphones now available to priority users through local radio jobbers.



UNIVERSAL MICROPHONE COMPANY
INGLEWOOD, CALIFORNIA



FOREIGN DIVISION: 301 CLAY STREET, SAN FRANCISCO 11, CALIFORNIA • CANADIAN DIVISION: 560 KING STREET WEST, TORONTO 1, ONTARIO, CANADA

4 • SERVICE, JULY, 1944

PICTURE PAGE of Mt. Carmel's Famed Precision-el



Ever hear the story of how "precision-el" originated? It was coined by a writer who visited the Meissner plant at Mt. Carmel some time ago. He had watched in amazement as hundreds of flying fingers handled intricate and delicate assignments with unerring precision. "This," he was told, "is just a small part of Meissner's personnel . . ."

"Personnel?" he exclaimed. "Well, from what I've seen today, I'd call them 'precision-el'! No wonder Meissner has such a reputation for quality!"

Specialist! Mt. Carmel, Illinois, is said to have more electronic technicians per thousand population than any other city in America. This young lady is one of many experienced workers at Meissner's Mt. Carmel plant.



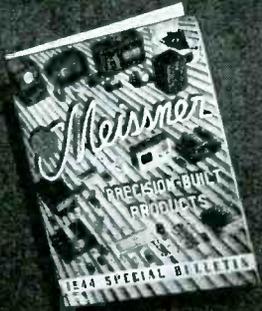
Time Out! This busy worker pauses for only a fleeting second as the roving photographer snaps his picture. He does his part in making the vital and highly technical products with which Meissner supplies Allied armed forces 'round the world.



Veteran! Here is another reason for Meissner's top reputation for precision work. Meissner people rightly take pride in their job, in their own personal production.



Precision-el at Work! These young women, like many Mt. Carmel residents, have literally learned the electronic business "from the ground up." They are versatile enough to handle any one of many difficult assignments.



Now! Special 1944 Bulletin

Here's what everyone in the industry needs to know about Meissner's 1944 line of radio parts. Contains complete descriptive matter, with pictures. Now, more than ever, it pays to keep posted on what Meissner offers. Send for your copy today, because the supply is limited. Free! Write to address below.

MEISSNER

MANUFACTURING COMPANY • MT. CARMEL, ILL.

ADVANCED ELECTRONIC RESEARCH AND MANUFACTURE



Are You Caught in War-Time Cobwebs? by Don Herold

I know a lot of folks who are sitting this war out. Oh, they may be hustling some, but they are giving their real brains and will-power a three or four-year vacation.

No use, they figure, to hump their cerebral muscles until peace comes.

I wouldn't put any radio service men in this class, but, just the same, a popular national business magazine tells of a radio dealer in Brooklyn who hadn't changed his window display since Pearl Harbor. An irate prospect for a scarce

facturers are preparing new products and there's bound to be an upsurge in competition too. The way for established service men to get their share of the clover is

"The radio shop put an International Resistor in our set"



"It sounds fine now"

to keep informed on developments, keep a live, neat shop, and cultivate future customers. Smart dealers always cash in on the real and prestige value of using and talking about famous radio parts, such as International Resistance Units.



radio tube insisted that the dealer take a tube out of one of three sets in his window. Dealer insisted there were no sets in the window, and nearly collapsed when he saw 'em.

Dealers who don't get ahead in their thinking now, are going to be behind when peace comes. Manu-

No. 6 in a series of special messages prepared by America's famous business writer, humorist and cartoonist, Don Herold. . . In sponsoring these Don Herold "broadcasts," IRC pays tribute to the thousands of Radio Service Men who, whenever possible, specify and use IRC resistance units in their work.



INTERNATIONAL RESISTANCE CO.

401 N. Broad St. • Philadelphia 8, Pa.

IRC makes more types of resistance units, in more shapes, for more applications than any other manufacturer in the world.



HOW CAN THE RCA ELECTRON MICROSCOPE HELP YOU?



The RCA Electron Microscope, an instrument which magnifies up to 22,000 times (and makes micrographs which, enlarged photographically, make possible useful magnifications up to 200,000

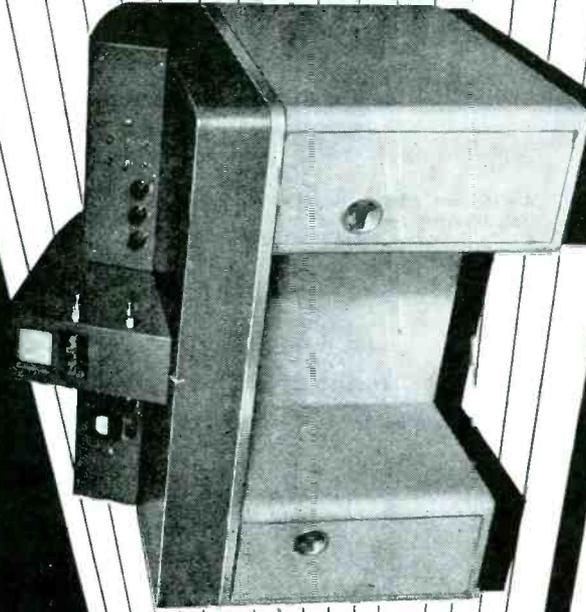
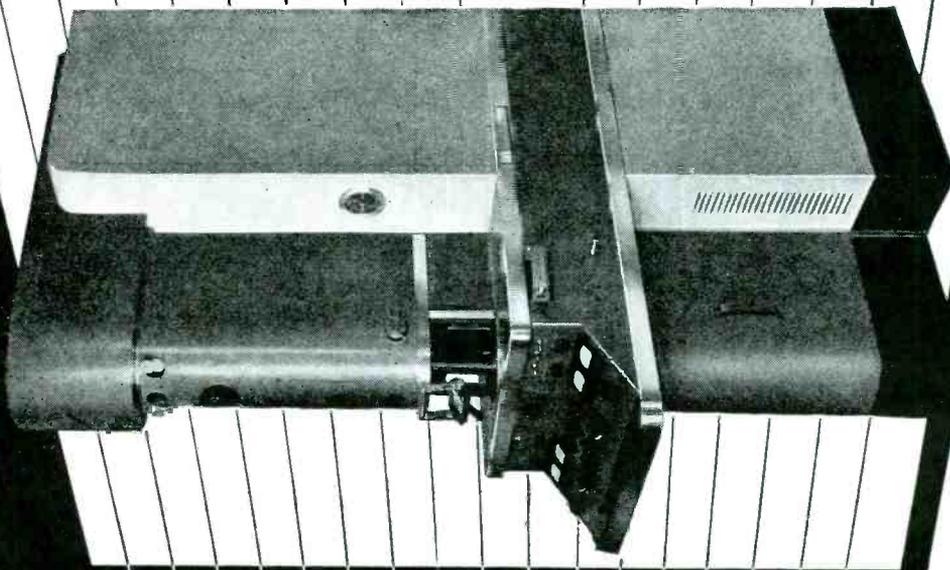
times), has enabled scientists to achieve important advances in industry and research. Its tremendous magnifying power is of great value to the chemical, metallurgical, ceramic, plastic, aviation, textile, rubber and petroleum industries—or to any field where particle size, shape, structure or distribution are of interest, or where minute surface details of metals or other materials must be studied.

Two new models of the RCA Electron Microscope are now available. One is a compact desk model—the other, a new Universal type containing an electron diffraction camera. Information on these instruments, their use and applications, is offered in a new 16-page booklet "The RCA Electron Microscope." The coupon at the left will bring you this booklet by return mail.

Please Use This Coupon

Electron Microscope Section, Dept. 126
Radio Corporation of America, Camden, N. J.
Please send me the new bulletin entitled "The RCA Electron Microscope."

Name.....
Position.....
Company.....
Street..... City.....



**BUY MORE
WAR BONDS**

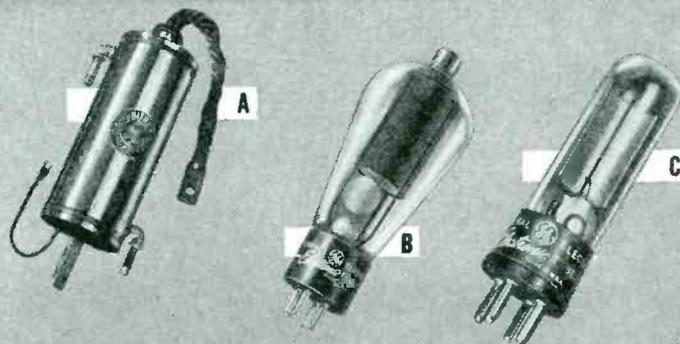
RADIO CORPORATION OF AMERICA
RCA VICTOR DIVISION • CAMDEN, N. J.
**LEADS THE WAY... In Radio... Television... Tubes...
Phonographs... Records... Electronics**



BEFORE THE WAR
YOU SOLD THESE
ELECTRONIC TUBES



a - Metal Radio Receiver Tube
b - Glass Radio Receiver Tube



AFTER THE WAR
YOU WILL SELL ALL THESE



A - Ignitron (for resistance-welding control, and converting a-c to d-c). B - Thyatron (for industrial equipment control). C - Phototube (for counting - sorting - grading). D - Cathode-Ray Tube (for television receivers and measuring instruments). E - Metal Radio Receiver Tube. F - Glass Radio Receiver Tube. G - Phanotron (for electronic heating).

TODAY more and more war production problems are being solved by the increasing use of the electronic tube.

Resistance welding, electronic motor control, electronic brazing and soldering, hardening and annealing — these are but a few of the new ways in which the electronic tube now is serving war industry . . . paving the way for a tremendous post-war market . . . when *better* products of peace will be produced in greater volume than ever before . . . by electronic means.

General Electric is manufacturing nearly one million dollars' worth of electronic equipment *every day* for the armed forces

and war industry. General Electric is informing industry about electronic methods. Thus, General Electric is helping to build your post-war electronic tube market—NOW!

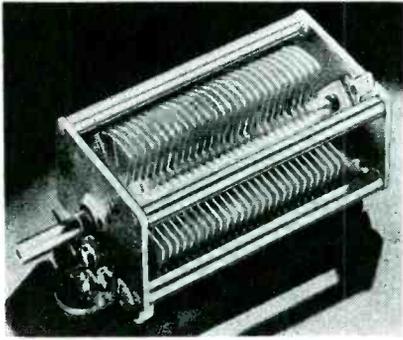
The radio service man of today—who will be the electronics maintenance man of tomorrow—can count on General Electric for the peacetime production of the world's most dependable electronic tubes. . . . *Electronics Dept., General Electric, Schenectady, N. Y.*

• Tune in General Electric's "The World Today" and hear the news from the men who see it happen, every evening except Sunday at 6:45 E.W.T. over CBS. On Sunday evening listen to the G-E "All Girl Orchestra" at 10 E.W.T. over NBC.

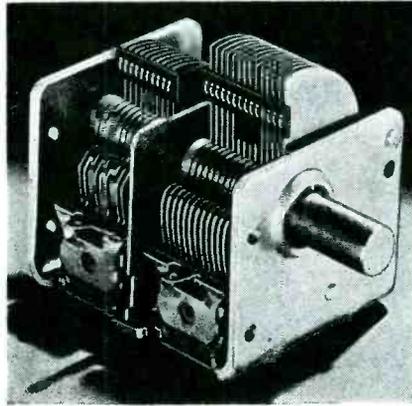
THERE'S A G-E ELECTRONIC TUBE FOR EVERY PURPOSE

GENERAL  ELECTRIC

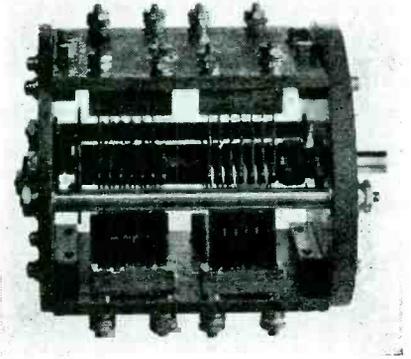
176-CA



A u-h-f, h-f type variable, with soldered rotor and stator assemblies. Frame is tied-rod construction, with metal and plates. (Courtesy Oak)



Ball-bearing type of variable for small receivers. (Courtesy Oak)



A special phase-shifter type of variable condenser having soldered brass-plate construction. Continuously variable. Ball thrust near bearing for low turning torque. (Courtesy Cardwell)

DESIGN AND APPLICATION OF VARIABLE CONDENSERS

ONE of the most important components in receivers and lab equipment is the variable condenser. Its vital function demands extreme care in design and manufacture. It is necessary, for instance, to consider materials used, dielectric losses, effective inductance and resistance, variations with temperature, etc.

The capacity of a condenser is proportional to the active area and inversely proportional to the spacing between the plates. Therefore, varying either the area in mesh, the spacing, or

by
ALFRED A. GHIRARDI
Advisory Editor

both factors at once will permit us to obtain the desired capacity variation. Practically all variable condensers handled by Service Men are of the 180° rotatable type, although a few rotate 270°. But there are several other types. One

Left, precision condenser with phosphor-bronze brushes bearing on a brass disc for rotor connection. Right, gear and worm-drive precision condenser.

early type utilized sliding plates in a grooved insulated block. Remler made a condenser in which two sets of plates were geared to the drive shaft and both rotated equally. All these types depend upon a change in area for varying capacity.

One design used mercury as a conductor to serve as a variable plate, but this proved unstable.

For very low capacities—up to about 20 mmfd—disc type condensers are often used, particularly for neutraliz-

(Continued on page 24)

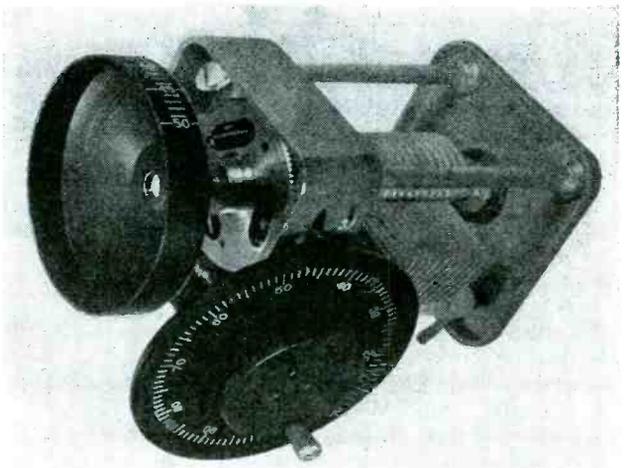
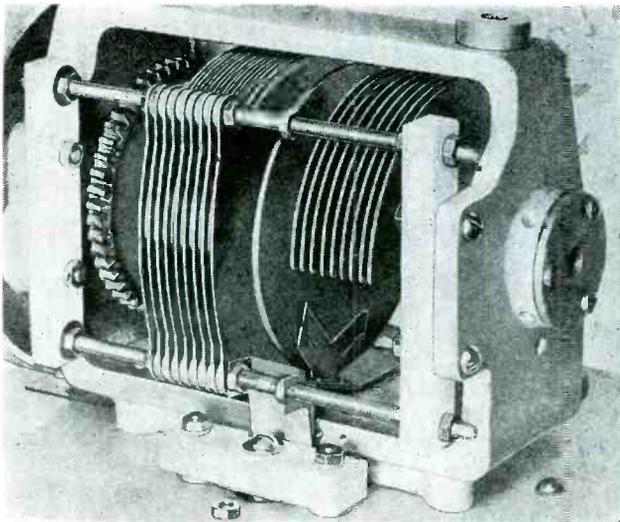


Illustration at left, courtesy General Radio; above view, courtesy Cardwell.

EVOLUTION OF THE CLIP

“HEY, Pa, what is a suspender clip?”

“Well, son, when I was a young fellow I used to wear long underwear. I also wore suspenders and between each of the two front forks hung a small spring clip which I snapped onto the top of the underwear, to hold them up. Those spring clips, my boy, were called suspender clips.”

In the 1880's and 1890's the early development of the telephone and electric lighting took place. Electricians felt the need of devices to make a quick, temporary electrical test connection and they naturally turned to the only thing of the kind available—the suspender clip.

Suspender Clip Design

These suspender clips were rather flat, had teeth only on the forward lips of the jaws and in many ways were unsuited to the new use being made of them. The first clips manufactured for electric testing were but glorified versions of the suspender clips and still retained a torsion spring with the fulcrum of the lever action in the middle. To provide greater jaw spread this construction required the two main members to diverge widely at the rear. This in turn made for inconvenient and awkward finger grips.

We developed a clip in 1910 that appeared to overcome the suspender clip awkwardness. Placing the fulcrum at the rear and crossing the jaws compacted the clip and resulted in comfortable, flat, finger-grip surfaces. Side teeth on the jaws improved contact in general and facilitated application to bare wires, fine or coarse. A spring, with point of application near the jaws, insured a strong bite even on small wires and thin terminals. Ears at the rear, to pinch down over the insulation of the cord, relieved the copper conductor of strain.

Clip Applications

When the early clips were first offered the market was quite limited. The first descriptive circular stressed applications in the telephone field and for potential leads. With expanding electrical development new uses for clips appeared which called for additional designs and sizes. Today there is no electrical field that fails to find

by **RALPH S. MUELLER**

Founder, Mueller Electric Co.

use for clips, and that statement goes as well for the many sciences in which electricity plays a part.

Clips have made the front cover of the *Saturday Evening Post* and have appeared in comic strips and the movies. A certain monkey circus can't function without them. There are many novel non-electrical applications such as for pinching off blood vessels in autopsies, holding rats for X-ray pictures and holding the cow's tail while milking. The editor set a limit to the length of this article else it could be told how clips have been used in crime and in at least one love affair.

Museum Displays

Museum displays by manufacturers have increased surprisingly in number during this century. They vary in size from exhibits that can be displayed on a space no greater than that of an extended dining room table to those requiring sizeable separate buildings, such as that of the Ford Motor Company at Dearborn. These displays have advertising, goodwill, sales and historic value and to some extent serve as engineering records.

By way of a museum display we have prepared a series of trays showing the inception and development of various types of clips. The accompanying illustration shows tray number one.

First Models

The first model of the *universal clip* was cut out of a stiff business card with a pair of scissors. In the upper left hand corner is shown the first model in steel whittled out during an evening in the basement. On the two immediately succeeding evenings improved hand-made models were tinkered.

Clip Progress

The tray shows the first model made from dies and then follows a showing of changes and improvements throughout the years leading up to the streamlined model of today. The development was largely one of strengthening

through ribbing, channeling and flanging.

In the second horizontal row is shown the first insulator ever offered for any clip. It was a nursing nipple with a larger hole punched in the end for the connecting cord to lead through. This insulator was not molded as in modern practice but instead pieces of a suitable size and shape were cut out of sheet rubber with a “biscuit cutter” and manipulated together by hand over a porcelain form. The bead was rolled by hand and then followed the vulcanizing.

Special Clips

In the middle of the bottom row is shown a sample of the special clip with which Admiral Byrd's antarctic expedition was fitted out. It is entirely non-ferrous with sides of copper, a screw of brass and a spring of phosphor bronze. After the return of the expedition we asked chief engineer Hansen in vain for the return of a clip that had actually been used at the South Pole. Should he happen to see this article it is hoped he will send one in, even at this late date, to take its place in this museum tray.

Millions of Clips in Use

From these crude specimens shown in the tray began a business which to date has made millions of clips. Whenever an electrical man works with his hands he is forever skinning wires and hooking them up. That is where the clips come in. *Clips* are indispensable tools in the electrician's kit along with his pliers and screwdriver.

International Use of Clips

Literally dozens of competing designs have come and gone throughout the years but the design of the *universal* has persisted and has been accepted as the standard throughout the world. These clips are in use in over 70 foreign countries. Through many years of foreign travel to distant parts this writer has not yet failed to find them even in such remote spots as Labrador, Alaska, Guatemala and the jungle of Yucatan. Truly, *wherever current flows you will find serving mankind.*

Sept. 1909



First hand-made model. No tail piece to crutch connecting wire.

Sept. 1909



Second hand-made model. With tail-piece.

Sept. 1909



Third hand-made model. With two lips in hinge and side teeth on jaws.

Feb. 1910



No. 1 First clip from dies. Sheared finish.

Dec. 1910



No. 3 With nursing nipple. First insulated clip ever offered.

Oct. 1913



No. 2 With hump to strengthen tail-piece. Nickel-plated.

June 1914



No. 8 Solid copper. Necks ribbed for strength.

Jan. 1915



No. 8-A Copper, lead-coated. First leading of any clip.

Mch. 1919



No. 27 Solid copper. Screw connection. First channeled necks.

1918



No. 27 in brass. Made during World War I when unable to get copper.

Mch. 1924



No. 27 in steel, copper-plated. First use of polarity marking.

May 1925



No. 27 in steel, nickel-plated. Helical spring. Wider ears to grip cord.

Aug. 1927



No. 27 in steel, cadmium plated. Screw bench enlarged.

Jan. 1929



No. 27 entirely non-ferrous. First made for Admiral Byrd's Antarctic Expedition.

July 1936



No. 27 Latest model with rounded jaws and interlocking necks.

-One of the trays from the Mueller display of clips, depicting the evolution of the clip.

WARTIME REPAIRS

A MAJESTIC console, 310B, with the primary of the second i-f transformer open, was brought to my shop for repair. I didn't have any of these i-f units for replacement, and knew they were practically impossible to buy. I decided to improvise. I slipped the shield off of the transformer, left all connections as they were and placed an r-f choke coil I had, on top of the transformer connecting it in parallel with the old primary coil. The receiver worked well. The volume had been cut a bit, but not

Fourth Prize Winner

CHESTER W. SHARP

enough to disturb the set owner.

On another occasion, I had to repair a Sentinel battery, model 118B, with a volume control that caused intermittent cutting off and on. The control was also noisy.

Not having a new control to replace this one, I decided to take the old one apart. On the shaft is a small spring which makes contact on the race. I slipped the U washer off the shaft. With a knife blade I then slipped the shaft out so I could get at the spring with a pair of long nose pliers. The spring was bent so it would make better contact with the race. I found later that many volume controls offered the same problem and could be repaired in the same manner I had followed.

IN my neighborhood, many of the buildings are steel, and thus well shielded. It is very difficult to receive short-waves, unless external antennas are used. Inasmuch as we cannot place antennas on roofs in this vicinity, a substitute had to be introduced. I found a substitute that worked quite well. My suggestion is primarily for console type receivers, although I have experimented with table model units, and find this idea also performs fairly well.

A paper foil condenser is used. I

Sixth Prize Winner

D. P. COHN

unwind and place one foil turn completely around the inside of the console or cabinet. One end of this foil is then connected to the antenna input of the receiver. It is interesting to note that the width of the foil affects operation,

on short-waves, which proves apparently that area is necessary for good short-wave reception.

I also found it necessary, recently, to replace mica condensers in practically all circuits except in the oscillator. A shielded wire approximately 10" long, curled up, with the insulated wire in the center as one plate of the capacitor, and the outer shield as the other, provides an excellent substitute capacitor. Any good shielded wire will withstand the voltage applied in the average radio set.

AN 8-tube t-r-f receiver of the late 20's was recently brought to my laboratory for revamping. The old 3-volt-indirectly heated triodes had been incorporated. Except for bad tubes, the receiver was quite intact.

It had in its favor a large well-preserved cabinet, well planned chassis about 12"x24"x3", sturdy power transformer, filter choke and condenser block, good size output and interstage transformers and a heavy dynamic—a good foundation for a revamp job. The power transformer had two 3-volt windings, which connected series-aiding would supply 6 volts for present day tubes with plenty of current carrying ability, for they had been designed for the old style heavy-drain tubes. The rectifier put out about 300 volts under load after filtering.

It was decided, for economy, to retain as many of the original parts as were useful. The following tube line-up was chosen as most readily available at the time and most applicable to the job: first r-f, 6SK7; converter,

Fifth Prize Winner

E. M. DE WAR

6K8; first i-f, 6SK7; second i-f, 6SK7; detector, avc, and first audio, 6R7; output, 2 6V6's; and an 80 as a rectifier.

The 80 was retained because it was still good and the socket could be easily changed, if necessary, to octal or a similar and later type. Since the original output transformer was thought to be about 8000-ohms impedance (the original had a pair of output tubes similar to the 45), 6V6's seemed the closest approach to that requirement in output impedance, when operated class A with about 285 volts on the plates. The 6R7 was an obvious choice for transformer coupling, the triode section being very similar in characteristics to the 27 type used with the original set. Also, since the 6V6's

have good power sensitivity and the voltage gain of the r-f and i-f end would be good, little audio gain was needed. The 6R7 diodes were used for detection and avc.

The choice of the remaining tubes was arbitrary. For instance, for the r-f and i-f amplifier, the 6K7 could have been used, and any other type of converter, 6SA7, 6A8 or 6J8.

The circuit adopted was conventional in every respect, no trick circuits, and the data were taken from suggested circuits in tube manuals.

The audio end consisted of a diode detector, the 6R7 transformer coupled to, and driving, the push pull 6V6's in class A.

It was perhaps unwise to attempt two stages of i-f. However, it was thought that if they proved too unstable, one could be eliminated. Standard 465-kc replacement type i-f coils were used. In fact the i-f's were critical and too selective. This was cleared up by slightly loading the primaries

(Continued on page 20)

SPRAGUE TRADING POST



A FREE Buy-Exchange-Sell Service for Radio Men



ASK FOR THEM BY NAME

If you appreciate the Trading Post Advertising Service—and hundreds of servicemen have told us that they do—we know we can count on you to ask for Sprague Atom midget dry electrolytic capacitors by name, and to insist on getting them whenever they are available. Atoms are smaller, less costly, and are fully as reliable as the big, old-fashioned condensers they replace. Use them universally on all of your jobs. They're more dependable—they speed up your work!

FOR SALE—Clough-Brengle OC oscillator in excellent condition, recently factory-recalibrated. \$40. Precision Radio Service, 40-13 Union St., Flushing, N. Y.

FOR SALE—Webster portable recorder, brand new, single speed motor, and feather pickup, complete in airplane luggage case, but no amplifier. Am badly in need of "Triplett 1600-E V-O-M, either panel or portable; also Precision E-200 sig. generator, Valley Radio, 887 Broad St., Central Falls, R. I.

WANTED—Late model tube checker, condenser tester, sig. gen., ohmmeter, and voltmeter by ex-soldier reentering service business. W. H. Chambers, Box 1774, Odessa, Texas.

SWAP OR SELL—Battery charger, practically new; also generator—needs new primary. Want slide rule or airplane type dial for counter-clockwise condenser and calibrated in 3 bands 528 to 1730 kc; 1.7 to 5.8 mc.; 5.75 to 18.3 mc. Lee Brooks, Box 260, Middlesboro, Ky.

WANTED—Book "Aircraft Radio & Electrical Equipment" by Morgan. Will buy or trade 6S47, 12SQ7, 12SK7 tubes or "Practical Radio Communications." Ptt. L. C. Woodard, 190 Lyons St., Macon, Ga.

WANTED—One 2000v center-tapped power transformer at 200 to 300 ma. Would accept one with 2500v rating if price right. Might be interested in complete power supply, transformer, chokes & condensers. Howard Miller, 313 44th St., Newport News, Va.

WANTED—One acorn tube socket for 955 tube. C. B. Davis, 681 Delmar Ave., Atlanta, Ga.

WANTED—New or second hand tubes of all types; also an ac-dc voltmeter 0-500 volts. Have a few second hand 55, 89, 2A5, 53, and 49's. How about your lists? Blundell's Radio Service, P. O. Box 385, Station A, Palo Alto, Calif.

WANTED—Sig. generator and late tube tester. Leo J. Erlich, 436 St. Mary's St., St. Marys, Pa.

WILL TRADE—Supreme 570 sig. generator; Agfa pioneer camera; and Remington 1-shot rifle with 200 shells. Want N.R.I. tester 117B or Sprayberry tester, and radio tubes. Bill's Radio Service, 514 Ninth St., Henderson, Ky.

WANTED—New or used console radio cabinets, var. condensers, resistors, coils, transformers, tubes, etc. Send your list. All letters answered. John A. Gruenigian, Central Y.M.C.A., Harrisburg, Pa.

WANTED—Will buy an obsolete Ortho-phon cabinet in which a Jensen co-axial speaker, turntable, and pickup can be installed. Must be expensive type of cabinet of fine wood and design. Scott Helt, Radio Station WIS, Columbia, S. C.

WANTED—Rider's manuals 8, 9, and 10. State price. General Appliance Repairs, 643 N. E. 1st Ave., Miami 36, Fla.

FOR SALE—Superior tube tester #1240 in A-1 condition. Checks almost any tube. \$40. Frank J. Nifong, Box 461, Warrenton, Mo.

WANTED—Howard #190 comm. receiver with crystal & speaker. Must be A-1. Advise air mail. Fred E. Fralick, Box 222, Salem, Ore.

FOR SALE—10 new J.F.D. #313 battery adapter harness in cases, substitutes separate batteries for Philco BC Paks, \$1 ea. 35 battery chassis, mostly later models, over half parts still mounted, \$1 ea. A-K 12" 32 watt speaker, with output trans. "B" eliminator with 607 rectifier tube. \$2. Parmak 6v fence, all accessories, display rack, \$15. Zenith pocket radio with tubes, less batteries, \$10. Edwin T. Larason, Box 46, Martinsburg, Ohio.

WANTED FOR CASH—R.C.P. tube tester with chart in good condition. Also, one each: 1B5; 1A7; 50L6GT; 12A8; 35Z5GT; 12SQ7; 6SK7GT. J. S. Tokarz, 30 Carver St., Fall River, Mass.

WANTED—RCA port. battery radio, #BP-10 or similar models, with or without batteries. What have you? Etc. Robt. I. Sadler, 3024th A.A.P. Base Unit, Section "C" M.A.A.F., Box 596, Tucson, Ariz.

WANTED—Tube tester & sig. generator, or signal tracer. Describe. J. A. Quarles, Gen. Delivery, Pine Bluff, Ark.

FOR SALE—G-E B40 car radio; \$6; DayRad 330 DC RF osc. \$10; Jewell audio output meter, \$6; 1000-watt projector bulbs, \$3; G-E rotary converter 110v DC to AC, \$10; new RCA 85 tubes, 50c ea. Riley Parsons, Raquette Lake, N. Y.

FOR SALE OR EXCHANGE—11 W.D. projector P.A. horns with 30-watt R.C.A. electro units. Six of latest design like new. Five of older type. 2-60 watt Radio Receiver custom built class A.B.2 output amplifiers, used 4 weeks. All perfect working order. Two Western Elec. carbon mikes, Dingman's Sound Service, Canastota, N. Y.

FOR SALE—A complete radio shop, instruments, parts, lots of tubes, condensers, resistors, etc. Write for complete list. C. Schrader's Radio Service, 301 So. 18th St., Escanaba, Mich.

TUBES FOR SALE—25-6K7; 25-6SQ7; 18-6Z7. Metal, unboxed, 50% off list. Want 35A5; 35L6; phono motors and pickups. Geo. H. Horst, 311 E. Cliveden St., Philadelphia 19, Pa.

IMPORTANT NOTICE!

We discourage offers to buy or sell anything beyond the O.P.A. ceiling prices, and will not knowingly accept such ads for the Sprague Trading Post.

WANTED—Communications receiver in good condition. William Heer, Box 32, Elmira, Ohio.

WANTED—AC-DC volt-ohm-meter, late model. Leo E. Robinson, 1017 Enos Ave., Des Moines 14, Iowa.

WANTED FOR CASH—Basic recording unit, new or used, dual-speed preferred. Carlton Allmon, Emory at Oxford Sts., Oxford, Ga.

TUBES FOR SWAP OR CASH—Mostly new, some used: 21-01A; 1-B1; 1-WD11; 3-6A6; 1-12A5; 1-30; 2-32; 1-53; 2-79; 3-81; 4-82; 7-83V; 3-89; 4-112A; 2-120; 12-331; 1-232; 4-864; 2-264. What have you? I need typewriter and test eqpt. All letters answered. Irving P. Horowitz, 118 Sutter Ave., Brooklyn 12, N. Y.

WILL TRADE—Two new 35Z5 tubes for a 3" dynamic speaker. Nick Bourisk, 11 Clifton St., East Lynn, Mass.

NEW TUBES FOR SALE—Original cartons: 1-2B7; 1-1R5; 1-1R5; 2-38A; 2-3Q5GT; 1-6A8; 1-6B8G; 4-6K7G; 3-6SCTGT; 1-6FBG; 2-6J5G; 1-6N7GT; 1-6L6G; 1-6SA7GT; 4-6SQ7GT; 3-6SK7GT; 3-6V6GT; 1-7G7; 2-7B8; 2-7C6; 1-79; 2-XXD; 1-XXFM; all Philco. Sell only in one lot. Also have several 2v battery set tubes. James Robertson, Box 21, Whitealand, Ind.

WANTED—0-1 milliamp meter; Midwest VT-30; Silver-Marshall V1; Hallicrafters SX-17, DD-2 or SX-28. Condition unimportant as long as parts intact. FIXIT Shop, 806 Van Ness, Fresno 1, Calif.

FOR SALE—2 wood projectors; 2 steel projectors (all for 12" speakers); 2-33 1/2 phono motors, heavy duty; 2-78 r.p.m. ditto; 2 Jensen 12" PM speakers, one new; 2 Utah 12" 32 oz. PM speakers; 1 Shure hand mike, new; 1 ditto with stand; also several amplifiers and 2 Wuritzer phono amplifiers. Write: Clifford Gunderson, Waubun, Minn.

WANTED—One 1H5G tube and one ea. of following: 1A7G; 1B7G; 1LA6; 1R5. New or good used ones. Velmer R. Zeigler, R. R. 1, Huron, S. Dak.

WANTED—Vols. 1, 2, 5, 13 Rider's, also a power unit rated at 115v 50 to 60 cy. to 6v DC at 8 amp. for testing and displaying auto radios. H. Hockey Radio Shop, 3902 Tyler St., Berkeley, Mich.

WANTED—Sig. gen., tube checker, V-O-M, also twin meters for Triplett 1200E V-O-M. Describe. Walter J. Cummings, R. D. No. 1, Havre de Grace, Md.

WANTED—Any make table model radio in good condition. Will trade stamp collection of 1500 stamps plus album. Bill Wrocklage, 381 Main St., Hackensack, N. J.

SWAP OR SELL—Have 1 Precision tube tester model 9-12, new. Will trade for Seeburg deluxe automatic record changer and home recorder, BR29 or Webster-Chicago changer recorder. John H. Carroll, Brook St., McDonald, Pa.

WANTED—Radio City tube tester and Triplett or Supreme AC-DC V-O-M. Miss Sophie B. Santiago, 3131 N. Percy St., Philadelphia, Pa.

WILL TRADE—One Readrite 720-A set analyzer (reads up to 750v AC, 600 DC 15150 mills.) for a sig. generator. Pay cash difference. S. Scovel Radio, 609 E. 5th St., Alton, Ill.

WANTED—Hickok 530 tube tester, Solar or C-D capacity analyzer. Will sell Teleplex Sr. with built-in oscillator, \$12. O. J. Rasmussen, 1129 N. 26th St., Billings, Mont.

WANTED—Who has a "Deluxe Show-Type Service Work Bench" for sale. Just the bench. Prefer type with stock drawers. All letters answered. F. A. Lanning, Utica's Cash & Carry Radio Service, 321 Columbia St., Utica 2, N. Y.

WANTED—Comb. recording and playback unit. Will trade a high voltage power pack. Carlton Cleveland, 35 No. Street, Geneseo, N. Y.

WANTED—Good condenser tester such as Sprague Telohmike, also manuals. C. A. Ripberger Radio Shop, Adrian, Minn.

URGENTLY NEEDED—One 35A5 tube to restore radio for elderly blind man. Frank M. Miller, 117 E. 9th St., Hutchinson, Kans.

FOR SALE—Clough-Brengle 1" scope, \$60; Solar condenser tester, \$40; two old style portable tube testers, \$25 ea. Kimbark Elec. Appliance Co., 1309 E. 53rd St., Chicago 19, Ill.

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When buying Capacitors—please ask for Sprague's by name. We'll appreciate it!
HARRY KALKER, Sales Manager

SPRAGUE PRODUCTS CO., DEPT. S-74, North Adams, Mass.

SPRAGUE CONDENSERS KOOLOHM RESISTORS

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PRODUCTION TESTING DEVICES

by S. J. MURCEK

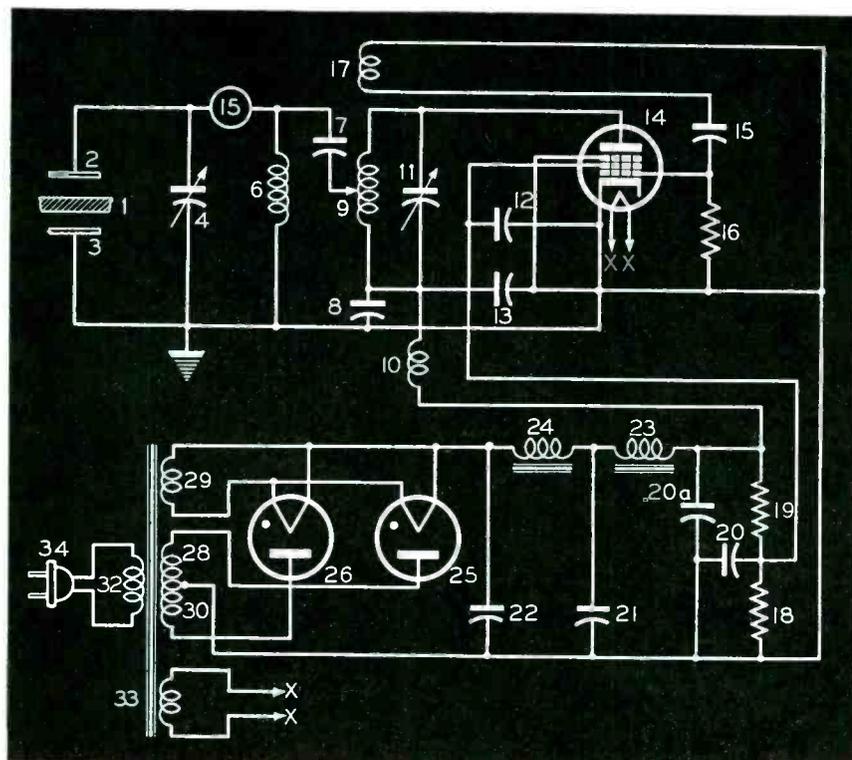


Fig. 1. Typical electronic thickness gauge. The power oscillator is dynamically coupled to the gauging circuit. American Standards Association war standard symbols have been used in this and other figures in this paper. Fixed condensers have a curved line adjacent to straight line. Variable condensers have arrows drawn through lines at 45° angle.

A major problem which often arises in the mass processing of raw materials involves the rapid and complete inspection of the fabricated product during the manufacturing process, as well as on its completion. This inspection must, as has been implied, be carried out at the same rate of speed as are the actual processing operations. Fortunately, wherever the characteristics of the material under processing are such that they may be readily converted into electrical equivalents, either in current or voltage, a suitable electronic device may often be applied to perform the inspection or testing procedure automatically.

The conversion of a product characteristic into an electrical equivalent is generally readily accomplished. In the processing of certain textiles, for example, the material absorbs a considerable quantity of moisture, and the electrical resistance, measured transversely through the material, is considerably decreased. Hence, the resistance of the material is a measure of the moisture absorbed during the processing operations. If a constant voltage is impressed across the material, the feeble current thus produced may be readily amplified and applied to the inverse control of the process speed. In this manner, the rate of speed at which the material is dried is directly dependent upon the amount of moisture present in

the material. Further, it should be observed that the drying process is a direct function of the material processing line, and that the speed of the entire process is thus necessarily dependent on the amount of moisture present in the processed material.

Other product characteristics may be treated in a like manner. The automatic control of the manufacturing process is not, however, always possible. Nevertheless, the engineering reductions of some of these processing inspections and tests have given rise to numerous special forms of electronic control equipment of a production testing nature. Here, as in all other electronic devices, a similarity exists between these various devices, this similarity leading to a ready understanding of the underlying theory involved in each.

In general, production testing devices are usually small in size, unless utilized in automatic process control systems, and the general dimensions and circuits involved are closely related to conventional radio receiving devices. In most instances, the testing device merely functions to indicate the condition of the material under test, and is designed to provide a visual or audible indication if the product condition varies from the desired values. Where the device is utilized to secure automatic processing control, it will be

found that the circuits originally designed to provide signalling indications have been altered to control, electrically or otherwise, the desired phase of the processing operation.

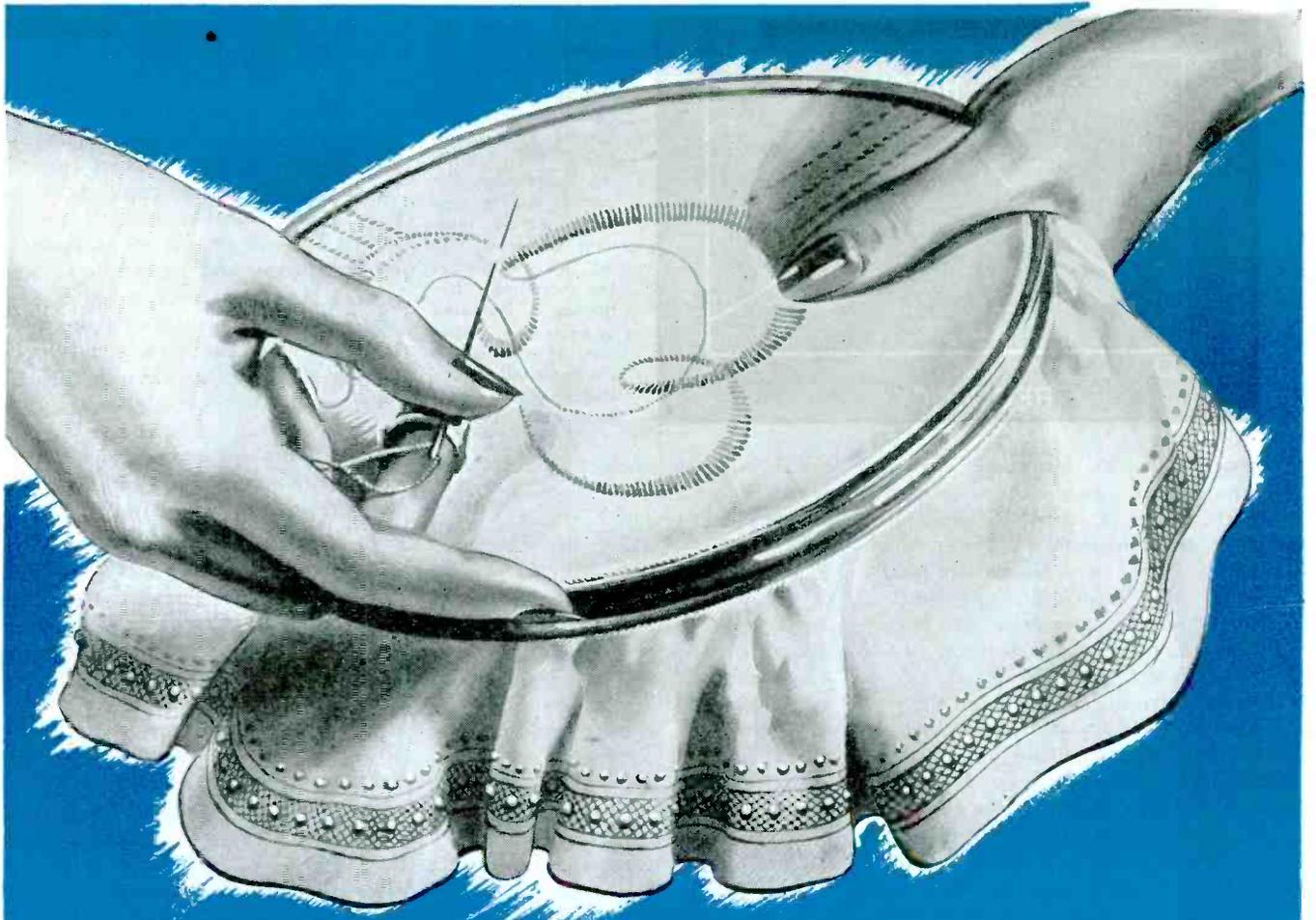
The fundamental principles involved in these production testing devices are closely allied to those often applied in photocontrols and electronic timers. Direct coupling of cascading circuits is the rule here, too, rather than the exception. Such an exception arises in the instance of the electronic thickness gauge, in which the measuring stage is dynamically coupled to the indicating circuit.

The R-F Thickness Gauge

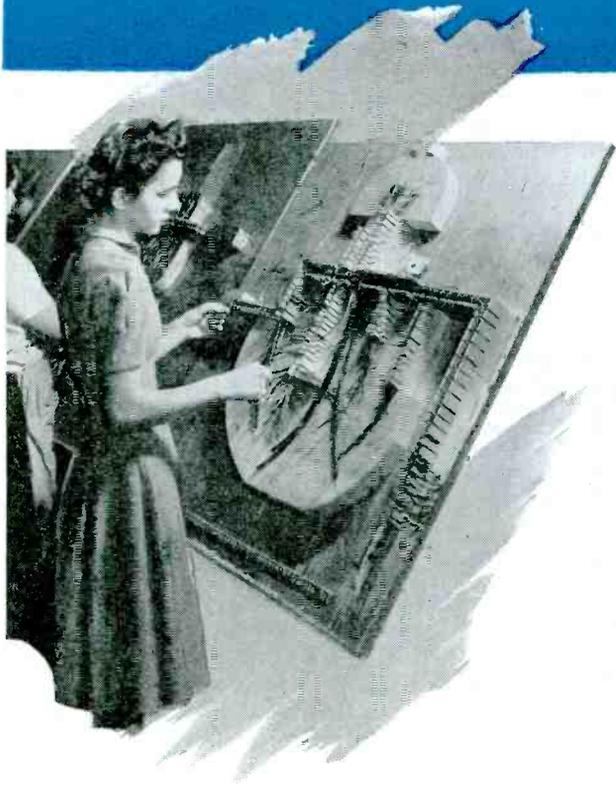
In the circuit of the r-f thickness gauge, shown in Fig. 1, several principles common to the radio transmitting and electronic control arts are combined to provide a device capable of measuring accurately the thickness of various production materials, such as paper, sheet rubber, or even metal strip. Through proper application of the device, the variation of the material thickness may be measured in thousandths of an inch. Obviously, the device finds considerable usage in many industries.

The r-f thickness gauge depends on the dielectric constant of the measured

(Continued on page 16)



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Both fine needlework and the delicate tasks of assembling quality electronic fighting equipment are natural for the supple hands of women, who compose 75 per cent of Detrola Radio workers. After Victory their skill and trained fingers will build highest quality radio and television for the American home. *Speed Victory—Buy War Bonds.*

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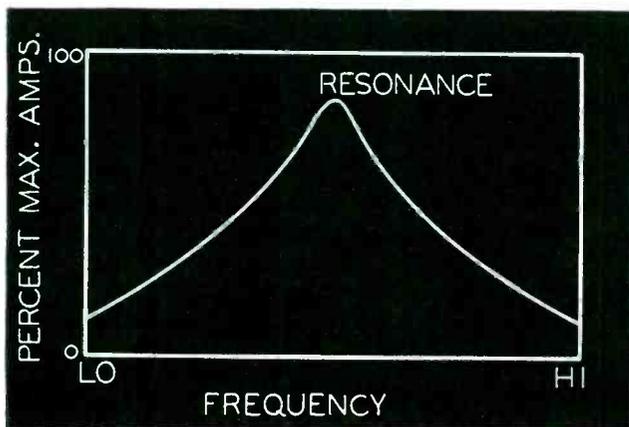


Fig. 2. Typical current or parallel resonant circuit characteristic, showing behavior of resonance current with alteration in the r-f exciting frequency. The current is at a maximum during resonant excitation, falling off rapidly as the exciting frequency is increased or decreased. Variation of the circuit constants, inductance and capacitance, produces a similar effect.

material in its operation. In any capacitor or condenser, the capacity of the device is actually a measure of the quantity of electrical power which may be stored on the condenser plates. In turn, the capacity rating, which is conventionally measured in microfarads, is directly dependent on (1)—the area of the metallic plates, (2)—the effective distance between the two plates, and (3)—the nature of the material occupying the gap between the plates.

It has been found, in the processes of scientific and engineering research, that many common materials have the property of increasing the capacity of a condenser when inserted between the condenser electrodes. The ratio of the increased capacity to that of a similar air condenser is referred to as the *dielectric constant* of the material. Where electrostatic condensers are concerned, the dielectric constant of a substance is the *multiplier* by which the capacity of a given air condenser increases through insertion of the dielectric material into the condenser gap.

Since the capacity of the condenser is also dependent on the area of the electrodes, which is usually a fixed factor, and the distance between the electrodes, it follows that the capacity of the condenser varies also as the

thickness of the dielectric. It is this principle on which the electronic thickness gauge operates.

In Fig. 1, the dielectric substance 1, such as paper, sheet cork, plastic, or any similar non-conductor, is placed between the electrodes 2-3 of the electronic gauge resonant system. These electrodes may or may not be in contact with the substance under measurement. Essentially, under these conditions, the electrodes 2 and 3, together with the measured material 1, comprise a variable condenser in which the capacity varies directly as the thickness of the measured material. This is to say, the capacity increases when the thickness of the material increases.

The condenser formed by the measuring electrodes is shunted across a small variable condenser 4, the function of the latter being to limit the minimum capacity present in both devices, when no dielectric material is present between the measuring electrodes. These two condensers, together with the air core coil, 6, are combined to provide a *resonant* current measuring system for the electronic gauge. The current flow through the circuit may be readily measured by means of the thermoammeter, 5.

Current resonance occurs in a circuit in which inductance and cap-

acitance are connected in parallel, when the a-c resistance (reactance) of the condenser exactly equals that of the inductor coil. This condition is present, in such a circuit, when the circuit input frequency exactly equals the natural resonance frequency of the circuit, the natural resonant frequency in turn being dependent on the amounts of inductance and capacitance comprising the resonance system. Under parallel resonance conditions, an appreciably high-resonance current flows in the capacitor/inductor circuit. Further, increase or decrease in the exciting frequency results in a sharp decrease in the circuit current, since the circuit is then *off resonance*. This effect is shown in the response curve of Fig. 2.

In the radio-frequency thickness gauge of Fig. 1, the parallel-resonant gauging system is tuned to resonance with the output frequency of the power oscillator comprising the components associated with the oscillation pentode tube 14. Dynamic coupling between the power oscillator and the gauge circuit is provided by means of the coupling capacitors 7 and 8.

Under normal operating conditions, the gauging circuit is resonant with the oscillator circuit only when the desired thickness of dielectric material passes between the gauge plates. Variation in thickness of the gauged material detunes the gauging circuit and the effect is a reduction of the circuit current, observed on the scale of the thermoammeter 5. This follows, since a reduction in the thickness of the gauged material results in a change in the thickness of the dielectric affecting the capacity of the gauging condenser, which consists of the plates 2 and 3, and the dielectric itself 1. A change in the circuit capacity results in a change in the natural resonant frequency of the gauge circuit, the latter no longer being identical with the frequency output of the exciting power oscillator. Hence, a resultant decrease occurs in the system circulating current.

The power oscillator is of the *tuned plate-untuned grid* type, in which only the oscillator tube circuit plate system is tuned to the desired frequency.

The various voltages required for the operation of the oscillator in Fig. 1 are derived from the power supply system consisting of the power transformer 33, rectifier tubes 25 and 26, together with the necessary associated components. When the proper a-c voltage is impressed across power input terminals 34, the oscillator and rectifier tube filaments are heated to operating temperature, and subsequent rectification by the rectifier tubes provides

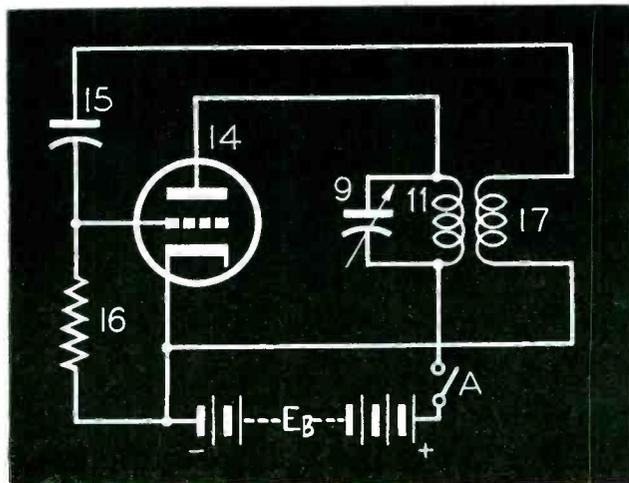


Fig. 3. Simplified diagram of power oscillator used in the thickness gauge shown in Fig. 1. Upper plate of capacitor 9 assumes a negative charge from the plate voltage supply E_{B1} in series with the triode 14. Consequently, on closure of switch A, the triode grid must swing negative with respect to the cathode.

suitable voltages for the operation of the oscillator system.

An equivalent circuit for the power oscillator is given in Fig. 3, in which the rectifier power supply of Fig. 1 has been replaced by the plate battery E_p , a plate circuit switch interposed at A , and substitution of the triode for the pentode 14 . In all other respects, the circuit is the prototype of the power oscillator in Fig. 1.

The simplest concept of an oscillator is that of a r-f amplifier stage which supplies its own input driving power. When B voltage is first applied to the plate of the tube, the bias on the grid is zero and the plate current and amplification high. Any transient voltage of resonant frequency will therefore be amplified. When the resonant voltage fed back to the grid through the coupling circuit is positive, the grid draws current. This current develops a bias voltage across the grid resistor, reducing the gain of the tube. This process continues until the gain stabilizes at a point where the power supplied to the grid by the plate is just enough to create that plate power. Any variation in the feed-back voltage causes a corresponding change in the bias voltage so that the grid resistor acts as a stabilizing element.

As has been previously stated, the r-f potential generated by the power oscillator circuit is applied to the gauging circuit through the dynamic coupling condensers 7 and 8, Fig. 1. Condenser 8 merely suffices to insulate the positive terminal of the high voltage supply from the grounded gauging circuit, at the same time serving as a low-resistance path for the transmission of the radio-frequency currents through the coupling system. Condenser 7 serves a similar purpose, providing an r-f path for the application of the desired voltage, secured from a series of taps on the power oscillator plate coil. The radio-frequency inductor, or *choke* 10, completes the r-f system, this component serving to prevent conduction of stray radio-frequency energy through the d-c power supply system.

In general, the r-f thickness gauge device is similar in all respects to a low-power radio transmitter. The d-c power supply is comparable to any high voltage power supply applied in conventional receivers or public address amplifiers, and is subject to the same electrical troubles. The only possible deviation from this rule lies in the small r-f inductors 27 and 28, which are intended for the dual purpose of attenuating stray r-f power voltages, and increasing the rectifier ignition angle, the latter to eliminate

(Continued on page 20)

DO 2 JOBS IN THE TIME NORMALLY REQUIRED FOR ONE!



A. A. GHIRARDI

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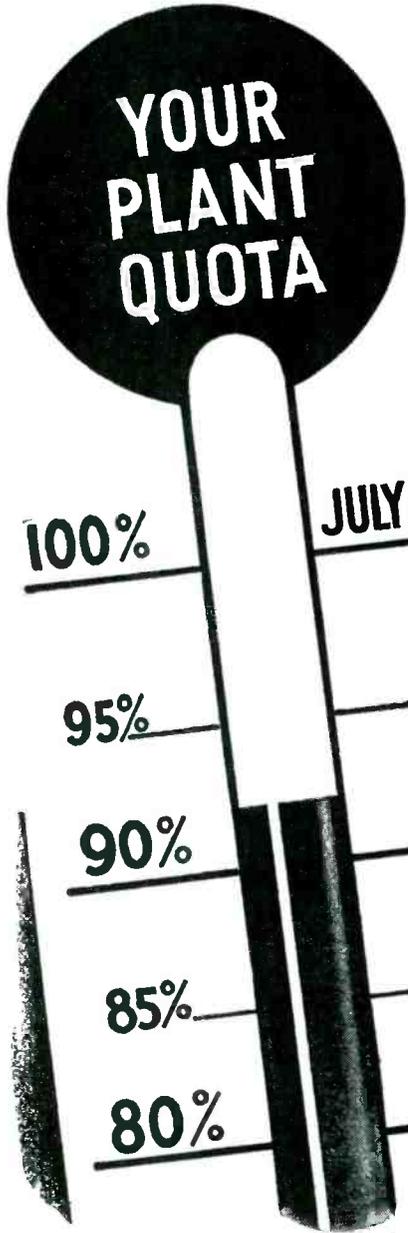
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 July 29th is the last pay day in the Drive.
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 Keep fighting. The 5th War Loan is a crucial home front battle of tremendous importance to the total war effort.
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3. Employees are expected to contribute toward raising the cash quota by buying extra 5th War Loan Bonds: 1—Outright by cash. 2—By extra installment deductions. 3—By extra installment deductions plus cash.

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BACK THE ATTACK—SELL MORE THAN BEFORE



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A-M/F-M AUDIO UNIT

(See Front Cover)

THE audio section of an a-m/f-m phono combination, Zenith 12H-689, employing a 7N7 meter amplifier-detector dual triode, appears on the cover, this month. The detector output consisting of avc voltage and a-f is fed to the amplifier grid through a low-pass filter to eliminate the audio. The filter is composed of a 2.2-megohm resistor and a .01-mfd condenser. It prevents audio frequencies from entering the output circuit where they may cause pointer oscillation in the tuning meter. The meter amplifier increases the sensitivity of the meter, permitting more accurate tuning on s-w and f-m, especially with weak signals. It is still useful on the broadcast band, but full amplifier sensitivity is not required. A cathode resistor of 3300 ohms is in the circuit at all times; a 1500-ohm resistor is also connected in series on the broadcast band only to reduce the amplification. Neither resistor is bypassed. Still another resistor, this being variable, is included for sensitivity adjustment; this may be set at the time of installation for optimum meter performance.

Substitute Antenna

Another feature is the line antenna connection brought out to the antenna terminal strip for use as a substitute antenna. The connection is taken from the line cord through bypass (or blocking condenser) which has a capacity of .0001 mfd. An r-f choke eliminates the shorting effect of the power transformer and phono motor. The other side of the line is bypassed to chassis.

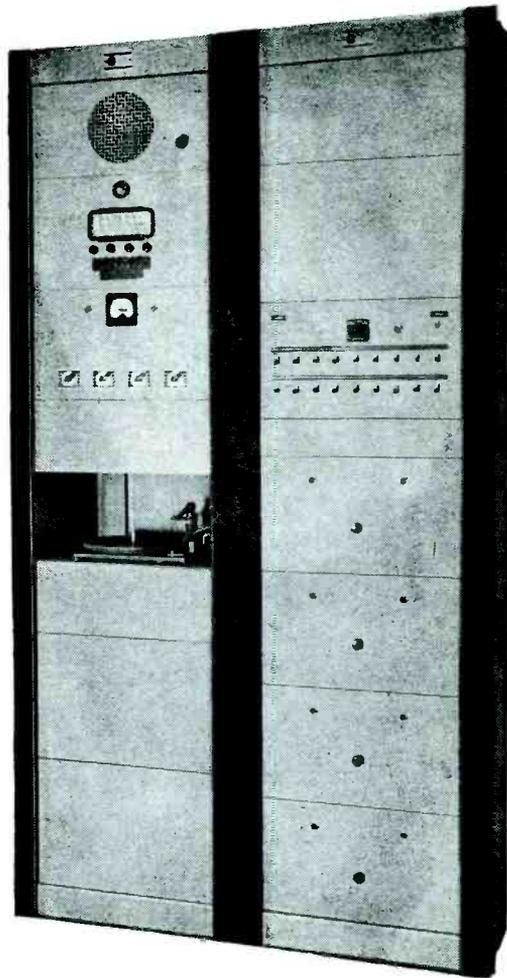
Tone Control

The detector output is connected to a 2.5-megohm volume control through a .02-mfd condenser in the usual manner. An elaborate 6-position push-button tone control is fashioned around the volume control, making use of two taps and a shunt condenser on the first a-f output. Grid leak bias is used in the first audio while the other half of the high mu 7F7, the inverter, uses an unbypassed cathode resistor.

The service bulletin, incidentally, contains an interesting shop note on a complaint of poor meter action and high audio level at the minimum volume control setting. The remedy is to replace the 7N7 tube even though it passes the standard tube test.

NOTE: American War Standard symbols recently approved by ASA have been used in the drawing on the cover. Condensers are indicated by adjacent curved and straight lines.

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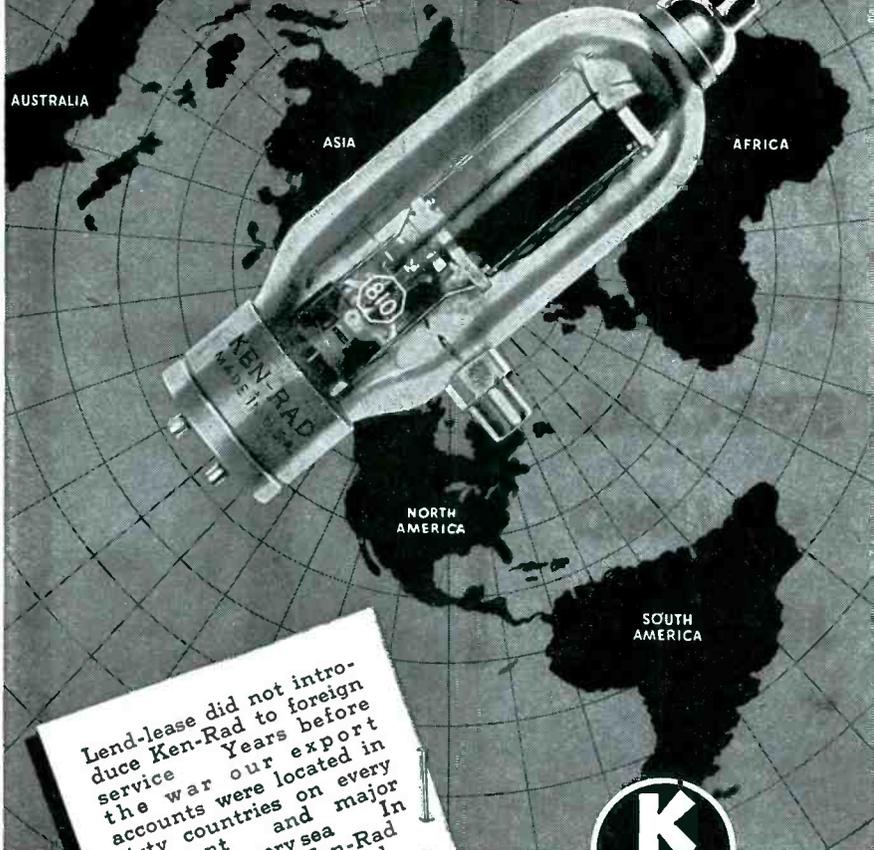


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SERVICE, JULY, 1944 • 19

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WARTIME REPAIRS

(Continued from page 12)

and secondaries with resistors and reducing the plate voltage through decoupling resistors. After this the i-f's showed excellent gain and stability with no apparent sideband cutting.

As for the r-f and converter, one section of the original four-gang condenser was left unused and the fourth r-f coil gave way to an i-f transformer. The rest of the original coils were retained. The antenna coil was, of course, satisfactory. The primary of the detector coil, which wasn't designed for pentodes with high plate re-

sistance, was retained for economy, even at a sacrifice of efficiency, since it was matched to the antenna coil. The third coil served as the oscillator. It had its primary removed and a tickler winding added.

The process of paring down the oscillator coil, bit by bit, and readjusting the series padder until proper tracking is obtained is familiar to most Service Men. After completion of spot checking with a tuning wand, we found that while tracking was not perfect it could be considered satisfactory. This was particularly so, since the i-f's were very selective and there was extra sensitivity in this modified receiver anyhow.

Only the broadcast band was included in the remodeled set. The customer claimed he was not interested in short-waves and since I feared he might have plenty of headaches as it was, I didn't encourage the inclusion of the s-w bands. The old gang condenser presented a problem. For its small capacity limited it to the former b-c band of 500 to 1500 kc and 1560 kc was out of reach.

The usual bugs were run into as in any construction, such as hum, but since their cure is known to every Service Man, their diagnosis isn't necessary.

However, the speaker did prove to be quite a problem. It was large and rugged but proved to have poor bass response and the cone being well aged rattled terrifically on the highs. (The set tested on another speaker had good fidelity.) The rattle was finally cured by replacing the cone with a brand of rather hard blotting paper. But the bass was still poor. The cabinet was large and provided a fairly good baffle. Finally by turning the speaker section of the cabinet into an infinite baffle by enclosing with celotex, the lows were brought up considerably.

The blotting paper affected the upper register response, but not sufficiently to prompt critical comment by the customer.

The dial, the old drum type, was also a problem. It was scratched and out of shape. At first a modern aeroplane type was considered but rejected because of mechanical difficulties. The gang lay parallel to the front panel and to change it would destroy the whole chassis layout. In a compromise move the old celluloid was eliminated and a new one about 3" wide in simpler style was calibrated. A show-card man lettered the scale with fancy colors. A new escutcheon was required, and was made up. The final result was most pleasing.

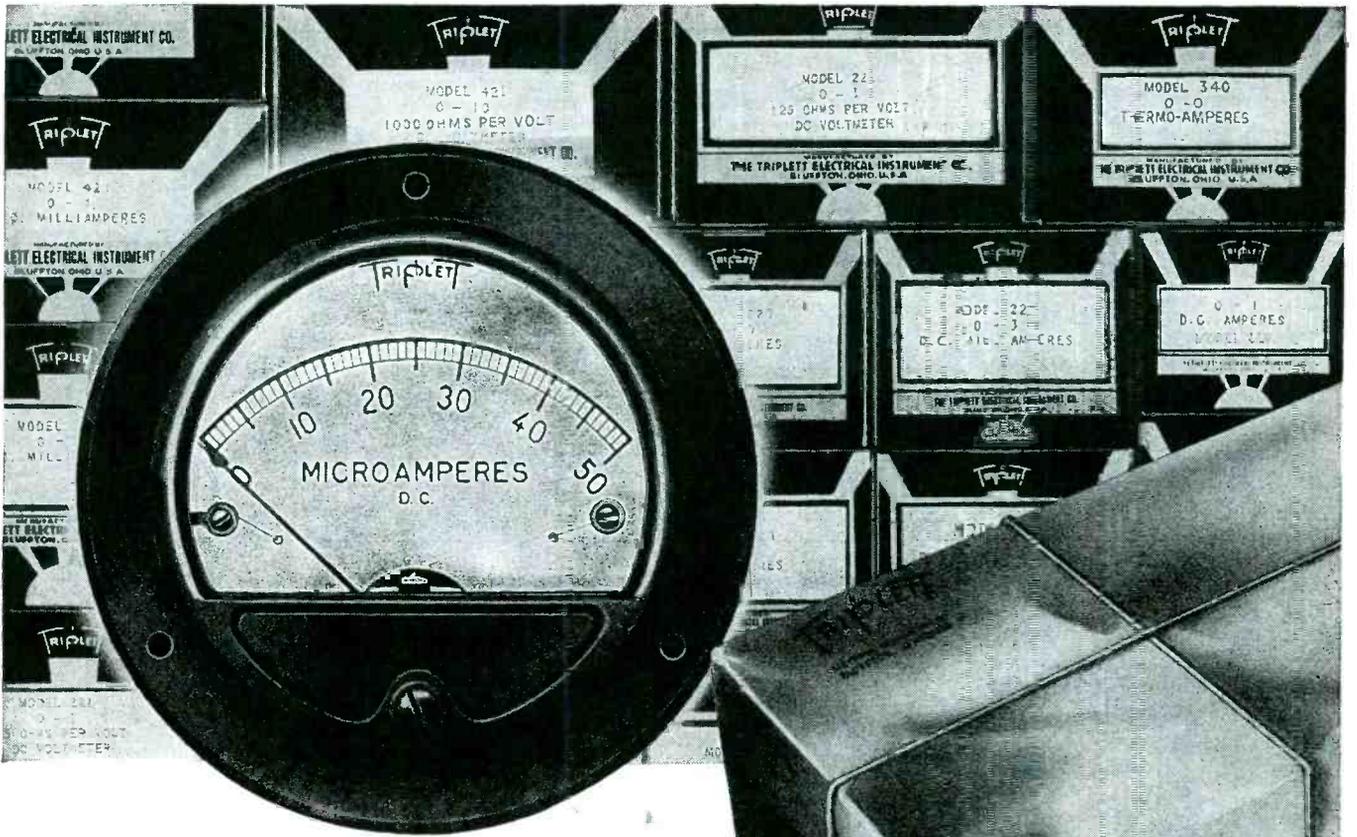
ELECTRONIC TESTING

(Continued from page 17)

radio-frequency interference to reception. Either of these *chokes* may open under heavy overload.

In the power-oscillator portion of the gauge device, any of the fixed capacitors may be subjected to dielectric puncture by reason of high r-f voltage amplitudes. In many instances, such punctures are caused by voltages due to parasitic oscillations, which, in turn, may be due to the arrangement of r-f wiring inside the oscillator cabinet in a manner other than that originally provided by the manufacturer of the device.

[To be continued]



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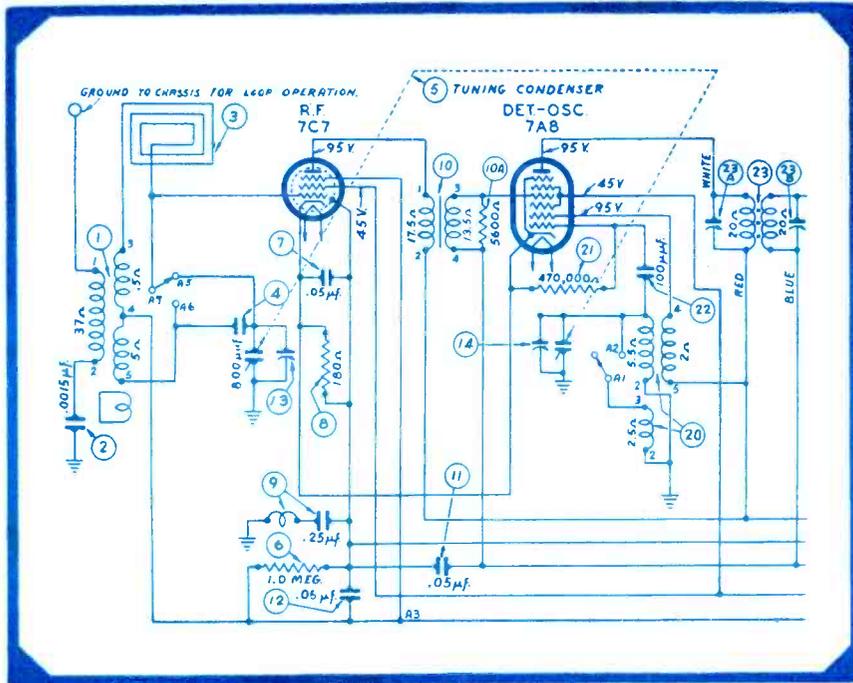
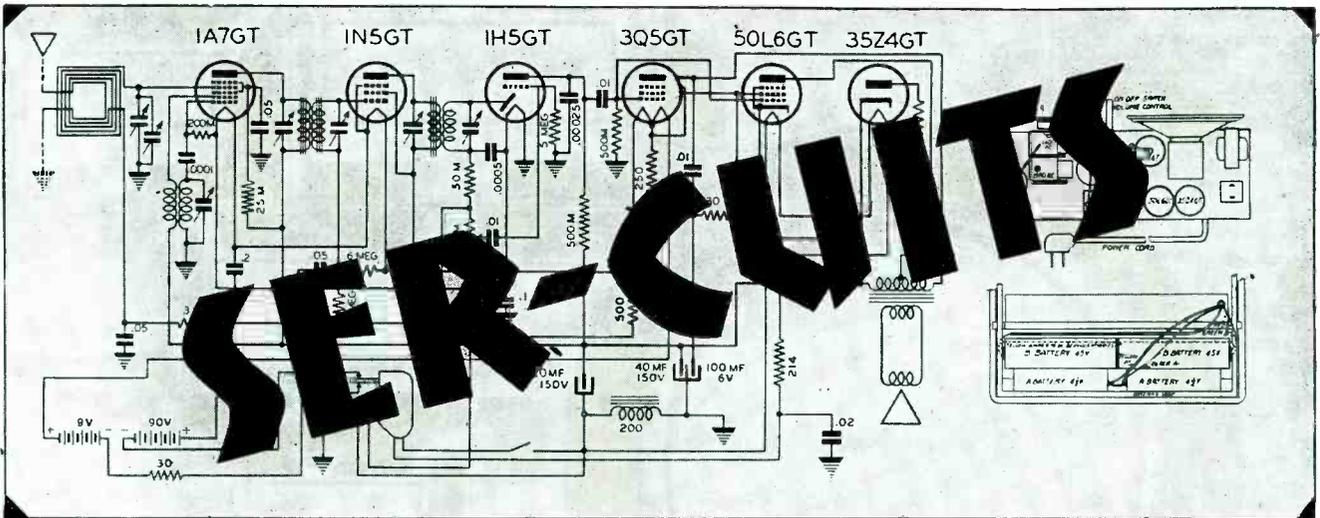
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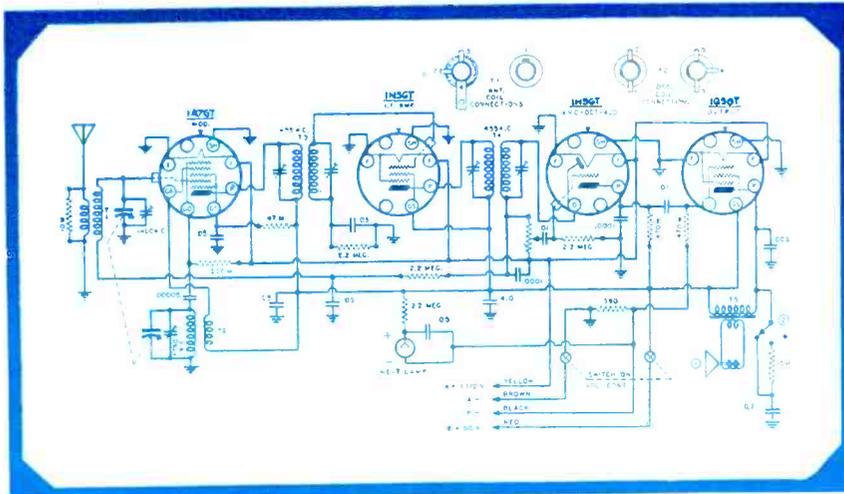
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Figs. 1 (top) and 2 (below). Fig. 1, antenna coupling system used in Philco 42-CCL. A shorted turn is used to prevent peaking at a particular point. R-f stage is coupled to detector with a fixed tuned iron core r-f transformer. Fig. 2, a four-tube battery receiver, Warwick 1-430. Resistor of 2.2 megohms in series with lamp limits battery drain to .04 ma.



by HENRY HOWARD

RECEIVERS made just prior to the war featured many unique antenna coupling systems to provide effective broadcast and s-w coverage. In Fig. 1, appears one of these receivers, a 2-band a-c series filament receiver, Philco 42-CCL, covering 1.6-3.3 mc and the broadcast band. Note the method of coupling the external antenna to the loop (secondary) circuit by an r-f transformer with split secondary. A shorted turn is used to prevent peaking at a particular point. With the wave-band switch in the upper position, the loop and r-f grid are connected to the r-f tuning condenser. In this model, the ave tap is grounded to r-i by a .05-mfd condenser shunted by a 1.0-megohm resistor. On short-waves, with the band-switch in the lower position, the lower winding is directly paralleled with the input grid and loop, all being connected in series with a .0008-mfd condenser to the tuning condenser.

The r-f stage is coupled to the detector by means of a fixed tune iron core r-f transformer. A 5600-ohm loading resistor parallels the secondary to assist in widening the pass band, 540 to 3300 kc. For reducing the wavelength of the oscillator on the short-wave band, a shunt coil is connected across the oscillator grid coil. Iron core 455 kc i-fs are used.

Warwick 1-43

A neon-tube relaxation oscillator used as an on-off indicator as well as a B battery voltage telltale has been incorporated in Warwick 1-43 battery set, Fig. 2. A 2.2-megohm resistor in series with the lamp limits the bat-

(Continued on page 31)

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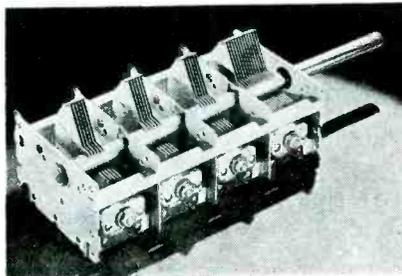
VARIABLE CONDENSERS

(Continued from page 9)

ing transmitting tubes where very high voltages are encountered. This type has a fixed disc and a parallel rotatable disc mounted on a precision screw to vary the spacing. A precision screw and tight bearing must be used if anything approaching a linear variation is to be expected; otherwise the wobble will lead to an unpredictable variation which will be hard to adjust. These disc types are useful as trimmers and tuning condensers in v-h-f work.

We have come a long way since the early days when variables used a variety of high-loss molded materials for insulation. Many of these materials were hygroscopic and caused high losses. And they warped plenty, too. In these specimens very little attention was given to bearings. Later types of condensers used a grounded frame construction with a minimum of insulation, and attempts were made to keep the insulating material outside of the strong electrostatic field to reduce losses to negligible proportions. In many types micalex and high grade ceramics replaced phenolic insulation. Attempts were made to die cast both rotor and stator, but this didn't prove successful, for warping and alignment problems arose.

The majority of the last types of condensers made for civilian receivers used stacked aluminum plates. Some models were made of brass which were usually cadmium plated and soldered. The scarcity of aluminum necessitated



Four gang variable with tie-bars staked to end plates and shields. (Courtesy Oak)

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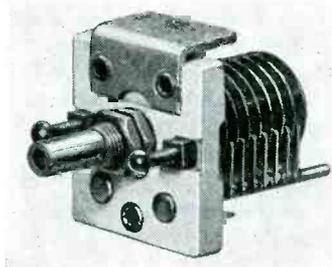
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A small variable, particularly designed for u-h-f, using low loss ceramic Alsimag 196. (Courtesy Bud)

a substitute material which was plentiful; so zinc or cadmium plated steel plates were employed. In the general trend toward smaller chassis, variable condensers have become smaller. The thickness of plates and the spacing have been reduced to about one-quarter the original dimensions.

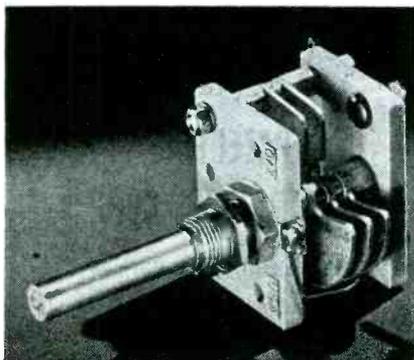
Early Gang Type Condensers

The first single-tuned receivers used three individual condensers mechanically coupled by means of straps, metal bands or gears. Each condenser could be adjusted individually. When the condensers were mounted in a composite unit with a single shaft, some rotors were made adjustable on the shaft through the use of set screws. Some units were compensated by individual rocking stators. Others had a single adjustable rotor plate. Then the book-type mica trimmers were added. The trimmers enabled the Service Man to compensate the condensers at the high frequency end in about a minute, while a split-rotor plate (or two) enabled him to do almost as good a job at the low frequency and in several minutes. Alignment of some of the old warping models took hours!

Bearings

The type and adjustment of bearings are important for maintaining proper calibration and keeping within a (Continued on page 26)

Ceramic end-plate midget variable used in h-f, v-h-f, and u-h-f circuits. Stator and rotor assemblies have separating spacers. (Courtesy Oak)



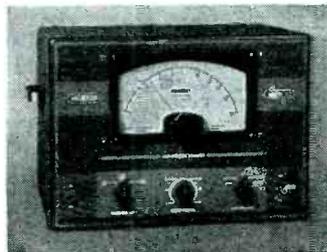
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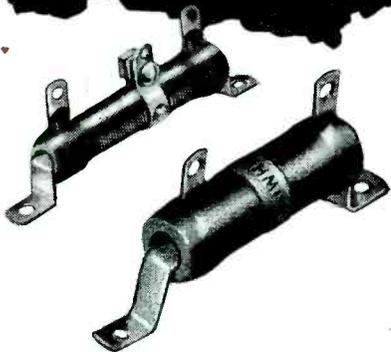
JACKSON ELECTRICAL INSTRUMENT COMPANY, DAYTON, OHIO

SERVICE, JULY, 1944 • 25



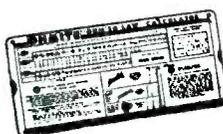
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(Continued from page 25)

certain torque to guard against slipping when planetary drives are used. A popular construction uses a full race ball bearing at the front and a single ball thrust bearing in the rear. A hardened cone bearing is sometimes substituted for the single ball. Some short-wave designs have an insulated front bearing to prevent noise from ground currents in the frame. One such type is the *National SE*, where contact noises are avoided by the use of a constant impedance pigtail instead of the usual spring wipers.

Single hole mounting condensers became popular around 1925 when they were offered to amateur set builders and s-w experimenters. These are still very popular for s-w, v-h-f, various types of equipment and general experimenting because they are small and easy to use. Some models have a single bearing; others, two. Capacities vary from 10 to 400 mmfd. Split-stator types are also available. These are used in push-pull circuits or in other circuits where the stators are at high potential and must be balanced to ground.

Plate Shapes

Variable condensers are further differentiated by the shape of the plates. Semi-circular plates are used for s-l-c (straight line capacity), condensers in which the capacitance varies as the angle of rotation. This shape gives a maximum capacity in a given space and is generally used where constant adjustment is not required, such as in i-f transformers for padding, transmitters, test equipment and for laboratory precision condensers of large capacity. Another standard plate type is the s-l-f (straight line frequency), where the scale divisions are proportional to frequency. This shape departs farthest from the semi-circular and gives a minimum capacity in a given space. Thus, it is not so well suited to general receiver work but is very valuable for signal generators and other types of oscillators, s-w and communication receivers where space permits. One type of condenser (*Cardwell*) used tapered plates to obtain the s-l-f characteristic.

Early receivers used s-l-c condensers which were the only type available. However, as the number of broadcast stations increased, they were pushed higher and higher in frequency (the only space available). Thus there were a great number of stations crowded into a few degrees on the receiver dial. Then and there a new type of condenser was born—the s-l-f type. Sets were large then and could readily accommodate s-l-f plates. But some

manufacturers thought the large step from s-l-c to s-l-f was unwarranted and so produced a compromise design, the s-l-w (straight line wavelength) or similar shape, such as *Hammerlund's Midline*. In the s-l-w condenser, the capacity is proportional to the square of the number of scale divisions (angle of rotation). This has become the most popular type of receiver condenser.

V-H-F Requirements

With the coming of f-m and other v-h-f developments special combination condensers have been made with single rotor shaft and split stators. High capacity section is for b-c band; low capacity section is for f-m, s-w, television and bandsread. Some of these special condensers have holes in the stator plates to correctly proportion the frequency coverage.

In picking a variable condenser for a particular job, it is important to know the minimum as well as the maximum capacity, for the frequency band covered will be the square root of the capacity ratio. A 9-to-1 capacity variation will permit tuning over a 3-to-1 frequency band. For accurate determination, the stray circuit capacity and the distributed capacity of

(Continued on page 28)

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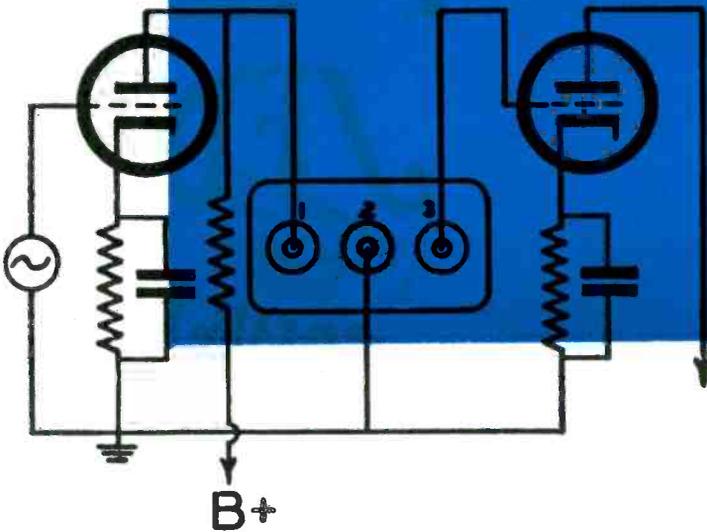
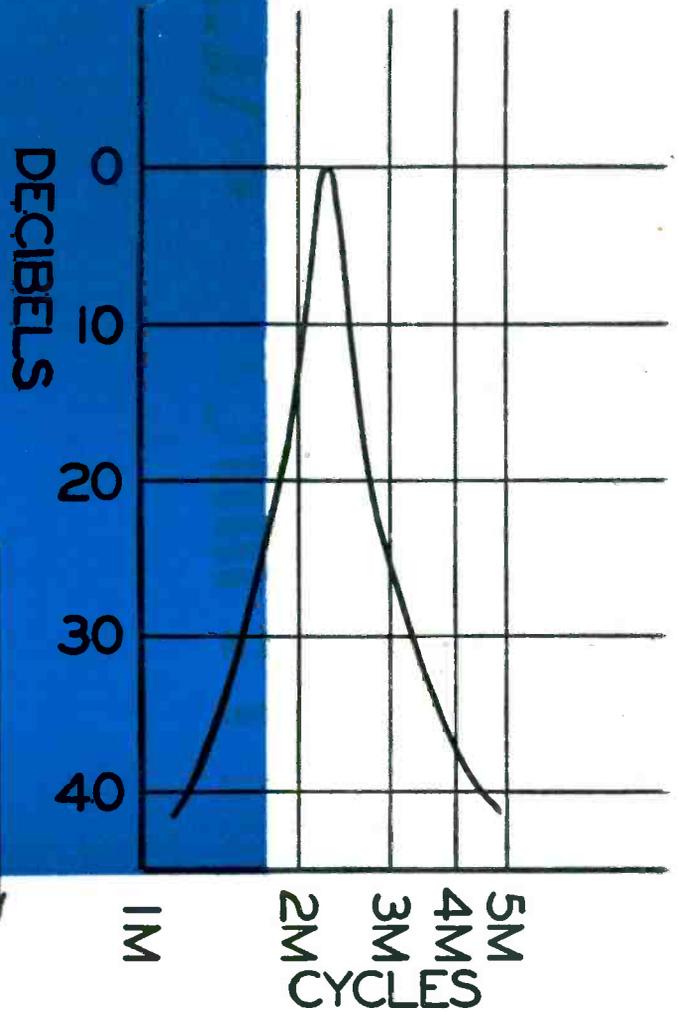
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(Continued from page 26)
the coil must be added to the capacity of the tuning condenser.

Servicing Condensers

In servicing receivers, noise or oscillation is often found to be caused by poor contact between the wipers and the rotor plates. Microphonics due to the condenser plates vibrating at an audio frequency, thus modulating the signal, have always been a source of annoyance, especially when the set is turned up to the limit. The mounting and placing of the condenser usually eliminates this effect. Where cushion-type mountings become hard, due to aging, microphonics might become troublesome. Cushioning the entire chassis may help.

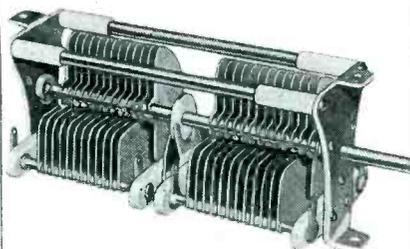
Another very irritating trouble is an intermittently shorting condenser; one which just manages to make contact at a certain critical point. In auto sets where viewing of the condenser is quite a problem, this short can sometimes be located by applying high voltage across each section and watching for the location of the spark. A spare-power transformer with a 15 or 25-watt lamp in series with the primary should be satisfactory for this work. Make sure to observe proper precautions against shock. The coil lead to the stator must be removed, of course.

From the designs employed in many of the immediate prewar period receivers it appears that the old familiar 3-gang variable will be retained for quite awhile. These sets use a t-r-f stage that improves the selectivity and signal-to-noise ratio.

Variable condensers have been having some competition in the permeability-tuned iron-core units, particularly in auto sets. And in the fields of u-h-f and v-h-f, where L's and C's don't look like coils and condensers, there will probably be little use for variables, as we now know them. But we'll still have plenty to keep us busy, so there's no cause for worry!

Dual u-h-f variable with ceramic insulation. Rotor contact is made at center of rod. Capacity ranges are from 25 to 200 mmfd per section.

(Courtesy Bud)



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BURLINGAME CONTEST FOR SERVICE BENCH IDEAS

Six-hundred dollars in War Bonds are being given away by Burlingame Associates for the best letters describing the ideal postwar radio and television service bench. The contest, which begins this month, will continue to the end of this year. The contest is open to anyone, and prizes are awarded monthly. A fifty-dollar bond is given each month for the best idea received, and a twenty-five dollar bond apiece for the second and third winning ideas.

Entrants are asked to describe the types and arrangement of radio, f-m, and television testing instruments which are necessary to make up a most efficient service bench. Further information and rules on the contest may be obtained by writing Burlingame Associates, 10 Murray Street, New York 7, N. Y.

* * *

J.F.D. ADDS NEW LINE OF TUBE ADAPTERS

With the addition recently of sixty-five new socket type radio-tube adapters, the J. F. D. Manufacturing Company, 4111 Ft. Hamilton Parkway, Brooklyn, N. Y., is now producing a total of 122 sockettes. The J. F. D. sockettes are said to be designed to meet more than ninety per cent of all Service Men's tube substitution requirements.

* * *

DR. OTT JOINS NATIONAL UNION

Dr. Ellis R. Ott has become executive engineer and assistant to the director of engineering at National Union Radio Corporation Research and Development Laboratories, Newark, New Jersey. Dr. Ott recently resigned his post as associate professor of mathematics at the University of Buffalo.

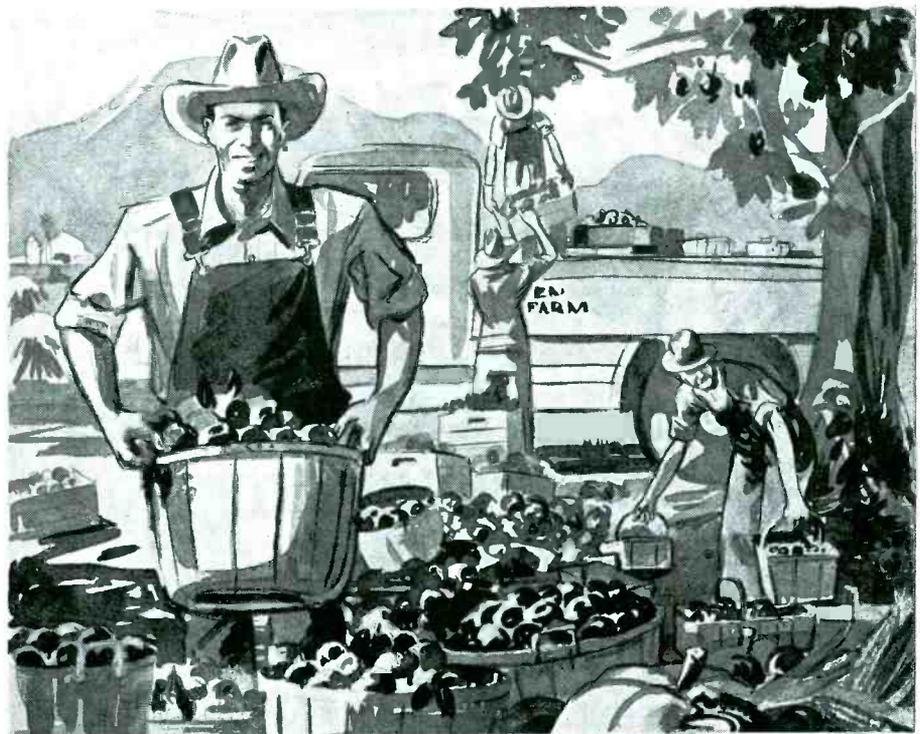


* * *

REHFELDT NOW WITH ELECTRONIC ENGINEERING

E. J. Rehfeldt has joined Electronic Engineering Company, 735 West Ohio Street, Chicago 10, as planning and production manager. Mr. Rehfeldt was formerly with Thordarson as ad and sales promotion manager. Harry Holubow, also formerly with Thordarson as design and research engineer, is chief engineer of EEC.

The company is specializing in special
(Continued on page 30)



Out of the Black Earth

NATURE has so planned it that out of black earth come beautiful flowers and the foods essential to our very sustenance. And so it is that from the darkness of the present hour . . . from the suffering and sacrifice of world war . . . will emerge a greater degree of understanding among men . . . more freedom for untold millions . . . and advanced ideas to make man's burdens lighter and life more enjoyable. Astatic, like so many other manufacturing concerns, has been broadened by the experience of war production, has employed its engineering skill and manufacturing facilities to create new products, the principles of which will be reflected in Astatic's commercial and civilian products of a new day.

★

In Active Service

The traditional quality and performance of Astatic products is reflected in Astatic's GDN Series Dynamic Microphones, now contributing to the high efficiency of radio communications in many branches of the service. Unaffected by wide variations in temperature. Includes relay operating OFF-ON Switch for remote control of transmitters and amplifiers. Designed with tilting head and interchangeable plug and socket connector. Army and Navy finishes.



ASTATIC

IN CANADA:
CANADIAN ASTATIC, LTD
TORONTO, ONTARIO

THE ASTATIC CORPORATION
YOUNGSTOWN, OHIO

(Continued from page 29)

electronic equipment, transformers, wave filters, and chokes. It also offers a consulting service for the testing and checking of proposed electronic equipment.

A branch office is at 5200 West Chicago Avenue, Chicago.

* * *

RALPH L. POWER RESUMES CONSULTANT PROJECTS

Having completed his duties as administrative inspector with the San Francisco Signal Corps inspection zone, Dr. Ralph L. Power is now resuming his radio consultant service at his office, 407 Van Nuys Building, Los Angeles. Among his clients are the Hoffman Radio Corporation of Los Angeles, and Universal Microphone Company of Inglewood, California.



* * *

SEVEN SALES OFFICES FOR NATIONAL CARBON

Four new division sales offices have been opened by National Carbon Company, Inc., and three others will be set up by October, to carry out a new sales plan for national distribution of NCC products.

J. F. Warnell has been placed in charge of the southeast division, with offices at 41 Marietta Street, Atlanta 3, Georgia.

The Dallas, Texas, office, 200 South Ervay Street, is under the direction of C. C. Joslyn.

R. P. Tolles is manager of the western division, 114 Sansome Street, San Francisco 4.

A. C. Bryan is in charge of the Kansas City, Missouri, office at 19th and Campbell Streets.

* * *

CARTER MOTOR APPOINTS MAGAZINES, INC.

Magazines, Incorporated, has been appointed by Carter Motor Company of 1608 Milwaukee Avenue, Chicago, to act as public relations counsel. Proposed campaign will be directed toward post-war applications of portable hand generators.

* * *

DAN FAIRBANKS WITH CORNELL-DUBILIER

Dan Fairbanks, formerly with Inter- (Continued on page 32)



Still your best bet for replacements

***Old Man Centralab**

"Old Man" is right... for he is a real "old timer". There is no substitute for experience, and the "Old Man" now, as in the past twenty-two years, is still your best bet.

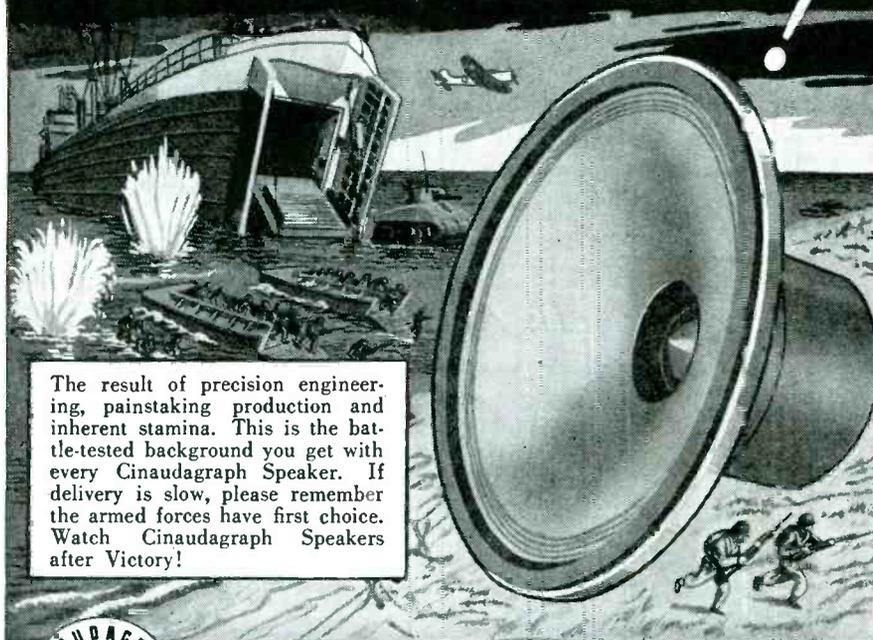
Centralab
VOLUME CONTROLS



Centralab

Division of GLOBE-UNION INC., Milwaukee

LEADERSHIP!



The result of precision engineering, painstaking production and inherent stamina. This is the battle-tested background you get with every Cinaudagraph Speaker. If delivery is slow, please remember the armed forces have first choice. Watch Cinaudagraph Speakers after Victory!



Cinaudagraph Speakers, Inc.

3911 S. Michigan Ave., Chicago
Export Div., 13 E. 40th St., New York 16, N. Y.

"No Finer Speaker Made in all the World"

CASE HISTORIES

PHILCO 59

Intermittent operation: Due to corroded antenna terminal. A wire soldered to the lug gives better results for connection of an antenna.

Noise: Loose shield on i-f transformer. The shield may be removed if proper mounting cannot be arranged, without danger of oscillation becoming troublesome. Readjust feedback control.

PHILCO AUTO 5-1826

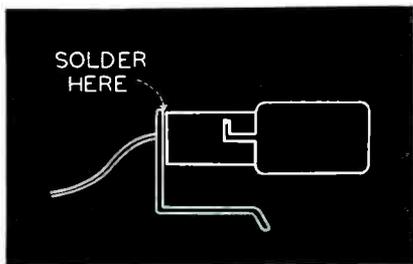
Intermittent reception: Primary in plate circuit of 7A7 i-f defective. Plate voltage goes on and off at tricky intervals. New transformer needed.

Willard Moody

MANTOLA 1942 MODEL

Loud, scratching static: Caused by a slight arcing between the two parts of the pilot-light sockets. To remedy, solder body of socket to clamp which attaches it to dial assembly.

Clifford R. Stout.



SER-CUITS

(Continued from page 22)

tery drain to .04 ma, which is certainly low. A .05-mfd condenser across the lamp charges up until the lamp ignition voltage is reached, causing the lamp to glow and discharge the condenser after which the cycle repeats. When the battery is normal the oscillator frequency is rapid to the eye, falling off as the battery ages.

Warwick 1-61

Another Warwick model, 1-61, shown in Fig. 3, at right, has i-f wavetraps in cathode circuit of 6SK7 r-f amplifier. Resistance coupling is used to the detector stage. A 1000-ohm shunt has been linked in on the oscillator coil for short-waves. Avc is supplied to only the r-f and converter stages while the i-f stage is self biased.

Electro-Voice MICROPHONES

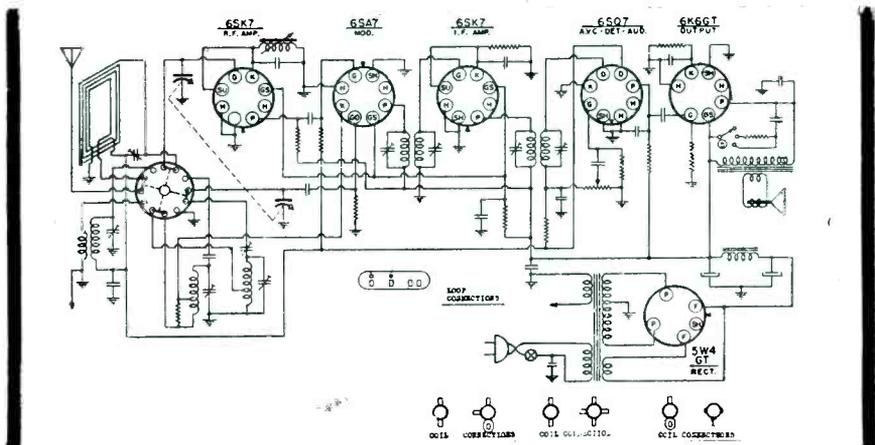
The extent of our line is but partially illustrated in this advertisement. Our current production is now being utilized in essential services. Soon, however, there will be Electro-Voice Microphones available for civilian use... and these will be described fully in subsequent advertisements.

In our South Bend laboratory, we have complete facilities for accurate frequency checking, harmonic wave analysis, measurement of ambient noise, etc. Electro-Voice Microphones reflect painstaking care in design and construction by superior performance in the field. They serve you better... for longer periods of time.

If your present limited quantity needs can be filled by any of our Standard Model Microphones, with or without minor modifications, we suggest that you contact your nearest radio parts distributor.

Paper Packs a War Punch . . . Save Every Scrap

ELECTRO-VOICE MANUFACTURING CO., INC. • 1239 SOUTH BEND AVENUE • SOUTH BEND, INDIANA
 Export Division: 13 East 40th Street, New York 16, N. Y. — U. S. A. Cable: 4RLAB



NEWS

(Continued from page 30)

national Resistance Company of Philadelphia, has been named jobbing division sales manager for Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey. He will be stationed in New Bedford, Massachusetts.



SYLVANIA NEWS LISTS OPA TUBE CEILING RULING

A detailed story on the recent OPA price ceiling for tubes and a listing of these tubes and prices are included in the May-June issue of *Sylvania News*, published by Sylvania Electric Products, Inc., Emporium, Pennsylvania. This issue also carries an article on recommended tube substitutions and replacements.

W. J. STEVENSON NOW UTAH RADIO SECRETARY

William J. Stevenson has been appointed secretary of Utah Radio Products Company, 816 Orleans Street, Chicago. Mr. Stevenson has been associated with Utah for the past seven years as general counsel.



O'LEARY NEW ENGLAND WPB RADIO & RADAR CHIEF

Frederick A. O'Leary, formerly of Raytheon Manufacturing Company and the Eastern Company of Cambridge, Massachusetts, has been named director of the radio and radar section of WPB's New England production department.

EPEI FALL CONFERENCE NEWS

The Electronic Parts and Equipment Industry Conference, that will be held at the Stevens Hotel, Chicago, Thursday, Friday and Saturday, October 19-20-21, will be sponsored by the Association of Electronic Parts and Equipment Manufacturers (formerly Western Division, Sales Managers Club); Sales Managers Club (Eastern Division); and the National Electronics Distributors Association. Charles Golenpaul is chairman of the Publicity Committee.

The three days will be packed with meetings and conferences. On October 20 are scheduled NEDA meeting, manufac-

What's New at Radiart



PROTECTED DISTRIBUTION

In these times of limited civilian production there are many orders for every available RADIART VIBRATOR. Service men want Radiarts because of their long life and dependability.

Radiart is giving its Jobbers 100% Protection. They are receiving all available RADIART VIBRATORS.

As military needs lessen, your Radiart Jobber will receive ample supplies of RADIART VIBRATORS, VIPOWERS and other products.

Patronize your Radiart Jobber for he can recommend the best RADIART VIBRATOR for each individual application.

Radiart Corporation

3571 W. 62nd. St.

CLEVELAND 2, OHIO



for EXCEPTIONAL PERFORMANCE

INSULINE has been awarded the Army-Navy "E" for exceptional performance in the production of Radio-Electronic Products.

We are resolved that this honor shall be answered with stepped-up production . . . with new records of exceptional performance worthy of the trust placed in us by the Armed Forces.

Looking Ahead! Though engaged in vital war work, Insuline is looking ahead. We are gearing our organization for the post-war requirements of the Radio-Electronics Industry.

Write for 48-page Catalogue.



INSULINE

CORPORATION OF AMERICA

INSULINE BUILDING • LONG ISLAND CITY, N.Y.

turers meeting and representatives delegates meeting.

Each registered manufacturer will have a conference booth in the exhibition Hall, to be used for conferences only. Because of limited space, there will be only one booth to each manufacturer.

Manufacturer's registration is \$50, which includes the conference booth with furnishings, identification sign, conference luncheons each day for one registrant; \$10 for each additional registrant. Distributor's registration is \$15, including conference luncheons for each of the three days for one registrant; \$10 for each additional registrant. Representatives will pay \$7.50 which includes two conference luncheons.

Because of limited facilities, prompt registration (by August 1 at latest) is urged in order that everyone who is coming can be accommodated. Hotel Stevens has the reservation blanks which can be obtained from the jobbers association. The Sales Managers Club (Eastern Division) and the Association of Electronic Parts and Equipment Manufacturers are arranging to issue their applications for room reservations at the hotel. All communications, excepting those regarding sleeping room reservations which should be addressed to the Stevens Hotel direct, should be addressed to P.O. Box 5070-A, Chicago 80, Ill.

ILLINOIS CONDENSER COMPANY EXPANDS

The Illinois Condenser Company has added another floor to its facilities at their plant at 1160 North Howe Street in Chicago, Illinois.

Jerome J. Kurland, graduate of the Armour Institute of Technology, has joined the company as chemical engineer.

WHITE STAR FOR UTAH RADIO

Utah Radio Products Company of Chicago was awarded the white star recently for the company's Army-Navy "E" flag.

CLIFF ESTEY WITH BURTON BROWNE

F. Clifford Estey has joined the staff of Burton Browne Advertising, 150 East Superior Street, Chicago. Mr. Estey was formerly assistant general manager for American Zinc Products Company, sales engineer of the radio division of the Aluminum Company of America, assistant to the president of United Reproducers Corporation, and assistant to Powell Crosley of Crosley Radio Corporation.

CONTINENTAL-DIAMOND U-H-F INSULATION FOLDER

A 4-page folder has been released by Continental-Diamond Fibre Company, Newark 51, Delaware, describing dilectene, a low loss u-h-f insulation material. The composition, fabrication, physical data, uses and advantages of the insulation are detailed. Tables outlining the properties of dilectene, its chemical stability, sheet and rod tolerances, and variation of loss properties with frequency and upon immersion in water, are also given.

JESTER OF MEISSNER RETURNS FROM WESTERN TOUR

Oden F. Jester, vice president of the Meissner Manufacturing Company, Chicago and Mt. Carmel, Illinois, returned recently from a western tour of radio dealers and distributors. Purpose of the

"THE HELP SITUATION" by Lariar



Employees really need vacations this year. High speed effort, long hours and personal war-born worries cause fatigue that can be relieved only by a complete change.

How to maintain production during the vacation period? That is the problem of all employers today.

True, temporary, substitute help is not available, but permanent authoritative help is yours for the small effort of ordering Rider Manuals and Rider Books.

These time-savers should be by the side of your employees all year 'round, directing them to better, more efficient methods of radio servicing and providing them with the reference material they need to handle the huge volume of work coming to your shop today.

Have all thirteen volumes of Rider Manual on each of your benches and circulate the other Rider Books among your employees.

The greater their knowledge, the better their tools—the bigger their production. Place that order today!

HERE'S HELP THAT KNOWS NO VACATION

RIDER MANUALS (13 VOLUMES)

Volumes XIII to VII.....\$11.00 each volume
Volumes VI to III..... 8.25 each volume
Abridged Manuals I to V (1 volume).....\$12.50
Automatic Record Changers and Recorders 6.00

OTHER RIDER BOOKS YOU NEED

The Cathode Ray Tube at Work
Accepted authority on subject..... \$3.00
Frequency Modulation
Gives principles of FM radio..... 1.50
Servicing by Signal Tracing
Basic Method of radio servicing..... 3.00
The Meter at Work
An elementary text on meters..... 1.50
The Oscillator at Work
How to use, test and repair..... 2.00
Vacuum Tube Voltmeters
Both theory and practice..... 2.00
Automatic Frequency Control Systems
—also automatic tuning systems..... 1.25
A-C Calculation Charts
Two to five times as fast as slide rule..... 7.50
Hour-A-Day-with-Rider Series—
On "Alternating Currents in Radio Receivers"—
On "Resonance & Alignment"—
On "Automatic Volume Control"—
On "D-C Voltage Distribution"..... 90c each

JOHN F. RIDER PUBLISHER, INC.

404 Fourth Avenue, New York 16, N. Y.
Export Division: Rocks-International Corporation
13 E. 40th Street, New York City Cable: ARLAB

RIDER MANUALS GIVE YOU THE HELP YOU NEED!



trip was to acquaint dealers with the new radio-phonograph which Meissner is planning to produce, and to survey conditions preparatory to setting-up the company's distributing organization.

Designer Frank C. Lee of Grand Rapids, Michigan, has been commissioned by Meissner to create a series of cabinets for the new radio-phonograph.

KARP METAL APPOINTS THREE NEW SALES REPS

Three new sales representatives were appointed recently by Karp Metal Products Company, Inc., 129 Thirteenth Street, Brooklyn 32, New York. Paul R. Sturgeon of 25 Huntington Avenue, Boston 16, Massachusetts, will handle Karp products in the New England area; The E. W. McGrade Company, Porter Build-

ing, Kansas City, Missouri, has the states of Missouri and Kansas; and Samuel K. MacDonald, Liberty Trust Building, Broad and Arch Streets, Philadelphia, has the New Jersey area from Trenton south, Pennsylvania, excepting the three northwest counties, and Delaware, Maryland, Washington, D. C., Virginia, and West Virginia.

NEW TRINITY COLLEGE PRESIDENT FORMERLY WITH SYLVANIA

G. Keith Funston, recently elected president of Trinity College, Hartford, Connecticut, and now on leave of absence as a lieutenant commander in the United States Navy, was formerly associated with Sylvania Electric Products Company, Emporium, Pennsylvania, as director of purchases.

The New
DUMONT
TYPE P6
Paper
CAPACITOR

"Durasealed"
for high tem-
perature uses
... no END
WAX to run
out.



PAT. PEND.

The NEW Dumont
"Durasealed"

● has its ends sealed in Bakelite Resinoid ... therefore they cannot drip out under any temperature ... they are highly moisture-proof.

● Suitable for operation at 95% to 100% humidity

● Write for Descriptive Literature.

BUY
MORE
BONDS

DUMONT
ELECTRIC CO.
MAKERS OF
CAPACITORS FOR EVERY REQUIREMENT
34 HUBERT STREET NEW YORK, N. Y.

NEW
PRODUCTS

RCP TUBE TESTER

A tube tester, model 314, for testing octal, loctal, bantam jr. miniature, midget and all acorn tubes, is now available from Radio City Products Company, 127 West 26th St., New York 1, N. Y. The filament voltage switch is designed to test all present filament voltages from 1.1 to 117 volts.

Has lever type switching to individually control each tube prong, check roaning filaments, dual cathode structures and multi-purpose tubes.

Oak carrying case with handle for portable or counter use, 14 1/4" x 13" x 6"; weight 12 1/4 pounds.

* * *

RCA PHOTOTUBES AND HI-MU TRIODES

A 9-stage, electrostatically focused, ultraviolet-sensitive multiplier phototube, 1P28, and a duplex-diode high-mu triode, 6AQ6, have been developed by the RCA Victor division of RCA.

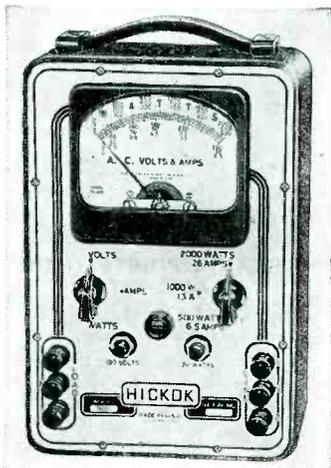
The 1P28 has the same size and general appearance as the 931-A but is constructed with a special glass bulb which transmits radiant energy in the ultraviolet region down to about 2000 angstroms.

The 6AQ6, a miniature multi-unit tube, containing two diodes and a high-mu triode in one envelope, is similar to the metal type 6Q7, but the 6AQ6 requires only half the heater current and has appreciably lower grid-cathode and plate-cathode capacitances.

* * *

HICKOK APPLIANCE TESTER

An improved electrical appliance tester, model 900, to operate at an extremely low range of 0-20 watts as well as the high range to 2000 watts, has been announced by the Hickok Electrical Instrument Company, 10521 Dupont Avenue, Cleveland 8, Ohio. It tests all electrical appliances from bell transformers and clocks to electric ironers and ranges operating on the 220-volt three-wire Edison system. This tester measures actual load values of volts, amperes, and watts. Locates trouble in a-c appliances while in actual operation. Overall dimensions are 9 1/2" high, 6 3/4" wide, 3" deep; weight 8 1/2 lbs.; meter 4" square.



NEED PARTS?

National can supply you quickly with most of those hard-to-get parts at exceptional prices. Take a look at these bargains—

STANCOR MIDGET OUTPUT TRANSFORMERS, L6 to 3-6 Ohms. Mounting strap center 1 5/8" Each, 55c; 10 for \$4.95

10 WATT PIGTAIL WIREWOUND RESISTORS—500, 1000, 1250, 1500, 1750, 2000, 2500, 3000, 4000, and 5000 ohm sizes in stock. Each, 24c; 10 for \$2.19

AERIAL KIT containing aerial wire, rubber coated lead-in, insulators, ground clamp, window strip, etc. Each, 89c

24 MFD 150WV Tubular Electrolytics. One Year Guarantee Each, 36c; 10 for \$3.35

12 MFD 450WV Tubular Electrolytics. One Year Guarantee Each, 43c; 10 for \$4.21

CLAROSTAT 1 MEG. (#6 Curve) VOLUME CONTROL WITH SWITCH. Shaft 1/4" x 1" Each, 44c; 10 for \$3.90

100 Ohm (Tapped at 30) WIRE WOUND CEMENT COATED RESISTORS 30 Watt. Each, 45c; 10 for \$3.90

8" PAPER RECORDING DISCS. Good one side only Each, 5c; 100 for \$3.99

ASSORTMENT OF 147 FIRST LINE 600WV TUBULAR BY-PASS CONDENSERS CONSISTING OF 64 .01-600 WV, 32 .02-600 WV, 24 .05-600WV, 27 .1-600WV. One Year Guarantee. List Price, \$33.30. **\$11.95**
Your cost only.....

20x20/150WV Tubular Electrolytic. First Line Condenser. One Year Guarantee. Each, 61c; 10 for \$5.60

Assortment of 100 1/4 and 1/8 Watt RMA Color Coded Carbon Resistors, including 5, 10 and 20% Tol. Your Cost Only \$1.89

BALLAST TUBES—K42B, K42C, K49B, K49C, K55B, K55C, L49B, L49C, L55B, L55C. Each, 45c; 10 for \$3.99

100-37, 100-70, 100-77 and 100-79. Each, 59c; 10 for \$5.45

Continental Bakelite Suppressors—S19A (Straight type with Rajah spring snap-on connector, fits all makes of spark plugs. Terminal nut cable connector). Each, 18c; 10 for \$1.65

GENERATOR CONDENSER—Universal type with six inch lead. .5MFD 200WV. Each, 18c; 10 for \$1.65

HI-TEMP RUBBER PUSH BACK WIRE—Solid and Stranded (#20). 100 Ft. Roll, 71c; 10 for \$6.50

HEAVY DUTY RUBBER COATED STRANDED LEAD IN WIRE—100 Ft. Roll, 54c; 10 for \$4.90

ROLA 8" AUTO SPEAKERS—6 Ohm Field. Copper Hash Buckler Plate. A beautiful job Each, \$1.15; Lots of 16, 99c Ea.

50x60/150WV Tubular Electrolytic. One Year Guarantee (Solar or CD). Each, 85c; 10 for \$7.95

LOCTAL SOCKETS—(Metal Supporting Ring) .10 for \$1.10; 100 for \$9.99

QUAM 3 1/2" P. M. Without Transformer. Originally made for Majestic. Each, \$1.39; Lots of 20, \$1.21 Ea.

10x10/450WV Tubular Electrolytic. First Line Condenser. One Year Guarantee. Each, 74c; 10 for \$6.90

Assortment of Twenty-Five Muter Candohm Wire Wound Resistors. (Fifteen or more are between 100 & 500 Ohm). Assortment, \$4.99

STANDARD F. P. CAPACITORS (Standard Round Aluminum Containers) 177 MFD/150WV \$1.15 Ea.; 10 for \$9.90 15x15x1200/150x150x1.5V. 1.25 Ea.; 10 for 10.90 20x20x20/All 25V .33 Ea.; 10 for 2.99

20% Deposit required on all C.O.D. orders. Don't forget L-265 or AA-3 Certificates. Orders of \$25.00 or more, accompanied by payment in full, will be shipped prepaid.

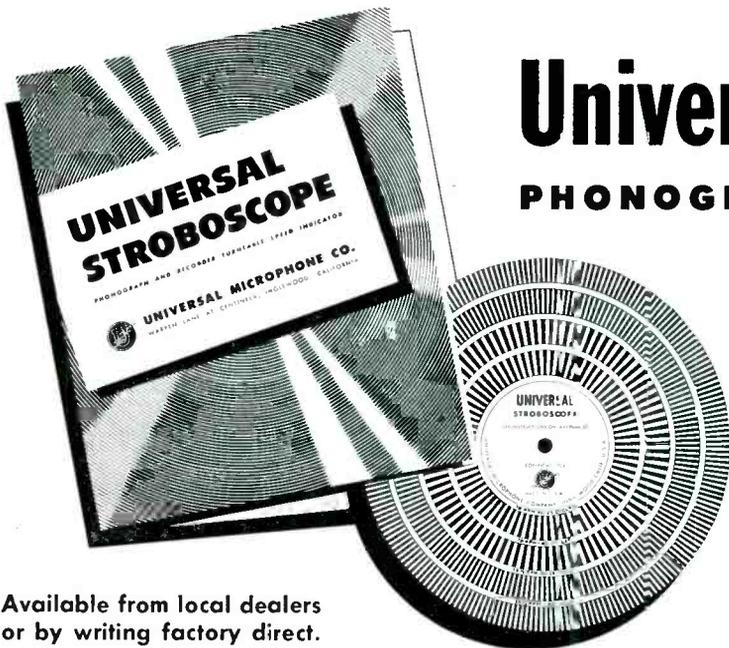
Free Bulletin No. S 1061 lists hundreds of other radio parts and supplies. Write for it today!

NATIONAL
ELECTRONIC SUPPLY

77 W. Washington Blvd. Chicago 2, Ill.

Universal Stroboscope

PHONOGRAPH AND RECORDER AID

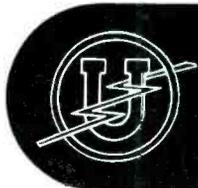


Available from local dealers or by writing factory direct.

Yours for the asking!

This handy phonograph turntable speed indicator, complete with instructive folder, is now available gratis to all phonograph and recorder owners through their local dealers and jobbers. As a recorder aid the Universal Stroboscope will assist in maintaining pre-war quality of recording and reproducing equipment in true pitch and tempo.

Universal Microphone Co., pioneer manufacturers of microphones and home recording components as well as Professional Recording Studio Equipment, takes this means of rendering a service to the owners of phonograph and recording equipment. After victory is ours—dealer shelves will again stock the many new Universal recording components you have been waiting for.



UNIVERSAL MICROPHONE CO.

INGLEWOOD, CALIFORNIA

Radio AND ELECTRONIC DEVICES



BURSTEIN-APPLEBEE CO.

1012-1014 McGee St.

Kansas City 6, Missouri

TUBES—PARTS

RADIO DEALERS—SERVICEMEN

Send for our list of available tubes and repair parts. Sylvania, Tung-Sol, National Union.

M. V. MANSFIELD CO.

937 LIBERTY AVE.

PITTSBURGH 22, PA.

WHEN YOU CHANGE YOUR ADDRESS

Be sure to notify the Subscription Department of SERVICE at 19 E. Forty-seventh St., New York 17, N. Y., giving the old as well as the new address, and do this at least four weeks in advance. The Post Office Department does not forward magazines unless you pay additional postage, and we cannot duplicate copies mailed to the old address. We ask your cooperation.

Fourth Revised Edition

WAR-TIME RADIO SERVICE

The Only Book of Its Kind—All Data Compiled from Practical Experience. Every Substitution has been tried in a Radio.

TUBE SUBSTITUTIONS

The description of each substitution is complete and there is nothing for you to figure out yourself—no reference is necessary—almost 500 substitutions for all the impossible to get tubes all set down like the example below:

TUBE	SUBSTITUTE	CIRCUIT CHANGES NECESSARY
12SA7	12B7/14A7	Change socket to octal and rewire as follows: No. 2 on octal to No. 1 on octal No. 3 on octal to No. 2 on octal No. 4 on octal to No. 3 on octal No. 5 on octal to No. 6 on octal No. 6 on octal to No. 7 on octal No. 7 on octal to No. 8 on octal No. 8 on octal to No. 4 on octal

CHANGING FARM RADIOS FOR ELECTRIC OPERATION

Diagram and text are included for changing battery radios to electric. This is a practical and profitable job if you don't have to fight too many bugs. With the information in WAR-TIME RADIO SERVICE the bugs are eliminated.

REPAIRING BURNED OUT TUBES

Many tubes can be repaired after they have burned out so that they will give additional service. Diagram and data are included for building simple inexpensive apparatus for repairing burned out tubes.

BEST METHODS FOR MAKING ADAPTORS

It is generally considered better to use an adaptor when making a substitution in order to avoid altering the original circuit of the radio. The best methods for making adaptors are described in detail.

PRICE \$3.00 POSTPAID

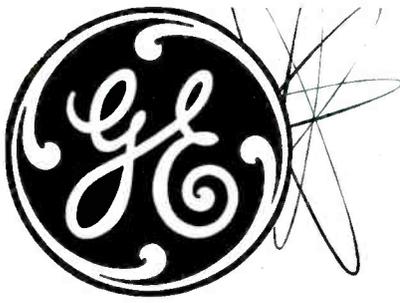
If you have an old copy the publishers imprint and \$1.00 buys the Fourth Revised Edition
SUPPLEMENT NUMBER ONE

Over 700 additional substitutions. Practical—Profitable—Tested data for changing many models of Silvertone and other 2-Volt Battery radios for electric operation. This supplement is for use in connection with the fourth revised edition of WAR-TIME RADIO SERVICE

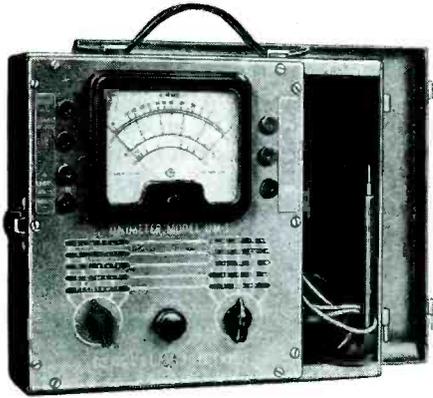
PRICE \$1.00 POSTPAID

Get both of them from your distributor or order from

CITY RADIO COMPANY
504-6 E. Washington St. Phoenix, Arizona



UNIMETER



• Completely portable all-around utility instrument, ideally suited for reliable service work. Large meter calibrated to reduce the error possibility in readings makes the G-E unimeter a popular one with servicemen.

Other General Electric units available for testing electronic circuits and component parts are: audio oscillators, oscilloscopes, condenser resistance bridges, signal generators and other utility test instruments.

For complete details about the new General Electric line of SERVICE TESTING EQUIPMENT, please fill out the coupon below. . . .

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CATALOG

**ELECTRONICS DEPARTMENT
GENERAL ELECTRIC CO.
Schenectady, N. Y.**

Please send, without obligation to me, the General Electric Testing Instrument Catalog, S-7 (loose-leaf), for my information and files.

Name _____

Company _____

Address _____

GENERAL ELECTRIC
Electronic Measuring Instruments

JOTS & FLASHES

A RMY-NAVY "E" for outstanding production performances awarded to Aerovox Corporation, New Bedford, Mass., Universal Microphone Co., Inglewood, Cal., Electronic Enterprises, Inc., Newark, N. J. . . . congratulations. . . . third white star for "E" pennants awarded to General Radio Company, Cambridge, Mass. and Federal Manufacturing & Engineering Co., Brooklyn, N. Y. . . . it's now Corporal Frank M. Thompson . . . the first step up the ladder . . . hats off to employees of John Meck Industries, Plymouth, Ind. . . . oversubscribed their Bond quota by \$15,000 . . . "no civilian radios in '44," says Ray C. Ellis, Director of Radio and Radar Division, WPB . . . S. I. Cole, president of Aerovox Corp. and Frederick R. Lack, v-p and manager Western Electric Co. radio division, elected directors of Radio Manufacturers Association . . . W. S. Hartford, sales manager of Webster Products, back at his desk after recuperation from recent operation . . . Operadio Mfg. Company adds Frank A. Bailey to sales engineering staff . . . General Electric Company appoints J. W. Bryant district representative for sales of transmitter division products in Central and Southwestern sections of country . . . Bryant's headquarters are at 840 S. Canal St., Chicago . . . O'Donnell-Dunigan Co., Inc. made Crosley distributors in Rochester, N. Y. . . . *Micro Topics*, house organ of Universal Microphone Co. is reprinting series of communications advertisements currently appearing in SERVICE . . . Alfred A. Ghirardi, Advisory Editor of SERVICE and author of technical books, recently married to Evelyn Reilly in Phoenix, Ariz. . . congratulations . . . Harry J. Deines, former advertising manager electronics department, General Electric Co., joins Arthur Kudner, Inc., New York advertising agency, in executive capacity . . . John Meck Industries appoints Harry T. Byrne as director of advertising and sales promotion . . . Byrne has been identified with radio for many years, and was recently advertising manager of Majestic Radio & Television Corp. . . the Yellow and Zone Cab Companies, Cleveland, O., contemplate installation of country's first two-way taxicab radio system soon as possible after the war, if FCC approval can be obtained . . . proposed installation being worked out with the help of General Electric's electronic department.

SAVE and CONTRIBUTE Your SCRAP PAPER for the WAR PROGRAM

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ACTUAL
SIZE



Select a "SEALDTITE"

9
CAPACITIES
ALL 600 VW

**WHEN YOU NEED
A PAPER TUBULAR CAPACITOR**

To meet the demands for a capacitor that will stand up under *all* climatic conditions, SOLAR has designed the "SealDtite." It is the only WAX MOLDED paper tubular available. Standardize on "SealDtite 600" tubular for safety and convenience!

Catalog Number	Capacity Mfd.	Dimensions, Inches		List Price
		Diameter	Length	
S-0203	.00025	3/8	1-3/16	\$.20
S-0211	.001	3/8	1-3/16	.20
S-0212	.002	3/8	1-3/16	.20
S-0215	.005	3/8	1-3/16	.20
S-0221	.01	7/16	1-3/16	.20
S-0224	.02	7/16	1-5/8	.20
S-0230	.05	9/16	1-5/8	.25
S-0240	.1	9/16	2-1/8	.30
S-0257	.25	3/4	2-3/16	.45

Solar **SOLAR** CAPACITORS



SOLAR CAPACITOR SALES Corp., 285 MADISON AVE., NEW YORK 17, N. Y.

SOLE NATIONAL DISTRIBUTORS OF SOLAR CAPACITORS TO THE JOBBING TRADE



Microscopic enlargement
approximately 10 power

Science on the Production Line

Commonly you think of the microscope as a scientific laboratory instrument. But at National Union, these days, you will find it even more extensively used, as a *production* machine, insuring microscopic precision step by step through many processes of manufacture.

With the aid of microscopes, National Union workers accurately check almost invisibly small parts. They *see* to it that welds are sound, clearances are exact and the structure is mechanically perfect. In the photograph above for example, a N. U. 6AG5 miniature tube mount, no higher than your thumb nail is enlarged approximately 10 times, to permit minute examination of important structural factors. Enlargements up to

500 times—making a hair on your head look as tall as a tree—are just as readily obtained, when needed. Moreover, this tube, assembled from 31 individual parts, must pass 40 individual inspections, in addition to thorough examination under the microscope.

The advanced scientific production techniques developed by National Union engineers are helping to raise tube performance standards and lengthen tube life. To service engineers with an eye to the future, they assure the superior post-war values that will win loyal friends and build profitable business. *Count on National Union.*

NATIONAL UNION RADIO CORPORATION, NEWARK, N. J.
Factories: Newark and Maplewood, N. J.; Lansdale and Robeson, Pa.



NATIONAL UNION

RADIO AND ELECTRONIC TUBES

Transmitting, Cathode Ray, Receiving, Special Purpose Tubes • Condensers • Volume Controls • Photo Electric Cells • Panel Lamps • Flashlight Bulbs