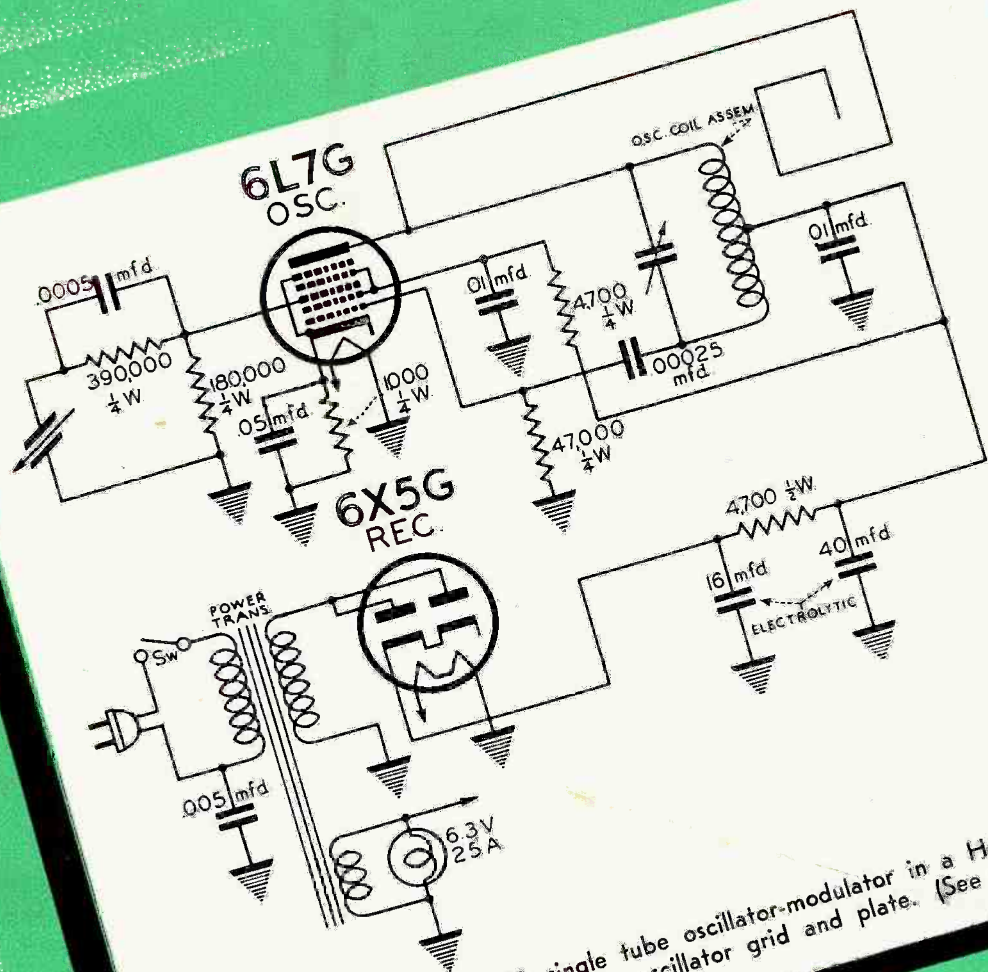
SERVICE

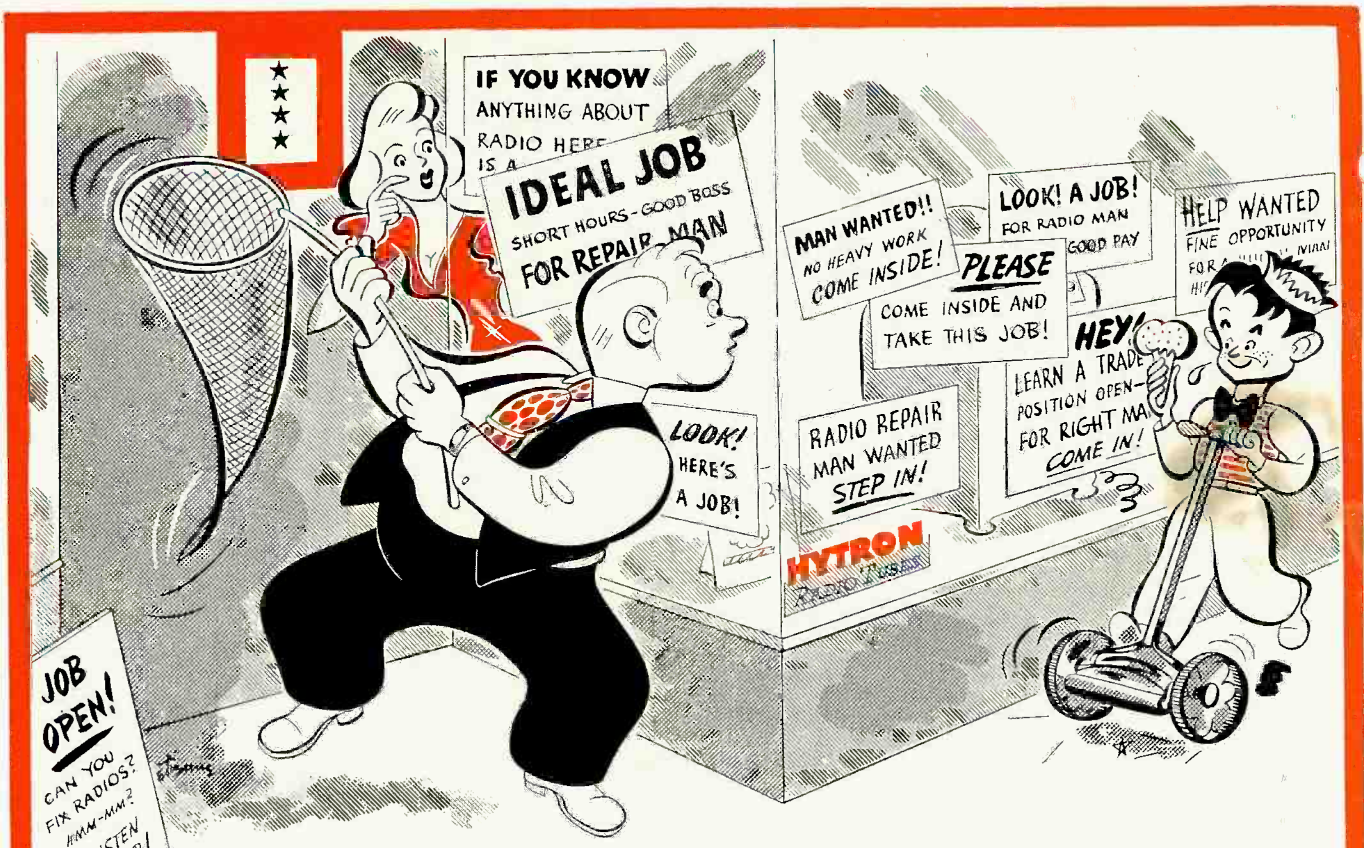
A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE



A wireless record player with single tube oscillator-modulator in a Hartley circuit with four grid elements between oscillator grid and plate. (See page 26.)

★ RADIO
★ TELEVISION
★ ELECTRONICS

September 1943



FOUR-STAR PERFORMANCE—OVER THERE

...means little help and few spare parts for dealers and jobbers over here.

The labor and replacement tube situation is tough!

Yes, even the kids are busy—mowing lawns—delivering papers—pinch-hitting for brothers and dads who are helping to win the war.

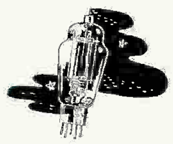
Naturally, Uncle Sam must have most of our output now; and your supply of M-R (Maintenance and Repair) tubes must of necessity be limited.

Hytron's war effort is vital. Keep in mind, however, that the more equipment our fighting forces get now, the sooner they, and Hytron, will bring back your peacetime profits and prosperity.

HYTRON HYLIGHTS

NOW IT CAN BE TOLD!

With a "radio" war demanding more and more Hytron special purpose tubes, Hytron converted 100% to War Production on June 12, 1942. It was the first receiving-tube manufacturer to do so. Rather than wait for new equipment to be procured, Hytron converted its own machines, at its own expense. Consequence: months of productive time were saved; and hundreds of thousands of War tubes reached our fighting men on time.



OLDEST EXCLUSIVE MANUFACTURER OF RADIO RECEIVING TUBES

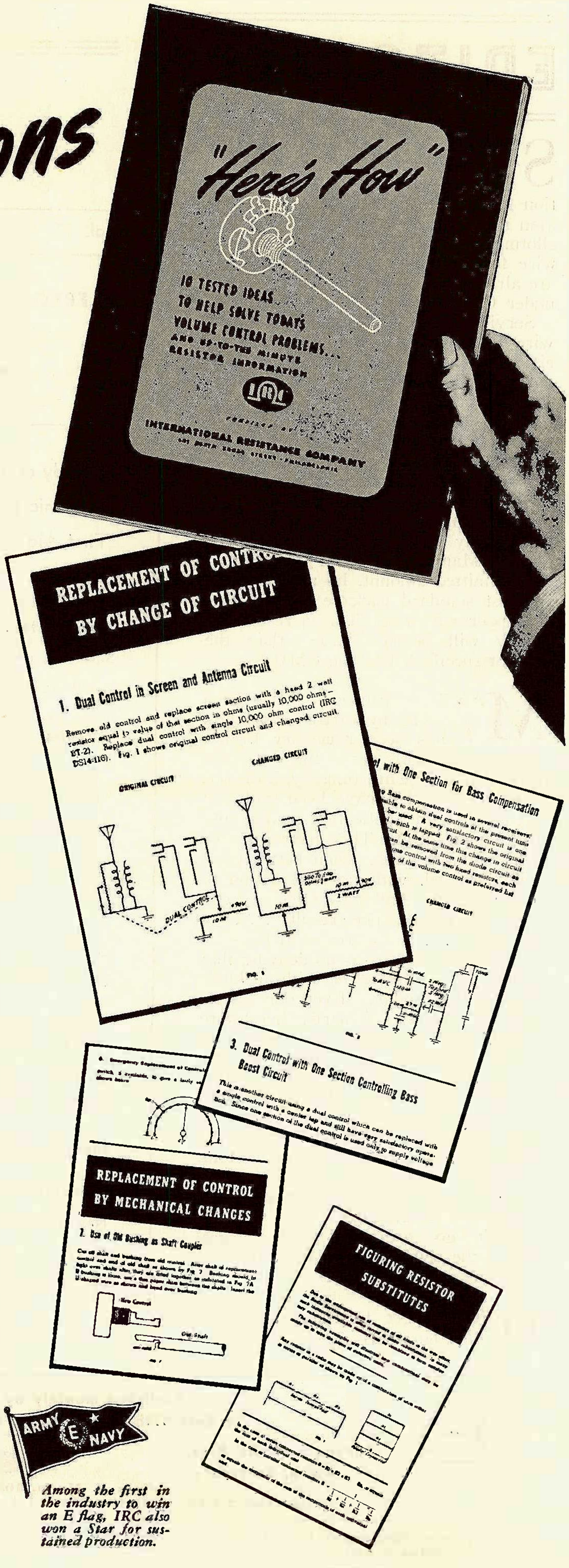
HYTRON CORPORATION ELECTRONIC AND RADIO TUBES

SALEM AND NEWBURYPORT, MASS.

IRC Answers Your Questions

ON TODAY'S

VOLUME CONTROL and RESISTOR PROBLEMS



"HERE'S HOW"—IRC's new, free booklet—just off the press, is chock-full of tested ideas and information to help Service Men keep home radio sets functioning satisfactorily. Well illustrated and written in simple, understandable language, it should prove a real time and money saver. Included in its contents are the latest facts on ½, 1 and 2 Watt Resistors, an up-to-the-minute listing of Preferred Number Ranges, an easy to read and complete Resistor Determination Chart as well as other important data.

Write for Your FREE Copy Today

Drop a card or a note today to secure your free copy. Requests will be filled in order of their receipt and, as the supply is limited, we suggest prompt action. Simply address—

PREFERRED FOR PERFORMANCE • FIXED & VARIABLE RESISTORS •

INTERNATIONAL RESISTANCE COMPANY

Dept. S • 401 N. BROAD STREET
PHILADELPHIA 8, PA.

ARMY ★ E ★ NAVY

Among the first in the industry to win an E flag, IRC also won a Star for sustained production.

EDITORIAL

SERVICE Men are again permitted to buy copper wire, thanks to a new WPB ruling, CMP Regulation 9. Under this new ruling Service Men may use a certificate, under CMP allotment symbol V-3, to obtain copper wire for resale or repairs unless they are already operating with an allotment under CMP-4B.

Service Men can now order $100 of wire in any calendar quarter or one-eighth of the amount they sold or used during 1941. Selling is permitted without restriction, except in the case of an AAA priority request.

The restriction covering inventory equipment, included in the original copper order M-9-C has been retained here, too. Inventories are restricted to a fifteen-day supply. However, if the supply of any kind of copper which the Service Man has on hand is less than the permitted amount, he may buy the smallest standard package of that kind of copper wire even if as a result, his supply will become larger than the amount specified. Use the CMP Reg. 9.

MANY substitutions have been prompted by wartime shortages. It has been necessary to use alternates of both parts and materials in repair work. Unfortunately, however, some Service Men have been guilty of bad faith in the application of this substitution program. They have installed inefficient alternates, when better parts could be used, with no explanation to the customer. And they have charged excessive rates. The results . . . we all know . . . caustic criticisms of Service Men. There is no denying that Service Men are meeting with all kinds of difficulties today. Everyone knows that the variety of parts, heretofore available, are not around any more. But this condition does not condone the unfair practice of some Service Men. Service Men should play ball with the public. If it is necessary to install an alternate part that is not a duplicate of the original, the customer should be told. And every effort should be made to adjust the receiver so that maximum efficiency will be available.

Don't go overboard on charges. Watch the ceiling price. Be wise, and cooperate with the public.

DON'T forget to back the attack and buy more war bonds.

SERVICE

A Monthly Digest of Radio and Allied Maintenance

Reg. U.S. Patent Office

Vol. 12. No. 9 — September, 1943

ALFRED A. GHIRARDI
Advisory Editor

LEWIS WINNER
Consulting Editor

F. WALEN
Managing Editor

BARRY KASSIN
Assistant Editor

Page

Member Audit Bureau of Circulations

Published monthly by Bryan Davis Publishing Co., Inc.
19 East 47th Street, New York, 17, N. Y. Telephone PLaza 3-0483

Bryan S. Davis, Pres.
F. Walen, Secretary

Paul S. Weil, General Manager
A. Goebel, Circulation Manager

James C. Munn, 10515 Wilbur Avenue, Cleveland
Pacific Coast Representative: Brand & Brand, 4310 Los Feliz Blvd., Los Angeles 27, Calif.

Entered as second-class matter June 14, 1932, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Subscription price: $2.00 per year in the United States of America and Canada; 25 cents per copy. $3.00 per year in foreign countries; 35 cents per copy.


12,000 REASONS
FOR RAYTHEON'S REPUTATION!
RAYTHEON tubes are selected as original equipment by America's leading radio manufacturers. Cost is a factor . . . but consistent performance, RAYTHEON performance, outweighs any cost factor. The 12,000 highly skilled RAYTHEON employees are 12,000 reasons why the RAYTHEON tubes you select will give consistent performance . . . they are a quality product and RAYTHEON quality never varies.
RAYTHEON PRODUCTION CORPORATION
Newton, Massachusetts
Los Angeles . . . New York . . . Chicago . . . Atlanta
ARMY
NAVY
RAYTHEON
TUBES
RADIO & TRANSMITTING
DEVOTED TO RESEARCH AND THE MANUFACTURE OF TUBES FOR THE NEW ERA OF ELECTRONICS

AS YOU NEVER DROVE BEFORE!

Many a soldier owes his life to a commander who drove him to the utmost in battle—*never let him slacken for a single fatal instant!* And after the war, many a worker will owe his economic safety to a leader who drove him continuously for higher Pay-Roll allotments for the purchase of War Bonds!

Despite higher taxes and prices, the average worker still has more money than ever before—particularly on the basis of the *family* income. With others in the family earning, too, just let the worker 'figure it out for himself', and he usually will realize that *now* he can put more into War Bonds than he has been doing.

That's why the Treasury Department has set new quotas for the current Pay-Roll Allotment Drive—*quotas running about 50% above former figures.* These quotas are designed to reach the *new* money that's coming into the family income. Coming from millions of new workers . . . from women who never worked before . . . from millions who never before earned anything like what they are getting today!

The current War Bond effort is built around the *family* unit, and the Treasury Department now urges you to organize your War Bond *thinking*—and your War Bond *selling*—on the basis of your employees' *family* incomes. For details, get in touch with your local War Finance Committee which will supply you with all necessary material for the proper presentation of the new plan to your workers through your labor-management committees.

Today about 30,000,000 wage earners, in 175,000 plants, are buying War Bonds at the rate of nearly half a billion dollars a month. Great as this sum is, *it is not enough!* So turn-to today! Get this new *family income plan working!*

This Space is a Contribution to America's All-Out War Effort By

SERVICE

Voice communications on every front...

Whether by radio or land wire telephone, a voice command gets the job done with clarity and speed.

Available from stock, 1700U series microphone. Single button carbon type, push-to-talk switch, etc. For trainers, intercommunication and general transmitter service.

UNIVERSAL microphones are playing a vital part in voice communications of all the Armed Forces . . . being the first instrument through which a command is given. Care must be taken that the electronic patterns of the voice are held true for the many electrical circuits through which they must later pass. UNIVERSAL microphones with their precise workmanship are carrying the message through in all forms of voice communication whether from a tank, ship or aeroplane. UNIVERSAL products meet all U. S. Army Signal Corps Laboratory tests. Standardization of parts, inspection, and workmanship of high order combined with the best of material, make UNIVERSAL'S microphones and accessories outstanding in every application.

U. S. Army Signal Corps and U. S. Navy plugs and jacks are offered as voice communication components to manufacturers of transmitters and sound equipment for the Armed Forces. Catalog No. 830 contains complete details.

UNIVERSAL MICROPHONE CO. LTD.

INGLEWOOD, CALIFORNIA

FOREIGN DIVISION, 301 CLAY ST., SAN FRANCISCO 11, CALIF. • CANADIAN DIVISION, 560 KING ST. W., TORONTO 2, ONTARIO

How an RCA Electron Tube 

Can Help Dress a Woman

REMEMBER how radio once mystified people? "What? Hear music from 1000 miles away through a bunch of *tubes* in a wooden box?" Well, you know the rest of that story. You helped write it!

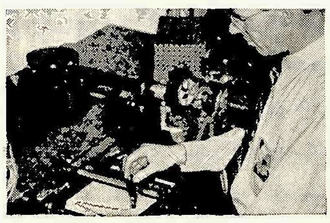
Now it's Electronics—*your* biggest opportunity for tomorrow.

Today, thanks to an RCA electron tube, a device might even be built to stop a cloth-printing press the instant the uniformity of the printed color changed in the slightest. It's been estimated that such a modern "electric eye" can analyze and sort out 2,000,000 separate color variations. Think what that can mean to the woman who insists on perfect color matching—and to the textile industry that has to supply her.

You, Mr. Distributor, may well find yourself one day selling electronic equipment for this and a thousand other uses. And you, Mr. Serviceman, installing and maintaining it.

Just bear in mind two things: First—that its operation will largely depend on circuits, tubes, and parts already familiar to you from your radio days. Second—that *the Magic Brain of All Electronic Equipment Is a Tube and the Fountain-Head of Modern Tube Development Is RCA! RCA Victor Division, Radio Corporation of America, Camden, N. J.*

TUNE IN "WHAT'S NEW?"—*RCA's great new show, Saturday nights, 7 to 8, E.W.T., Blue Network*



This electronic automatic recording spectro-photometer is used at RCA for testing luminescent materials for cathode-ray tubes. In 2 minutes it does accurately what a trained man formerly did, but not as well, in 2 weeks.

ASK ABOUT...
RCA INDUSTRIAL MUSIC SERVICE

RCA

RCA ELECTRON TUBES

SERVICE
A Monthly Digest of Radio and Allied Maintenance

ELECTRONIC TIMER TROUBLES

By S. J. Murcek

ONE of the most useful forms of electronic devices is the electronic timer. In its industrial form, it enjoys even greater popularity than the photocontrol, since applications for precision equipment and process timing are quite numerous.

Mechanical timing devices, especially where the timing period is of the order of a few seconds, are usually complicated and cumbersome. Alteration of the timing period is, in such devices, likely to be difficult and tedious. In contrast, the electronic timer is often found to be quite simple in construction and operation, and the timing period may be readily and quickly adjusted over a wide range of timing periods.

Fundamentally, the electronic timer is a resistance-capacitance timed relay, which may operate either on the charge or the discharge of the condenser. Fig. 1 illustrates this point. If terminals *1* and *2* are connected to a source of d-c voltage, the capacitor *C* will draw a charging current. The current will cease when the voltage across the capacitor equals that impressed across the terminals.

However, at the start of the charging operations, capacitor *C* possesses no charge. The charging current at this time is limited by the value of the resistance *R*. As the capacitor accumulates a charge, the voltage across its terminals rises, the current through *R* falling off as this voltage approaches the value existing across terminals *1* and *2*.

This relationship is given by the exponential expression

$$e = E\,(1 - \varepsilon^{-t/CR}) \qquad (1)$$

where *e* is the voltage across capacitor *C* in Fig. 1. The capacitance *C* is in microfarads, and resistance *R* in megohms. *E* is the voltage impressed across terminals *1* and *2*. Timing *t* is given in seconds, and ε is the base of the natural system of logarithms.

It follows, then, that an interval of time must elapse before capacitor *C* of Fig. 1 accumulates its maximum charge and that the time interval is proportional to both *C*, the capacity, and *R*, the series timing resistance.

A rapid practical approximation of expression *1* is often found useful. If, in this expression,

$$t = RC, \quad e = E(1 - \varepsilon^{-1}) = 0.63E. \qquad (2)$$

Evidently, the voltage across the capacitor, rises to 63 percent of the impressed circuit voltage in a time interval which is equivalent to the circuit resistance-capacitance product. This approximation is, coincidentally,

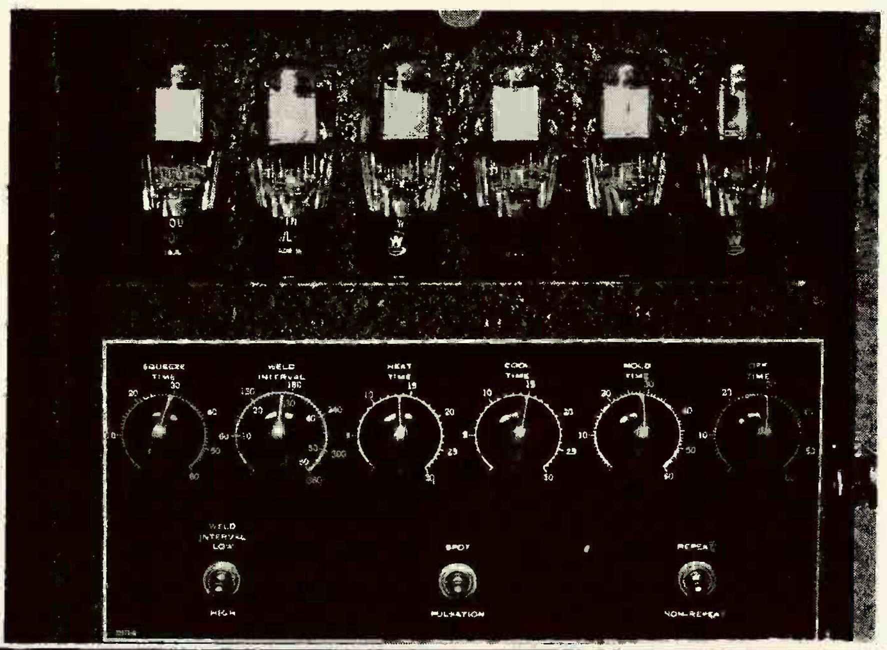
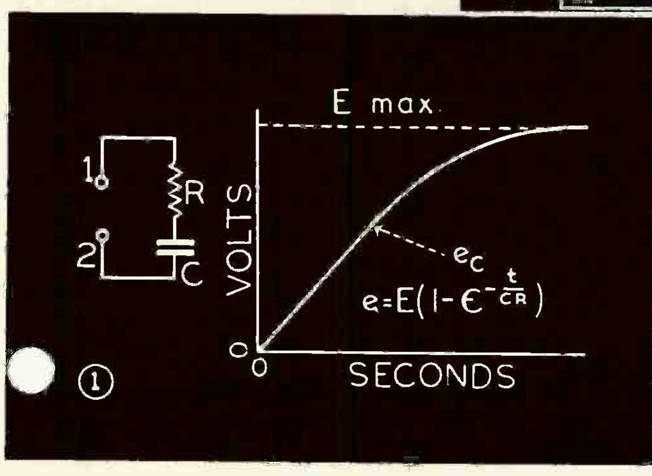
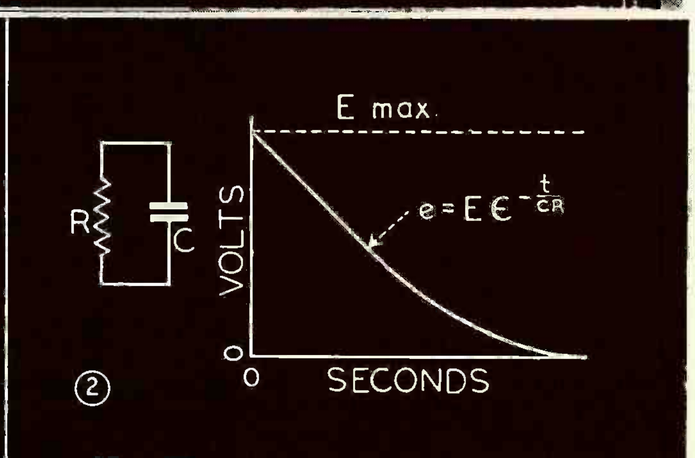


Fig. 3. A commercial sequence timer. (*Courtesy, Westinghouse*)





Figs. 1 (left) and 2 (right).
Fig. 1. Characteristics of resistance-capacitative relay. . . . Fig. 2. Discharge timing circuit.

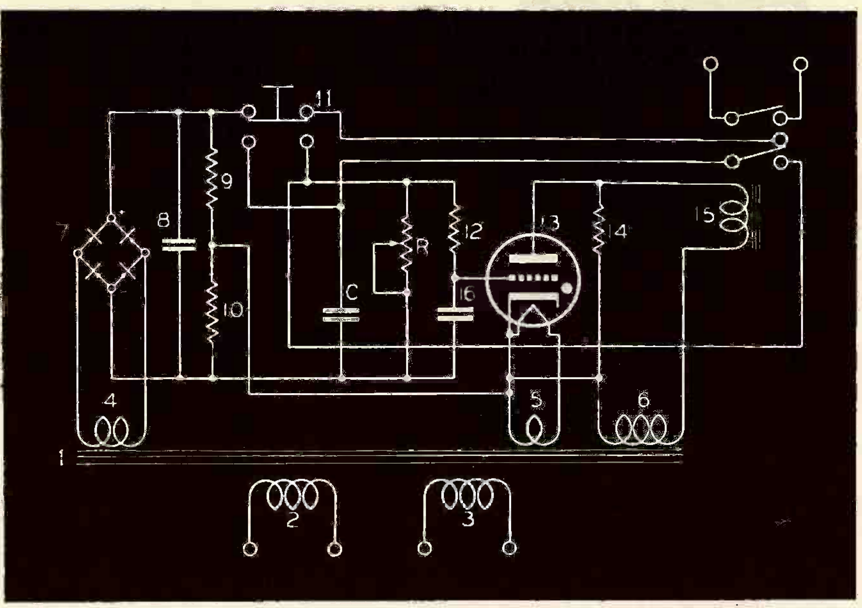


Fig. 4. Fundamental timing circuit using thyratron tube.

near the upper limit of the essentially linear portion of the curve given by equation *1*. As a result, the time interval ascertained by equation *2* is often quite near the design value for such a timing circuit.

A discharge timing circuit is given in the diagram of Fig. 2. Here, capacitor *C* is initially charged to a maximum value, *E*, discharging slowly through the timing resistance *R*. In such an instance, the relations of the timing factors are given by

$$e = E\varepsilon^{-t/CR}, \qquad (3)$$

Here, *E* is the maximum value to which capacitor *C* is initally charged, and *e* the voltage after a given discharging interval, *t*. Inasmuch as the time interval, here, is inversely proportional to both *R* and *C*, the former in megohms and capacitance *C* in microfarads, it is obvious that variation of either *R* or *C* will result in a change in the time, *t*.

A practical approximation for (3) is again

$$t = RC. \qquad (2)$$

Substituting this relation in equation *3* gives

$$e = E\varepsilon^{-t/RC} = 0.37E,$$

which indicates that *C* discharges to a potential 63% *less* than the initial value, *E*. Thus, in the time *t*, as ascertained from *2*, the voltage across the capacitor of Fig. 2 discharges to a value well below the lower linear limit of the discharge curve given by *3*.

From the preceding discussion, it is evident that the approximation *2* will suffice, in most instances, as a means for determining the design limits of an electronic timer.

The peculiar adaptability of the electronic device is remarkably well illustrated by the modern electronic timer. It is obvious, from the foregoing analysis of basic timing circuits, that it would be extremely difficult, if not impossible, to couple an electromagnetic relay with such a timing circuit. However, since the control grid of either a vacuum tube or a thyratron will draw very little current, even when positive with respect to the anode, it follows that the operation of the relay by the controlled-tube plate or anode current is an eminently successful combination.

A fundamental timing circuit of this type, using a thyratron control tube, is shown in Fig. 4. Here, the basic timing circuit contains the capacitor *C*, and the resistor *R*. The latter is a rheostat, making possible the variation of the timing interval merely through adjustment of the rheostat knob.

Heater and anode power for operation of the thyratron are obtained from windings *5* and *6*, respectively, of the power transformer *1*. Resistor limits the maximum current which the grid of the thyratron may draw from the timing capacitor. The rectox rectifier *7* rectifies the a-c power available from winding *4*. The output of this rectifier is partially filtered by capacitor *8*, and the resultant d-c voltage is connected across the voltage divider consisting of resistors *9* and *10*. The latter are so selected that the voltage across resistor *10* is approximately thirty-five per cent of the total voltage across the voltage divider.

It is well to observe here that the function of the small capacitor *16*, in Fig. 4, serves to *increase* the capacity between the cathode and grid of the thyratron *13*. Under this condition, the capacity between the grid and anode of this tube is comparatively negligible, thus effectively reducing the grid a-c component of the tube anode voltage to zero. The high resistance *14*, is also important since it impresses a small a-c demagnetizing voltage across the coil of the relay *15*, thus obviating the effects of core residual magnetism.

Prior to a timing cycle, the timing capacitor *C*, of Fig. 4, is charged the full voltage available across the voltage divider, through the *break* contacts of the push-button or foot switch *11*. Thyratron *13* does not conduct, since its cathode is connected to the voltage divider tap, and the voltage across the resistance of *R* is zero,

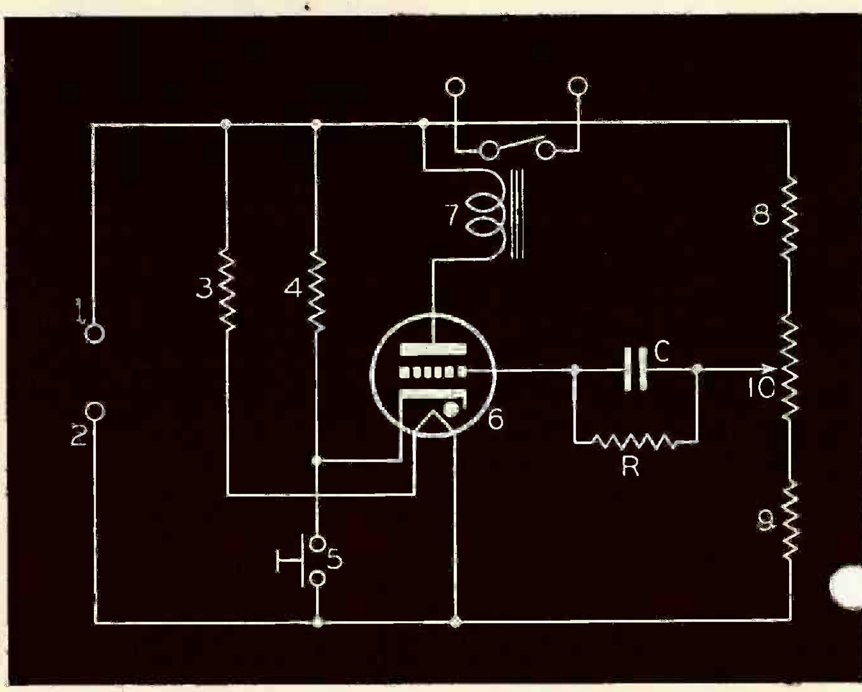


Fig. 5. Unique electronic timer using thyratron tube.

holding the grid negative with respect to the cathode.

Depressing push-button *11* places the timer into operation. Capacitor *C* then begins to discharge through the rheostat *R*. Since this capacitor initially was charged to the full d-c level available, the grid of the thyratron is temporarily positive with respect to the cathode, and the tube *fires*. As a result, the coil of relay *15* is energized from the winding *6* through the thyratron. One pair of relay *15* "make" contacts now short-circuit the "make" contacts of the push button. Release of the push button at this time does not stop the timing operation, since the capacitor *C* is still connected to the rheostat *R*.

Eventually, depending on the setting of rheostat *R*, the timing capacitor discharges to a level which is a few volts less than that existing across resistor *10*. When we have this condition, the grid of the thyratron is negative with respect to the cathode, and the tube ceases to conduct. Relay *15* is then de-energized, reconnecting the timing capacitor to the positive terminal of the d-c voltage divider. The timing cycle is then complete, and the device is ready for the succeeding operation.

A commercial electronic timing device of this type is illustrated in Fig. 3. The usual practice, with reliable electronic equipment manufacturers, is to include with the device a photoreduction of the circuit diagram, as shown in Fig. 6. Thus, the service and maintenance necessary for proper operation of the equipment is readily possible.

Another commercial timer utilizes a circuit similar to that of Fig. 4, except that the thyratron tube is replaced with a vacuum pentode. Due to the sharp increment of the pentode plate current with reduction in the negative grid biasing voltage in such a timer circuit, it becomes possible to manipulate the end relay with the variation in the potential across the timing capacitor.

A unique electronic timer is diagrammed in Fig. 5. The circuit is at its best when employed with a thyratron tube.

In the latent, or pre-operational period, the timing capacitor *C* of Fig. 5, has impressed across it the half-wave rectified peak a-c voltage applied to the a-c power supply terminals *1* and *2*. In series with the condenser charging current is the limiting resistor *4*, the grid and cathode of the thyratron *6*, and the resistances of the potentiometer *10* and the voltage divider resistor *9*. Since the grid of the tube, at this time, acts as the plate of a diode rectifier, the grid end of

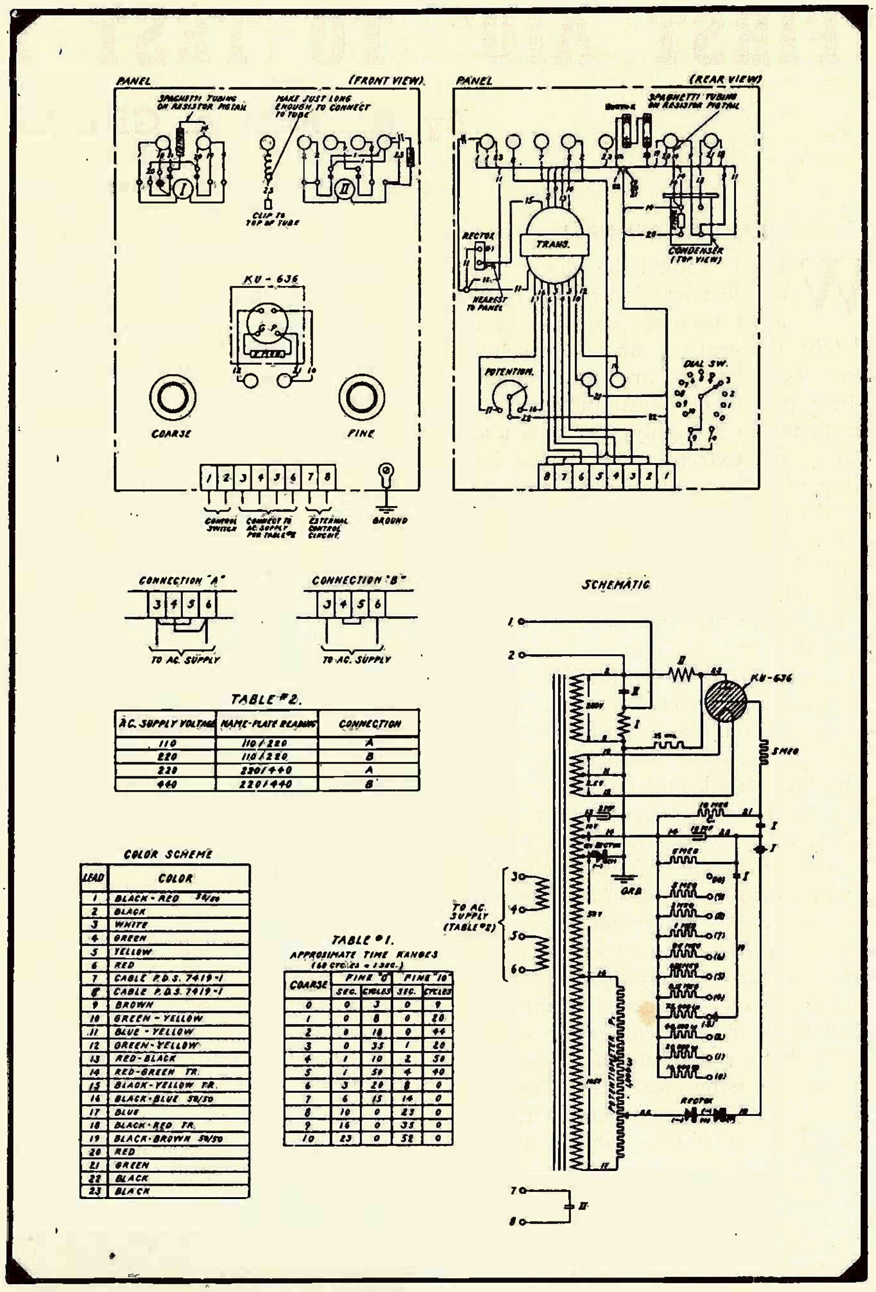


TABLE #2.

A.C. SUPPLY VOLTAGE	NAME-PLATE READING	CONNECTION
110	110/220	A
220	110/220	B
220	220/440	A
440	220/440	B

COLOR SCHEME

LEAD	COLOR
1	BLACK-RED 50/50
2	BLACK
3	WHITE
4	GREEN
5	YELLOW
6	RED
7	CABLE P.D.S. 7419-1
8	CABLE P.D.S. 7419-1
9	BROWN
10	GREEN-YELLOW
11	BLUE-YELLOW
12	GREEN-YELLOW
13	RED-BLACK
14	RED-GREEN TR.
15	BLACK-YELLOW TR.
16	BLACK-BLUE 50/50
17	BLUE
18	BLACK-RED TR.
19	BLACK-BROWN 50/50
20	RED
21	GREEN
22	BLACK
23	BLACK

TABLE #1.
APPROXIMATE TIME RANGES
(60 CYCLES = 1 SEC.)

COARSE	FINE "0"		FINE "10"	
	SEC.	CYCLES	SEC.	CYCLES
0	0	3	0	9
1	0	8	0	20
2	0	18	0	44
3	0	35	1	20
4	1	10	2	50
5	1	50	4	40
6	3	20	8	0
7	6	15	14	0
8	10	0	23	0
9	16	0	35	0
10	23	0	52	0

Fig. 6. Diagrams of a typical timing unit with circuit characteristics.

the timing capacitor *C* is negative, and the terminal connected to the potentiometer slider arm, positive. It should be observed that the actual peak voltage charging the timing capacitor is dependent, to a small extent, on the setting of the potentiometer slider arm.

Closure of the push-button contacts *5* connects the cathode of the thyratron to the lead from a-c terminal *2*, starting the timing cycle. It has been previously stated that the capacitor terminal of the now charged capacitor connected to the tube grid is negative. Therefore, the tube does not immediately conduct.

The timing capacitor slowly dissipates its charge in the timing resistor *R* during the timing cycle. Eventually, however, the voltage across the capacitor falls off to a value something less than the a-c voltage appearing between the potentiometer arm and the lower terminal of resistor *9*. As a result, with the first positive a-c half-cycle, where its voltage exceeds the voltage across the capacitor, the grid of the thyratron swings positive with respect to the cathode, and the tube fires. Here, the relay *7* is energized, its armature closing the relay "make" contacts, thus completing the timing cycle.

When the push button contacts are reopened, the timing capacitor recharges, preparing the timer for the next timing cycle.

Since the circuit of Fig. 5 is relatively simple, requiring few com-

(*Continued on page 24*)

"FIRST AID" TO TEST INSTRUMENTS

By ALFRED A. GHIRARDI
Advisory Editor

PART II (REPAIRS)

WHAT should be done when an electrical indicating instrument becomes damaged, completely inoperative, or so inaccurate that its readings are not reliable? The repair of electrical indicating instruments is a highly specialized art, calling for extreme skill in the handling of delicate mechanical and electrical parts, and often requiring special tools. In many respects, it is a task very similar to that of the watch repairman.

Relatively few radio-electronic Service Men have the delicate touch, ability and experience or facilities necessary for making *major* repairs or adjustments on these instruments and subsequently recalibrating them. Those who have tried, and failed, will agree that *when an electrical indicating instrument needs repair, unless it is an extremely simple job, normally it is by all means best to send it to the manufacturer, an authorized instrument service station, or a reputable specialist for repairs.* They *know* what must be done, have the special training and skill to do it, and can make a quick, satisfactory repair in almost every instance. Furthermore, they have the special tools, replacement parts and skilled personnel necessary for the job, and are equipped with the proper precision primary standards against which to check the repaired instrument and recalibrate it if necessary. They stand ready to guarantee results. Furthermore, if the magnets need remagnetizing, they have the necessary equipment with which to magnetize and age them properly so the calibration of the instrument will be maintained.

Emergency Repair of Indicating Instruments

In spite of what has just been said, in emergencies where the repair job does not require replacing major parts and where it would be a hardship to get along without a badly needed instrument during the time required to send it away for repairs, the Service Man who is capable of careful and precise work may find it practical to undertake the emergency repair of the instrument himself. This course of action is more frequently justifiable now that the defense program has made long delays likely in having instruments serviced outside. But remember, the repair information that follows here is *not* written to encourage Service Men to take apart their instruments merely to see what "makes 'em tick" or just to see if they really can make repairs themselves after all. And in all cases where minor repairs are attempted, remember to carry out every operation as carefully as you would on your own most prized watch.

Special Repair Tools and Equipment

In addition to the usual assortment of screwdrivers, pliers, socket wrenches, etc., to be found in every radio — electronic service shop — and which will be needed to take the instrument movement out of its case— the following special tools (illustrated in Fig. 1) will be found very helpful in making emergency repairs on indicating instrument movements because of the extremely small parts used in them. The most important items are:

(*1*)—Nest of small screwdrivers — jeweler's sizes — such as are sometimes supplied with sewing machines.

(*2*)—Magnifying glass held in eye (jeweler's type) or otherwise supported so as to leave both hands free.

(*3*)—A medium or small darning needle with the *threading* end inserted into a wooden match stick as a handle.

(*4*)—Pair of small tweezers.

(*5*)—Pair of small long-nosed pliers.

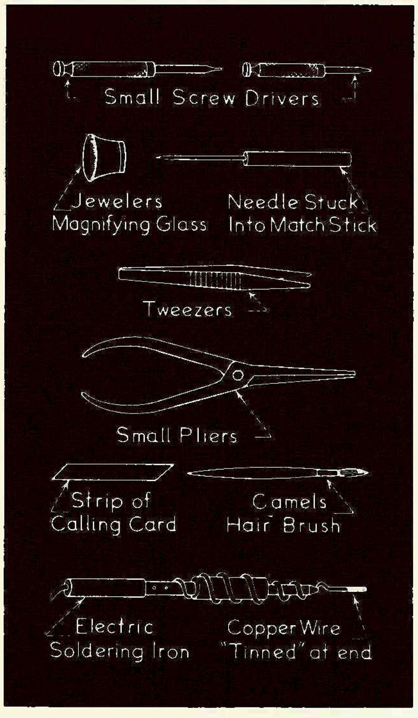
(*6*)—Small strip of very thin cardboard (such as a business or calling card) or fibre. Narrow strip cut from this will serve to clear air gap and other confined spaces of fuzz, etc.

(*7*)—Special soldering iron made by winding a piece of heavy copper wire around the heating element of the smallest radio soldering iron available, and acting as an extension for it.

(*8*)—Small, soft camel's hair paint brush.

In addition to these special tools a clean well-lighted level bench or table covered with a piece of clean white paper *having a glazed surface* free from all lint or fuzz will be required. Do not use a cloth cover for the table as it will invariably contribute dust and lint that will find its way into the instrument movement. Select a place f[illegible] from drafts, blown dust, etc., for [illegible] table.

Fig. 1. A few "special" tools required for instrument repair work.



Repairing D-C Instruments

We will now consider the emergency repair of small permanent-magnet moving-coil type instruments, since this is the most common type used in the various test instruments employed in radio-electronic service work. Later, the repair of moving-iron a-c instruments will be considered.

Most of the common troubles that occur in electrical indicating instruments were described in last month's article. The troubleshooting chart of Fig. 2, summarizes all of this information. A study of the various trouble symptoms, their possible causes, locations and remedies as listed therein will be helpful in this work.

No Indication—If the pointer does not move from its zero position on the scale when a current or voltage is applied, or if it moves erratically, it is almost certain that the trouble is *electrical* in nature. If the indicating instrument is part of a tester of some sort (such as a multimeter, tube tester, circuit analyzer, etc.) is is wise to first determine whether the trouble lie[illegible] the indicating instrument itself, or in the circuits of the test equipment it is used in. To determine this, clear one

INSTRUMENT TROUBLE SHOOTING CHART

TROUBLE SYMPTOM	POSSIBLE CAUSES	REMEDY
NO INDICATION	1—OPEN-CIRCUIT in test instrument circuits external to indicating instrument; in moving coil; in springs; in series multiplier resistor; in field coil (of moving-iron type a-c inst.); in test leads; in soldered joints; in fuse. 2—SHORT-CIRCUIT in shunt 3—GROUND in moving coil circuit	(a)—Examine all soldered joints and mechanical connections (b)—Inspect moving coil and springs for evidence of damage due to excessive heat and overload (c)—Test moving coil circuit for "open"; for "ground" (d)—Test continuity of multiplier resistors (e)—Check fuse
ERRATIC INDICATION	1—FAULTY SOLDERED JOINTS anywhere in instrument 2—LOOSE, BROKEN CONDUCTORS anywhere 3—FAULTY CONTACTS 4—PARTIAL OR COMPLETE "SHORTS" or "GROUNDS"	(a)—Check all soldered joints (b)—Check for broken conductors (c)—Check for faulty contacts in range switches, pin jacks, dirty test prods (d)—Check for erratic grounds or shorts in moving coil circuit, multiplier resistors, etc. (e)—Check for broken strands in test leads
INACCURATE INDICATION	1—SAME AS LISTED ABOVE FOR "ERRATIC INDICATION" 2—DAMAGED RECTIFIER (in a-c rectifier type instrument) 3—OPEN SHUNT CIRCUIT 4—PARTIALLY SHORTED, OR GROUNDED, SERIES MULTIPLIER RESISTOR 5—WEAKENED PERMANENT MAGNET 6—SPRINGS DAMAGED DUE TO OVERHEATING OR OTHER CAUSE 7—SPRINGS KINKED	(a)—Same as listed above for "ERRATIC INDICATION" (b)—Install new rectifier (c)—Check shunt circuits for continuity (d)—Check series multiplier resistors for partial shorts or grounds (e)—Remagnetize and age permanent magnet and recalibrate instrument (factory job) (f)—Replace springs and recalibrate instrument (factory job)
"STICKING"	1—PARTICLE OF FOREIGN MATERIAL LODGED IN INSTRUMENT on scale; at moving coil; at top or bottom of hairspring; near tail of pointer; in airgap of d-c movement; on moving-iron vanes or in damper box of moving-iron a-c instrument. 2—ROUGH SURFACE ON PAPER SCALE 3—LOOSE BEARINGS CAUSE MOVING COIL TO TOUCH POLE PIECES 4—TANGLED SPRINGS	(a)—Locate foreign material by inspection, and remove with tweezers, needle, or small strip of thin cardboard (b)—Remove obstruction on scale with tweezers or sharp knife point (c)—Carefully adjust bearings—not too tight, not too loose! (d)—Untangle springs with needle. Inspect both springs
"FRICTION" OVER ENTIRE SCALE	1—PARTICLE OF FOREIGN MATERIAL LODGED IN INSTRUMENT AS EXPLAINED ABOVE FOR "STICKING" 2—BEARINGS TOO TIGHT 3—DIRTY PIVOTS OR JEWELS 4—DULL PIVOTS 5—CRACKED JEWELS	(a)—Locate and remove foreign material as explained above (b)—Carefully loosen upper bearing slightly (c)—Pivots or jewels need replacement (factory job)
UNBALANCE	1—MOVING ELEMENT OF INSTRUMENT UNBALANCED	(a)—Adjust position of three balance weights on tail of pointer and cross-arm
BENT POINTER	1—POINTER BENT BY APPLICATION OF OVERLOAD CURRENT OR VOLTAGE	(a)—Straighten pointer by pressing against flat piece of stiff cardboard. Rebalance if necessary
ZERO ERROR	1—CONTROL-SPRING TENSION INCORRECT	(a)—Turn "zero-adjust" screw on instrument case until pointer stands at zero

Fig. 2. Troubleshooting chart for emergency repair of electrical indicating instruments.

terminal of the instrument from all external connections and test the moving coil and series resistors (if any) for electrical continuity. Either an ohmmeter, or the familiar old 1½-volt dry cell and earphone continuity test-circuit, may be used for this purpose.

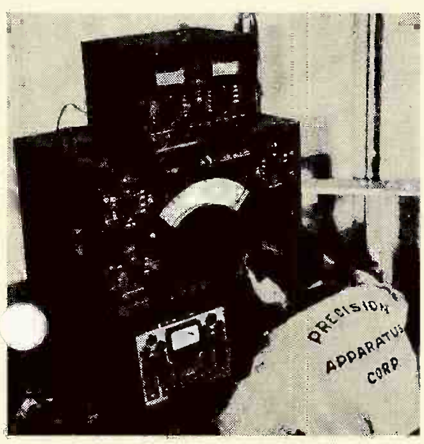
If the continuity of the indicating instrument checks okeh (its pointer may even deflect when the continuity test is applied) it may be cleared of suspicion and all the circuits and connections in the test instrument it is used on (including the test leads) should be checked for a faulty connection or open-circuit, and the trouble remedied. If the continuity check on the indicating instrument reveals that it is *open* or if no trouble is discovered in the associated circuits of the tester, it will be necessary to carefully uncase the instrument in order to track down the cause of the trouble.

Remove the necessary screws and take off the case. Then remove the back connection nuts from the studs that project through the instrument base. *Do not unsolder any wires or other parts of the instrument!*

A careful visual inspection of the various parts of the instrument (see Fig. 3 and Fig. 2) may now reveal the cause of the trouble, or the extent of any damage the instrument may have suffered. If the moving coil is burned, the springs are out of position, sagged or otherwise damaged, it is best to consider the instrument beyond repair by a novice. For replacement of these parts requires more skill and equipment than the average radio Service Man possesses. It is wise to send such instruments to the factory for repair.

If the inspection reveals these parts to be in good condition, it is worth while to proceed further. If a faulty soldered joint or a broken connection is discovered, it should be carefully soldered. *Use only rosin-core solder*, and prevent spattering of the flux on adjacent parts by covering them with pieces of thin, lintless paper such as lens-cleaning paper. The open-circuit may be located by checking the individual parts of the instrument with an ohmmeter, or with another instrument in series with a current-limiting resistor so that no more than full-scale deflection on the testing instrument will be obtained when the test leads are touched together.

Fig. 4. Testing an instrument in a factory laboratory.



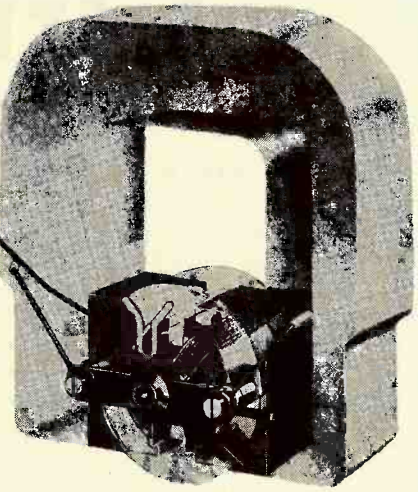
When testing the movable coil remember that the coil itself may not necessarily be *open*. Some instruments have one side of the coil grounded with the magnet. If the other lead of the coil in such instruments should make contact with any metal portion of the movement a *short* will result. Examine the leads connected to the movement under observation to determine how they are connected. If the bottom spring support is insulated, it may have been turned in such a way that it makes contact on the grounded part. Loosen the bottom locknut and turn it slightly to clear any such contact.

If the instrument is provided with a fuse, its continuity should be checked.

Erratic or Inaccurate Indication—A review of what has already been said here about troubles of this nature, and reference to the chart of Fig. 2, will indicate the steps to be taken to correct them.

Sticking—If the trouble experienced is mechanical in nature (such as *sticking, friction*, unbalance, etc.) a repair may usually be effected once the instrument has been removed from its case. If the complaint is that of *sticking*, set up a suitable battery or power supply and potentiometer circuit so the pointer can be *slowly* run up and down the scale; or as an alternative to this, blow at the pointer *lightly* in order to make it deflect across the scale. If it tends to *stick* when it reaches some particular point (or points) on the scale, it is possible that a piece of foreign material has lodged itself between the moving coil and the core or one of the pole pieces of the magnet. Obstructions of this kind can often be seen by looking down through the opening between the moving coil sides and the magnet and core against the white paper as a background. They may be removed with the darning needle, pushing it down or withdrawing it slowly and being careful not to touch the springs while probing with it. It should be manipulated carefully. A few tries will usually be necessary before success is attained at this tedious sort of work.

Sticking may also be caused by a tiny piece of hair or lint obstructing the free movement of the top or bottom hairspring, or touching the moving coil, pointer, or tail of the pointer. The tweezers, needle or small strip of cardboard will aid in removing it when located. As even very small particles may interfere with a moving part of the instrument, they should be searched for thoroughly and carefully with the aid of the magnifying glass.



(Courtesy Weston)

Fig. 3. The interior of a typical permanent-magnet moving-coil type instrument.

Sticking may also be caused by projecting fibres from a paper scale, or by the pointer end touching the scale. In the former case, remove the fibres with the tweezers and burnish the scale at the troublesome area; in the latter, carefully straighten the pointer with the tweezers so it clears the scale.

Sticking may also be caused by the moving-coil bearings being sufficiently loose to allow the moving coil to fall away from the true center and touch the core or one of the pole pieces of the magnet. To rectify this condition, the bearings must be tightened carefully by first loosening the locknut on the jewel screw of the top bearing (see bearing illustration in last month's article), then *very carefully* tightening the jewel screw with a small screwdriver. When the correct adjustment is obtained (as evidenced by the fact that the movable system of the instrument can be moved back and forth easily, but not sloppily, by holding the pointer between the thumb and forefinger), the locknut is tightened while the jewel screw is held in the current position. Then the motion of the moving coil is checked again and a slight readjustment made if necessary. The jewel screw should *never be screwed in tightly*, for this pressure is likely to dull the pivots in both the top and bottom bearings, resulting in excessive friction throughout the entire scale thereafter.

(*Continued on page 26*)

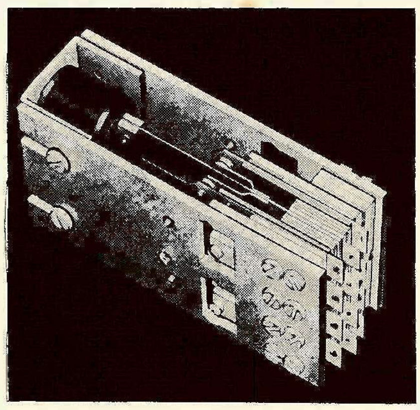
A STUDY OF VIBRATORS

By M. E. HELLER

PART II

SOME applications of vibrators not mentioned thus far include phonograph, p-a and 2-volt portables. Most applications call for a low frequency, usually between 100 and 135 cycles, but vibrators give satisfactory performance up to about 200 cycles. The power output at the higher frequencies is probably reduced because of the smaller reeds and contact spacing. An advantage of high frequency is the reduction in size of transformers and chokes due to reduced core requirements. There has been a market for 400-cycle vibrators for aircraft use but, so far, no successful design has been forthcoming.

Fig. 1. A polarity changer type vibrator (tandem).
(*Courtesy Electronic Laboratories*)

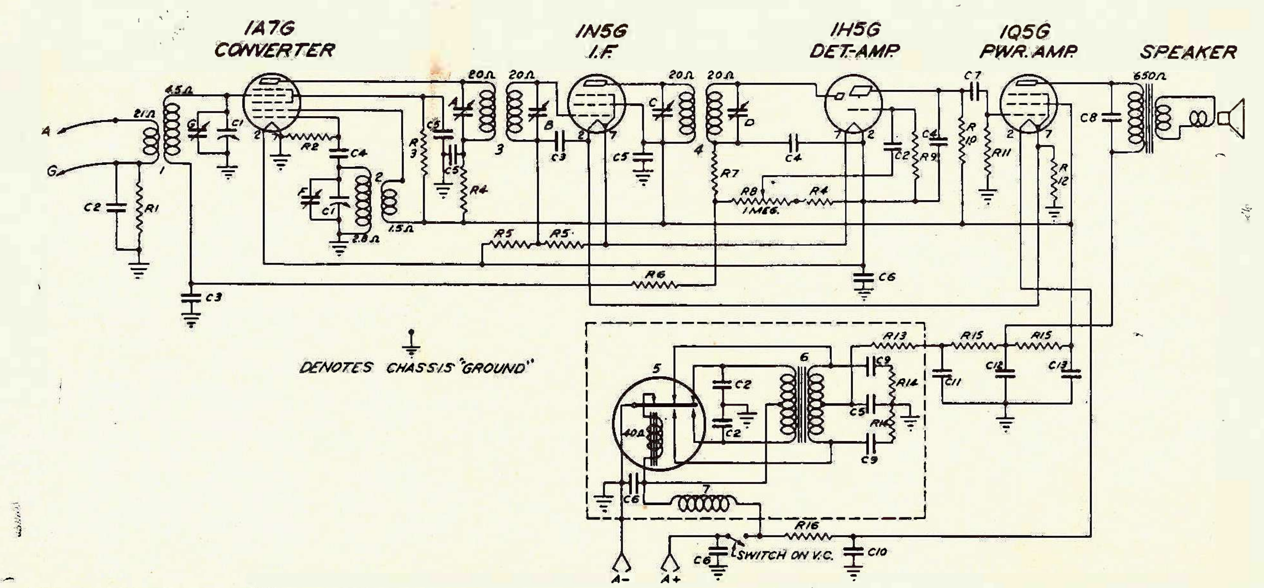


An economical 6-volt vibrator receiver which employs 50-mil tubes and a series coil type rectifier vibrator is shown in Fig. 2. This is Zenith's 4B422. Note particularly the anti-sparking filter for the rectifier section consisting of a .04-mfd condenser in series with 100 ohms on each contact. A .05-mfd condenser from high voltage centertap to ground helps to suppress hash. The *B* filter consists of a 3-section resistance type. The four filaments are in series with the 1Q5G power amplifier on the positive side, enabling its grid bias to be obtained from the battery. The antenna coil in the r-f transformer is not directly connected to the chassis, the circuit being made through a .01-mfd condenser and a 470,000-ohm resistor.

A more elaborate dual supply vibrator receiver is shown in Fig. 3 (Zenith chassis 5679). This receiver operates on either 110 volts a-c or 6 volts d-c. A separate transformer winding is used for 110 volts while the filament winding doubles as the vibrator primary on battery operation. The power amplifier consists of two 6G6Gs in parallel. For more economical battery operation, switch *12* turns off the filament of one of these tubes and cuts off the two pilot lamps. A 6ZY5G rectifier is used with a multiple resistance filter. A .05-mfd r-f bypass connects the rectifier filament to ground.

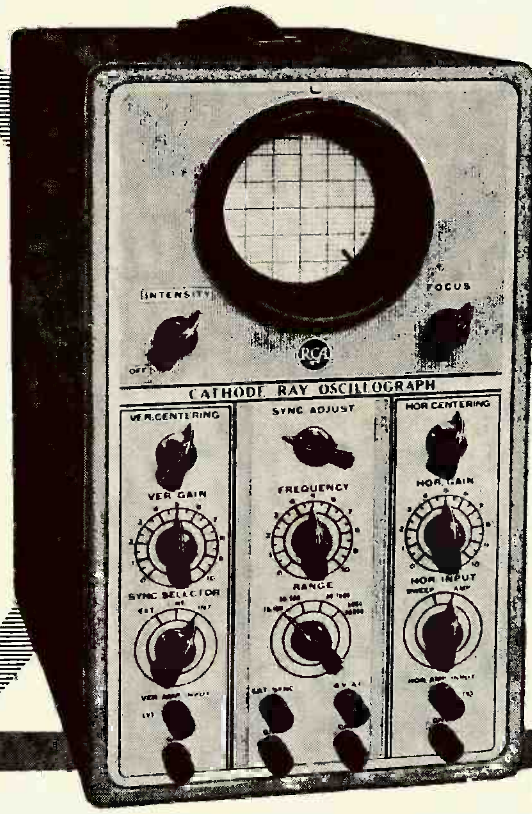
This chassis is equipped for 3-band operation and also has a push-button tone control with six positions. For all these effects, a 2½-megohm volume control is tapped in two places and the first audio is shunted with a .004. The highs are emphasized by shunting the top section of the volume control with small condensers (.00015 for treble; .00025 for voice) while the highs are

Fig. 2. An economical 6-volt vibrator receiver with 50-mil tubes.



DIAG. Nº	PART Nº	DESCRIPTION		DIAG. Nº	PART Nº	DESCRIPTION		DIAG. Nº	PART Nº	DESCRIPTION
C1	22-695	TWO GANG VARIABLE		R2	63-595	100M OHM	¼ W.			
C2	22-826	.01 MFD.	200V.	R3	63-594	68M OHM	¼ W.	1	20-208	ANTENNA COIL ASSEMBLY
C3	22-829	.05 MFD.	200V.	R4	63-583	1000 OHM	¼ W.	2	S 6381	OSCILLATOR COIL ASSEM.
C4	22-162	.0001 MFD.	600V.	R5	63-296	220M OHM	¼ W.	3	95-589	1ST I.F. TRANS.
C5	22-828	.05 MFD.	400V.	R6	63-669	3.9 MEGOHM	¼ W.	4	95-590	2ND I.F. TRANS.
C6	22-199	.5 MFD.	200V.	R7	63-593	47M OHM	¼ W.	5	190-17	VIBRATOR
C7	22-243	.01 MFD.	400V.	R8	63-1079	VOLUME CONTROL		6	95-635	POWER TRANSFORMER
C8	22-448	.004 MFD.	600V.	R9	63-604	10 MEGOHM	¼ W.	7	S 5043	CHOKE ASSEMBLY
C9	22-966	.04 MFD.	600V.	R10	63-271	1 MEGOHM	¼ W.			
C10	22-961	500 MFD. ELECTROLYTIC	15 V.	R11	63-600	2.2 MEGOHM	¼ W.			
C11		15 MFD. "	250 V.	R12	63-1060	90 OHM WIREWOUND	1 W.			
C12	22-742	15 MFD. "	250 V.	R13	63-577	100 OHM	¼ W.	A		1ST I.F. TRANS. PRI.
C13		10 MFD. "	250 V.	R14	63-697	100 OHM	¼ W.	B		1ST I.F. TRANS. SEC.
				R15	63-605	1000 OHM	½ W.	C		2ND I.F. TRANS. PRI.
				R16	63-1061	7 OHM	½ W.	D		2ND I.F. TRANS. SEC.
								F		B'DCAST OSC. (ON GANG)
R1	63-597	470M OHM	¼ W.					G		ANT. B'DCAST (ON GANG)

The New RCA 3-INCH CATHODE RAY OSCILLOSCOPE No. 155-C



10 TO 60,000 CYCLES!

New improved timing axis oscillator provides extraordinarily wide range — 10 to 60,000 cycles — never before available in a 3-inch 'scope.

EXTRA-BRILLIANT IMAGE!

New built-in, deep, light-shield makes image appear surprisingly brilliant—even in bright daylight. Screen is quickly removable — easily changed.

DIRECT DEFLECTOR PLATE CONNECTION!

A special side opening in case is provided for direct deflector plate connection — facilitating use of tube for the higher frequencies.

Rugged enough to withstand every-day field and service usage, yet built throughout to exacting laboratory standards, this RCA 155-C 3-Inch Cathode Ray Oscilloscope is particularly recommended for all-purpose requirements. Note its unusual features, briefly described on this page. Write for special RCA Bulletin containing complete information about this fine instrument. Address Test Equipment Section 44E, RCA Victor Division, Radio Corp. of America, Camden, N. J.

RCA

RCA TEST AND MEASURING EQUIPMENT

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

NEW RCA UNIVERSAL BINDING JACK!

Extremely handy. A combination binding post and pin jack for universal application. Permits quick, positive connection with any type lead terminals. An exclusive RCA feature.

3-INCH CATHODE RAY TUBE!

Three-inch cathode ray tube assures adequately detailed image for practically all applications.

VERSATILE, PORTABLE, FOR LABORATORY AND SERVICE WORK!

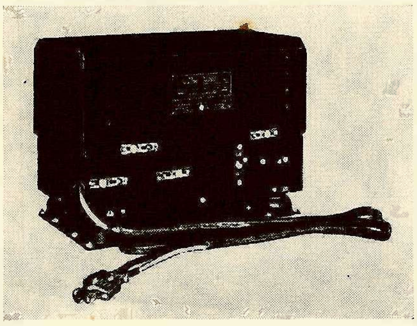
Especially intended for the better class service engineers. For field service, industrial testing, and general commercial and laboratory work.

dropped by shunting the bottom section of the control and connecting the .004.

As we pointed out earlier there are low- and high-power type vibrators. Electronic Laboratories vibrators fall into these two groups. In the high-power group, there is the converter type, the tandem type, and the polarity changer type.

According to E-L data, their engineers have been able to double and triple the output wattage ratings of vibrators by passing the current through multiple contact points, so as to divide the current *equally* among the points. Thus no one set of contact points bears the full current load.

Fig. 4. A vibrator converter unit.
(Courtesy Electronic Laboratories)



E-L low and medium-power vibrators are available for power supplies having an output wattage not exceeding 75 watts. Such power supplies are generally used for radio receivers of either the auto-radio type, or the military type, and which ordinarily operate from 12 or 24 volts. Average life expectancy of these vibrators is 500 hours.

Vibrators of this type are operated either as shunt-drive vibrators, or with an actuating point as series-vibrators. They may be supplied either with self-rectifying construction, or as straight primary interrupters. The number of contact points depends upon the individual design.

Electronic Laboratories has devoted especial attention to the 180-cycle, or *high-frequency* vibrator because it makes possible a material reduction in the size of the power supply through a reduction in the size of the transformer and filter system.

Because of their small size the current-carrying capacity of these vibrators is limited by the thermal factor, even though large contact points are used. The passage of excessive current through the vibrator would result in annealing the vibrating center reed which usually does not exceed .006" in thickness.

Converter Type

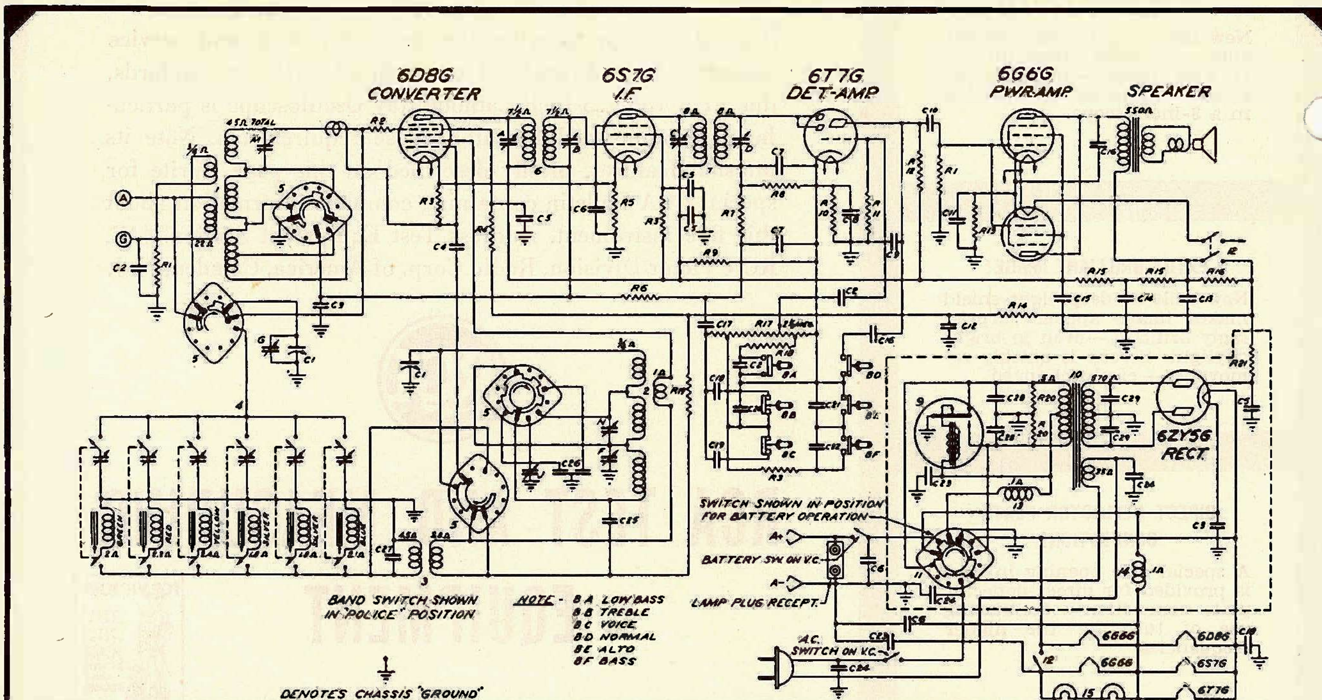
The E-L converter type vibrator has a maximum input wattage rating of approximately 150 watts, and an average life expectancy of 1,500 hours. It is used in small transmitters and small d-c to a-c converters. Input voltages are 4, 6, 12, 24, 32, 64, 110, and 220 volts. Standard frequencies are 60, 100, and 120, though custom-built vibrators may be produced with a frequency as low as 20 cycles. In the converter-type vibrator any of these frequencies are available either as a constant frequency or variable frequency. In the latter case the variability of frequency is accomplished by altering the power of the actuating coil.

Tandem Type

In the E-L tandem-type vibrators, output wattage rating is materially in-

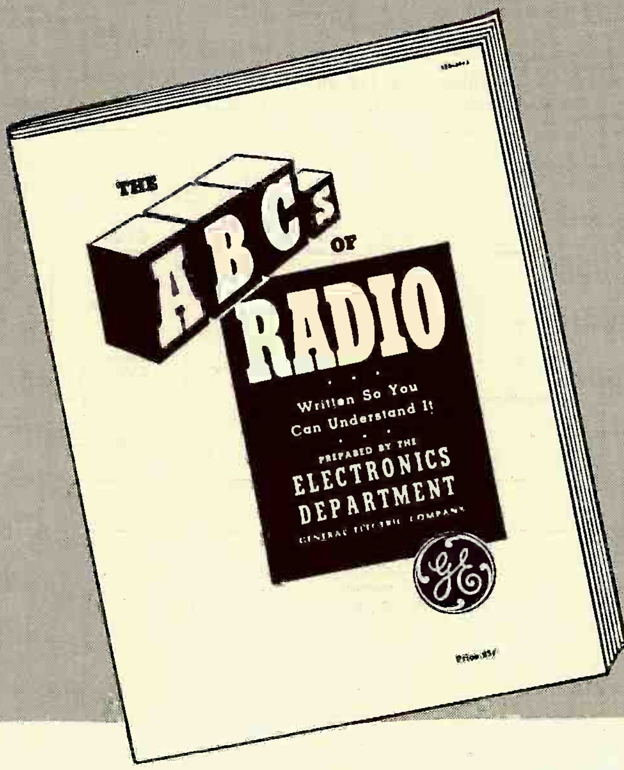
(*Continued on page 31*)

Fig. 3. A dual supply vibrator receiver.



DIAG. NO.	PART NO.	DESCRIPTION		DIAG. NO.	PART NO.	DESCRIPTION		DIAG. NO.	PART NO.	DESCRIPTION		DIAG. NO.	PART NO.	DESCRIPTION
C1	22-964	TWO GANG VARIABLE		C24	22-850	.02 MFD.	600K	R15	63-605	1000 OHM	½W.	14	S2778	CHOKE ASSEMBLY
C2	22-826	.01 MFD.	200K	C25	22-350	.002 MFD.	600K	R16	63-966	4700 OHM	2W.	15	100-39	PILOT LIGHT 2.9V. .17A
C3	22-829	.05 MFD.	200K	C26	22-973	DUAL OSC. PADDER		R17	63-990	VOLUME CONTROL				
C4	22-289	50 MMFD.	600V	C27	22-868	COMPENSATING COND.		R18	63-591	22M OHM	½W.			
C5	22-828	.05 MFD.	400V	C28	22-319	.005 MFD.	200K	R19	63-675	5600 OHM	½W.			
C6	22-350	.25 MFD.	200K	C29	22-372	.016 MFD.	600K	R20	63-969	120 OHM	½W.	A		1st I.F. TRANS. PRI.
C7	22-162	.0001 MFD.	600K					R21	63-577	100 OHM	½W.	B		1st I.F. " SEC.
C8	22-827	.1 MFD.	200K									C		2nd I.F. " PRI.
C9	22-856	.0005 MFD.	600K									D		2nd I.F. " SEC.
C10	22-188	.02 MFD.	400K	R1	63-597	470M OHM	½W.					F		B'DCAST OSC. (SEE NOTE)
C11	22-976	20 MFD. ELECTROLYTIC	25V.	R2	63-576	68 OHM	¼W.	1	S7811	ANTENNA COIL ASSEMBLY		G		ANT. B'DCAST (ON GANG)
C12		20 MFD. "	250K	R3	63-599	47M OHM	½W.	2	S8007	OSCILLATOR COIL ASSEMBLY		J		B'DCAST PADDER (SEE NOTE)
C13		20 MFD. ELECTROLYTIC	250K	R4	63-649	56M OHM	½W.	3	S7507	OSC. COUPLER COIL ASSEMBLY				
C14	22-771	15 MFD. "	250K	R5	63-628	270 OHM	½W.	4	S7643	AUTOMATIC TUNING UNIT ASSEM.		M	22-788	S.W. ANTENNA
C15		10 MFD. "	250K	R6	63-599	1.5 MEGOHM	½W.	5	85-210	BAND SELECTOR SWITCH		N		POL. BAND OSC. (SEE NOTE)
C16	22-448	.004 MFD.	600K	R7	63-711	22M OHM	½W.	6	95-649	1st I.F. TRANSFORMER				
C17	22-327	.02 MFD.	200K	R8	63-657	470M OHM	½W.	7	95-650	2nd I.F. TRANSFORMER				
C18	22-182	.00025 MFD.	600K	R9	63-160	100M OHM	½W.	8	S8013	TONE CONTROL SWITCH				NOTE-
C19	22-470	.00015 MFD.	600K	R10	63-634	820 OHM	½W.	9	190-11	VIBRATOR				TRIMMERS F, J & N
C20	22-716	.0005 MFD.	600V	R11	63-271	1 MEGOHM	½W.	10	95-645	POWER TRANSFORMER				ARE MOUNTED ON STRIP
C21	22-458	.006 MFD.	600V	R12	63-296	220M OHM	½W.	11	85-477	POWER SUPPLY SWITCH				822-1008
C22	22-326	.003 MFD.	400V.	R13	63-977	270 OHM WIREWOUND	½W.	12	85-171	BATT. CONSERVER SWITCH				
C23	22-199	.5 MFD.	200V	R14	63-796	10M OHM	½W.	13	S5043	CHOKE ASSEMBLY				

One answer to your radio service problem—



a new handbook that helps your newer radio service people to help themselves

Just off the press, "The ABCs of Radio" is a helpful new book prepared by General Electric to aid you in training your radio service people. Packed with valuable information, this 68-page, fully illustrated book presents the fundamentals of radio, written in language the beginner can understand.

This book is the outgrowth of a training course prepared by the General Electric Company for radio service beginners, radio salesmen and students.

The scope of the material is broad and it is treated from the standpoint of the practical service man rather than the advanced radio engineer.

Here are some chapter headings in this new book:

Symbols and Abbreviations, Wave and Electron Theory, Direct Current Theory, Inductance Theory, Magnetic Induction Theory, Electron Tube Theory, Radio Communications System, Rectifier and Power Theory, Antenna and R. F., Oscillator and Converter, Test Equipment, Trouble Analyzing and Corrections . . . (speaker stage, R-F amplifier stage, etc.).

For service men, salesmen and students of radio—here's a new book that's really worth while. Costs only twenty-five cents a copy! Send for your copy today . . . fill out and mail coupon to *Electronics Department, General Electric, Bridgeport, Connecticut.*

ELECTRONICS DEPARTMENT
GENERAL ELECTRIC, BRIDGEPORT, CONNECTICUT

I am enclosing__________for which please send me__________ copies of the new 68-page book, "The ABCs of Radio," at twenty-five cents per copy.

NAME________________________________

ADDRESS________________________________

CITY________________________ STATE__________ S

GENERAL ELECTRIC

175-85

SER-CUITS

By HENRY HOWARD

As we pointed out last month, amplifiers and recorder players are no longer the primary type a-f and motor units we knew years ago. They are now effectively engineered pieces of equipment with many design features.

Knight Amplifier

Let us look at the 14-watt, 5-tube, 3-stage amplifier, in Fig. 1, for instance. This Knight unit has microphone, phono and radio inputs.

A single-ended 6SJ7 is used instead of the cap types, and *C* bias is obtained by contact potential with a 5-megohm grid leak. The 6SJ7 output is fed to the arm of a volume control through a .05-mfd stopping condenser and a 100,000-ohm load resistor. This is an unusual method, but the reason is obvious when we note that the phono input is connected in a similar manner to the same second stage grid. If the grid were on the arm, moving the arm toward ground would short out both input channels. The 100,000-ohm resistor prevents the possibility of a very low output load for the first stage, with the consequent distortion. Similarly, a 1-megohm resistor is used in the phono input to the arm of the phono volume control.

The tone control is also a bit unusual. Instead of a fixed 250,000-ohm plate load in the second stage, a potentiometer is used. The arm is connected to a .01-mfd condenser which cuts out highs as the arm is moved toward the plate. The second triode section of the 6SC7 serves as inverter. A pair of 6V6G's deliver the output to a speaker socket. A 5-megohm resistor connects each output tube plate with its driving triode plate to contribute a bit of degeneration.

Silvertone 12860-12862

A simpler unit containing a record player appears in Fig. 2. This is a 14-watt, 5-tube, 3-stage job, with 118 db gain at the microphone input and the usual amount of gain at the phono input to the second stage. Note the method of controlling volume at the second grid. Two ½-megohm controls are used with ½-megohm series resistors in the arms to prevent the shorting out of one channel by the other. A 6Y7G dual triode is used instead of the more popular 6SC7. Tone control is obtained in the usual manner at one of the output grids.

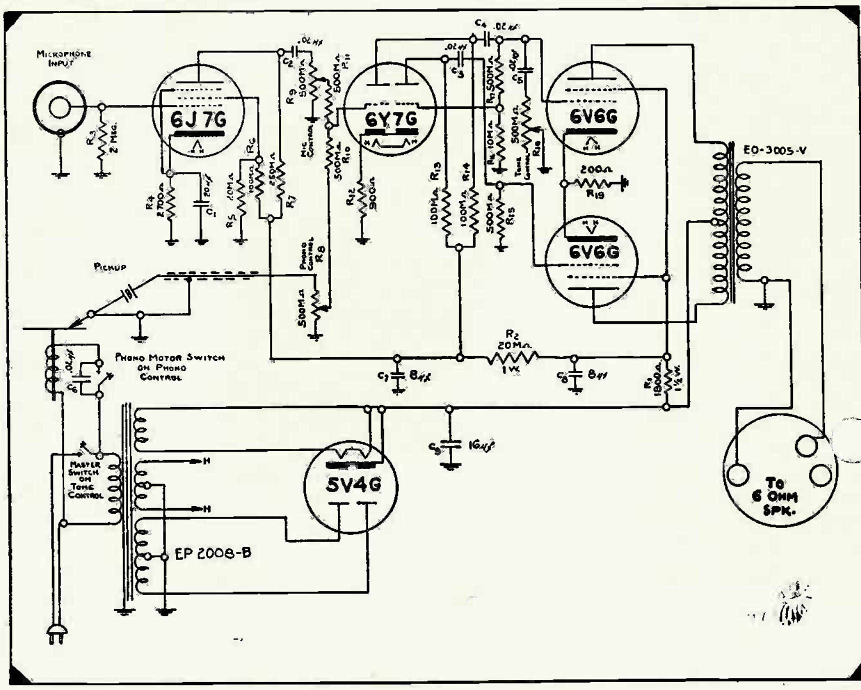


Fig. 2. A 14-watt amplifier with 118-db gain at the microphone input.

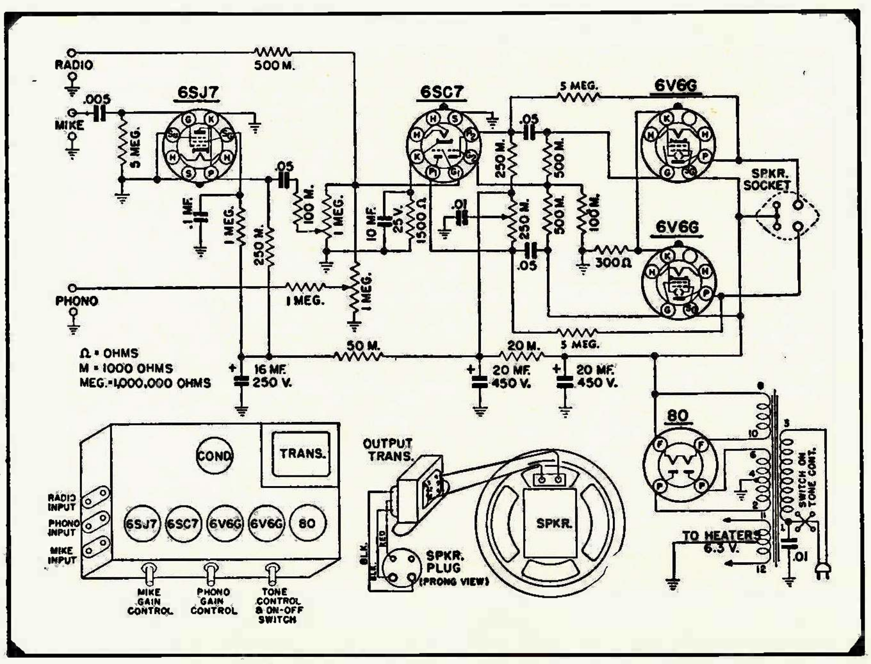


Fig. 1. A 14-watt 5-tube 3-stage amplifier with microphone, phono and radio inputs. In this receiver, *C* bias is obtained by contact potential with a 5-megohm grid leak.

Knight Phono Amplifier

Fig. 3 shows a 3-tube Knight type phono amplifier with degeneration applied from the voice coil winding to the first audio cathode. The feedback voltage is applied across a 4-ohm resistor in the cathode. This is in series with the bypassed 2,000-ohm bias resistor. A 50-ohm resistor determines the amount of feedback applied; 4 parts in 54 or, about 8%. Note that no part of the feedback circuit is grounded.

Knight Expander-Compressor

Knight has an Expander-Compre adaptor unit which may be used for several purposes in conjunction with a standard amplifier (Fig. 4).

The bulk of UTC production today is on special units designed to specific customers' requirements. Over 5,000 new war designs were developed this past year. These designs ran from open type units to hermetically sealed items capable of many cycles of high and low temperature and extreme submersion tests. They included units from 1/3 ounce in weight to 10,000 lbs. in weight and from infinitesimal voltages to 250,000 volts. It is impossible to describe all these thousands of special designs as they become available. Our staff of application engineers will be more than pleased to discuss your problem as related to special components.

UNITED TRANSFORMER CO.

150 VARICK STREET • NEW YORK 13, N. Y.

EXPORT DIVISION: 13 EAST 40th STREET, NEW YORK 16, N. Y., CABLES: "ARLAB"

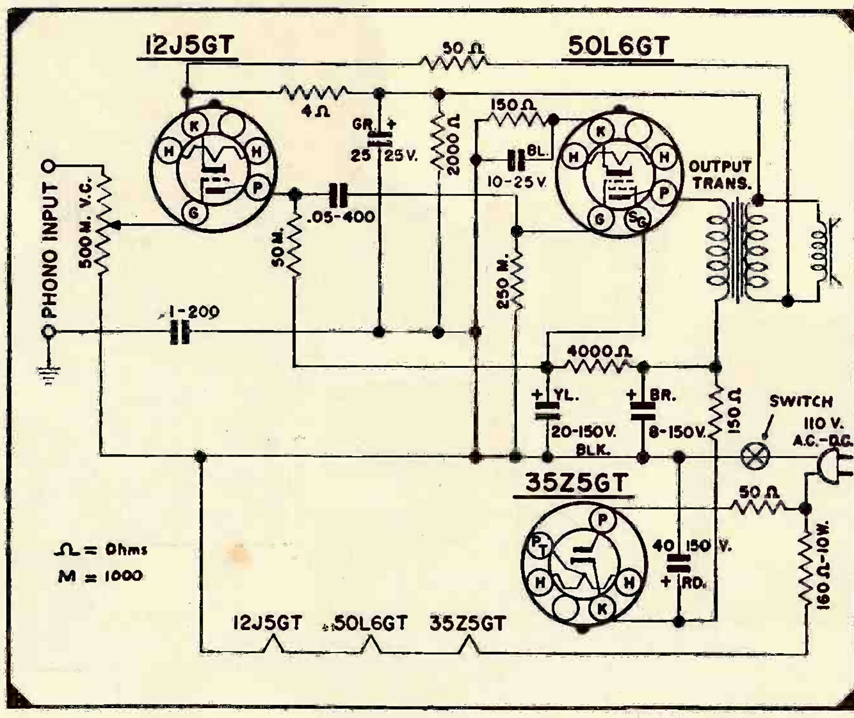


Fig. 3. A 3-tube amplifier with degeneration. A 50-ohm resistor determines the amount of feedback applied.

Besides its use with a record player, it may be used with a p-a system to produce a constant input level as [illegible] speaker whispers or m[illegible] about the microphone. This eliminates the need for a monitoring operator.

In this unit, a 6SK7 is used as a controlled-amplifier tube. The expansion-compression amplifier is a 6SJ7 pentode. This stage feeds a dual-diode rectifier with the elements in series, instead of parallel, in such a manner that the variable bias delivered to the 6SK7 may be either positive (expansion) or negative (compression). A 1-megohm center-tapped control provides zero alteration when the arm is in the center. As the arm is moved to the left, positive voltage is fed to the amplifier while movement to the right gives negative output. A proper operating point for the remote cut-off 6SK7 is obtained by means of the 3,000-ohm cathode resistor.

Firestone S-7401-6

An unusual wireless record player is the Firestone S-7401-6, Fig. 5. This oscillator uses a beam power tube, the 35L6GT, with the screen grid acting as the modulating grid. The screen is

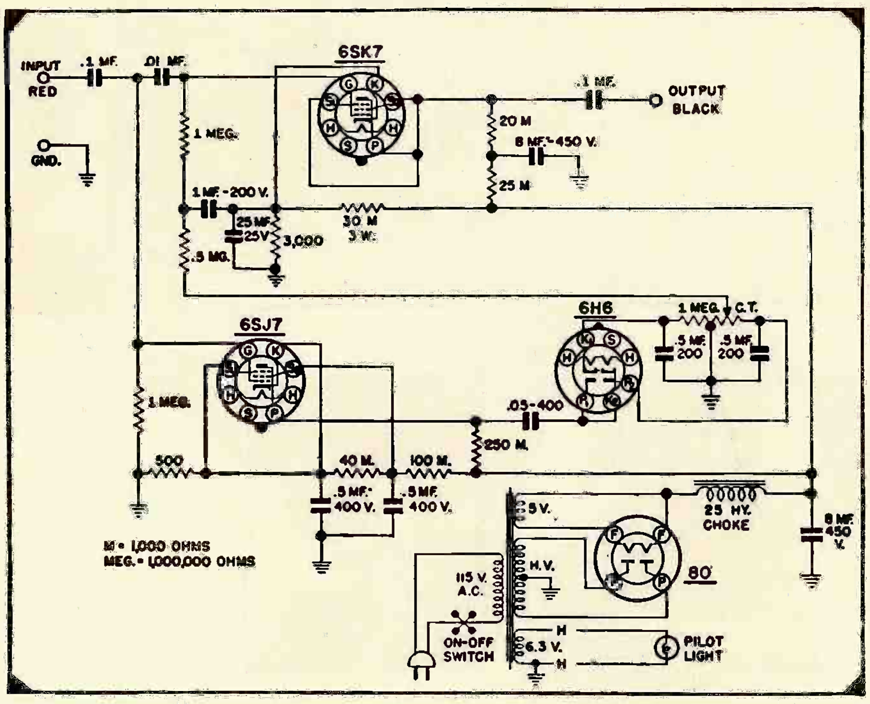


Fig. 4. Expander-compressor adap[illegible] unit that can be used with a standard amplifier.

ordinarily considered a power dissipating element, but in a beam power tube the screen current is low due to the fact that the screen grid is hidden from the cathode by the control grid. As in all simple wireless record players, the modulation factor is necessarily low. There is not enough audio voltage or audio power to do much modulating. The beam tube should not be replaced with a suppressor pentode or the performance will suffer due to the greater power required by the screen grid of a pentode.

Apparently, r-f feedback into the crystal pickup is of no consequence because no filter is provided and the screen is at an r-f potential. Note the audio equalizer combined with the d-c voltage divider for the screen voltage. The audio elements are the ¼-megohm volume control, 470,000-ohm shunt, 68,000-ohm series resistor and 3.3-megohm shunt. The remainder of the circuit is conventional, a grid tickler and tuned plate circuit being u[illegible]. The antenna is coupled to the [illegible] through a .00026-mfd mica condenser.

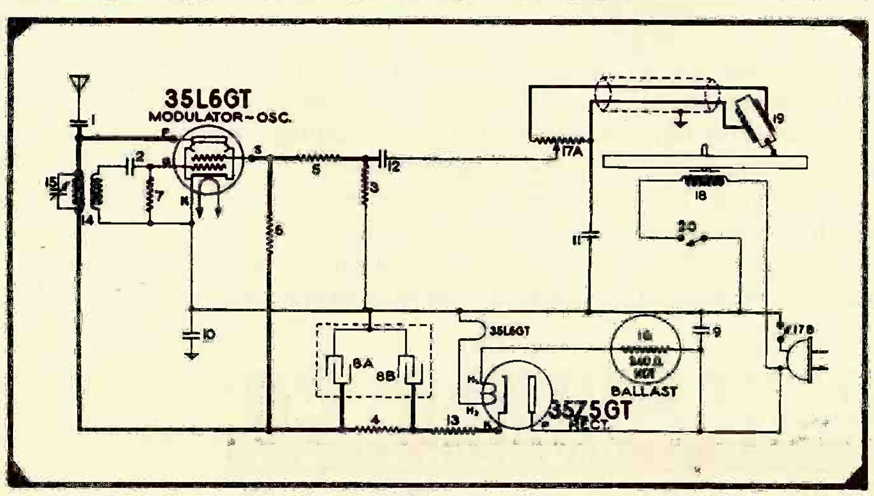


Fig. 5. Wireless record player with beam power tube, 35L6GT.

The SPRAGUE TRADING POST

EXCHANGE — BUY — SELL

Your own ad run FREE!

The "Trading Post" is Sprague's way of helping radio servicemen obtain the parts and equipment they need, or dispose of the things they do not need during this period of wartime shortages. Send in your own ad today—to appear free of charge in this or one of several other leading radio magazines on our list. Keep it short—WRITE CLEARLY—and confine it to radio items. "Emergency" ads will receive first attention. Address it to:

SPRAGUE PRODUCTS CO., Dept. S-39
North Adams, Mass.

WANTED URGENTLY—Late model Supreme multitester. Describe fully. James Hosie, 1530 Archer Road, Parkchester, Bronx, N. Y.

WANTED—Supreme No. 1230 signal generator or something similar. Offer Ghirardi's Radio Physics Course in part payment. Fred L. Stahl, 25 W. Clinton St., Valhalla, N. Y.

WANTED—Superior instrument, 1940 model, in good condition. Tube checker combination or single. Cash. William Knowlton, 675 Garfield, Detroit, Mich.

SWAP OR SELL—One new 906 scope tube, $20. John M. Steward, 1050 102nd Ave., Oakland, Calif.

WILL PAY CASH for your junked burned out Wurlitzer and Seeburg power and audio transformers. Wm. Loftstrom, 1302 West Hill Ave. Valdosta, Ga.

FOR SALE—Super signal generator, never used. One 2-tube reflector type metal locator. Fine magnet type speakers. Six oscillator and antenna coils, three radio chassis, three tuning condensers, one Zenith receiving set, model 5G442. Write for details. Albert Nolan, Jr., Hensley, Ky.

WANTED—Multimeter and signal generator. Marland Barsness, Baldwin, Wis.

WANTED—Antenna coil for American Bosch model 640 or 50; also for Motorola 5T model radio. State best cash price. John W. Reigel, RD No. 2, Annville, Penna.

EXCHANGE — Keystone projector, 500 ft. of film, rewind on motor, excellent cond., for a tube checker [illegible]ring latest tube types. Dwight [illegible]ios, 102 Hancock Ave., Jersey City, N. J.

WANTED FOR CASH — Rider's Manuals Vols. 1, 2, 3, 4, 7, 8, 9, 10, 11, 12, and 13. State price and condition. Peter Rice, 856 Montrose Ave., Chicago, Ill.

FOR SALE—Model 560A Supreme Veedolyzer and model 914 Precision tube tester. Both in good condition. What do you offer in cash? Cpl. Steve Shewchik, c/o 730 S. Arlington St., Akron, Ohio.

WANTED—Signal generator, such as Precision E200 or Radio City 703; also model 165 Junior voltohmyst. Give cond. and price. R. A. Malmberg, 335 Atlantic St., Quincy, Mass.

SELL OR TRADE—Two complete Crosley model C417A carrier-operated intercommunicating units. New—in original cartons. Sell or trade for table model std. broadcast receiver of equal value. T. M. Lurry, C.A.A., La Guardia Field, N. Y.

WANTED FOR CASH—R.C.P. 661 or 662 electronic multitester. Also want PrecisionE 200 signal generator. The Radio Man, 1724 Central Ave., Middletown, O.

FOR SALE OR SWAP—An electric Hawaiian guitar in 1st class condition for a Hickok signal generator or other good make. Albert A. Church, 57 Cottage Place, New Britain, Conn.

WANTED—Tube tester and VOM. Describe fully. R. W. Thompson, Federal Dam, Minn.

FOR SALE—Two 80 mil meters, $5 ea. One 0-100 l. to r., 7" or 8" galvanometer (Jewell), including AC meters 0-150 V., $20. Janette converter, 115 DC input, 110 AC output, 1000 watts, $75. One 3 kw. Western Electric generator, 115 DC. 30 amps., $60. One 6 cyl. Chev. engine to drive above (complete), $40. All three of foregoing, only $150. 1/6 h.p. Century refrigerator motors, $20 ea. "Bud Unit" air column horn 6 V. fld. complete, for hall or theatre, $30. Dockstader's Electrical Repair Service. Clinton, Iowa.

FOR SALE—Portable RCA 16 mm. sound-on-film with record player. Two machines with automatic throwover. Two large speakers in portable cases equipped with 75 feet of cable. Folding 8'x10' screen. Two 6L6's in output give up to 50 watts. This is no amateur outfit, but the real thing in four portable cases. Can you offer $850 cash or better for the outfit? Seymour Radio Service, 20 New St., Seymour, Conn.

TUBES WANTED—For servicing and instructing in the army air forces. Will pay cash for new tubes: RK-38, RK-807, RK-829, 956, 954, 955, 957, 24G, or will trade quality test eqpt. Edward J. Smith, 308 E. Gorham St., Madison, Wis.

FOR SALE—Hickok crystal signal generator, latest model, 188x, with 3 range DB meter. 7 frequency ranges on fundamentals, 100 kc., 110 mc. Built-in electronic sweep generator, $80. Also offer General Industries heavy duty phono motor with weighted turntable, 2 speeds, 117 V. 60 cycles, $14. Phono motor as above for operation on AC-DC, $16. Three 110 V. DC vibrator power supplies, delivering 25 watts at 117 V. 60 cycles, $7 each. Charles Wachspress, 78-15 68 Road, Middle Village, N. Y.

WANTED — Modern tube checker and analyzer, also the following tubes: 12SA7, 12SK7, 12SQ7, 50L6, 35Z5, 35Z3, 35Z6, 25L6, 6SA7, 6SK7, 6SQ7, 1A5, 1A7, 1W5, 1H5, 3Q5. E. M. Gilbert, 1296 Sheridan Ave., Bronx, N. Y.

FOR SALE — RCA aerodynamic microphone MI-6226-A, $10. Triumph Model 800 oscilloscope, 3" screen, perfect condition, best cash offer takes it. Triumph Model 180 (wobbulator) signal generator, companion to above, $20. Sola neon lighting transformer 115/15000 V., 60 cycles, 450 V. A. secondary, 30 ma., $10. Lowry E. Easley, 43 Ashwood Ave., Dayton 5, Ohio.

WANTED — Model 562 Audolyzer, also following tubes: 12SK7; 12SQ7; 50L6; 1H5; and 12SA7. Charles S. Clark, Clarkton, N. C.

WANTED IMMEDIATELY — Precision 920P or 954P, Precision E-200, Weston 772 and Weston 773. Will pay cash. Leo's Radio Service, 715 Hopkinson Ave., Brooklyn, N. Y.

WANTED—Majestic Model 250 5-tube AC-DC superhet receiver in good condition. William O'Brien, 609 W. 1st St., Fulton, N. Y.

WANTED—V.O.M., prefer 5,000 ohm per volt or more. Also a good signal generator. Julius Urbanek, P. O. Box 384, Heber, Calif.

FOR SALE — First ed. Ghirardi's Radio Troubleshooter's Handbook, also Radio Service Handbook by J. T. Bernsley. Good condition. $3.75 for both. K. R. Snyder, 5703 Hoffman Ave., Philadelphia, Pa.

WANTED — Supreme Vedolyzer in A-1 cond. Will trade RCA Chanalyst, or buy Vedolyzer for cash. R. O. Millican, Box 464, Lewisville, Texas.

WANTED—Overhead cutting assembly unit, with cutting head, suitable for recordings up to 12". Dorman D. Dove, Box 555, Winchester, Va.

FOR SALE—Brand new Solar CE capacitor analyzer, $30 cash. C. A. Raudonis, 1513 S. 51st Ave., Cicero 50, Ill.

WANTED—Crystals, coils, and parts for making crystal radio receivers, also small cabinets. What have you? J. Barry, American Radio Service, 57 Central Ave., White Plains, N. Y.

SWAP OR SELL—Rack and panel 250-watt Xmitter, 6L6, 807, T-55; 3 power supplies, 3 meters; Xtal switch, 20-40-80 meter bands. Need tube checker, signal osc., multimeter, or what have you? Lewis Daufman, 233 S. Connecticut Ave., Atlantic City, N. J.

TUBES FOR SALE — Can furnish most of the hard-to-get types at list. Write, stating your needs. Thos. J. Ambrose, 211 Farren Ave., New Haven 13, Conn.

MANUALS FOR SALE — Rider's Nos. 1 to 13 with index. Best offer takes them. Want pocket V.O. meter or what have you? Turner's Radio Service, 829 E. Central Ave., Moultrie, Ga.

TUBE CHECKER FOR SALE — Triplett Model 1210A, in good condition. Beacon Radio Service, 532 E. Blancke St., Linden, N. J.

WANTED — A tube tester and V.O.M., Hickok or Precision. Cash to best offer. B. L. Camp, 300 6th St., Petaluma, Calif.

WANTED AT ONCE — Volt-ohm-milliammeter for cash. Describe fully. J. B. McDonald, W5KIV, Box 907, Pasadena, Texas.

THIS HELPFUL BOOKLET FREE

Write today for your copy of the Sprague "VICTORY LINE" Folder. In addition to listing the various Sprague Atom electrolytics and the Sprague TC Tubulars now available for civilian service use under wartime restrictions, this contains helpful data on how to use these few condensers in handling practically every replacement job. The folder tells you, for instance, how to replace 600-volt Capacitors with 450-volt types; how to use drys on wet electrolytic jobs, and much more. Rush a post card today for your free copy!

SPRAGUE
PRODUCTS CO.
North Adams, Mass.

SPRAGUE CONDENSERS
AND KOOLOHM RESISTORS

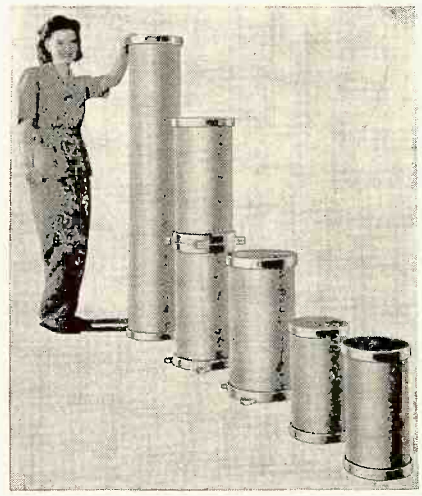
Obviously, Sprague cannot assume any responsibility, or guarantee goods, services, etc., which might be exchanged through the above advertisements.

NEW PRODUCTS

BAKELITE-CASED HIGH-VOLTAGE TUBULARS

High-voltage capacitors for x-ray, impulse generator and other intermittent d-c or continuous a-c high-voltage applications such as indoor carrier-coupler capacitors, test equipment and special laboratory work, have been announced by Aerovox Corporation, New Bedford, Mass.

These capacitors, type 26, are oil-impregnated oil-filled with Aerovox hyvol



vegetable oil. The capacitors are b[illegible] with adequately insulated and matched sections of uniform capacitance, connected in series. High-purity aluminum foil with a generous number of tab connectors is said to provide high conductivity with low inductive reactance. Capacitor sections are dried and impregnated under high vacuum in a closely-controlled long cycle.

The case is of laminated bakelite tubing, protected by a high-resistance insulating varnish for high dielectric strength and maximum safety from external flashover.

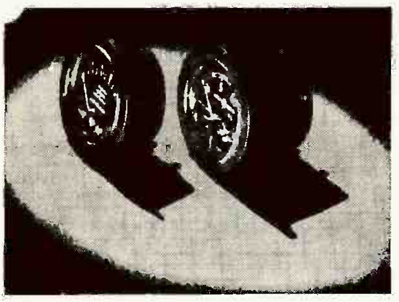
The terminals are two-piece cast-aluminum end caps with bakelite-treated cork gaskets, which are locked in to provide leak-proof hermetic sealing. Caps are available with mounting feet for space-saving assemblies in series, parallel or series-parallel arrangements. Also obtainable with plain end caps.

* * *

G. E. INSTRUMENTS WITH INTERNAL-PIVOT CONSTRUCTION

A new line of small, thin, d-c panel instruments featuring internal-pivot construction has been announced by the General Electric Company. Available with either brass or molded Textolite dustproof and moisture-resisting cases in 2½-inch sizes. The line consists of d-c voltmeters, ammeters, milliammet[ers,] microammeters, radio-frequency ammeters and milliammeters, and d-c volt-ammeters. The volt-ammeter, one of the group designed for naval aircraft, has a push-button-operated switch to change the reading from *amperes* to *volts*.

In the new instruments, the pivots are solidly mounted on the inside of the armature shell instead of being secured to the outside of the armature winding in the conventional manner. One jewel bearing is mounted rigidly on top of the core-and-frame assembly, and the other is mounted in an adjustable sleeve fitted into the lower part of the soft-iron core. Thus the element assembly is a single, self-contained unit, all parts of which are supported by a high-coercive cast magnet, and it can be removed easily for inspection or repair in the field.



The instruments will operate satisfactorily in temperatures ranging from -50 C to 70 C, and said to be accurate to within the limits of ±2 per cent of full-scale value.

Two publications are available on request to General Electric at Schenectady. Publication GEA-4117 covers the 2½-inch panel instruments; publication GEA-4064 covers the 2½-inch diameter panel-type.

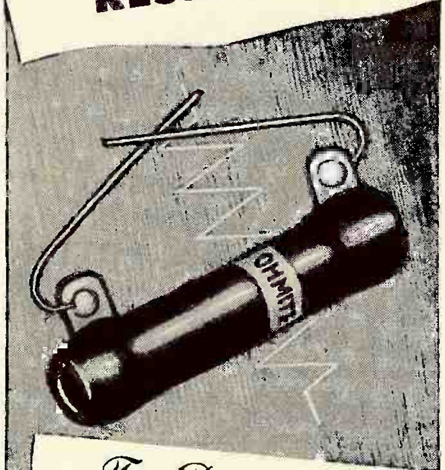
* * *

INDUSTRIAL CONDENSER HEAVY DUTY CAPACITORS

The Industrial Condenser Corp., Chicago, is now in production on a new line of heavy duty, high voltage capacitors for continuous operation up to 150,000 volts working. The 0.5-mfd unit (shown) is a 50,000 volt d-c capacitor 28 inches high and weighs 175 pounds. It is said to withstand 24 hours continuous operating total submersion in salt water.

They are equipped with solder seal terminals, for operation at high altitudes and under humid conditions.

(*Continued on page 29*)



ELECTRONIC TIMERS

(*Continued from page 9*)

ponents, it can be readily seen that it is quite practical to use a number of such timer circuits in a multi-step or sequence timer.

An electronic sequence timer, incorporating a number of circuits similar to that of Fig. 6, is shown in the photo, Fig. 7. The intended application for this timer is the proper sequencing of complicated spot-welding machine operations. Thus, the first timer operates the welder jaws to grip the work which is to be welded. After a brief interval, the second timer starts the welding current, and third and fourth timers alternate to "make" and "break" the welding current. Once the welding operation is complete, the final timer functions to maintain the welder jaws closed until the work has cooled sufficiently to insure adhesion of the welded parts.

From the foregoing discussion, especially with respect to devices similar to the sequence timer, it is evident that operational troubles must eventually appear. Analysis of these troubles is nearly always evident in the manner in which the defective device functions, or fails to function. A rapid visual observation, then, will suffice to localize the trouble in the majority of such instances.

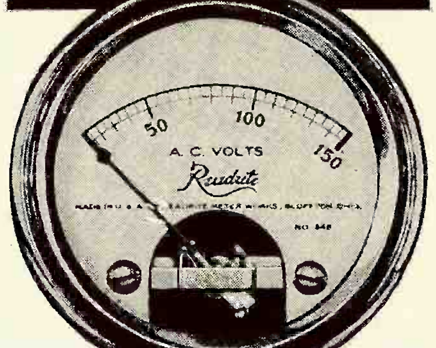
Evidences of incorrect operation which are common to all electronic timers are many. However, each of these trouble symptoms points to a definite reason for the appearance of undesired characteristics.

An example of such erratic operation is one in which the timer fails to provide any measurable timing period, energizing the end-relay immediately after closure of the push-button or foot-switch contacts, in the case of a *discharge* timer, and failing to close the end relay at all, as in the case of the *charge* timer. For short timing periods, in either type of timer, the initial discharge or charge current is exceedingly high, this high current being conducted by the timing rheostat resistance element. When the timer is consistently operated in the short time range, the low resistance section of the rheostat eventually opens. As a result, the timing condenser fails to either discharge or charge, giving rise to the type of operation described here.

This type of operation may also be found in the case of a leaky or short-circuited timing capacitor. However, additional troubles will also appear. In the case of the discharge timer, the charging rectifier will heat from the overload current. Since the thyratron bias is also supplied from this source, the lack of a sufficient negative grid bias will, in some cases, permit the thyratron to energize the relay continuously.

A leaky or short-circuited timing capacitor, in the case of a charge circuit timer, will also cause charging rectifier to heat, in addition to the evidences of improper operation previously described. This is true of either timer type.

Tubes, especially thyratrons, may sometimes occasion intermittent operation. Where the tube is conducting a-c, as is usually the case, a frequent



occurrence is an apparent inability of the thyratron to conduct sufficient current to close the end relay, even though a glow is observed in the tube.

Tube checker tests of such a tube usually indicate its rejection.

In less frequent cases, a tube will be found noisy or microphonic with relay chattering or *bouncing* troubles prevailing during the timing cycle. Such tubes should be immediately replaced.

Oxidized and dirty relay contacts are a cause of minor operating thoubles. However, dust films and dirt accumulations in the timer may even provide a low enough resistance leakage path *to alter the timing cycle*. If such a condition is present, and the timer is inoperative, the leakage through the dust film to a negative, or possibly a positive lead within the timer, is high enough to either *block* the relay tube grid, or to cut off conduction completely, despite the initially high voltage present across the timing capacitor contacts.

Most of these troubles may be avoided through proper installation of the timing device. In general, the timer should be mounted in the cleanest location convenient to the timed operation. It should, preferably, be mounted on a solid base, such as a brick wall, and away from heavy equipment capable of transmitting sharp physical shocks and jars, as would be true in the case of a small drop or shaping hammer. Moisture and vapor, especially acid or alkali vapors, must be avoided at all costs. Careful attention to these details insures customer satisfaction and low maintenance time.

Usually, the process or operation under control by the timer may be speeded up. This is especially true of the sequence timer. The timer, if economy is to be gained through its application, should be adjusted to the shortest possible timing consistent with the requirements of the controlled process. In the case of the sequence timer, each unit operation should be so adjusted. Attention to these details economizes the process control time. Once all adjustments are satisfactorily accomplished, the equipment should be padlocked against tampering. Hasps for this specific purpose are provided on equipment provided by the reliable manufacturer.

Finally, customer inquiries on process or equipment timing details can be answered by referring to standard timing equipment listed in the manufacturer's catalogue leaflets. Exceptions, which may occasionally appear, should be referred to the manufacturer concerned, for their final and proper disposition.

WIRELESS RECORD PLAYER

(See Front Cover)

A WIRELESS record player (Zenith S-6622) consisting of a single tube oscillator-modulator in a conventional Hartley circuit with, however, four grid control elements interposed between the oscillator grid and plate, appears on the cover, this month. Both grid leak and cathode bias are used and the audio modulating voltage is fed to the number 3 grid of the 6L7G. This grid has remote cut-off characteristics which permits the omission of an audio gain control.

An equalizer which boosts the high frequencies is permanently connected. This consists of a series element composed of a 390,000-ohm resistor shunted by a .0005-mfd condenser to favor the high frequencies, and a shunt element of 180,000 ohms which attenuates the lows. Remember that a crystal pickup acts like a condenser in that its impedance varies inversely as the frequency. The value may reach several megohms at the lowest bass note while it may drop to a small fraction of a megohm at the top frequency of response. Hence, a shunt element of a fraction of a megohm will pull down the bass output considerably, while the treble will be only slightly affected.

A half wave rectifier (both elements in parallel) serves adequately for the small d-c load and so does a resistance filter. For satisfactory r-f bypassing, a .01-mfd low-impedance condenser is used in parallel with the second filter condenser which is a poor bypass. A short wire attached to the plate serves as a transmitting antenna.

* * *

TEST INSTRUMENTS

(Continued from page 13)

Friction — If the moving coil and pointer tend to stick or drag over the entire scale when the pointer is blown at, excessive friction is indicated. First, look for lint or fuzz as explained above. If none is present, it is possible that the pivots or jewels are in need of cleaning or repolishing, or a jewel is cracked. Repair or replacement of these are beyond the scope of the radio Service Man since they usually involve dismantling the instrument movement.

Sometimes friction is caused by a bearing that is too tight. In such cases, the upper jewel screw may be loosened a half turn or so to relieve the condition.

Unbalance—If the instrument pointer is unbalanced, it may be rebalanced by whatever means is provided for the purpose in the design of the instrument. Some instruments employ three tiny screw-type threaded weights on the cross-arm and tail of the pointer as illustrated in Fig. 5. Others use tiny coils of wire which may be slid along th[illegible] parts for balancing. In some, a f[illegible]le tail weight, or drops of shellac or varnish are employed.

First make sure the pointer is perfectly straight. If it is bent, straighten it with the tweezers, or by carefully pressing it against a piece of stiff cardboard. Now, while holding the instrument so its scale or dial lies in a *horizontal plane*, as shown at (*a*) in Fig. 5, set the pointer on zero by means of the zero-adjustment screw. Next, hold the instrument with the plane of its scale or dial *vertical* as at (*b*), and turned so the zero point lies in a horizontal line with the pivot, as shown. With the tweezers, adjust the tail weight until the pointer lies exactly in a horizontal position as indicated. Now, still maintaining the instrument in a vertical plane, turn it around until the zero on the scale assumes the position shown at (*c*). Adjust the two side weights for side balance until the *pointer* lies exactly vertical, as shown. It is well to repeat this process at least once as a check.

When adjusting the balance weights, use as little force and pressure as possible, for the pivots can be damaged during this operation if care is not exercised. Also be careful not to touch or disturb the springs, and do not allow any fuzz, lint or metal particles to fall into the movement or remain on the pointer, cross-arm, or balancing weights.

Bent Pointer—If the pointer is bent, it may be straightened either with the tweezers or by carefully pressing it against a piece of stiff cardboard. Also see that it does not touch the scale as it sweeps across it. Check the instrument for balance after this operation, and rebalance as explained above if necessary.

Cleaning and Recasing—Before putting the instrument back into its case make certain that all parts of both the instrument and the case are clean and free from all dirt, lint and other foreign particles. Use the camel hair paint brush to clean all parts.

Calibration—If the instrument springs have not been damaged and if the internal shunts or series resistors have not been unsoldered, the instrument should retain its original calibration fairly accurately after the repairs have been made. If it requires a checking or re-calibration however, it is best to do this carefully, using instruments of sufficient accuracy for the checkup. This subject will be discussed in detail in next month's article.

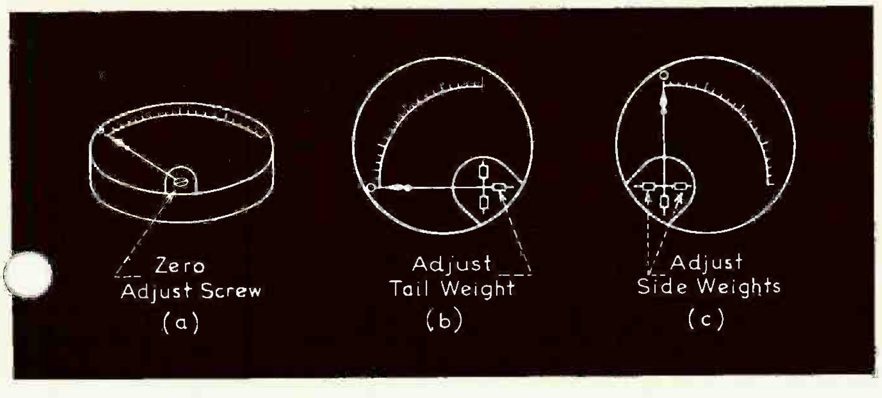


Fig. 5. The three steps in balancing the moving-coil pointer assembly of an indicating instrument.

NEWS

E. F. PETERSON IN CHARGE OF G. E. RECEIVING TUBE DESIGN ENGINEERING

E. F. Peterson has been placed in charge of design engineering of receiving tubes of General Electric.

K. C. DeWalt, designing engineer, tube division, will continue his responsibility for design engineering of all other product lines of the division.

* * *

COSGROVE ON RMA POSTWAR COMMITTEE

R. C. Cosgrove, vice-president and general manager, manufacturing division, The Crosley Corporation, has been named by P. V. Galvin, president of RMA, as chairman of a new special committee on postwar planning.

Looking toward the resumption of domestic production, the committee will have wide jurisdiction in the field of postwar planning, including reconversion of the industry to civilian manufacturing and also immediate problems relating to war contracts and their termination.

Mr. Cosgrove said that the work of his committee on economic problems of the industry would be correlated with that of the technical planning agency now being organized by the RMA and the Institute of Radio Engineers.

* * *

W. L. FATTIG NAMED ACTING SUPERVISOR OF G. E. RECEIVER TECHNICAL SERVICE; P. R. BUTLER IN NAVY

W. L. Fattig has been appointed acting supervisor of the technical service section of the General Electric receiver division. P. R. Butler, former manager of the section, is now a lieutenant in the U. S. Navy.

* * *

A. A. BRANDT, G. W. HENYAN, V. M. LUCAS IN NEW G. E. POSTS

Arthur A. Brandt, George W. Henyan, and V. M. Lucas have been appointed to new positions in the electronics department of the General Electric Company.

Mr. Brandt has been made general sales manager. Mr. Henyan has been made assistant to the vice president of the department, and Mr. Lucas has been appointed manager of the Government division.

KARET BECOMES SALES MANAGER OF UTAH'S WHOLESALE AND SOUND DIVISION

R. M. Karet has just been appointed sales manager of the wholesale and sound division of the Utah Radio Products Company, O. F. Jester, vice president in-charge-of-sales, announced recently.

Mr. Karet has been a member of the Utah organization since 1936. He will assume responsibility for the sale of Utah products distributed through parts jobbers, sound houses and similar organizations.

* * *

QUAM NOW STEEL WIRE COMPANY DIRECTOR

James Quam, president and general manager of Quam-Nichols Company, Chicago, Illinois, has been elected a director of the Nichols Steel and Wire Company.

* * *

CLAROSTAT MOVES OFFICES

The Clarostat Mfg. Co., Inc., has moved its general offices to 130 Clinton Street, Brooklyn, N. Y. The new 'phone number is MAin 4-1190-1-2-3-4-5.

* * *

MALLORY WINS THIRD WHITE STAR

P. R. Mallory & Co., Inc., Indianapolis, Ind., has just been awarded a third star for their "E" pennant, which was first won in January, 1942.

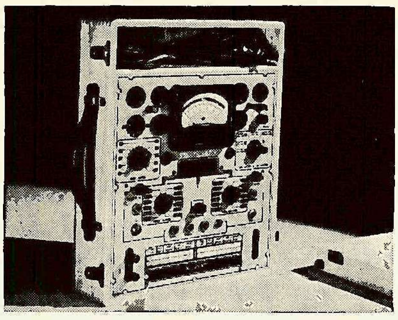
(*Continued on page 30*)

NEW PRODUCTS

(*Continued from page* 23)

A new portable test instrument, model 804 dual-tester for direct testing of all acorn tubes as well as all old and new types of regular receiving tubes, rectifiers, which has been released by Radio City Products Co., Inc., 127 W. 26th Street, N. Y. City.

Size is 14½"x13"x6"; weight, 12¼ pounds. For operation on 105-135 volts, 50-60 cycles. Features are Dynoptium tube test circuit; double line fuses; instrument fuse; sensitive leakage, noise and hum tests; a-c measurements. The ohmmeter reading ratio is 500,000,000 to 1; current reading ratio is 1,000,000 to 1; voltage reading ratio is 100,000 to 1. Contains a built-in *Rotindex* mechanical roller tube chart. Instrument has an electrostatic leakage tester for all mica and paper condensers; also an electrolytic leakage tester for all electrolytic capacitor readings on a *good-bad* scale. A battery tester determines the actual condition of the battery by testing under



load for various voltage ratings of batteries.

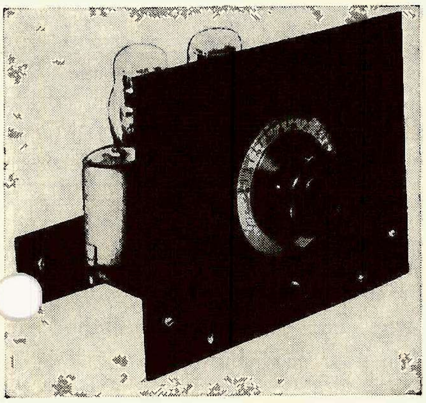
The d-c voltmeter ranges are from 0-2.5-10-50-250-1000-5000; a-c voltmeter ranges from 0-10-50-250-1000-5000; output voltmeter ranges are 0-10-50-250-1000-5000; d-c milliammeter ranges: 0-.5-2.5-10-50-250-1000; d-c ammeter range, 0-10 amperes.

* * *

LAFAYETTE TRAINING KITS

Lafayette Radio Corp. of Chicago and Atlanta is now producing one- and two-tube regenerative kits to provide complete basic receiver training.

The one tube kit, when assembled, demonstrates grid leak detector operation and the effects of regeneration on a detector circuit. An r-f stage can be added without redrilling the chassis or moving any component parts of the detector circuit. Alignment procedure can then be demonstrated in its simplest form. These kits may be operated either



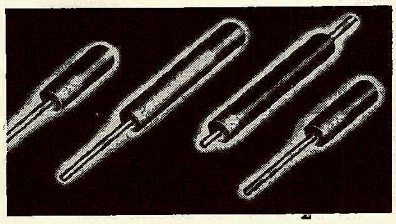
from power supplies or from batteries when proper tubes are used.

* * *

STACKPOLE HIGH RESISTIVITY INSULATED CORES

Iron cores having high unit resistivity are now available from the electronic components division of the Stackpole Carbon Company, St. Marys, Penna. The material is recommended for applications where a resistance of 150 megohms or greater is required, and where voltages do not exceed the breakdown value.

This high resistivity is said to reduce



leakage currents and their resultant noise troubles. Possibilities of voltage breakdown between coils and cores are also said to be reduced. In applications using cup cores, the high resistivity core material avoids the necessity for heavy insulation on lead wires.

(*Continued on page* 31)

BUY UNITED STATES WAR SAVINGS STAMPS AND BONDS FOR VICTORY

NEWS

(*Continued from page 28*)

DAVID GRIMES KILLED IN PLANE CRASH

David Grimes, vice president in charge of engineering for Philco Corporation, who was abroad on a special war mission, was killed recently when the transport plane in which he was traveling with Commodore James A. Logan, Commandant of the United States Naval operating base at Londonderry, crashed into a mountain in Northern Ireland. He was 47 years of age.

Following his graduation from the University of Minnesota, Mr. Grimes served in the last war as chief radio officer at Kelly Field, Texas. From June to December, 1918, he was Signal Officer attached to the British Air Forces at Aldershot and Littlehampton, England.

After the war, Mr. Grimes joined the American Telephone and Telegraph Company as a research engineer in telephony. In 1922 he established his own engineering organization. It was during this period that he invented the famous *Grimes Inverse Duplex circuit*. From 1930 until 1934, he was license engineer with the Radio Corporation of America.

Mr. Grimes joined Philco in 1934.

* * *

MINIMIZING POSTWAR PARTS DUMPING

Postwar dumping of surplus radio parts need not be a serious threat to the trade if manufacturers and jobbers cooperate in maintaining price structures and brand reputations, according to Charley Golenpaul, sales manager of the Jobber Division of Aerovox Corporation and chairman of the Eastern Group, Sales Managers Club.

Mr. Golenpaul points out that while radio parts are now being produced in fantastic quantities, such parts are just as rapidly assembled into radio and electronic equipment for our armed forces. Much of that equipment will be used by our armed forces or placed in reserve after fighting ceases. Thus completed equipment, much of it of a vital military character, will hardly be dumped into civilian hands. Also, it will hardly pay to break up discarded military equipment in order to salvage second-hand parts.

Nevertheless, he explains, the fact remains that radio parts are now being produced on a fantastic scale. No doubt there is some over-buying here and there. Considerable quantities of parts may be dumped by equipment manufacturers caught with over-supplies. What about this very real threat?

Mr. Golenpaul points out that a sharp distinction can be drawn between such surplus parts and regular items produced for the jobbing trade. Thus parts made for set or equipment manufacturers are usually not individually packaged. That is distinction No. 1. Loose goods are apt to be considered with suspicion.

Again, manufacturers' parts usually carry an entirely different part number or type designation to the confusion of the jobbing trade. That is distinction No. 2. Manufacturers can accentuate the disrepancy in type numbers or designations, explains Mr. Golenpaul.

Still again, parts sold to manufacturers are protected by a blanket guarantee covering the initial buyer only. In other words, if such parts are resold to others as parts, the guarantee no longer holds. That is distinction No. 3.

Our normal trade must be insured against the inroads of dumping, says Mr. Golenpaul. Here we have a far better chance of playing up the distinctions between regular goods and dumped goods. The Service Man, with a reputation at stake, and working with an adequate markup on the materials he uses, may think twice before he takes a chance on a nondescript dumped part which comes unpackaged, carries a different type designation, and carries no guarantee whatsoever. He simply can't afford to gamble that way.

Our main job, continues Golenpaul, is to win the war. We cannot afford to spend valuable time worrying and fretting about postwar problems. However, without detracting one iota from the all-out war effort, both manufacturers and jobbers alike can and must do a little thinking and planning as to how the postwar dumping situation can be met. There is a place for both kinds of goods. But the two classes of trade must be kept separate and distinct if we are to maintain our price structures and brand reputations. Now is the time to be doing a little thinking and planning before the storm breaks, points out Mr. Golenpaul.

●

Our country is at war. On the home-front, it is your obligation, small enough surely, to keep your industry functioning smoothly "for the duration".

STANDARD VOLUME CONTROLS

At the urgent request of the WPB and OPA members, the list of so-called *Victory* models has been finally cut down to eleven types as follows:

Composition Element with Integral Flatted Shaft

Part Number	*Resistance in Ohms*	*Taps at Ohm Points*	*Taper*
VVC- 1	10,000	......	Symmetrical
VVC- 2	25,000	......	Symmetrical
VVC- 3	250,000	......	Clockwise Audio
VVC- 4	500,000	......	Clockwise Audio
VVC- 5	500,000	150,000	Clockwise Audio
VVC- 6	1 megohm	......	Clockwise Audio
VVC- 7	1 megohm	300,000	Clockwise Audio
VVC- 8	2 megohms	......	Clockwise Audio
VVC- 9	2 megohms	15,000 & 500,000	Clockwise Audio
VVC-10	2 megohms	500,000 & 1 megohm	Clockwise Audio

Wire-Wound Element with Integral Flatted Shaft

Part Number	*Resistance*	*Taper*
VVC-34	10,000	Linear

Switches

Units furnished with switches shall have the applicable suffix listed below added to the part number.

Suffix	*Switch*
S	single pole, single throw
T	double pole, single throw
U	single pole, double throw
V	4 pole, single throw shorting

CASH MONEY

Will be paid for shop notes, servicing short c service hints, etc., accepted and published in SERVICE. Send in your contributions.

CASE HISTORIES

SILVERTONE MODELS

Silvertone 4462: If set plays intermittently and all tubes and voltages [illegible] all right, change 6B5.

Lawrence Roeshot.

* * *

ZENITH MODELS

Zenith 7S487: When set plays weakly, look for partially shorted .05-mfd condenser from B+ return of second i-f ground.

Zenith 8S463: Squeal due to volume control being beyond middle position is normally due to open 16-mfd condenser No. C23 and not due to the volume control being worn.

Zenith 10S589: When phono arm does not finish complete cycle due to improper adjustment, turn clutch adjusting screw *D P*, one-half turn.

Lawrence Roeshot.

* * *

VIBRATORS

(*Continued from page* 16)

creased through the use of multiple contact points. This makes possible an input wattage rating as high as 1,000 watts. By synchronizing one or more of these vibrators combined wattage ratings in excess of 2,000 watts can be obtained. Tandem-type vibra[illegible] used alone, are usually employed [illegible] power supplies delivering as much as 750 watts a-c or d-c.

Polarity Changer Type

This type of vibrator is available in as a single frame or a tandem vibrator. It is used to produce a d-c to a-c inverter in which there is no transformer involved. It actually is a power supply in itself, being most frequently employed to change 110-volt d-c to 110-volt, 60-cycle a-c.

Maximum input wattage rating for the single life expectancy is 1,500 hours in both cases. Frequencies for both range from 50 to 100 cycles, and may be constant or variable.

DATA TABLE FOR ALL TYPES OF E-L VIBRATORS

Characteristics	Low Power Vibrators	Converter Type	High Power Vibrators: Tandem Type	Polarity Changer: Single	Polarity Changer: Tandem
Input Wattage Rating (Maximum)	75 watts	150 watts	1,000 watts	100 watts	300 watts
Input Voltage	4-32 volts	4-220 volts	2-220 volts	4-220 volts	4-220 volts
Frequency-Cycles	180	60,100,120 Std.	60,100,120 Std.	60,100,120 Std.	60,100,120 Std.
Constant or variable?	Constant	Available either way	Available either way	Available either way	Available either way
Weight	Av. 4 oz.	Av. 1 lb. 14 oz.	Av. 2 lbs.	Av. 1 lb. 14 oz.	Av. 2 lbs.
Effective Life	500 Hours	1,000 Hours	1,500 Hours	1,500 Hours	

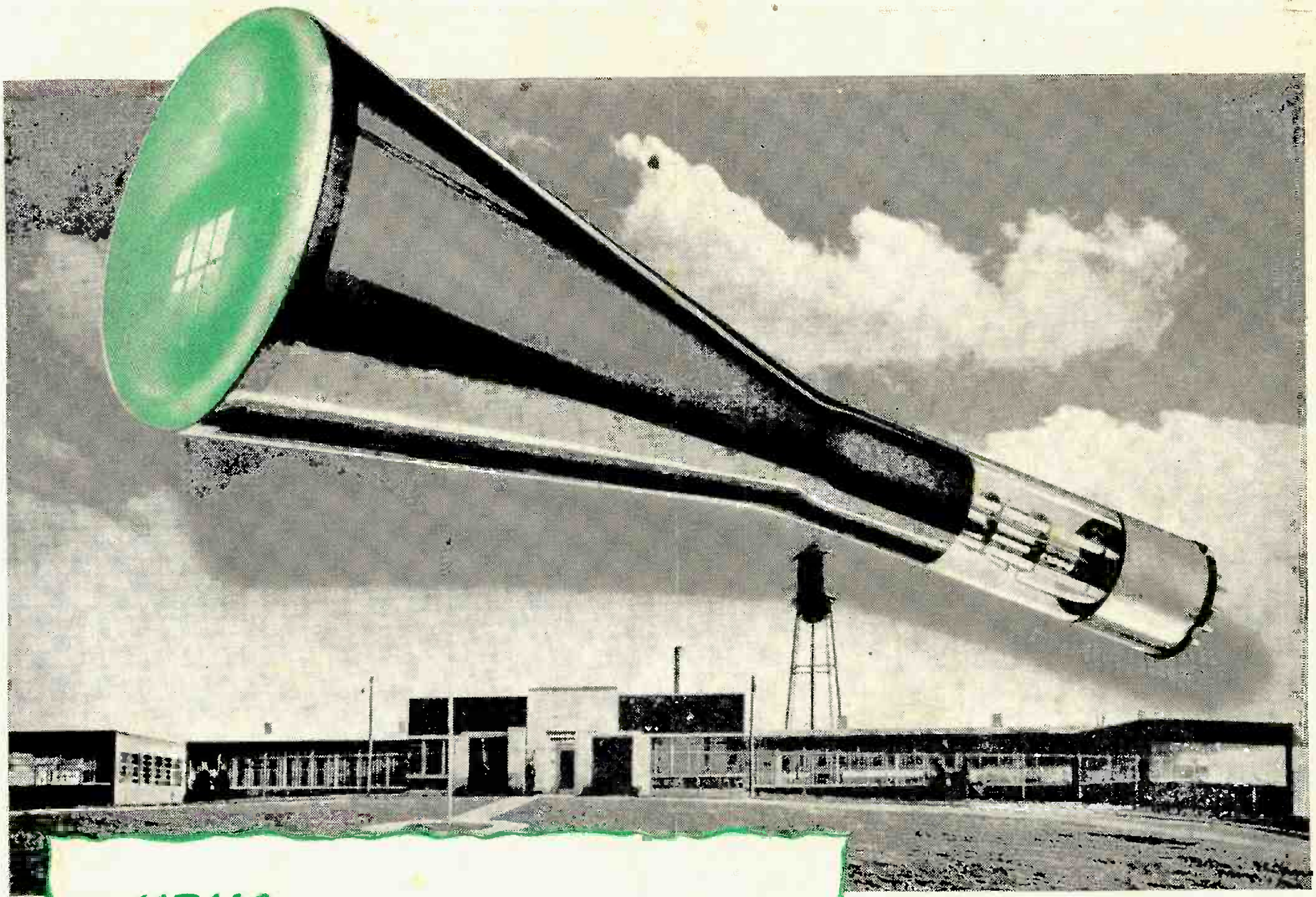
JOTS & FLASHES

CLAROSTAT moves executive and sales offices to 130 Clinton St., Brooklyn, N. Y. . . . congratulations on Army-Navy "E" production award to National Union and Hazeltine Electronics Corp. . . . welcome to E. G. Brown, new advertising manager of Hallicrafters . . . Capacitrons, Inc., 318 W. Schiller, Chicago, formed to manufacture oil and wax capacitors . . . owners are Al Sklar and Dick Laycock, both identified with condensers for a long time . . . J. J. Nance, v-p of Zenith Radio Corp., appointed to postwar planning committee of RMA . . . we like *The Clipper*, newsy and laugh-giving house journal of Mueller Electric Co. of Cleveland . . . better get on their mailing list . . . welcome to Hytron advertising in SERVICE . . . more and more manufacturers are planning their postwar programs and realizing the importance of radio Service Men during the coming readjustment period and thereafter . . . radio receiver manufacturers should consider the sales and recommending power of you Servicers . . . you get into the homes of the country by invitation, the best possible point of sale . . . your opinions are asked and respected . . . your advice can make or break many a sale . . . A. C. Sanger appointed sales manager for appliance divisions of General Electric . . . Universal Microphone Co. appoints Richard Earnest supervisor of their newly established cost accounting department . . . same company makes G. Schmidt director of plant protection . . . E. C. Crowther of Philadelphia accepted for membership by Mid-Atlantic chapter of The Representatives . . . Hy Steinberg, popular N. Y. rep, announces birth of a new heir named Lester Morton . . . congratulations, Hy . . . increased demand for United Transformer Co. products necessitated the leasing of extensive additional factory space in N. Y. . . . don't overlook your obligation and privilege as American business men to participate up to the hilt in the current 3rd War Loan Drive . . . while news from the various war fronts looks good at this time your Uncle Sam needs every available dollar to bring world-wide hostilities to a speedy and victorious conclusion . . . so let's all do a bit more than our share . . . how about dropping us a line expressing your ideas on the editorial material that has been appearing in SERVICE . . . the editors would appreciate your comment and welcome any thoughts or suggestions you might submit . . . news of Service Men in the armed forces would be appreciated also . . . that's that for September . . . don't forget to

Buy Bonds

ADVERTISERS IN THIS ISSUE

SERVICE—SEPTEMBER, 19



MEMO **for Post-War Reference:**

NATIONAL UNION IS ONE OF THE LARGEST PRODUCERS OF CATHODE-RAY TUBES

In our cathode-ray tube production record, now climbing upward week by week, we see the working out of plans made long ago. Here are the dreams of our engineers come true. Here is the model factory they planned and equipped especially for cathode-ray tube manufacture—one of the Industry's largest. Here are the mass production machines they designed—built by this company's own equipment division. Here are the hundreds of skilled workers to whom they taught this special art of tube making that calls for the utmost precision and accuracy. Here are their laboratories with research continuing at an even greater pace, as though their work had just begun. And here are the results of all this thought and effort—National Union Cathode-Ray Tubes *by the carload.* Today, enroute to those who need them most—our fighting forces! Tomorrow, destined to bring to millions of homes a marvelously improved kind of television with larger images, with greater sharpness, reality, at mass-market prices—and to thousands of factories many new precision testing and measuring devices.

For engineers and production men, National Union is planning a comprehensive electronics industrial service—available as soon as war commitments permit.

NATIONAL UNION RADIO CORPORATION NEWARK, N. J. LANSDALE, PENNA.

NATIONAL UNION
RADIO AND ELECTRONIC TUBES