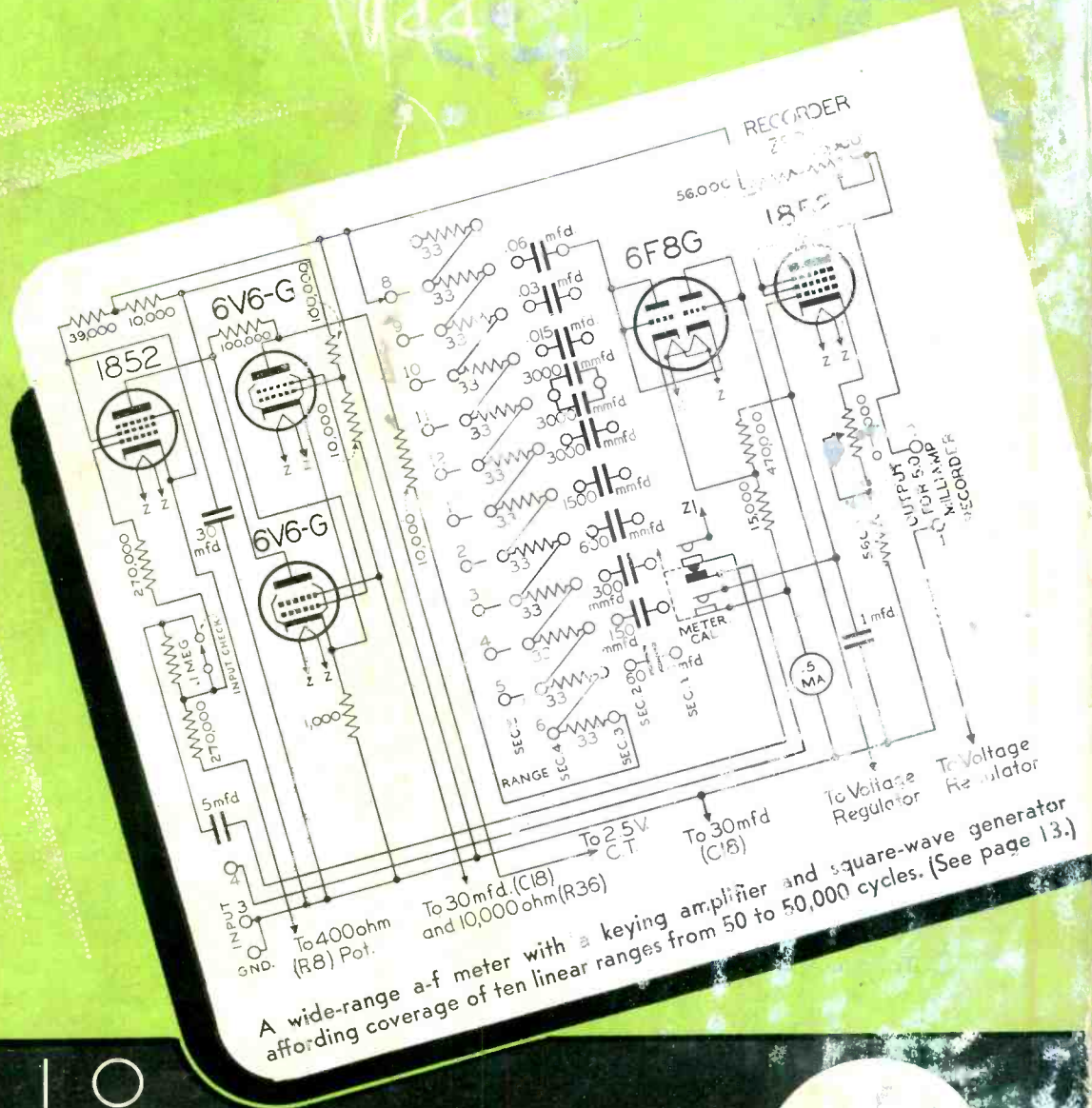


SERVICE

A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE



- ★ RADIO
- ★ TELEVISION
- ★ ELECTRONICS

January
1944



"Nothing Like Being Rugged, Eh Kid?"



Our mechanized Army must have brains, but brawn still counts. The big fellow wrestling interminably with 155 millimeter shells serves his greedy howitzer with the broad back developed by endless months of bone-tiring drill.

If it cannot take the jolts, vibrations, concussions, and extreme atmospheric variations of mechanized global war, the best electronic fighting equipment in the world is useless. Hearts of this combat equipment — electronic tubes — have two strikes against them from the start. Inherently delicate and fragile by nature, still

they must be as rugged as the men who depend upon them.

Bump, vibration, immersion, life, and other punishing tests prove the mettle of Hytron tubes before they leave the factory. More important still, results of these tests form the basis for continual improvements in construction and processing. Throughout manufacture — in stem, mount, sealing-in, exhaust, aging, basing, and test departments — engineers, foremen, and skilled operators are ceaselessly striving to achieve in Hytron tubes not only the tops in electronic performance, but also the peak of dependable stamina which combat demands.



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HYTRON
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ELECTRONIC AND
RADIO TUBES

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ANOTHER
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● SERVICE CONTEST ●

First Prize \$100 WAR BOND
Second Prize \$50 WAR BOND
3rd, 4th and 5th Prizes \$25 WAR BONDS
Additional Prizes (See Instructions)

Here's What You Do—

Tell in your own words how you have repaired or rebuilt a radio receiver, phonograph or sound system where parts shortages have been a factor. And remember, it's your idea that counts, not your writing ability. Your entry can be brief or as long as you desire.

NOTE

The five main prize winning entries will be printed in full after editing and checking for technical accuracy in future issues of SERVICE. Watch for them. They'll probably contain ideas that will be helpful to you. Other entries which do not qualify for one of the main prizes will also be published in full or in part.

—Now don't think you have to be an Einstein to win a prize. A simple idea explained in very few words may qualify. So get going! What can you lose?

INSTRUCTIONS

- 1—This contest is open to anyone who has done radio service work at any time during the past two years. You don't have to be a subscriber to SERVICE.
- 2—Your entry will be judged by the originality and value of your idea and its technical accuracy—literary merit is not a consideration.
- 3—All entries must be postmarked *not later than March first, 1944. Mail to SERVICE, 19 E. 47 St., New York 17, N. Y.*
- 4—Prize winners will be announced in March SERVICE and prizes given out not later than March 15.
- 5—All entries become the property of SERVICE magazine and in case of a tie duplicate prizes will be awarded.
- 6—When entries do not qualify for one of the main prizes but are of sufficient merit to be printed in full or in part in future issues of SERVICE, \$10.00 in war stamps will be awarded to the contestant.
- 7—The judges are Lewis Winner, Consulting Editor of SERVICE; Donald McNicol, Past Pres. of IRE, and A. E. Rhine, Past Pres. IRSM. Decisions of the judges are final.

Attention Association Secretaries:—How's about mentioning this contest at the next meeting?

SERVICE

A Monthly Digest of Radio and Allied Maintenance

19 E. 47th Street, New York 17, N. Y.

EDITORIAL

THOSE scarce tubes . . . 12SA7, 12SQ7, 12SK7, 50L6, 35Z5, 35L6, 1H5, 1A7 and 80 should be soon available again. For the WPB has set up a program calling for the production of these and other hard-to-get tubes. The program specifically calls for the production of at least 4,500,000 tubes during the first quarter of 1944. Tubes will be marked "MR" for maintenance, repair, and operating supply purposes. This means that they will not be available for rated orders and thus will not be diverted from civilian channels.

The Service Man and consumer is grateful for this allotment. We hope that the WPB continues this progressive policy, and provides for, in the next quarter, an increased allotment, to accommodate the many receivers that are still in need of new tubes.

THE radio tube black market seems to be on the loose again. From many quarters have come reports that black market trading of tubes is rampant. It is a dangerous and vicious practice and must be stamped out at once. It is detrimental to the war effort and to every Service Man!

THERE will be no civilian production of receivers in 1944 according to Bond Geddes, executive vice president and general manager of RMA. The function of the Service Man will, therefore, be more vital than ever before . . . to keep receivers working!

THE Fourth War Loan is now under way. Do your share today. Buy a bond!

SERVICE

A Monthly Digest of Radio and Allied Maintenance

Reg. U.S. Patent Office

Vol. 13. No. 1

January, 1944

ALFRED A. GHIRARDI

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Building TOMORROW ... Today!

Electronic engineering laboratories are busy keeping pace with the tremendous number of new wartime tube developments. RAYTHEON engineers are doing this and more—giving RAYTHEON tubes that “Plus-Extra” that set manufacturers and dealer servicemen have always known throughout the years; that “Plus-Extra” put into every design and each step of the manufacturing processes. It is just that extra performance quality, built into RAYTHEONS, that assures their leadership in the new post-war era of electronics.

When we can again return to the peacetime American system of free enterprise, the RAYTHEON jobber, dealer and serviceman will have the additional advantage of RAYTHEON’s wartime engineering development and production of electronic tubes for the great number of new applications.

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High Fidelity
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All Four Raytheon Plants Have Been
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DEVOTED TO RESEARCH AND THE MANUFACTURE OF TUBES FOR THE NEW ERA OF ELECTRONICS



STARTING JANUARY 18TH IT'S UP TO YOU!

STARTING January 18th, it's up to you to lead the men and women working in your plant to do themselves proud by helping to put over the 4th War Loan.

Your Government picks you for this job because you are better fitted than anyone else to know what your employees can and should do—and you're their natural leader. This time, your Government asks your plant to meet a definite quota—and to break it, *plenty!*

If your plant quota has not yet been set, get in touch now with your State Chairman of the War Finance Committee.

To meet your plant quota, will mean that you will have to hold your present Pay-Roll Deduction Plan payments at their peak figure—and then get at least an average of one **EXTRA \$100 bond from every worker!**

That's where your leadership comes in—and the lead-

ership of every one of your associates, from plant superintendent to foreman! It's your job to see that your fellow workers are sold the finest investment in the world. To see that they buy their share of tomorrow—of Victory!

That won't prove difficult, if you organize for it. Set up your own campaign right now—and don't aim for anything less than a 100% record in those *extra \$100 bonds!*

And here's one last thought. Forget you ever heard of "10%" as a measure of a reasonable investment in War Bonds under the Pay-Roll Deduction Plan. Today, thousands of families that formerly depended upon a single wage earner now enjoy the earnings of several. In such cases, 10% or 15% represents but a paltry fraction of an investment which should reach 25%, 50%, or more!

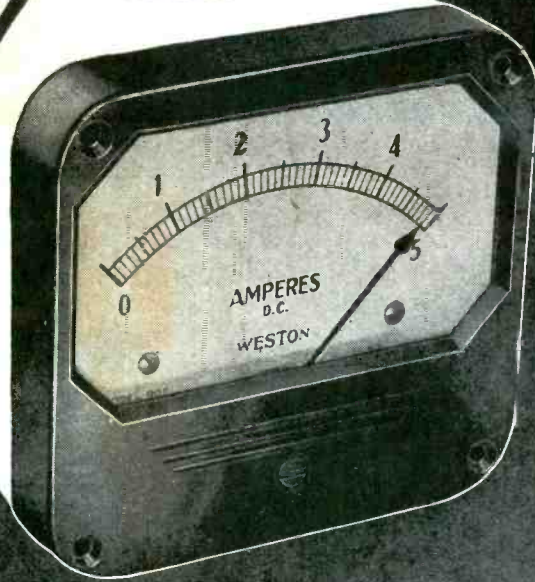
Now then—Up and At Them!

Keep Backing the Attack!—WITH WAR BONDS

This space contributed to Victory by SERVICE

This advertisement prepared under the auspices of the United States Treasury Department and the War Advertising Council

WESTON



CONTINUING LEADERSHIP ... through the war and beyond!

The start of the new year finds instrument headquarters still busy at it in the final drive for victory. Dependable WESTON instruments, in all familiar types, continue flowing in unprecedented quantities to every battle front. In new types, too; for all during this period of stress WESTON development laboratories also have led the way ... continually meeting the new

measurement problems of this mechanized war. Thus when instrument priorities are relaxed, WESTONS will continue as industry's standards for all measurement needs. For, new measurement tools as well as old will be available in their most trustworthy form ... here at instrument headquarters. Weston Electrical Instrument Corp., 604 Frelinghuysen Ave., Newark 5, N. J.

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MT. CARMEL WHERE ELECTRONICS IS KING



Keen Eyes and Sensitive Fingers: Here's skill—plus imagination! A typical scene at Meissner's Mt. Carmel plant as vital war supplies, precision-made in every detail, are kept moving to world battle fronts.



Can He Qualify? Even in wartime, Meissner prides itself on its "hand-picked" personnel. Here Personnel Manager White is interviewing a promising applicant. (See main caption at right.)



Your Guarantee of Perfection: Down through the years, the Meissner name has come to stand for the ultimate in radio quality. These two, along with hundreds of other experienced technicians, are very good "reasons why!"



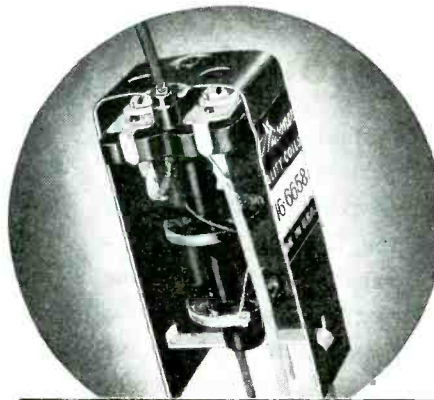
Precision Family: It is said that Mt. Carmel, Illinois, has more electronics technicians per thousand population than any other city on earth. Shown here are five of the six members of the Collins family — one of the many families helping to make the delicate, sensitive equipment for which Meissner is famous.

PERSONNEL? Here It's PRECISION-EL!

Mt. Carmel, Illinois, (population 7,000) is famous for two things: music and electronics. The first reputation is based on its top-flight civic and high school music groups — on such outstanding home-town "products" as Howard Barlow, renowned symphony conductor. The reputation for great electronics ability centers around the humming Meissner plant—where scores of employes have spent their entire working lifetimes on the exacting requirements of Meissner's "Precision-Built" line. Their flying fingers, now assigned to war orders of tremendous strategic importance, long ago lifted them above mere "personnel" into the radio industry's highest honor—"PRECISION-EL!"

Ready for Delivery

Good news! You can now obtain a quantity of the highly popular Meissner "Plastic" I. F. Transformers. As you know, these are particularly suitable for use in small receivers—where space is at a premium, yet superior performance is required. Meissner "Plastic" I. F. Transformers are famous for remarkable stability, high gain, wide range and double tuning. Typical of Meissner precision building, they are only $1\frac{1}{4}$ " square x $2\frac{1}{2}$ ", yet are not affected by temperature, humidity, or vibration. Specially served Litz wire! One-piece molded plastic coil-form and trimmer base! Order at once for prompt service.



MEISSNER

MANUFACTURING COMPANY • MT. CARMEL, ILL.

ADVANCED ELECTRONIC RESEARCH AND MANUFACTURE

WARTIME SERVICING

In New Zealand



ALTHOUGH parts shortages have been severe in New Zealand, we have found many effective servicing methods that seem to have alleviated the problem.

In the ordinary course of radio servicing in this country, the Service Man would be called upon to do quite a considerable amount of conversion work. After doing much of this work there is one point which will strike the Service Man as nothing short of amazing. That is the extent to which *B* voltage may be lowered with satisfactory performance. In the standard a-c receiver using 250 volts on the tubes it is necessary to make a very substantial drop in *B* voltage when changing to a-c/d-c, if the field coil is to be retained as a filter choke. Of course, the change involves a change of all tubes not .3 amp heaters. Generally the output tube and rectifier are changed to 25A6 or 25L6 and a 25Z6 rectifier. Our line voltage here is 230 volts and in the average receiver changed to a-c/d-c, the rectified and filtered *B* supply will be something between 125 and 150 volts depending upon the resistance of the field coil. It then becomes possible to raise the screen voltages on the converter and i-f tubes, and decrease the bias. The 25L6 with its correct plate load gives

by **E. B. MENZIES**

something over 2 watts, which is plenty of audio for the average home. The performance will leave nothing to be desired. Signal generator tests prove only slight reduction in sensitivity, and the audio output is only slightly less than with the ordinary 6F6 output. The only actual difficulty is in hum level which naturally rises as a result of the half-wave rectifier. This means either additional filter capacity or hum balancing.

Tubes

Tubes are a difficult problem, more so in this country because of the large variety of English and Continental tubes in general use.

With a greatly reduced number of tube types available it is now getting to the stage where r-f pentodes are r-f pentodes regardless of base or filament voltage. The .3 amp and .15 amp tubes are reserved for a-c/d-c work, but for straight a-c jobs whether it be a 58, 78, 6D6, 6K7, 6U7, or an EF39 (Eng.) it is a matter of making the set to fit the tube, not getting a

tube to fit the set. The greatest assistance in tube difficulties is to wind up some small 2.5 to 6.3 volt auto-transformers. These only handle a few watts and can be wound on some of the smaller speaker transformer cores. It then becomes possible to use 2.5 or 6.3 volt tubes in any a-c receiver. Difficulties here are complicated in the case of English and Continental a-c/d-c receivers which use .2 amp heaters. Substitution of these tubes with American types means shunting of the remaining tubes to .3 amp. Tube sockets are now of course changed without hesitation. The 1.4-volt octals 1LN5, 1LN5, etc., are always changed to the equivalent octal type. 3Q5 and similar tubes are changed to a 1.4-volt type with a series resistor, when the 3Q5 filaments are in series.

Controls

A few words with regard to tone and volume controls are necessary. In general any control working either as diode load or audio grid control, can be .5 or 1 megohm, or even .25 megohm without undue alteration in performance. Tone compensation has, in most cases been dropped, where a tapped control is used. If the lower values of control are not available for tone

(Continued on page 28)

CATHODE-

by **ALFRED A. GHIRARDI**

Advisory Editor



Operating a typical cathode-ray oscillograph. Note the a-c wave form on the oscilloscope screen.

(Courtesy DuMont)

THE cathode-ray oscillograph has become one of the most useful tools available to radio, electronic and electrical workers. Essentially an instrument for plotting an instantaneous visual curve of one electrical quantity as a function of another electrical quantity on the screen of the cathode-ray tube, it is versatile in the extreme. Equipped with high quality amplifiers, it becomes a sensitive, high impedance voltmeter which cannot be damaged by voltage overload. The multitude of its applications

has not been fully appreciated by the average Service Man, although the more progressive men have been quick to capitalize its possibilities.

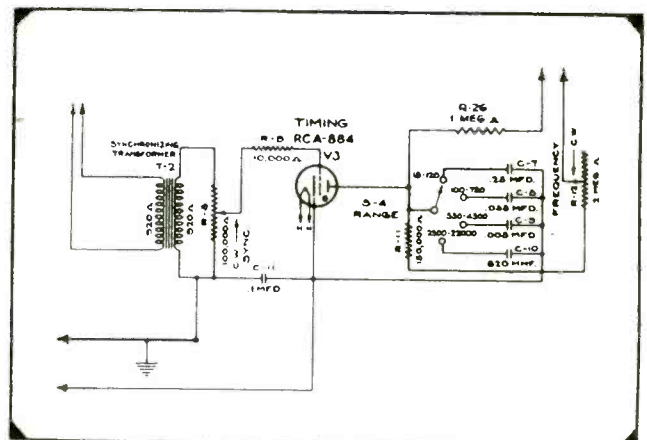
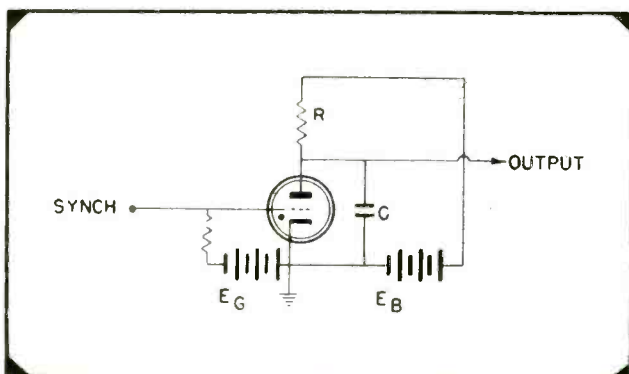
The cathode-ray oscillograph is of considerable assistance in designing, testing and adjusting receivers and transmitters and many of their component parts. When we speak of transmitters we include standard signal generators and all types of test oscillators, both audio and radio frequency. Most Service Men are familiar with the visual alignment equip-

ment consisting of an oscillograph, r-f and i-f oscillator, a frequency modulator for the oscillator and means for synchronizing the sweep, or timing circuit with the modulator. This combination of equipment makes exact adjustment of the tuned circuits a pleasure instead of an art. Several oscillograph manufacturers have incorporated all the elements required for alignment in one case. Among these we have Hickok's model RFO-4, Dayrad's model series 65, RCA, Clough-Brengle, etc. Others have separate oscillographs and frequency-modulated oscillators, making a two-unit set-up. The features of some of this equipment will be described in detail later.

Sweep Circuits

The main purpose of an oscillograph

Figs. 1 (below) and 2 (right). Fig. 1, basic gas triode sweep oscillator circuit (Courtesy DuMont). Fig. 2, RCA thyatron sweep circuit.



RAY OSCILLOGRAPHS

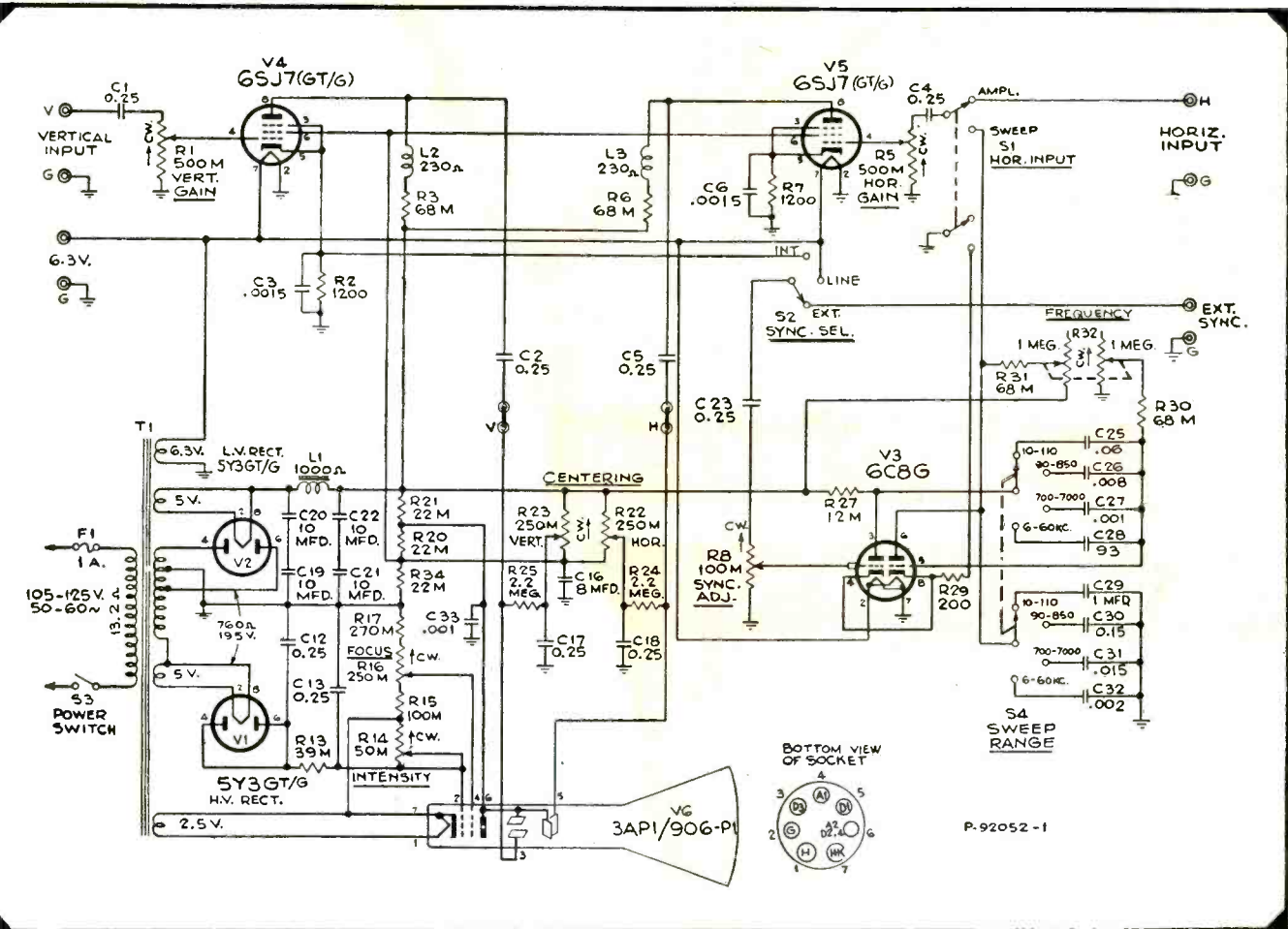


Fig. 3. Circuit of the RCA 155C oscillograph. A trigger circuit is used with a dual triode, 6C8G, in this system.

in radio service work is to spread the a-c or pulsating voltage so that the waveform can be examined on the screen. This requires the regular repetition of the image so as to make it appear constant. This is accomplished by the sweep circuit which is preferably a sawtooth-wave oscillator. To properly view waveforms of unknown voltages we need a linear time base which is most easily obtained by a sawtooth relaxation oscillator.

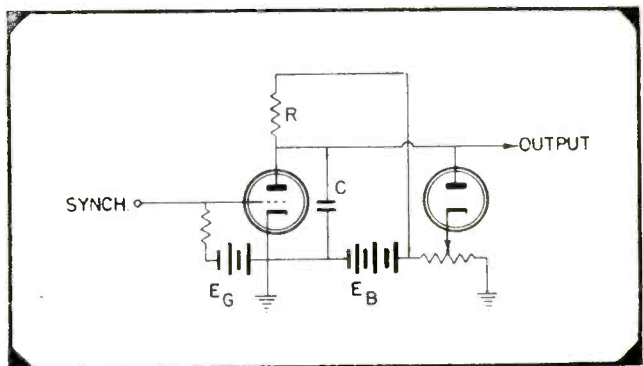
The frequency generated depends upon the individual thyatron, voltage, resistance and capacitance. It is convenient to vary R and C to cover a wide range of frequencies. For stability, it is important to keep the voltage constant. The circuit is simple in operation. When d-c is applied the condenser will charge through the resistor until a critical value (for the tube) is reached at which point the tube will *break down*, or ionize, becoming a low resistance conductor. This discharges the condenser rapidly, also pulling down its own potential which stops the ionization. The circuit then recycles. The charging volt-

age across the condenser is linear with the charging time for the beginning of the cycle, after which it starts to curve, or fall off. It is important to utilize only the straight part of the cycle for sweep purposes.

The upper frequency range of gas-

triode oscillators is limited to approximately 50,000 cycles by the de-ionization time of the tube. At low frequencies the time base is often not linear over the entire sweep cycle. Leakage in the condenser being charged (which prevents the voltage building up to its full value) is one cause of this. When a non-recurring transient or surge is to be observed it is desirable to allow only a single sweep cycle to occur, the period being adjusted so that it lasts as long as the transient. This can be accomplished by adding a diode and

Fig. 4. A basic single-sweep circuit used in oscillographs. (Courtesy DuMont)



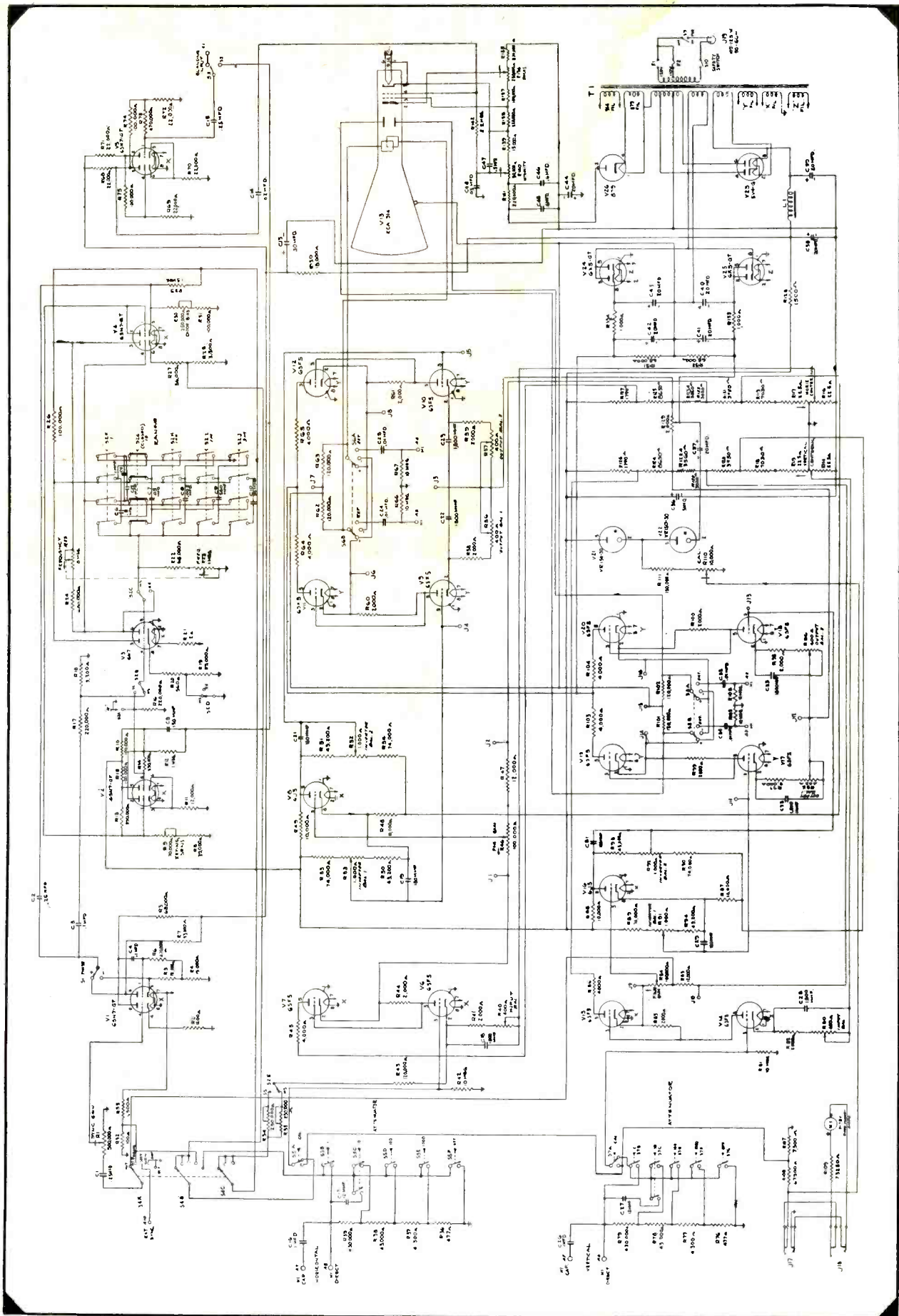
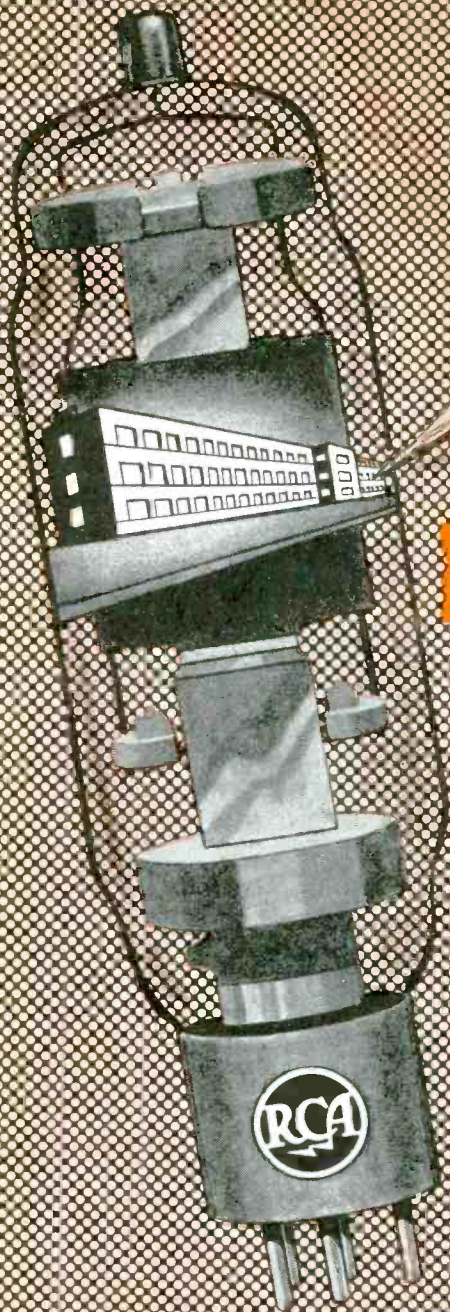


Fig. 5. Circuit diagram of the RCA 327-A oscilloscope.



THE EXTRA ELEMENT IN EVERY RCA ELECTRON TUBE

YOU can hold the tube in your hand and examine it thoroughly, but you won't see the extra element that distinguishes it.

Not until after you've put the tube to use will you finally become aware of that extra element.

It's in every RCA Electron Tube—the extra element that makes the RCA monogram worth looking for and insisting on.

It's research. It's engineering knowledge. It's experience.

It's "know how"—the kind of "know how" that's built into every RCA Electron Tube—and it's best exemplified by the modern RCA Laboratories at Princeton, N. J., devoted almost exclusively to electronic research.

There, men skilled in research seek new electronic facts.

There, the electron tube is recognized as the keystone of the whole vast structure of electronics.

There, basic facts are uncovered to assist RCA tube engineers on design, development, and production in turning out ever better and more advanced electron tubes.

The RCA Laboratories are a fitting symbol of the extra element that recommends RCA Electron Tubes to you.

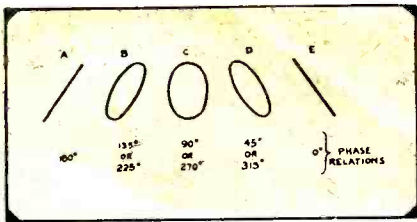
The Magic Brain of All Electronic Equipment is a Tube and the Fountain-Head of Modern Tube Development is RCA



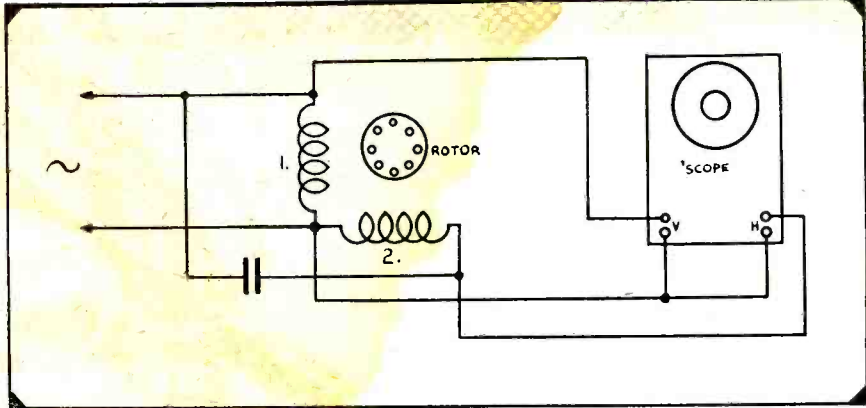
TUNE IN "WHAT'S NEW?"
RCA's great new show,
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Figs. 6 (top) and 7 (right). Fig. 6 shows five different phase angles that may be seen on the screen of an oscilloscope. In Fig. 7, we have a set-up for checking the phase angle between two phase windings 1 and 2. The angle depends upon the ϕ of phase 2, which in turn depends upon the mechanical load on the motor.



potentiometer to the circuit of Fig. 1, as shown in Fig. 4. This is simply a diode clipping application similar to others that we encounter, i.e., noise limiters in good f-m receivers and communication sets.

The diode cathode is set at some value of potential, positive to ground, below that at which the thyatron will conduct. As the *B* voltage charges condenser *C* through resistor *R*, the diode will conduct and prevent a further rise in plate voltage when the plate potential exceeds the cathode potential. Now, if a positive pulse is applied to the grid, the thyatron will fire until the tube voltage drops below the extinction potential. The circuit will then attempt to recycle and if the grid signal is still present, it will do so. If, however, the signal is removed, only a single sweep will occur.

Vacuum tubes, instead of thyatrons, may be used to generate linear sweep voltages, in which case frequencies above a megacycle may be obtained. A multi-vibrator or trigger type circuit is usually employed with a dual triode, as the 6C8G in RCA's new 155C oscillograph whose circuit is shown in Fig. 3. Note also the 6N7 timing axis oscillator in the new RCA 9-inch oscillograph, 327-A, in Fig. 5.

Operation

The sweep circuit is usually set at a lower frequency than the observed signal, often one-half frequency which allows two complete cycles to be observed, which is particularly good for scrutinizing the waveform. The synchronizing control locks the signal voltage in step with the sweep oscillator by feeding a small part of the signal voltage to the input circuit (usually the grid) of the timing supply. The timing may also be synchronized with the 60-cycle supply line or with some external supply. The introduction of excessive synchronizing voltage decreases the fidelity of the pattern and, if very excessive, may change the waveform completely. In most oscillographs, a certain percentage of the signal is used for synchronizing so that as the signal voltage changes, the synchronizing control must also be changed in step to prevent losing the pattern with too little sync voltage, or ruining it with too much.

Oscillographs equipped with high gain amplifiers are very useful in signal tracing in audio, supersonic and intermediate frequency amplifiers. The more expensive units have wide-band amplifiers covering up to 1 megacycle and more which could be used in the broadcast band. Other useful applications include the investigation of vibrator power units and the selection of correct buffer condensers for a par-

ticular load, the balancing of phase inverters, checking detector and a-f overloading, hum investigation, frequency measurement and calibration, and phase angle measurements.

Checking Phase Inverters

Phase inverters should be adjusted so that the voltages fed to the power tube grids are equal. A vacuum tube voltmeter will usually suffice for this adjustment but distortion may be missed which would be obvious on the cathode-ray screen. A-f overloading may be most easily observed by using a sine wave input and noting the position of the gain control at which distortion begins. This is handy for impedance matching at the output and for measuring the undistorted power output. Detector action may be similarly observed. The presence of r-f or i-f in the detector output is easily seen in the fuzzy patterns produced.

Tracking Down Hum Source

In tracking down hum, the waveform gives a clue to the source. A 60-cycle hum may be induced by the filament current or by the magnetic field of the power transformer or input choke; 120-cycle hum would originate in the full-wave power supply via plate, screen or bias circuits. The reduction of hum by employing degeneration may be noted. Low values of hum voltage may be observed by using a weak signal, letting the hum modulate the signal. The pattern will be clear if the signal frequency is at least several times the hum frequency.

Frequency Measurement

In frequency measurement or calibration a known frequency is compared with an unknown and as long as one is a simple multiple of the other, the pattern will be stationary and the ratio can be ascertained. For measuring rotational speed it is convenient to attach an a-c generator to the rotat-

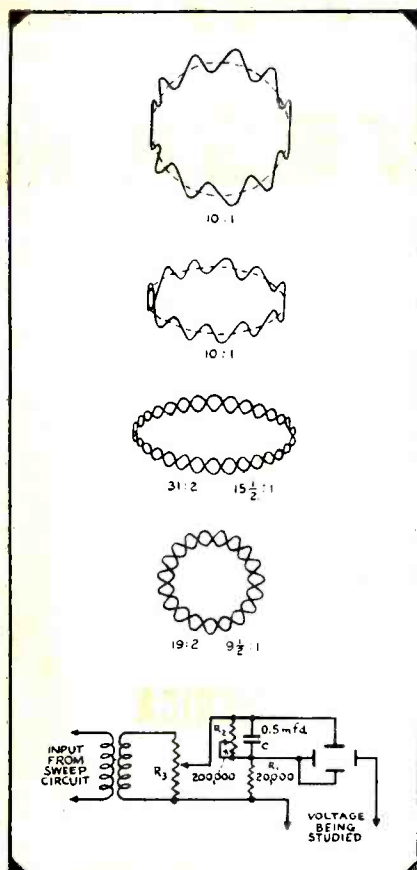


Fig. 8. The phase-splitting circuit which creates a circular or elliptical axis. Patterns obtained by adjusting this circuit are shown above the circuit diagram.

(Courtesy RCA)

(Continued on page 29)

AN A-F METER

[See Front Cover]

THIS RCA instrument (306-A) affords 10 linear-range frequency coverage from 50 to 50,000 cycles full scale. In addition to the indicating meter on the panel, provision has been made to supply power sufficient to drive a 5-milliampere recorder, having an internal resistance of 1,000 ohms or less. The current supplied is linear within 5%. The unit is stable over a wide temperature and power supply voltage variation (see sources of error). A change in ambient temperature from 25°C to 45°C will cause an error of less than 1/2% of reading for the three lowest ranges and less than 1/4% of reading for the seven remaining ranges. A change of line voltage from 105 volts to 120 volts on the 110-volt tap and 110-volts to 125 volts on the 120-volt tap has very little effect on the meter accuracy. These changes, however, do cause the recorder to shift its zero as much as 5%.

The instrument consists of a keying amplifier; square-wave generator; differentiating circuit with an associated meter to indicate the input frequency; d-c amplifier connected to the metering circuit to operate a recorder, and an electronically regulated power supply.

The keying amplifier uses an 1852 tube (V-1), whose grid bias is set

for maximum sensitivity by adjustment of R-8. The function of this tube is to operate the square-wave generator, which is of the multi-vibrator type. Since the generator is d-c connected, it is aperiodic and will remain with V-2 passing current and V-3 cut off, or vice versa, until keyed, providing that the bias of the keying tube is correctly adjusted. Thus only the time between successive crossings in the same direction, of the zero axis by the input wave, and not its shape, will determine the width of the generated square waves. The square waves enter the differentiating circuit, which consists of a condenser, resistor and rectifier network. The time constant is such that the condenser on any range is more than 99.9% discharged at the end of every positive half cycle. The indicating meter is placed in the cathode circuit of one of the two rectifiers. The other rectifier is placed in the circuit inverted and discharges the condenser on the negative half cycles. The current indicated by the meter is dependent upon the number of charges per second delivered to the resistance-capacity network. The condenser charge is the product of the capacity and the applied voltage. Therefore, changing the applied voltage 2% changes the meter reading 2%. This voltage is determined by the IR drop

in resistor R-10, a plate resistor of the square-wave generator, and consequently can be varied by adjusting the plate current of the square-wave generator by means of a screen voltage control (meter calibration control). At the top of the rectifier cathode resistor a filter circuit is connected to the d-c amplifier, which operates as an impedance-changing device. It embodies a variable cathode resistor, R-40, for adjusting recorder scale deflection length and a variable bucking voltage (recorder zero) for adjusting the recorder meter current to zero when there is no signal.

To have negligible effect resulting from the recorder resistance in the d-c amplifier circuit and from the bucking voltage, the recorder is connected in the positive plate lead of the amplifier. This places the meter about 100 volts above ground. The power supply is electronically regulated and provides constant voltage for wide changes in line voltage and load current.

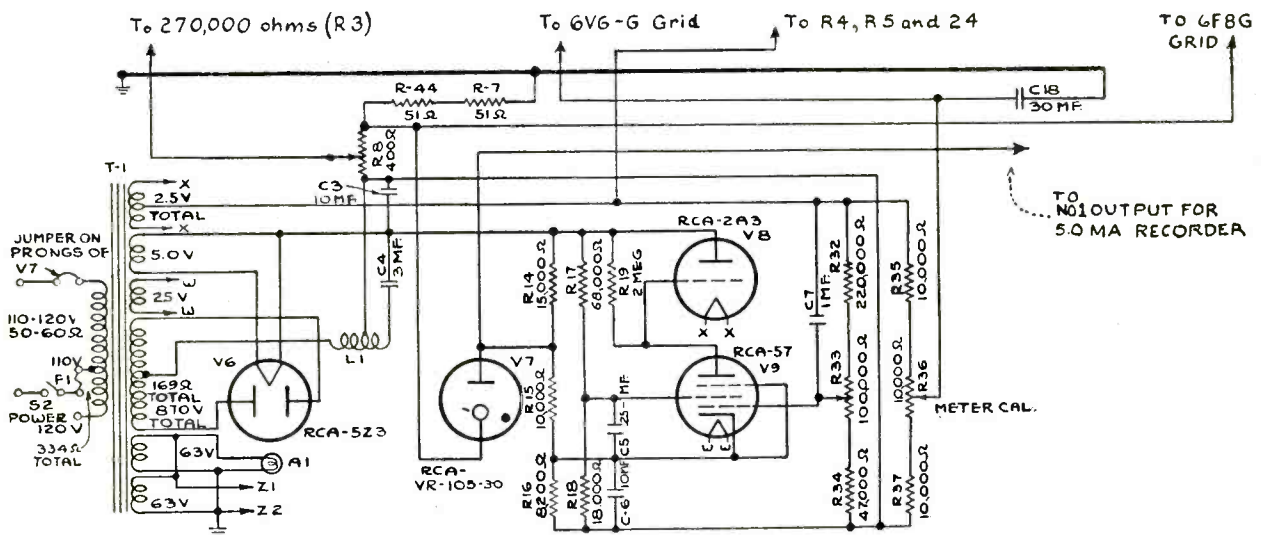
Sources of Error

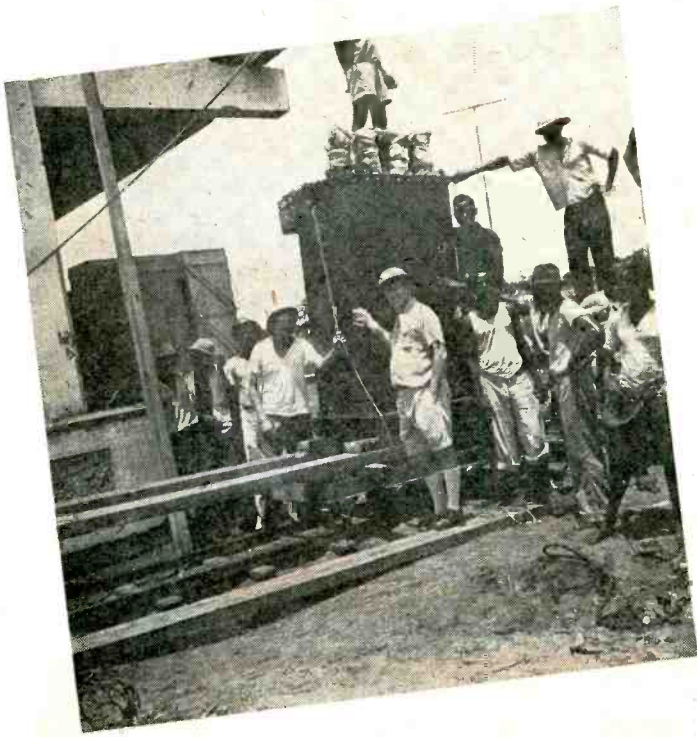
Line voltage changes from 105 volts to 120 volts (fuse in 110-volt position) will cause the indicating meter to increase its deflection less than 1.0% and the recorder to shift its zero (positive) less than 5%.

During the first five minutes of operation the meter may increase its reading about 5%. Poor wave shape

The power supply for the RCA audio-frequency generator.

(Continued on page 32)





(Left) Field Service Men at the railroad station in Brazzaville, French Equatorial Africa, with a huge transformer for a 50-kw short-wave transmitter.



Merrill Chapin (left) and Frank Hartwick, RCA field Service Men, who have just returned from servicing operations on the war front. Chapin's last assignment was in the Aleutian Islands and Hartwick spent a year in the Southwest Pacific.

WAR BROUGHT GLOBAL JOB TO SERVICE MEN IN 1943

by W. L. JONES

*Vice-President and General Manager
RCA Service Company*

LEADING lives no more predictable than the tides of battle, Service Men of the radio and electronics industry during 1943 have had an important part in turning the tide of battle against the Axis.

Global war has meant a global job for these unsung heroes of war industry. It has meant taking on new responsibilities of tremendous scope and importance, while at the same time meeting vastly increased demands from commercial customers. The job of installing and servicing electronic equipment for the armed forces of the United Nations around the world, and of training military and naval operating personnel, has naturally come first. The next most important job has been to keep home-front equipment such as radio, motion picture, plant broadcasting, and industrial apparatus in good

repair. Such equipment is vital to home-front communications, production and morale.

Military and Naval Services

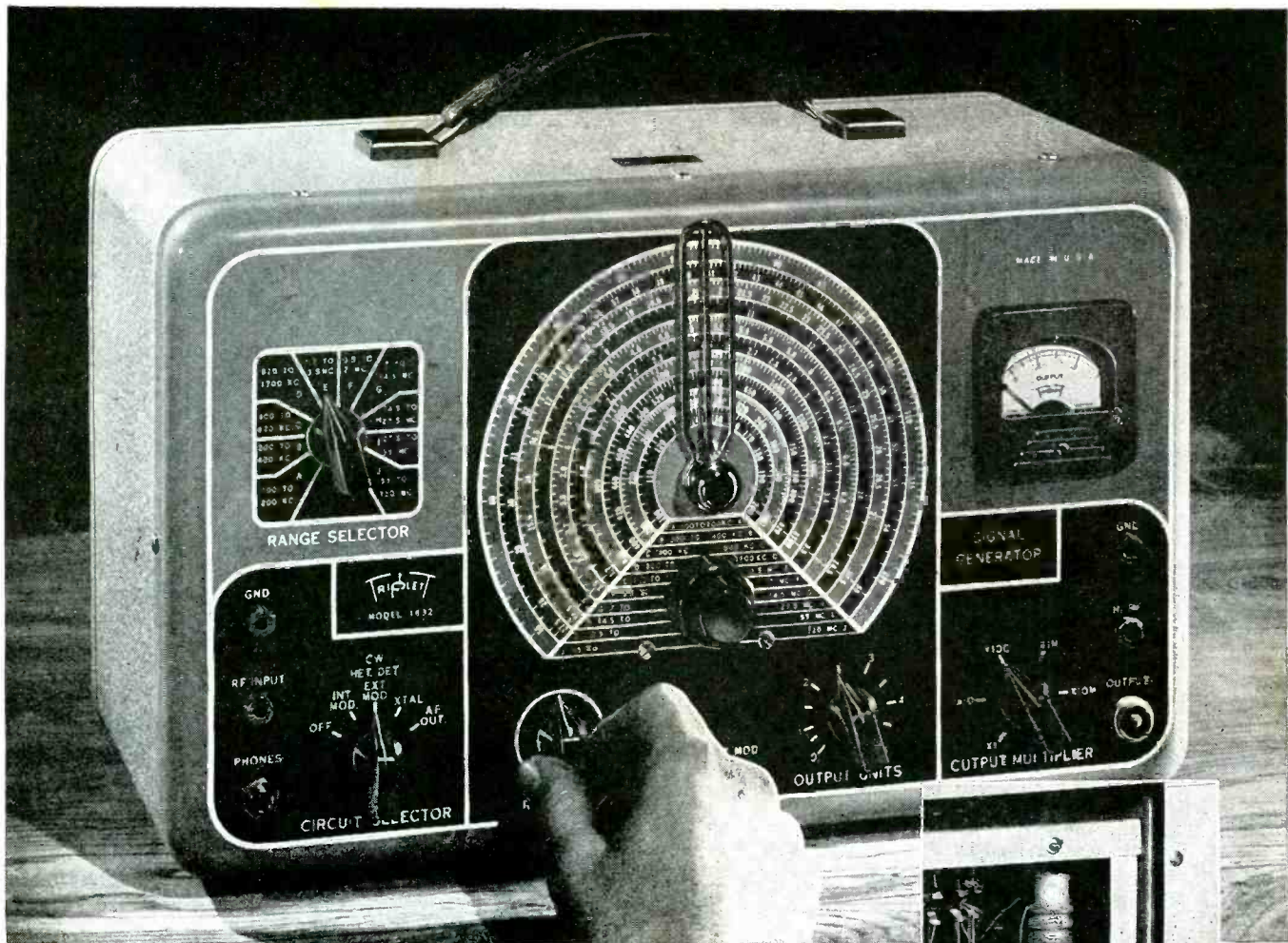
Many members of our staff have served during the year on assignment to various branches of the Army, Navy, Air Force, and Marine Corps, while others have been rushed from civilian assignments to attend to emergency service calls from the armed forces.

Although neither the extent nor the nature of this work can be revealed at this time, for obvious reasons, it may be stated that our men have served during the year on fighting fronts in the South Pacific, the Aleu-

tians, Iceland, England, Africa, Sicily, and Italy. Their work has included installation and maintenance of equipment, much of it secret, training of personnel, and checking performance and testing new designs under combat conditions.

One man was assigned to a specific job on Navy equipment at Pearl Harbor. He had scarcely unpacked when he was sent out to handle an emergency job at one of the Southern Pacific Islands. He never got back to his original base, but spent a year hopping from island to island in a huge triangle extending from New Caledonia to Guadalcanal to the Fiji Islands, serving as trouble-shooter and check-up expert on airborne electronic equipment. He traveled over 100,000 flying miles and experienced

(Continued on page 33)



MODEL NO. 1632

Signal Generator

CONTINUOUS COVERAGE—100 KC. TO 120 MC. • ALL FREQUENCIES FUNDAMENTALS

A complete wide-range Signal Generator in keeping with the broader requirements of today's testing. Model 1632 offers accuracy and stability, beyond anything heretofore demanded in the test field, plus the new high frequencies for frequency modulated and television receivers, required for post-war servicing. Top-quality engineering and construction throughout in keeping with the pledge of satisfaction represented by the familiar Triplet trademark.

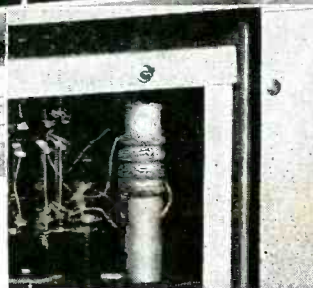
Of course today's production of this and other models go for war needs, but you will find the complete Triplet line the answer to your problems when you add to your post-war equipment.

Triplet

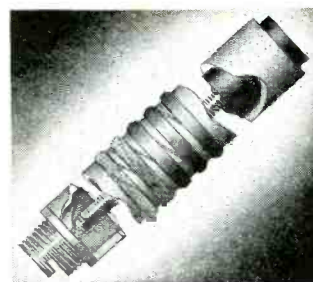
ELECTRICAL
BLUFFTON



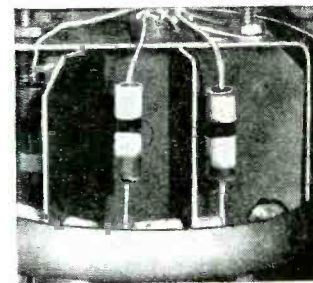
INSTRUMENT CO.
OHIO ***



• Triple shielding throughout. Steel outer case, steel inner case, plus copper plating.



• All coils permeability tuned. Litz wire wound impregnated against humidity with "high-Q" cement.



• Note sections individually shielded with pure copper. Entire unit encased in aluminum shield.



V-NEWS

RADIO INDUSTRY NOW PRODUCES FOR WAR—BUT PLANS FOR PEACE

UTAH EMPLOYEES BREAK PRODUCTION RECORDS FOR UNCLE SAM

Month by month, production records have been broken as Utah has gone "all out" for Uncle Sam, according to Fred R. Tuerk, President.

He points out that experience gained during the war period will be ably utilized in efficient peacetime production.

With emphasis on quality, the dependability of Utah parts, long a byword in the radio and sound equipment industries, will be maintained.



FRED R. TUERK

YOU ARE PART OF UTAH'S POSTWAR PLANS

"We're working for Victory and planning for peace now," stated Oden F. Jester, Vice-President in Charge of Sales of the Utah Radio Products Company, when queried recently on Utah's postwar plans. "Our experts are hard at work, developing plans for the future—plans that take utmost consideration of the needs of industrial concerns. Better products are on the way. In the Utah laboratory rapid strides have been made in adapting new electronic and radio developments for war uses—and making them available for the requirements of tomorrow."



ODEN F. JESTER

THE JOBBER-DEALER POLICY FOR 1944

Robert M. Karet, Sales Manager of the Wholesale and Sound Division of Utah Radio Products Company, declared in a recent interview that Utah's traditional Jobber-Dealer Policy of distributing through the recognized channels would be maintained in 1944 and in the postwar period.



R. M. KARET

In selection of jobbers Mr. Karet stated that Utah would continue to select carefully in order to avoid unfair competition. The trade's merchandising activities would be backed up by Utah advertising in leading publications.

Utah jobbers will be assured of a new and better Utah line, keyed to "tomorrow's" demands—and products that will have maximum profit opportunities.

WAR DEVELOPMENTS AND THEIR PEACETIME MARKETS

The war has speeded discoveries and improvements in many fields, said W. A. Ellmore, Vice-President in Charge of Engineering of the Utah Radio Products Co. "Nowhere," he went on, "has this been more true than in the radio and communications fields. Today, electrical and electronic miracles are enlisted in the armed forces—but tomorrow they will be at the service of peacetime America." Mr. Ellmore further pointed out that because of the wartime research and improvements now going on at Utah, there will be greater enjoyment and convenience in the American home—greater efficiency in the American factory.



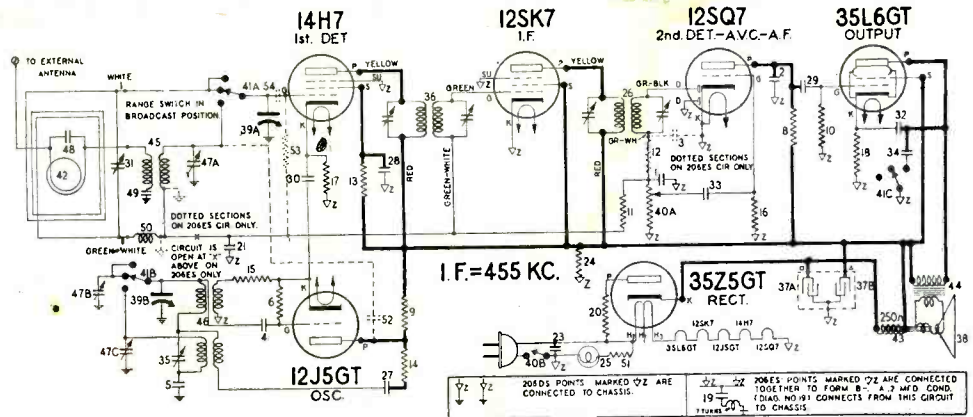
W. A. ELLMORE

UTAH RADIO PRODUCTS CO., 816 Orleans St., Chicago, Ill.

RANGE-TONE SWITCH

The range and tone switch are combined in this receiver. This table shows the various positions.

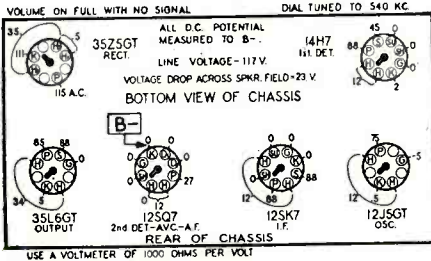
SWITCH POSITION	BAND	ZONE
EXTREME COUNTER-CLOCKWISE	BROADCAST	LOW
MIDDLE POSITION (Shown on Circuit Diagram)	BROADCAST	HIGH
EXTREME CLOCKWISE	FOREIGN	HIGH



ELECTRICAL PARTS

Diagram No.	Part No.	Description	Diagram No.	Part No.	Description
1, 2	83539	Condenser, Mica 260 Mmfd.	35	500131	Transformer, 1st I.F.
3, 4	83783	Condenser, Mica 110 Mmfd.	37A, 37B	500256	Condenser, A-40 Mid. 150 Volt
5	88587	Condenser, Mica .0042 Mid.	38	R-500331	Electrolytic B-20 Mid. 150 Volt
6	110552	Resistor, Carbon-47,000 Ohms 1/4 Watt	39A	500442	Condenser, Variable Tuning (with drum)
7	110553	Resistor, Carbon-220,000 Ohms 1/4 Watt	40A, 40B	500480	Volume Control, Mag. (with switch)
8	110557	Resistor, Carbon-4,700 Ohms 1/4 Watt	41A-11B 41C	500500	Switch, Tone & Band
9	110558	Resistor, Carbon-470,000 Ohms 1/4 Watt	42	500612	Loop Antenna & Cabinet Back (206DAS & 206ES)
10	110559	Resistor, Carbon-180 Ohms 1/4 Watt	42	500613	Loop Antenna & Cabinet Back (206DAS & 206ES)
11	110560	Resistor, Carbon-5.2 Meg. 1/4 Watt	42	500660	Loop Antenna & Cabinet Back (206DAS & 206ES)
12, 13	110578	Resistor, Carbon-68,000 Ohms 1/4 Watt	43	R-500920	Speaker, Electro-Dynamic (5" Oval)
14, 15	110580	Resistor, Carbon-180 Ohms 1/4 Watt	44	R-500921	Transformer, Output for R-500920 Spkr.
16	110580	Resistor, Carbon-3.3 Meg. 1/4 Watt	45	500645	Coil, Short Wave Antenna
17	116079	Resistor, Insulated 1200 Ohms 1/4 Watt	46	500646	Coil, Oscillator (B.C. & S.W.)
18	501053	Resistor, 120 Ohms, 1 Watt W.W.	47A to 47C	500647	Condenser, Three Section Trimmer
19	116705	Condenser, 2 Mid. 600 Volt (206E only)	48	83783	Condenser, Mica 110 Mmfd.
20	116752	Resistor, 33 Ohms, 1 Watt-W.W.	49	119193	Condenser, 01 Mid. 600 Volt (206DS only)
21	116819	Condenser, .05 Mfd. 600 Volt	50	500911	Loading Coil
22 to 23	118813	Resistor, Carbon-5000 Ohms W.W.	51	160078	Resistor, 220 Ohms, 1 Watt W.W.
25	500897	Lamp, Dial (Mazda C7)	52	110510	Condenser, Wire 3 Mmfd.
26	119024	Transformer, 2nd I.F.	53	110570	Resistor, Carbon-2.2 Meg. 1/4 Watt
27 to 30	119193	Condenser, .01 Mid. 600 Volt	54	83539	Condenser, Mica-260 Mmfd. (206ES only)
31	119345	Condenser, Trimmer (Loop)			
32	119414	Condenser, .02 Mfd. 600 Volt			
33	119817	Condenser, .004 Mfd. 600 Volt			
34	119880	Condenser, .04 Mfd. 600 Volt			
35	119934	Condenser, Padder			

SOCKET VOLTAGES



too. A separate oscillator is cathode-coupled to the 14H7 first detector, but with a different circuit arrangement. No oscillator cathode bias is used. Instead a 180-ohm resistor is inserted in series with the cathode feedback coil. A similar resistor is in the r-f plate

Fig. 3. Delco portable.

circuit, while the plate supply shunt resistor is rather low, 4,700-ohms. The bandswitch and tone control are combined in this receiver. Three positions allow b-c and low tone, b-c and high tone and s-w and high tone. Low tone is caused by a .04-mfd condenser from the 35L6GT output plate to ground. A loop loading coil is in-

Fig. 2. Stewart Warner 206DS and 206ES.

serted in the low side of the loop antenna.

Delco R-1406

The Delco portable R-1406, shown in Fig. 3, uses adjustable iron core i-f

(Continued on page 35)

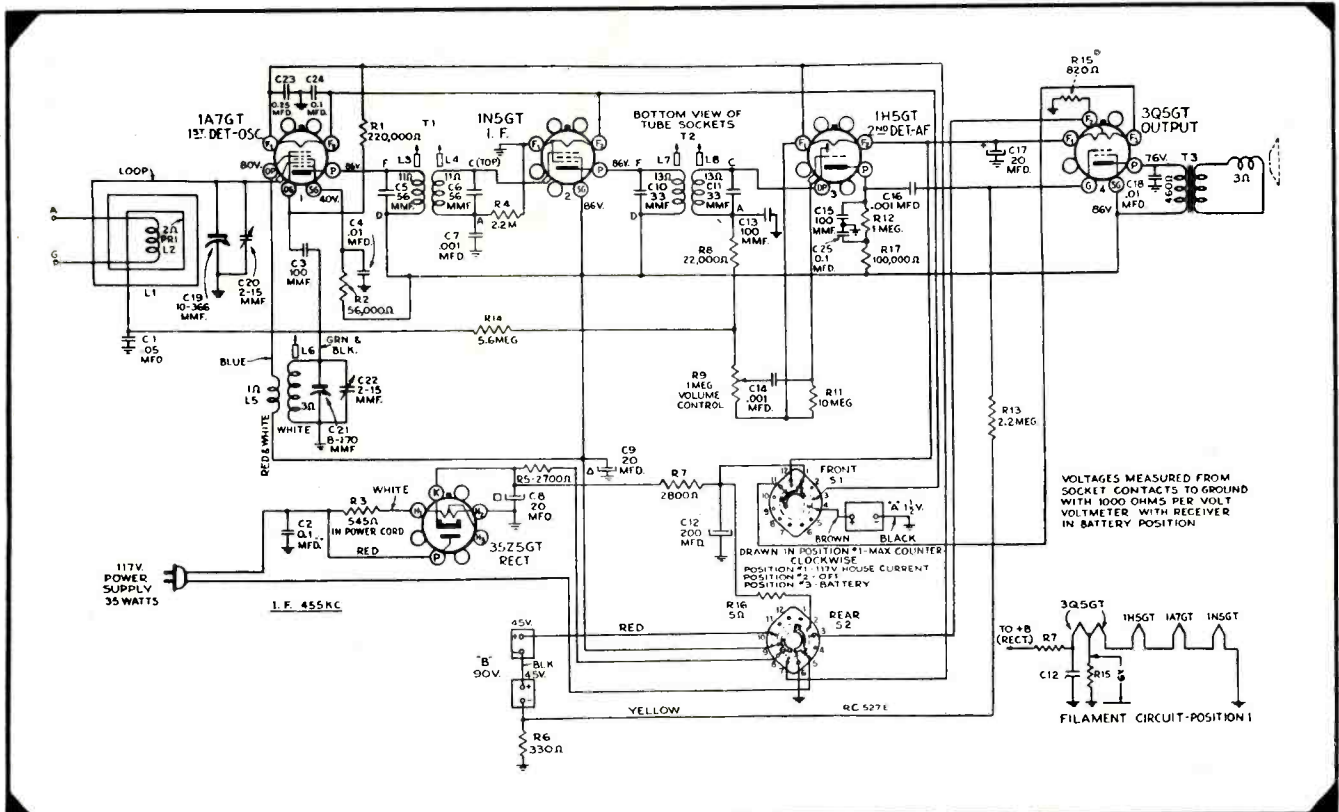


PHOTO CONTROL

APPLICATIONS

PART TWO

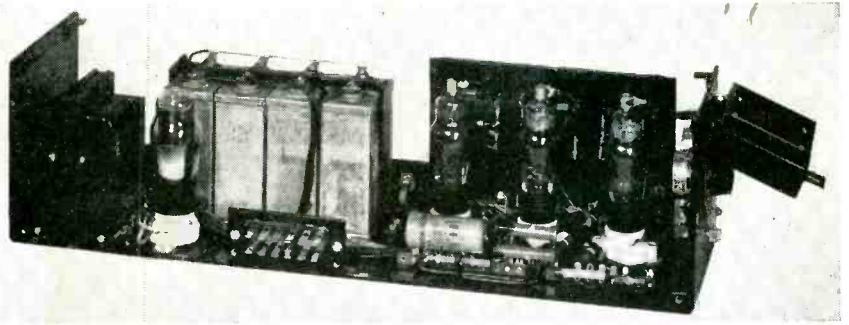
by S. J. MURCEK

AN entire pinhole detector unit is simple and effective, often rejecting perforated sections having perforations invisible to the naked eye. The light source and photoelectric camera in a commercial device of this type are shown in Fig. 6. The valve timer device appears in Fig. 7. All these components are finished in a heat resisting black enamel for applications involving operation in steel or sheet metal plants.

The largest group of special dynamic photocontrols are the *register regulators*. These devices control such operations as strip printing and lithographing, label cutting, packaging, and product wrapping. Each of these operations is performed by a machine designed for the task, the operation being carried out in a fraction of a minute per product unit processed. It is evident that the operation, whatever it may be, must start at a desired instant during the travel of a labeled strip of wrapping paper, so that the label message is on the proper surface of the wrapped or packaged product unit. These labels are produced in strip form, and are delivered in standard rolls, much like the paper strip in the conventional adding machine. Appearing at the edge of the strip, between each label message, are small printed marks, termed "register impressions." It is the function of the register impression to initiate the operation of the register regulator.

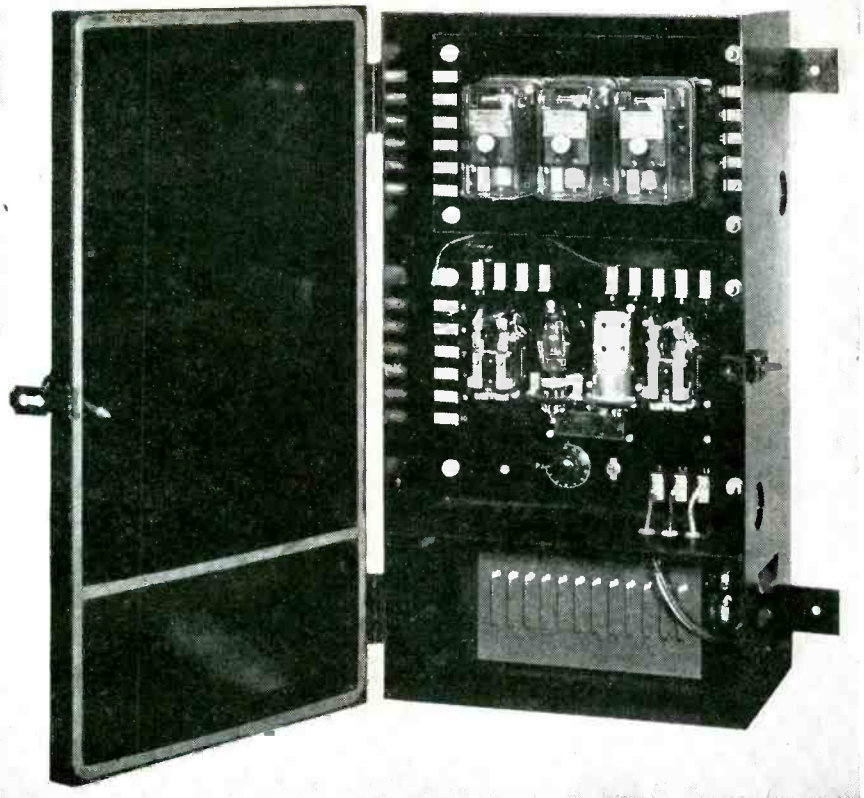
Register Regulator

In general, the circuits of a register regulator are simple and readily serviced, as may be seen from Fig. 8. Resemblance of register regulator circuits to those of an ordinary photocontrol, end in the register regulator, with the introduction of a delay circuit between the phototube preamplifier and the end-thyratron.



Figs. 6 (above) and 7 (below). In Fig. 6 appears the light source and photoelectric camera of a pinhole detector unit. Fig. 7 illustrates the valve timer device used in conjunction with the pinhole detector.

(Courtesy Westinghouse)



In the circuit of Fig. 8, the label strip 29 moves over a drive roll 30, to which is attached a small drum contactor 31. The function of this contactor is to prevent the operation of the register regulator if the register impression 36 is early with respect to the position of the shear knife.

As the label strip moves under the lens 37 of the electronic camera, the register impression reduces the diffusion aura emanating from the strip with each traversal through the light source 38 filament image, which is

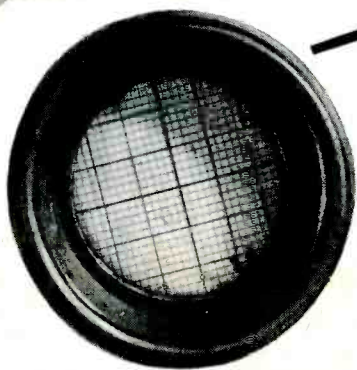
projected on the strip by means of projection lens 28. Since the strip moves at a rate of approximately 300 feet per minute, this reduction of illumination on the phototube cathode is of very short duration.

Reduction of the phototube illumination results in a decrease of the voltage across phototube load resistor 11, coupling capacitor 13 discharging through resistor 11 and grid resistor 12, swinging the control grid of pentode 14

(Continued on page 22)

It's the Little Things That Count

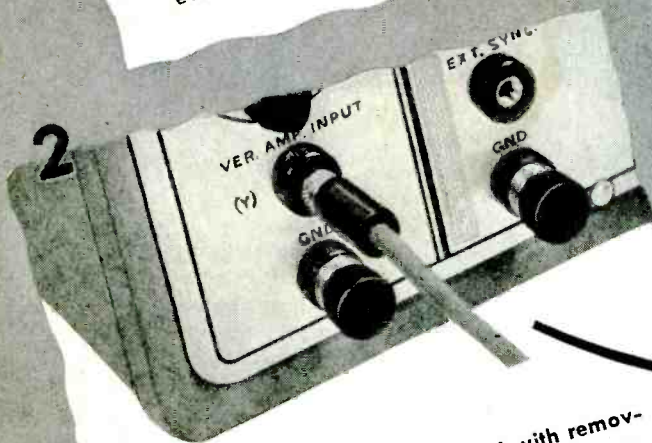
OR, WHAT MAKES THE 155-C DIFFERENT FROM OTHER 3" OSCILLOSCOPES?



"built-in light shield" — The front of the tube is recessed; you can see transients even in bright light.



"removable graph screen" to permit special observations — Place or replace it with a twist of the wrist.



"binding jacks" — Can be used with removable binding posts or with locking pin plugs. A new convenience feature.

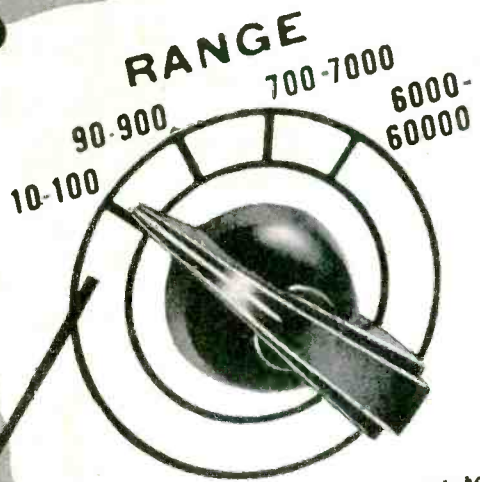
BUY MORE WAR BONDS

4



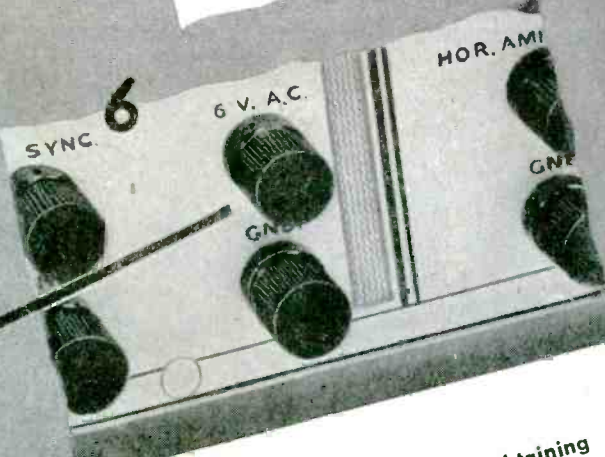
"direct deflector connections" — For observations at radio frequencies when such are desirable.

5

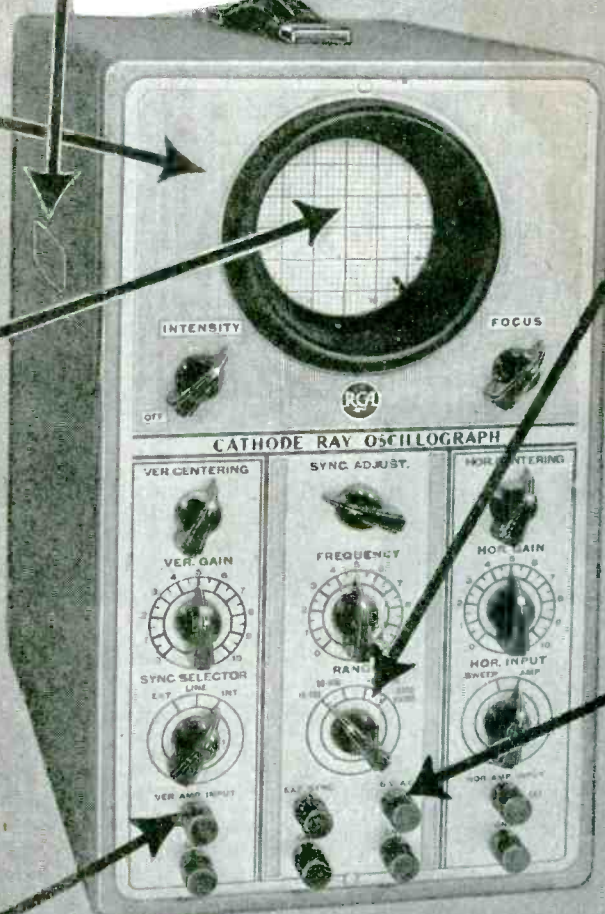


"improved timing axis oscillator" — range extended to 60 kilocycles — more linear sweep.

6



"6-volt AC terminals" — For obtaining a handy sine wave ordinate for calibrating purposes.



Please address inquiries to
Test and Measuring Equipment
Section, Radio Corporation of
America, Camden, N. J.

Test and Measuring Equipment
RADIO CORPORATION OF AMERICA

negative with respect to its cathode. The attendant reduction in the pentode plate current results in a decrease in the potential across plate resistor 22, and a rise in the cathode to plate voltage across the tube. Thus, the plate of the pentode is momentarily positive with respect to its shield grid, which places the control grid of thyratron 24 momentarily positive with respect to its cathode. This tube fires, discharging delay capacitor 26. The voltage across capacitor 26 is zero at this time, which places the cathode of end-thyratron 32 negative with respect to its grid. This tube now conducts, energizing end-relay 33, causing this relay to seal.

Thyratron 32 continues to conduct until, as the delay capacitor recharges, the voltage across this capacitor exceeds the voltage across voltage divider section 20, thus driving the cathode of the end thyratron positive with respect to the grid. This thyratron then ceases to conduct, which causes the end relay to unseal. Under these conditions, the relay obviously remains sealed for the period of time required to charge the capacitor 26 to the normal voltage. Variation of this delay period is accomplished through variation of the rheostat 25 resistance.

It is thus apparent that end relay 33

seals for a definite period with each appearance of a register impression under the camera lens, unless the impression is early with respect to the position of the shear knife blade.

In printing and wrapping processing line operation, the label strip feed speed is less than that of the drive roll. Thus, if the register regulator does *not* operate, due to the functioning of the drum contactor, the label strip *skids* against the forward friction of roll 30, bringing register mark 36 nearer the blade position with each revolution of the drive roll. Once the drum contacts begin to indicate, by their closure, that the shear knife is now *late* with respect to the register impression, the regulator operates and the rapidly recurring closures of the end relay cause the strip feed to increase in a series of thrusts or pulses. In this manner the regulator causes the register impression to oscillate or *hover* over the position of the knife blade.

Label strip feed is usually provided by means of a d-c shunt motor. A decrease in the field winding exciting current results in an increase of the motor armature speed. This decrease is introduced by the opening of the end relay *break* contacts, which inserts a resistor in series with the field winding and the d-c voltage supply.

The various heater and plate power requirements of the regulator circuit are provided in the register regulator from power transformer 5, which is provided with a twin primary winding for operation from either of two a-c line voltages. It should also be observed that the pentode and delay circuit d-c voltages in Fig. 8, are supplied from a voltage doubling rectifier system, which incorporates two barrier type rectifier units 18 and 19.

Register Regulator Assembly

A typical commercial register regulator assembly is shown in Fig. 9. This regulator is unique in that the light source and camera are an integral part of the regulator assembly. The internal components of the device may be seen in Fig. 10. The unit is provided with a conventional male chassis socket for connection to the system cable female plug. Obviously, this facilitates the service and maintenance of the complete unit, since the entire unit may be quickly removed and a spare substituted in its operating position. Another notable feature of this unit is its application of standard radio tubes throughout, together with a conventional automobile headlamp bulb, which is incorporated into the light source.

Among other photocontrols of the dynamic classification is one which is capable of actually following a given line, such as a line printed on a paper strip. The device positions the material bearing the line so that the line is under the knife blade at all times. Commercially, this type of control is known as a *slitter regulator*.

Slit Regulator Circuit

The circuits of a slitter regulator are shown in Fig. 11. Here, a synchronous a-c motor, which operates at a speed of 1,800 rpm for 60-cycle operation, drives an opaque disc. This disc bears four small perforations, equidistantly spaced near its outer edge. Above the disc itself is mounted a lamp 3, together with the lens 4, this system being focussed so that the filament image spreads over an area equal to one-fourth of the total disc area. Just below the disc, on the same axis as lens 4, is projection lens 5, which projects the image of disc perforation 37 on objective material 6, which bears line 7.

From the foregoing, it is obvious

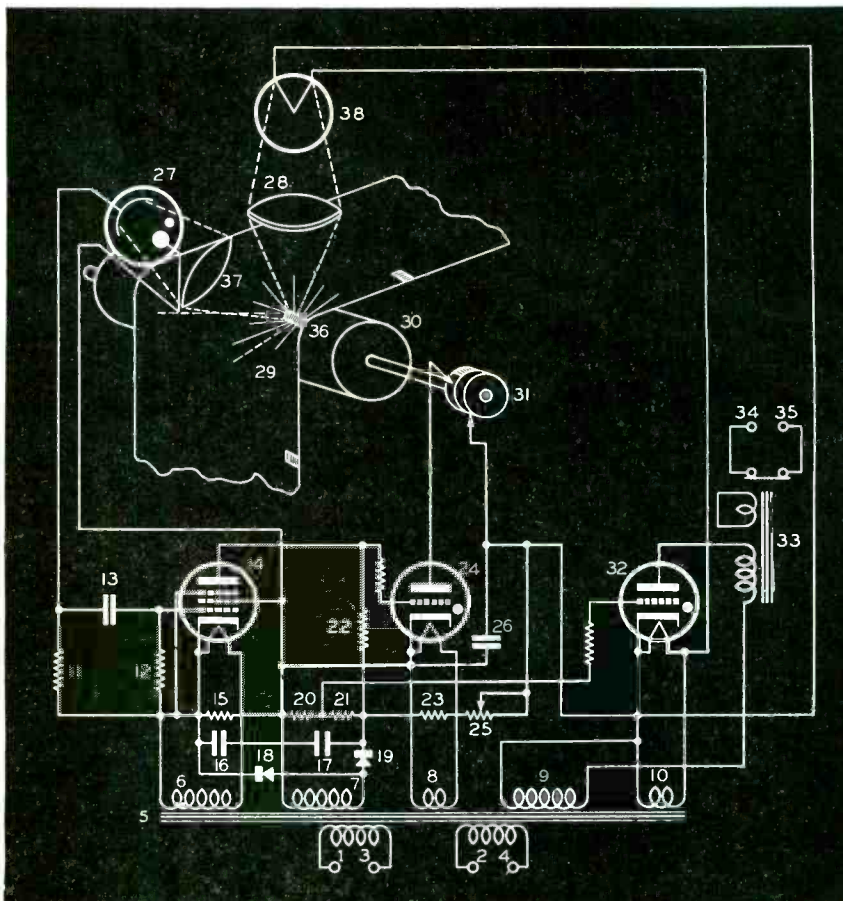
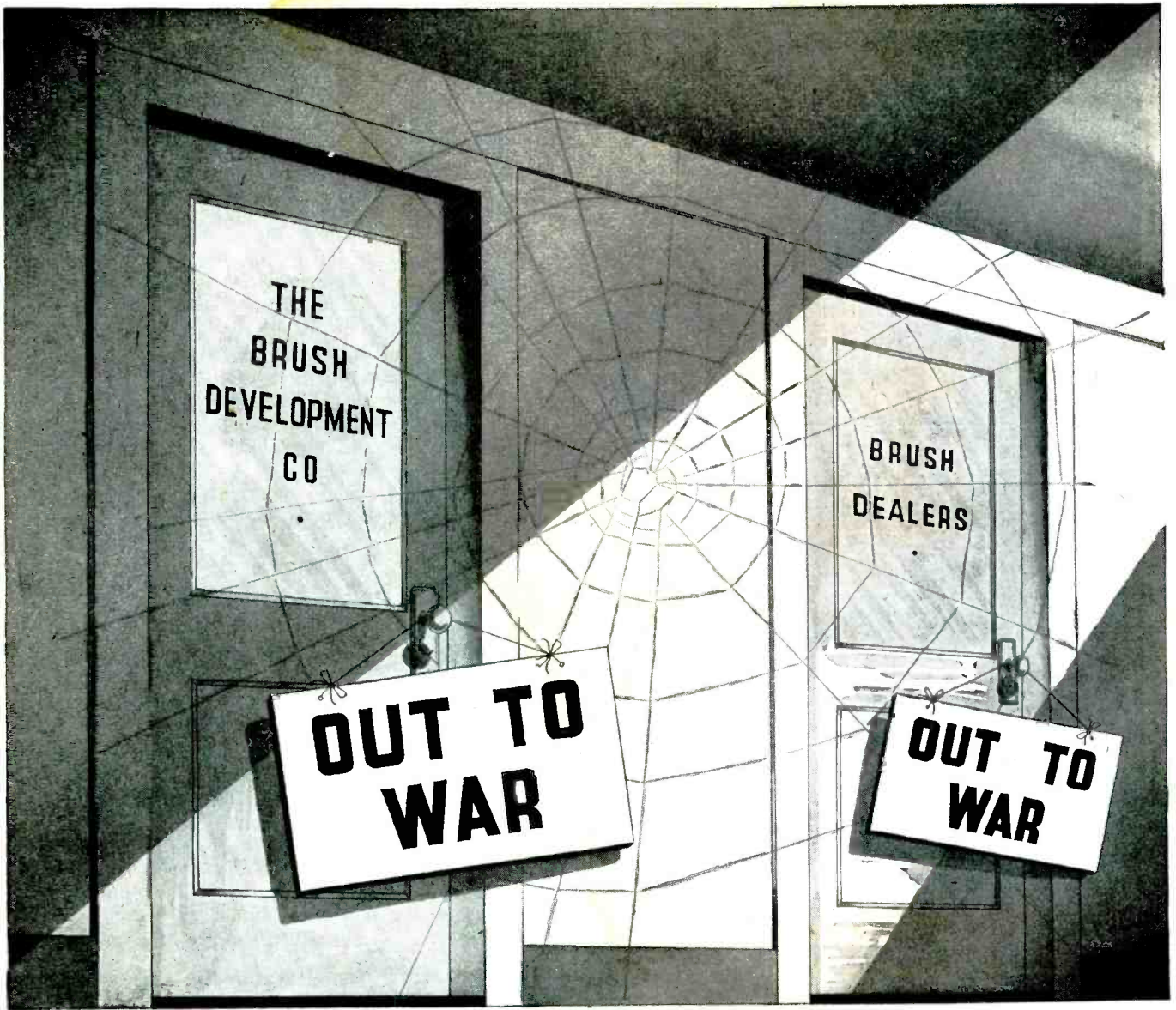


Fig. 8. Circuit of a register regulator.



- These signs could be on thousands of doors all over America. They are certainly on the doors of The Brush Development Company and the Brush Dealers. We're both "Out to War" 100%, but there's progress being made in the science of Electronics while these peacetime doors are "closed".
- We've been together a long time, and when our job is done — when it's all over — we'll be together again with a sign outside that reads **BACK FROM WAR! OPEN FOR BUSINESS!**

THE BRUSH DEVELOPMENT COMPANY

3315 PERKINS AVENUE • CLEVELAND, OHIO

SERVICE, JANUARY, 1944 • 23

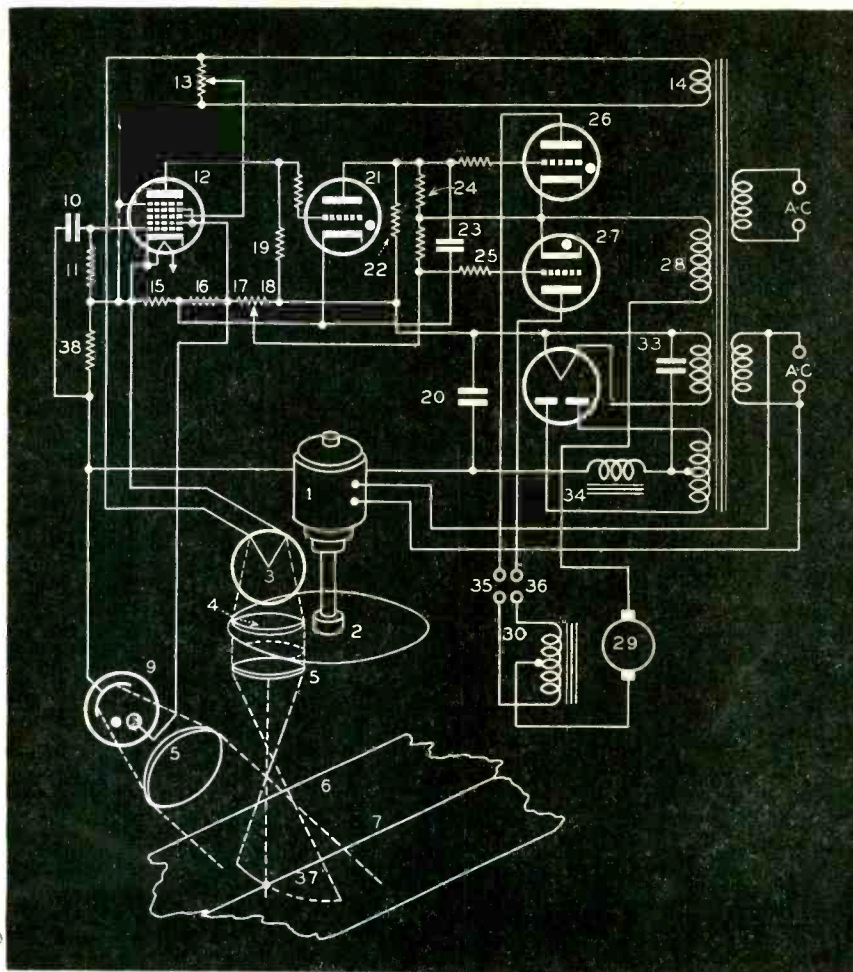


Fig. 11. Circuit diagram of a slit regulator. A synchronous a-c motor operating at a speed of 1800 rpm is used

nected to a tap on voltage divider 13, which is connected across low voltage winding 14. One terminal of this voltage divider is connected to the cathode of tube 12. Consequently, the a-c voltage between the auxiliary grid and the cathode of tube 12 alternately drives the tube plate current from *blocking* saturation at the positive peak of the a-c voltage wave, to *normal* saturation at the negative peak of the a-c voltage wave. Accordingly, plate current of tube 12 cannot be reduced to cut-off by the first grid, when its second or auxiliary control grid is driven positive with respect to the cathode by the a-c voltage component from voltage divider 13.

Perforated disc 2 is so adjusted with respect to motor 1 shaft that a perforation image crosses register line 7. This line is in the desired position, just as the a-c voltage wave passes through zero potential between successive alternations. Incidentally, the image crosses the line in a clockwise direction. Under these conditions, the auxiliary grid of tube 12 is positive with respect to the tube cathode during the movement of the image over the initial half of the objective material strip, 6, and negative with respect

that the perforation image *moves* across the material 6 surface transversely, as indicated by the arc shown in broken lines. Further, it is observed that the perforation image traverses the line inscribed on the material surface. Thus, with each traversal of the perforation image across the objective surface, the diffusion aura momentarily decreases as the perforation image crosses the line, 7.

With the disc drive motor operating synchronously at 1,800 rpm, we can see that these line traversals occur at a rate of 7,200 per minute, or 120 per second, the disc having four perforations. The illumination focussed on phototube 9 by means of the camera lens 8, thus decreases momentarily 120 times each second, the phototube conductance being decreased in like manner.

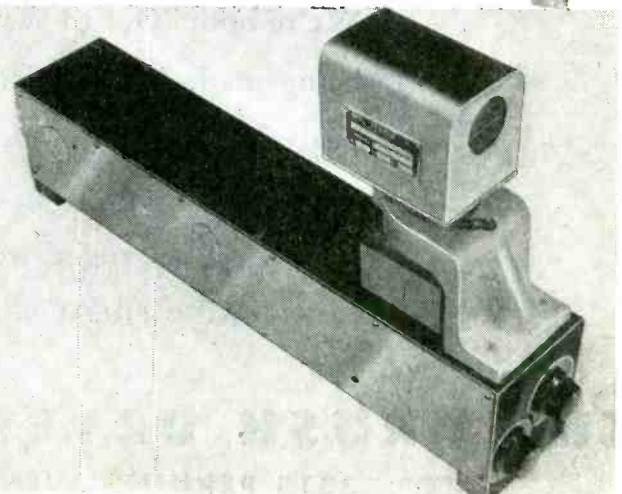
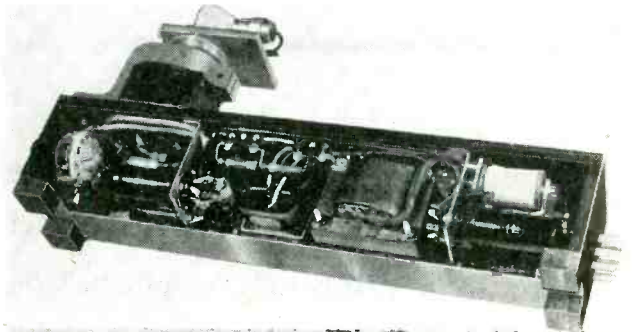
Therefore, as a direct result of these periodic illumination decreases, the voltage across phototube load resistor 38 pulses negatively with illumination decrease, at a frequency of 120 cycles per second.

For each negative impulse, capacitor 10 discharges momentarily, placing the grid end of the grid leak 11 negative with respect to tube, 12, cathode. This tends to decrease the conductance of this tube with each negative pulsa-

tion across the grid leak. However, this tube is provided with two control grids, the auxiliary grid being con-

Figs. 9 (below, right) and 10 (right). In Fig. 9 appears a typical commercial register regulator assembly. Note that the light source and camera are an integral part of the regulator assembly. In Fig. 10 we see the internal components of this device. Note its simplified construction and similarity to radio equipment.

(Courtesy United Cinephone Corp.)



SPRAGUE TRADING POST



A FREE Buy-Exchange-Sell Service for Radio Men

FOR SALE—Triplet 1181-C portable laboratory incl. 16-range AC-DC V-O-M, all-wave signal generator and free-point tester. Has new meter rectifier, meter serviced recently by mfr., new batteries, A-1 electrical condition. Oak case, \$65. York Electric Co., York, Nebr.

WANTED FOR CASH—Opening shop and need: Tube tester, combination V-O-M, signal generator, capacitor bridge tester, 3" scope, multitester, and set of Rider's Manuals. Jules M. Kleinman, 243½ East Pitt St., Bedford, Pa.

TO TRADE—Hallcrafters Sky Traveler S-29 to trade for a Hallcrafters SX-25, SX-24, SX-17, or Howard 450, 450-A, 440 or what have you? Robert F. Scott, 12014047, USMA Cavalry Detachment, West Point, N. Y.

WANTED—Hickok traceometer, Dumont oscillograph, and good r-f test oscillator. Dwight W. Cannon, 309 N. Reese Pl., Burbank, Calif.

FOR SALE—Rider's Manuals Nos. 4, 7, 8, 9 and 10, \$40; Meissner analyst, model 10-1154, \$60; Hickok 170X signal generator, 100 to 30 meg. (not crystal controlled), \$40; Pioneer red top AC power plant, 300-watt, 110-volt, 60-cycle, \$55; Aerovox LC checker #95, \$25. Also have homemade 35-watt sound system to sell. Write for full details. Irvin B. Weeks, 9 Bowker Block, Minot, N. D.

WANTED—Good short-wave set such as Hallcrafters Sky Buddy, or Echophone EC-1, or will take home set (table model) with both long and short-wave band. Pvt. Fred Foster, 413th A.B. & Hq. Sgdn., Tonopah Army Field, Tonopah, Nev.

FOR SALE—Rack and panel 500-watt transmitter; two 60" steel W.E. racks on rollers; r-f and phone in separate racks. Misc. xmitting tubes; coils, hundreds of parts; condensers & transformers; extra chassis with plate and grid condensers to handle kw together with 450TL Eimac tube; vibroplex; type 22D Turner dynamic mike with 15' cable. E. S. Hillery, 23 East 11th St., Bayonne, N. J.

WANTED—One ohmmeter and test prods. Cash or swap. Alton Parris, Jr., Union Grove, Ala.

WANTED—One Thordarson T90-S13 or T3S22 transformer; one Lansing Hi Fi speaker and cabinet. Late PM preferred. John E. Loraine, 211 Summer Ave., Newark 4, N. J.

SELL OR TRADE—6", 8", 11" dynamic speakers, speaker units, ear phones, electric vibrator, etc. Want voltohmmeter and Rider's Nos. 8 to 13. Theodore Lohr, 140-28 247th St., Rosedale, L. I., N. Y.

WANTED—Will pay cash for Rider's Manuals Nos. 6, 7, 8, 9, 11. Charles J. Breaux, Napoleonville, La., Rt. 2, Box 45.

URGENTLY NEEDED—We are asking owners of idle current measuring meters in any condition to sell them, so we can repair and place them where they can be of greatest use in the war effort. Give name of mfr., type, range, condition, sensitivity (if known), and reasonable description. Max Leibler, 2133 Green St., Harrisburg, Pa.

WILL PAY CASH for Supreme Audolyzer #562 or any other std. tester of this type. Al Crispo, 9745 89th St., Ozone Park, N. Y.

WANTED—Hallcrafters S-29 or similar small receiver. State price, condition. A. A. Herrick, S 2/C, V-5, U.S.N. A.A.S., T.S. 14-A, Kingsville, Texas.

FOR SALE—Zenith Radio, no case, but tubes good, \$15. Want multitester and tube tester combined, late model. Chas. Winn, Box 29, Tullahoma, Tenn.

WANTED FOR CASH—Signal generator; AC-DC voltohmmeter; tube tester; 456 kc. crystal; and parts. Ed. Baker, Anderson, Calif.

TEST EQPT. WANTED—Signal generator; V-O-M; tube tester; and Rider's Manuals, in good condition. Describe fully. Leo Navin, 1619 Willow St., Green Bay, Wis.

SWAP—Want a tube tester such as Supreme 589-P, or Precision 910. Have Million model A V-O-M and Triplet #666 to swap—both 1 ma. base movements and have just been completely worked over. Also have Philco O-24 battery operated sig. generator with bats. H. M. Fishman, 626 Hoover Ave., San Antonio 4, Texas.



WANTED—Full set Rider's Manuals; late tube tester; V-O-M; multi-meter; capacity analyzer; signal generator. Cash for good equipment. Elwood A. Capelle, 433 Home Ave., Plymouth, Wis.

NEEDED AT ONCE—Any well-known condenser-bridge analyzer, and any model Precision tube or set tester. Must be in good shape. Gerald R. Dawson, Ithaca Radio Repair, 310 Linn St., Ithaca, N. Y.

SELL OR TRADE—Westinghouse 115v DC to 110v AC 2-phase current converter unit in metal case, perfect condition. Also 110v DC to 110v AC phono motor converter, uses a vibrator. Need tubes, test eqpt., Rider's, etc. G. Thoden, RD #1, Asbury Park, N. J.

FOR SALE—Need a chart for your tube tester? We have them for all makes and models. B. Paine, 1186 Lexington Ave., New York 28, N. Y.

FOR SALE—Weston #547 3-meter set analyzer, also Tobe condenser leakage tester. Dave's Radio, 1316 42nd St., Brooklyn 19, N. Y.

WILL TRADE following tubes: 6N6; 6F5; 25L6; 25Z5; 35Z3; 50, 34, 117Z6 and few others for 47, 1A7, 35A5, 50L6, 35L6, 12S7, 12SQ7, 35Z5, etc. Also one VO-M with high megohm reading. Geo. Payad, 202 E. Main St., Staunton, Ill.

FOR SALE—Ranger #57 battery model signal generator. Want signal tracer and elec. signal generator (all-wave), Rider's Manuals from 1936 to 1942 and 12SK7, 50L6 and 35Z5 tubes. A. V. Larsen, 822 Fourth St., Madison, Minn.

FOR SALE—Readrite tube checker #432A in A-1 condition. R. E. Bashore, 326 Market St., Sunbury, Pa.

URGENTLY NEEDED—V-O-M preferably Supreme #54Z, but other types acceptable. Raymond Riddles, Route 4, Box 333, Pensacola, Fla.

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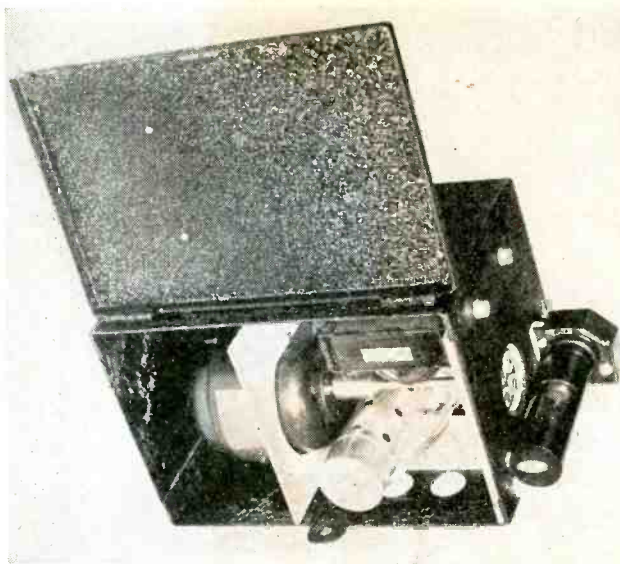


Fig. 12. A commercial version of the slit regulator utilizing a scanning disk with four small lenses to provide increased illumination.

(Courtesy Westinghouse)

to the cathode during the second half of the strip traversal.

Therefore, if a disc perforation image crosses the register line during the first traversal section, the plate current of tube 12 does not decrease, and tube 21 does not fire. The voltage across capacitor 23 is therefore at a maximum. Again, since the divider resistors 24 and 25 are connected between the anode and the junction between resistors 17 and 18, the grid of tube 26 is positive and the grid of tube 27 negative, with respect to their respective cathodes. Thus, tube 26 fires, conducting a rectified a-c current, the latter flowing through one-half the differential field winding 30 of register motor 29. The shaft of the motor now rotates in a direction which causes a system of material guides to move the objective material toward the sec-

ond traversal section, or *with perforation image progression*.

If, however, the perforation image traverses the register line in the second section of image traversal, the second grid of tube 12 is negative with respect to its cathode, enabling the negative impulse impressed between the first grid and cathode, to momentarily drive the tube plate current to cut-off. Here, the anode of tube 12 swings positive with respect to the shield grid, causing thyatron 21 to discharge capacitor 23. The control grid of thyatron 26 is now negative, and that of thyatron 27 positive, with respect to their respective cathodes. Thyatron 27 now conducts a rectified current, this current energizing the alternate half of the differential field 30 and the armature 29. The register motor shaft now rotates in a direction

which causes the objective material to move toward the first traversal section, or *against image progression*.

It becomes evident that the register motor shaft will oscillate over a small fraction of a revolution when the register line is in such a position, with respect to the perforation image phase location, that the a-c voltage wave impressed between the auxiliary grid and cathode of 12, just passes through zero voltage between succeeding alternations. That is, thyatron 21 will fire, discharging capacitor 23 on every other traversal of the register line by the perforation image. This, in turn, causes thyratrons 26 and 27 to fire alternately, energizing differential field 30 in alternate polarity respectively. Thus, the motor tends to provide shaft rotation, first in one direction, then in the other, at a frequency corresponding to the supply line frequency.

Limit switches 35 and 36 act to stop register motor correction if the register line does not appear on the material surface, this causing the motor to overrun the material guide travel limits in attempting to locate the position of the non-existent register line.

A commercial version of the slitter regulator utilizes a scanning disk which carries four small lenses instead of the described perforations, thus providing a greater intensity of illumination on the objective surface. Such a scanner is shown in Fig. 12.

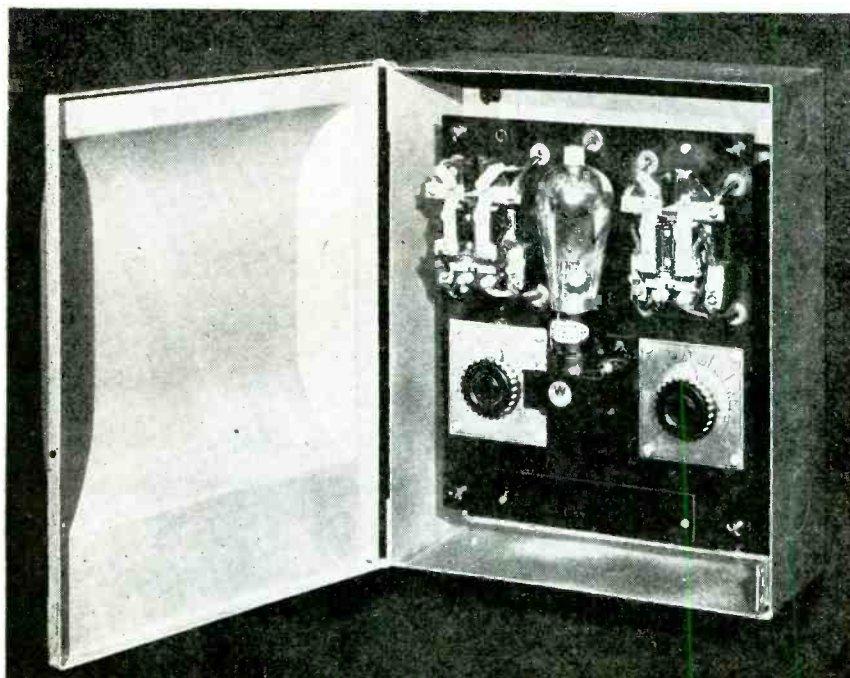
In a sense, the special photocontrols may be said to be a group of photocontrols termed *register regulators*. However, since the application of each device is determined by the problem encountered by the designer, many of these devices are actually photocontrols, such as we have in lighting controls and pinhole detectors.

Servicing and maintenance methods employed in the care of special photocontrols are comparable to those applied in radio equipment practice. However, the special precautions taken with photocontrols must be considered in the application of these methods to the servicing of special photocontrols.

Finally, diagnosis of photocontrol problems, where the photocontrol is of the special classification, is facilitated when an analysis of the photocontrol overall operation is performed before institution of diagnosing procedure. Briefly, it only becomes necessary to ascertain the function of the photoelectronic device, before actual trouble shooting instruments are applied. Once the theoretical diagnosis is complete, practical analysis becomes a foregone conclusion.

Fig. 13. A timer device used in electronic control applications.

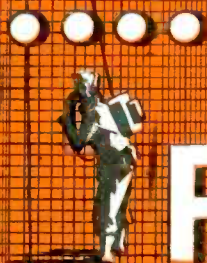
(Courtesy Westinghouse)



DESIGNS For WAR

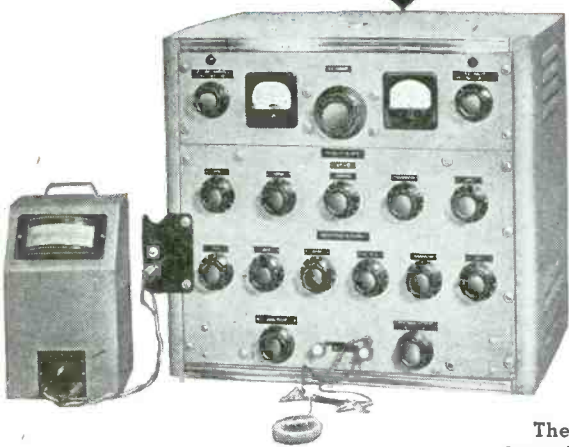


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Filter performance is dependent upon three major factors, basic design... Q of coil and capacitor elements... and precision of adjustment. The superiority of UTC products in this field has been effected through many years of research and development on core materials and measuring apparatus. We illustrate below a typical filter formula and some of the UTC apparatus used to determine quantitative and qualitative values:

$$\frac{(LC\pi^2 f_{\infty} - 1) \left(\frac{1}{Q^2} + 1 - \left(\frac{f_{\infty}}{f} \right)^2 \right)}{\frac{1}{Q^2} + \left(1 - \left(\frac{f_{\infty}}{f} \right)^2 \right)^2} = U_m \text{ (ATTENUATION CONSTANT)}$$



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SERVICING IN NEW ZEALAND

(Continued from page 7)

control work, we use the feed back type of control with a .5 or 1-megohm potentiometer as the audio output grid resistor, the slider going through a .00025 or .0005-mfd condenser to the plate of the output tube.

Bypass Condensers

Fortunately very little substitution has been necessary. It should be remembered anyway that replacing a screen bypass with one of lower capacity assists regeneration and consequent instability. In cathode circuits (two or more tubes linked) bypasses should be large or larger to avoid coupling and instability. Reducing the value of a cathode bypass (single tube) assists degeneration. Bypasses for avc can be larger, but we see to it that the time constant of the avc network is not too great or the avc voltage may not follow those surges of shortwave signals.

Filter Condensers

The war has given us dry electrolytics instead of wets. This has its problems since the dries are not self healing, and they must be worked within safe limits of voltage. In the case of an a-c receiver with a directly heated rectifier the peak voltage on the first filter condenser, before the other tubes warm up, may go dangerously near the peak voltage of the condenser. The use of relay or saturated reactor control of the rectifier filament may be interesting, but it is hardly of commercial value to Service Men. We have found that the best plan is to reduce the *B* voltage to a safe value or place a reasonably heavy resistive load on the rectifier output. If filter condensers are in short supply, then we resort to hum balancing. We have also found that what applies well to one receiver, does not apply to a receiver of another make or model. Obviously, the Service Man requires the simplest and cheapest method of eliminating hum without using filter condensers.

Special Assemblies

It has always been necessary in this country to do repairs to dials, and to special assemblies such as coil boxes, simply because spare units have never been available. A knowledge of lathe work, and the installation of a small lathe in the workshop is a well worth while investment. Very often faulty dial parts are very easily turned up on the lathe. With regard to coil and transformer assemblies, the Pilot 63B coil boxes have to be removed from the chassis, taken to pieces and



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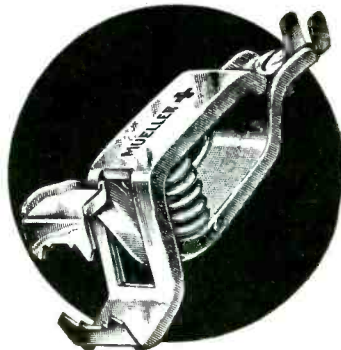


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the faulty coils rewind. The same procedure is necessary on the older RCA jobs using input and output transformers sealed in one can. A faulty transformer means heating up the can, pouring out the sealing compound and removing the faulty unit. This work takes time but it has always been necessary in this country.

C-R OSCILLOGRAPHS

(Continued from page 12)

ing member. This may be a simple bar magnet fixed to the shaft with a pair of pickup coils. For low frequencies, an iron core in the form of a rod, coupling the two coils, may be required to obtain sufficient voltage. While a single coil would suffice in most cases, the pair of coils is recommended to minimize 60-cycle pickup from motors, transformers or even wiring carrying heavy current. The two coils are additive for the rotating magnet flux but they buck one another for external fields. Using the 60-cycle line as a frequency standard, Table 1 gives some of the points at which the pattern stands still with the ratio to 60 cycles. These are, in other words, points that can be measured with 60 cycles on the horizontal plates and the generator output on the vertical plates.

The line may be considered accurate to a few tenths of a per cent and will be adequate for most purposes as a frequency standard. For accurate work, WWV, the National Bureau of Standards, broadcasts the standard of musical pitch; *A* above middle *C* which equals 440 cycles per second. This signal, plus one second clicks, is transmitted almost continually throughout the week on 5 mc (60 meters). A 1,000-cycle standard is broadcast a few hours per week on 10 mc.

Phase Angle Measurement

For measuring phase angles between two a-c sources of like frequency, one source is attached to the vertical, the other to the horizontal plates. No amplifiers should be used, or both amplifiers must be identical to prevent phase shift occurring in the amplifier. Fig. 6 shows five different phase angles which can be quite easily read; values between these may be interpolated. A common application of the phasemeter is in connection with the operation of a capacitor motor; one which is wound two-phase and run on single phase. These are becoming very popular so the Service Man should be familiar with their operation. Fig. 7 shows the set-up for checking the phase angle

(Continued on page 30)

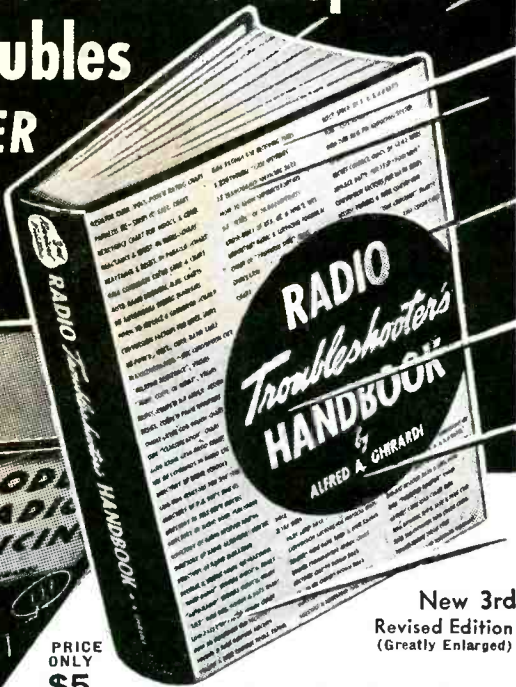
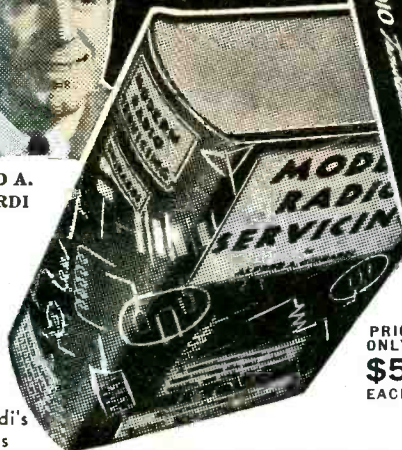
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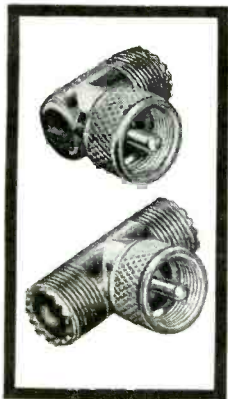


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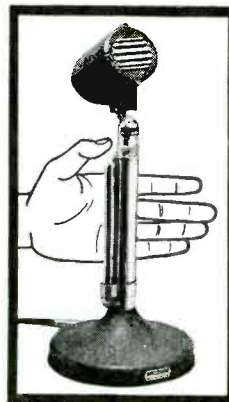
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between two phase windings, 1 and 2. The angle depends upon the Q of phase 2 which, in turn, depends upon the mechanical load on the motor. For optimum performance, the phase angle should be 90° when the motor is fully loaded.

When observing two frequencies having fractional relationships or when one is over ten times the other, it is necessary to separate the front and rear patterns. This is easily accomplished by the phase-splitting circuit shown in Fig. 8, which creates a circular or elliptical timing axis. Two separate voltage sources may be viewed simultaneously with a single time axis by the use of an electronic or mechanical switch which places each signal on the plates for half the time. If the rate of switching is rapid enough, no flicker is noted. The persistence of the screen emulsion is also a factor, tubes being available with several types of emulsions. Cossor, Ltd., in London, has a new double-beam cathode-ray tube which gives true simultaneous indications of two voltages on a common time axis without the aid of a switch. If the idea takes hold, we may expect similar American tubes.

Oscillograph Features

In the DuMont model 208 oscillograph an interesting cathode-ray tube arrangement is used. It is an accelerating electrode near the screen of the c-r tube. Note the dual voltage input posts to prevent overload of the amplifier and the cathode follower circuit in the first triode stage which is an attenuator without frequency discrimination. The tube is really an impedance transformer, not an amplifier. In Du Mont's model 148, the amplifiers may be switched to operate in cascade, as a two-stage amplifier. This model allows waves of 10 to 500,000 cycles to be observed with accurate linearity.

RCA 327-A

The RCA 327-A, shown in Fig. 5, contains direct-coupled amplifiers so that observation and measurement of direct currents are possible. A single sweep circuit for the observation of transients is included, as previously discussed. A d-c calibrating circuit provides a quick means of measuring applied voltages. The deflecting plates are above ground potential by about 500 volts plus the usual centering potentials.

Hickok RFO-4

Hickok's model RFO-4 has a return

trace eliminator which simplifies alignment of a-f and r-f circuits. It also contains a wide-band video amplifier covering up to 3 mc. For signal tracing, a demodulator is included so that only the modulation frequency is brought to the amplifiers. This enables readings to be taken anywhere in the r-f or i-f circuits.

Maintenance and Repair

Most c-r oscillographs have high grade components so the principal servicing required should consist of merely keeping the tubes up to par. Sometimes, however, signal voltage overloads may break down the input coupling condensers. The controls may wear and get *noisy*; indicated by disturbing flashes. Replacement power transformers should always be exact duplicates, or conservative units equally well built with low external fields so as not to modulate the c-r beam. Some c-r tubes just gradually lose intensity and die out; in others, the screen is burned at the center or along the usual horizontal sweep line before the intensity fades and so rendered almost useless. Tubes which dim out prematurely are usually replaced by the manufacturer.

Common Troubles

Probably the most frequent trouble occurs in the sweep circuit. The gas triodes, usually 884 or 885, change

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... and to all engineers planning for post-war radio



A simple yet compelling fact: Electronic and communications equipment will help profoundly in shaping the post-war world. Already the electron has become a powerful, responsive servant in a thousand tasks. Already our voices and images span oceans with the speed of thought. Let us not forget the strength of the tools so close at hand and the obligations they impose on us to use them well. And may we ask you to remember this, too: That in the peace to come Jackson will be making electronic and communications test equipment. It will be good equipment, made with care, accuracy, and fine components.

TEST POINTS FOR A FREQUENCY OF 60 CYCLES

ratio	rpm	ratio	rpm
6:1	600	7:6	3084
5:1	720	8:7	3150
9:2	800	9:8	3200
4:1	900	1:1	3600
7:2	1028.6	9:10	4000
3:1	1200	8:9	4050
5:2	1440	7:8	4120
9:4	1600	6:7	4200
2:1	1800	5:6	4320
9:5	2000	4:5	4500
7:4	2057.1	7:9	4630
5:3	2160	3:4	4800
8:5	2250	5:7	5040
3:2	2400	7:10	5400
7:5	2570	2:3	5400
4:3	2700	5:8	5760
5:4	2880	3:5	6000
6:5	3000		

LESS OBVIOUS POINTS

ratio	rpm
10:3	1080
13:4	1107.7
11:4	1309.1
12:5	1500
9:7	2800
10:9	3240

Table 1

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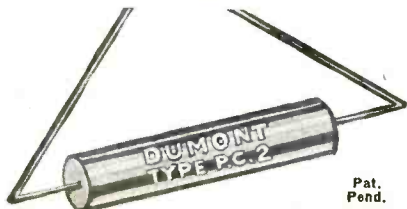
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A-F METER

(Continued from page 13)

affects the deflection only with respect to the time of the positive and the negative half-cycles, and not with amplitude. The meter operates on only one-half of the cycle. If the time for successive half-cycles is unbalanced by more than 60-40, it is necessary to phase the input so that the longer half-cycle is in phase with the measuring half-cycle.

The resistors used in the measuring circuit have a temperature coefficient of 0.002% per degree, and the capacitors have a temperature coefficient of less than 0.008% per degree. These values are over a temperature range of from 25° to 55°. Thus temperature changes have a negligible effect on the over-all accuracy.

The accuracy of calibration will depend upon the accuracy of the power supply frequency. Due partially to the widespread use of electric clocks, practically all commercial power systems are held to close limits from their nominal frequency. Any signal of known frequency within the range of the instrument may be used to calibrate by impressing it on the normal input terminals, in which case the *METER CAL.* button should not be pressed.

Maintenance and Service

In case of poor operation the tubes should be carefully checked and those found to be defective should be replaced. If the 1852 (V-1) keying amplifier tube is replaced the following sensitivity adjustments should be made: Apply about 1.0 volt rms 60 cycles to input. Then adjust the sensitivity potentiometer (screwdriver slot, located on the chassis between the 6F8G and the 6V6G) for maximum indicating meter reading. This should cover quite a few degrees rotation. Reduce input voltage until only one point on the potentiometer gives a maximum value on indicating meter. This is the position for maximum sensitivity.

Frequency Ranges

Full scale readings.....0-50; 0-100;
0-200; 0-500; 0-1000;
0-2000; 0-5000; 0-10,000;
0-20,000; 0-50,000 cycles.

Input

Voltage, up to 10,000 cycles.... (min.)
1.0 v. rms; (max.) 200 v. rms
10,000 to 50,000 cycles..... (min.)
2.0 v. rms; (max.) 200 v. rms
Impedance.....250,000 ohms

Recorder Output

Current.....full scale 5.0 ma
Impedance.....maximum 1000 ohms

Accuracy (1% full scale, with accurate line frequency)

Meter±2%

Recorder±5%

Power Supply

Line Rating..105-125 volts, 50-60 cycles
Power Consumption.....70 watts
Fuse Rating.....2 amperes

Tube Complement

1—1852 (V-1).....Voltage amplifier
2—6V6G (V-2 and V-3).....
Square-wave generators
1—6F8G (V-4).....Meter rectifier
1—1852 (V-5).....D-C amplifier
1—5Z3 (V-6).....Power rectifier
1—VR-105-30 (V-7).....Voltage regulator
1—2A3 (V-8).....Voltage regulating tube
1—57 (V-9).....Control tube

C-R OSCILLOGRAPHS

(Continued from page 31)

their operating characteristics or the condensers become leaky, giving a curved time axis which distorts the waveform patterns. If the sweep frequency calibration starts to change, watch for the foregoing. Many applications depend upon voltage regulators, both neon types and the VR series. These must be up to par. When a thyatron is replaced, a new frequency calibration is almost inevitable. Vacuum tube sweeps may give less trouble.

[The use of the cathode-ray oscillographs in everyday service work will be discussed in more detail in a subsequent article to appear shortly.]

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."

FADA

**FACTORY
SERVICE DEPT.**

OFFERS you a completely equipped service organization to handle your repairs on Fada and all other make radios.

FADA OF NEW YORK

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Tel.: GRamercy 7-0951-2-0980

LARGE STOCK OF REPLACEMENTS
AND CABINETS ALWAYS
ON HAND

GLOBAL OPERATIONS

(Continued from page 14)

a solid week of Jap bombing on Guadalcanal.

Even in the testing and servicing of equipment on coastwise vessels, the Service Man has met unusual requirements. He may be called from his bed in the middle of the night for a job expected to detain him for only a few hours. He may be put ashore several days later and 1,000 miles from home. Or he may spend the next six months at an island naval base, or find himself in a ringside seat for a skirmish with an enemy submarine. All of these things and many more have happened. Security often demands that these men travel under secret orders, and once aboard ship with a job to do, they must accept the fortunes of war if an emergency dictates a sudden departure or change of course before the job is finished.

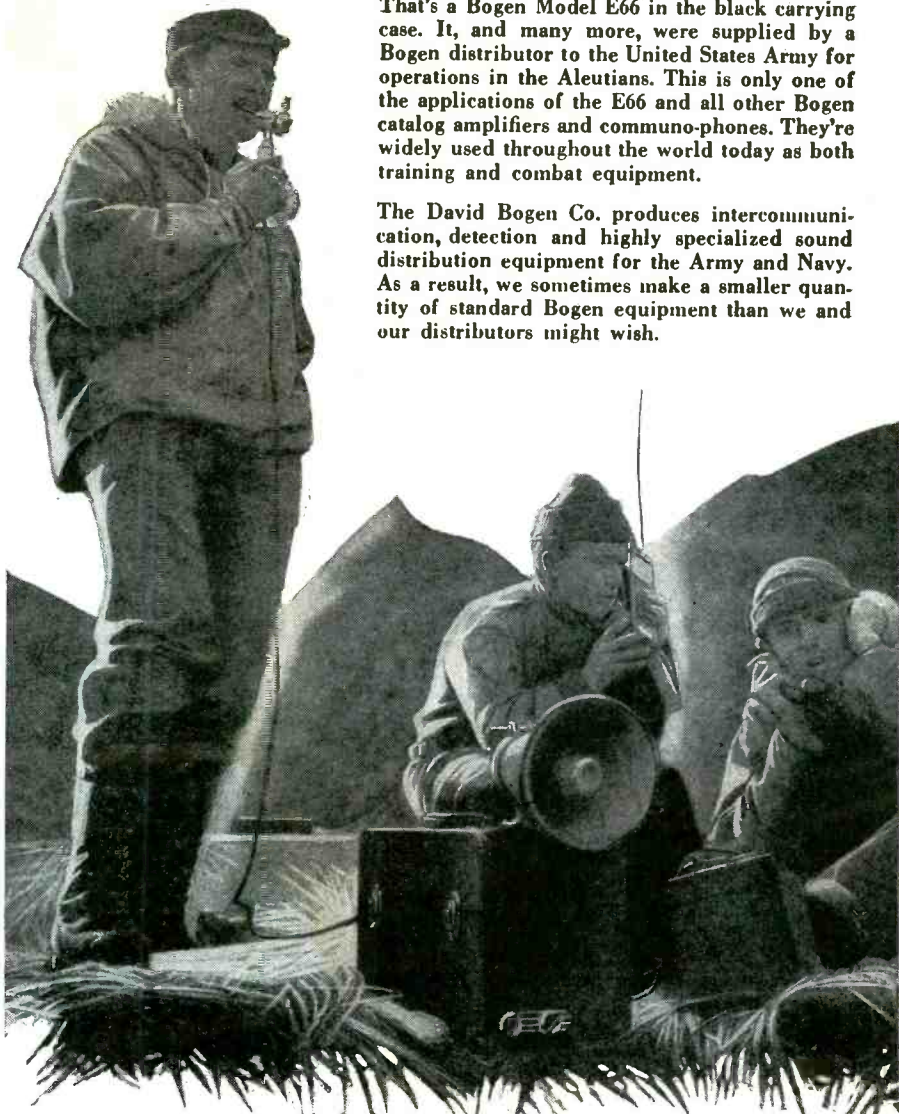
Broadcast Equipment

Installations of broadcast equipment during 1943 have been confined mainly to those intended for use in disseminating war information and propaganda designed to further United Nations objectives. Such projects have taken our field men to Brazzaville, in French Equatorial Africa; to Leopoldville, in the Belgian Congo; to Rio de Janeiro, and to England, where they have supervised installations of 50-kilowatt international short-wave transmitters.

At Brazzaville and Leopoldville, particularly, these men were required to work under handicaps which called for the utmost stamina, skill and ingenuity. Tropical heat, humidity, mosquitoes, and malaria conspired with a dearth of modern engineering tools and skilled labor to challenge the builders. At Brazzaville it was necessary to build a stretch of narrow-gauge railroad and push small trucks or "dollies" over it by hand to get the heavy parts of the transmitter to the construction site. Lacking cranes and derricks, long poles were used to slide equipment into place. A borrowed bathtub served to collect distilled water used in testing the equipment. Scarcely a man on the job escaped malaria. But the transmitter was completed a month ahead of schedule, despite these difficulties.

While some members of our staff were devoting their energies to these vital undertakings, others were busy carrying on the equally important job of keeping transmitters in this country "on the beam" through regular inspection and servicing—a job great-

This one is in the ALEUTIANS



Official U. S. Navy Photograph

That's a Bogen Model E66 in the black carrying case. It, and many more, were supplied by a Bogen distributor to the United States Army for operations in the Aleutians. This is only one of the applications of the E66 and all other Bogen catalog amplifiers and communo-phones. They're widely used throughout the world today as both training and combat equipment.

The David Bogen Co. produces intercommunication, detection and highly specialized sound distribution equipment for the Army and Navy. As a result, we sometimes make a smaller quantity of standard Bogen equipment than we and our distributors might wish.

If deliveries are sometimes delayed, we regret it sincerely. And we'd like our distributors to know that we appreciate their loyalty and patience. We would like to tell them, however, that our experiences as prime contractor for the military services have added considerably to our knowledge. What we've learned will be shown in great new Bogen equipment after the war.

BUY MORE WAR BONDS AND STAMPS

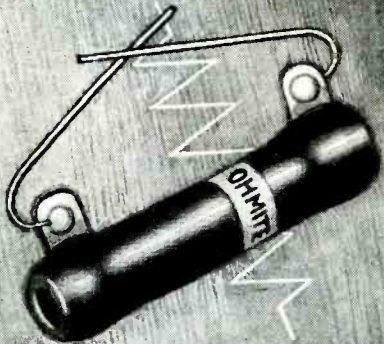
David Bogen Co. Inc.



663 BROADWAY NEW YORK 12, N. Y.

OHMITE

10 AND 20 WATT BROWN DEVIL RESISTORS



*For Dependable
Service in Electronic
Applications*

Long known for their dependable performance—Ohmite Brown Devil Resistors serve today in critical war applications—in radio communications and other electronic equipment. Their extra sturdy, wire wound, vitreous enameled construction insures permanent resistance. These same units will be ready to serve your peacetime needs after Victory is won.



Ohm's Law Calculator
Helps you figure ohms, watts, volts, amperes—quickly, easily. Solves any Ohm's Law problem with one setting of the slide. All values are direct reading. Send only 10c in coin. (Also available in quantities.)

CATALOG 18

Gives helpful information on Ohmite stock resistors, rheostats, chokes and tap switches for all types of applications. Free—Write for it.



Authorized Distributors
Everywhere



Ohmite Manufacturing Co.
4877 Flournoy, Chicago 44, U.S.A.

ly increased by the wartime need for conservation.

Industrial Applications

The application of electronics to various industrial operations is a comparatively new field in which great strides have been made during the year. These applications include plant sound systems to carry communications and music to industrial workers, the electron microscope for inspection and study of the structure of metals, plastics, chemicals and other materials (as well as for biological studies in hospitals and medical research institutions); and radio-frequency heating devices. The latter are used in such processes as molding and bonding of wood and plastics; case-hardening, annealing, soldering, and welding of metals; baking paint finishes, and drying textiles.

Theatre Sound Systems

With new civilian equipment unavailable because of production restrictions, the successful use of motion pictures for home-front morale building has depended upon maintaining existing theatre sound and projection systems in good operating condition.

Although this task has been complicated by material shortages, and shortage of trained personnel, the inspection and servicing of thousands of theatres were nevertheless completed.

Home Radio Receivers

Still another field in which the war has brought a new responsibility to the Service Man is in the servicing of home radio receivers. Dealers and distributors have been faced with a greatly increased demand for service to home receivers because of wartime curtailment of civilian production. At the same time, many have been handicapped by losses of skilled personnel to the armed forces and war industry. We have assisted in easing the situation by helping to locate additional qualified service outlets to meet customer needs.

The Outlook

Services rendered to military and naval forces have given all our men a vast experience in dealing with the new electronic devices now used exclusively for war purposes. The benefits of this experience will be invaluable to postwar America when adaptations of these devices are developed

Serving
the Armed Forces
...AND THE
HOME FRONT, TOO!

- Despite material and manpower difficulties, and our participation in the war effort, we are producing and delivering the Government-approved Victory Line of Condensers. Write for list of Victory items and prices. Shipments are made on L265 Ratings, or better.

For VICTORY Buy
United States War
Bonds and Stamps



POLYMET
CONDENSER CO.
699 E. 135th ST., NEW YORK 54, N. Y.

to provide new peacetime services.

New installations of r-f heating and other industrial equipment, as well as plant broadcasting systems, are expected to constitute an increasingly large and important phase of servicing work after the war. This type of equipment has proven its practical value in war industry, and will surely find wider usage in the years ahead.

In theatre sound and projection systems, as in broadcast equipment, the Service Man envisages a large amount of installation and replacement work, beginning as soon as the necessary equipment becomes available for civilian use.


For the present, war requirements must continue to occupy the center of the stage for the "dial doctors" whose brains and scopes and meters are so important to the radio and electronics phase of this global conflict. While meeting these requirements, they are also making every effort to keep up necessary civilian service here at home, and gaining knowledge and experience that will continue to serve us in the postwar "Age of Electronics."

SAVE ALL WASTE PAPER. THE WAR EFFORT NEEDS IT. FIGHT WASTE!

RADIO TUBE HINTS

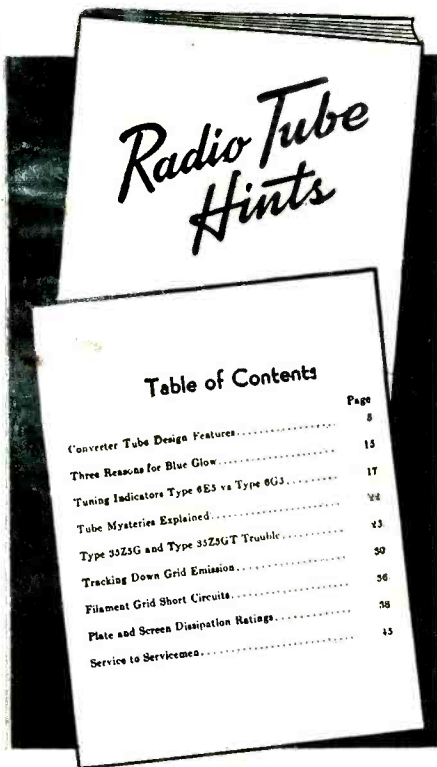
SYLVANIA SERVICEMAN SERVICE

by
FRANK FAX



SERVICEMEN will find answers they can use every day in "Radio Tube Hints," a 44-page book just published. Not intended as a complete treatise on tubes, this handy easy-to-read volume clears up tube mysteries, explains testing and helps you do your job.

Take a look at the table of contents, reproduced below, and you get an idea of the book's value.



This is the first of a new "Hints" series. Watch for others.

"Tube Hints" is FREE. If your jobber does not have copies in stock, write to: FRANK FAX, SYLVANIA, EMPORIUM, PA.

SYLVANIA

ELECTRIC PRODUCTS INC.

RADIO DIVISION • EMPORIUM, PA.

JOTS FLASHES

LOOKS like a big year ahead for Service Men . . . SERVICE will keep you posted on all new developments . . . television, f-m, test equipment, public address, etc. . . . read all advertisements carefully . . . manufacturers are postwar planning for your benefit *now* . . . Orrin E. Dunlap, Jr., appointed director of advertising and publicity by Radio Corp. of America . . . American Radio Hardware Co. opens new factory in Mt. Vernon, N. Y., to take care of increased production demands . . . Leon Adelman, jobber s-m for Cornell-Dubilier, recuperating after operation in Bronx Hospital, N. Y. . . . "Hank" Johnson, Lieut. (j. g.) USN, on leave from Sylvania, reports safely coming through recent Tarawa engagement . . . Sylvania's Williamsport, Pa., plant awarded Army-Navy "E" for outstanding production . . . Hudson-American Corp. now has five plants making equipment for Signal Corps all located in Times Square, N. Y. . . . commendation to the author of *The Creed of Ken-Rad* . . . a sincere and worthy pledge by a productive personnel . . . C. L. "Muggs" Pugh, ex-jobber s-m for Stancor, organizes C. L. Pugh Co., 2009 Elmwood Ave., Columbus, O., to serve as manufacturers' representatives in the Middle West . . . good luck, "Muggs" . . . sorry that current paper restrictions will not permit acceptance of "group" subscriptions for the duration . . . regular rates must apply . . . David Gross appointed sales director Materials Test Division of Allen B. DuMont Labs., Passaic, N. J. . . . same company appoints Samuel H. Cuff, sales promotion manager for television . . . Wm. C. Speed made v-p in charge of manufacturing by Reeves Sound Labs . . . Adair's Radio and Appliance Store opens for business at 155 American Ave., Long Beach, Cal. . . . Wm. J. Massey appointed general lamp sales manager by Westinghouse Lamp Division, Bloomfield, N. J. . . . Larson Distributing Co., Denver, Colorado, to distribute Crosley products in that State . . . 1st Lt. Robert Phillips, Jr., Signal Corps U. S. A. and T/Sgt. E. A. Hurley with an Air Base Squadron in the Aleutians tied for first prize in the Hallicrafters prize contest for radio men in the service . . . each received check for \$100 . . . 4th War Loan Drive started Jan. 18th . . . hope you've all exceeded your quotas . . . Uncle Sam still needs plenty \$\$\$ to finish the job . . . there's still plenty of time to buy that extra bond.

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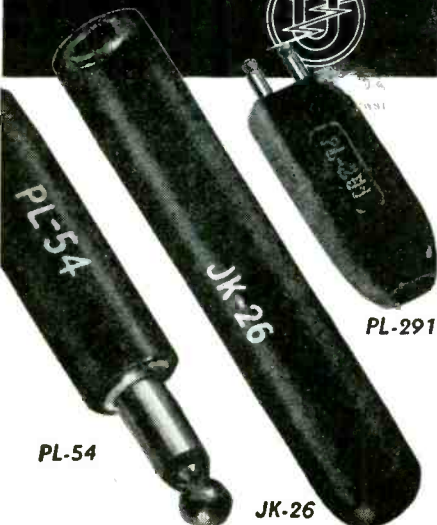
Voice Communication Components

Universal Microphones, as well as Universal Plugs, Jacks, Cords, and Switches, are vital voice communication components today in the War Effort. When peace comes, they will continue to fulfill their role in a postwar world surmounting the barriers of distance with Radio and Aircraft.

UNIVERSAL MICROPHONE CO., LTD.

INGLEWOOD, CALIFORNIA

CANADIAN DIV: 560 KING ST. WEST, TORONTO 2
FOREIGN DIV: 301 CLAY, SAN FRANCISCO 11, CAL.



ordinary light socket is mounted on a small chassis. Besides the phototube there is a power transformer and a rectifying and amplifying tube mounted on the top of the frame. Underneath a filter assembly is attached.

A tiny mirror no bigger than a baby's fingernail is glued to the shaft of the motor's armature. It reflects a beam of light every time the armature completes one revolution. This beam of light enters the phototube which in turn is connected to an oscillograph.

As it enters the phototube the light is converted to an electrical impulse which is amplified and deflects an oscillograph galvanometer.

The deflections of the galvanometer are recorded on a photographic film and, at the same time, a visual record of the current is photographed.

Thus it is possible, by examining the oscillograph's film, to count the number of revolutions the armature makes after the current has been cut off and until the motor armature comes to a complete stop.

* * *

CORD REPAIR SUGGESTION WINS PRIZE FOR DEALER

Meyer Eisenberg, Plaza Radio Shop, 44 Newkirk Plaza, Brooklyn, New York, won a \$25 War Bond from the Proctor Electric Company recently, for a cord repair suggestion. It was contributed to *Tel-Another*, a wartime idea exchange sponsored by Proctor for the benefit of electric appliance retailers.

Said Mr. Eisenberg: "Because of increasing service demands in the face of a manpower shortage, we wanted to see if we couldn't catch and cure little appliance troubles before they developed into big ones that took a lot more service time and inconvenienced customers.

"Most of the troubles, we figured, were in cords or started with cords. Since we had a complete list of customers, we systematically went through the list. 95% of the existing or imminent troubles were, as we suspected, in the cords. Prompt repairs were made in a few minutes, saving hours later. It meant immediate income for us and kept our customers happy."

* * *

NATIONAL CARBON DRY BATTERY BOOKLET

The story of the development and use of dry batteries is told in an illustrated 48-page booklet, *The Inside Story of Dry Batteries: A Guide for Students*, released by National Carbon Company, Inc., 30 East 42nd Street, New York 17, N. Y.

The booklet takes the reader from Alessandro Volta's discovery of the electrochemical principle, in 1798, to the efficient units of today.

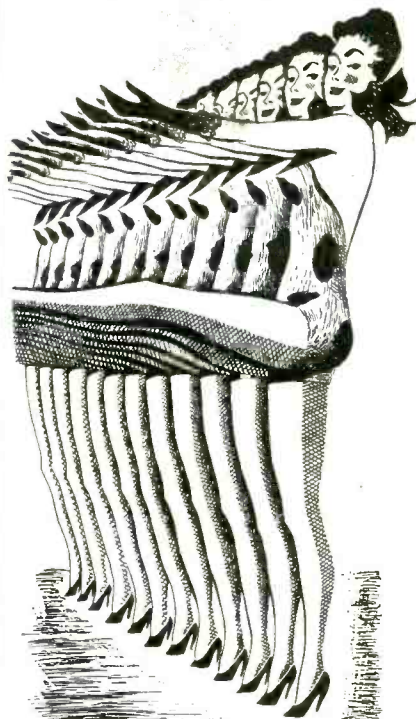
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IRC BOOKLET REVEALS WARTIME PRODUCTION FACTS

An unusual booklet entitled *Reporting on Plancor No. 1666*, telling how additional production facilities were secured under wartime conditions, has been released by the International Resistance Company, 401 N. Broad Street, Philadelphia, Pennsylvania.

The report reveals how difficult equipment was finally secured or built, manpower trained and a plant constructed. The report also points out that the entire nation was canvassed for parts and materials, some 23,000 telephone calls and telegrams were transmitted and 7,000 hours were involved in purchasing and expediting.

UNFAILING PRECISION



IN THE new General Electric line of SERVICE TESTING EQUIPMENT, unfailing precision is just one of many invaluable features. Designed by the famous G-E electronic laboratories for radio service men, service dealers and others—this line gives you a wide selection of portable, compact apparatus for accurate and rapid maintenance and testing work.

The units include: G-E unimeters, tube checkers, audio oscillators, oscilloscopes, condenser resistance bridges, signal generators and other utility instruments for testing radio electronic circuits and component parts.

These dependable G-E units are now in production primarily for the Armed Forces. But they may be purchased on a priority if you are engaged in war work. After victory, of course, the full line will again be available to everybody. . . . *General Electric, Schenectady, N. Y.*

**FREE
CATALOG**



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

Please send, without obligation to me, the General Electric Testing Instrument Catalog S-1 (loose-leaf), for my information and files.

Name _____
Company _____
Address _____

GENERAL ELECTRIC
177-C1
Electronic Measuring Instruments

WARTIME RADIO SERVICE

This booklet includes the following—
**Nearly 300 Tested Substitutions for All
 the Hard to Get Types of Tubes**

Gives instructions for Building Inexpensive Apparatus for Repairing Open Heaters in 150 Mil Heater Type Tubes and How to Use It. About 40% of These Tubes Can Be Made to Give Additional Service.

Tells How to Change the Late Farm Radios for Electric Operation. Diagram and Text Eliminate the Bugs.

The only book of its kind — it saves you valuable time, enables you to increase your sales and satisfy your customers. You can't afford to figure it out yourself.

\$3.00 per copy, postpaid

CITY RADIO COMPANY

The RADIO CITY of Phoenix, Arizona
 504-6 E. Washington Street

WHEN YOU CHANGE YOUR ADDRESS

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

POST-WAR PLANNING— *start yours now!*

Work closely with your distributor.

Read the timely and authoritative editorial content in your magazine—SERVICE—very carefully.

Advertising in SERVICE conveys messages of importance to you—follow it closely.

STANCOR CATALOG

A 36-page illustrated catalog, 140-F, describing various types and sizes of stock transformers has been released by Standard Transformer Corporation, 1500 North Halsted Street, Chicago, Ill. Converters are also listed in this catalog. In addition charts are provided to facilitate unit identification.

AMPEREX EXPANDS

Amperex Electronic Products, 79 Washington Street, Brooklyn, N. Y., now has a second plant in operation.

ERIE RESISTOR AWARDED "E"

The Erie Resistor Corporation, Erie, Pa., has been awarded the Army-Navy "E."

Honorable Elmer L. Evans, Judge of the Court of Common Pleas, Sixth Judicial District of Pennsylvania, was master of ceremonies. Lieutenant Colonel William H. Edwards, U. S. Signal Corps, presented the "E" flag to G. Richard Fryling, president.

NEW STACKPOLE CATALOG

A 36-page catalog with data on fixed and variable resistors, switches and iron cores has been published by the Stackpole Carbon Company, Electronic Components Division, St. Marys, Pa.

It is known as Catalog RC6, and contains a listing of Stackpole standard and high-frequency iron cores. In addition the catalog also contains helpful reactance charts as well as time constant charts for series circuits.

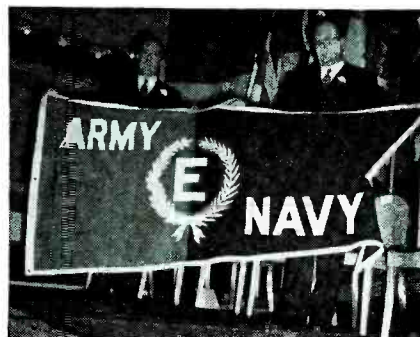
Other features include detailed listings, dimension diagrams, etc., of Stackpole's slide-line, and rotary-action switches;



$\frac{1}{8}$ -, $\frac{1}{2}$ - and 1-watt fixed resistors, as well as variable resistors in standard and midget sizes for practically any radio, hearing device, or similar application.

BELL SOUND WINS "E"

The Army-Navy "E" award has been won by the Bell Sound Systems, Inc., 1183 Essex Avenue, Columbus, Ohio. Lieutenant Governor Paul M. Herbert, of Ohio, served as master of ceremonies and delivered the main address. Colonel H. R. Yeager, commanding officer of the Signal Corps, Aircraft Signal Agency, Wright Field, Dayton, Ohio presented the flag to Floyd W. Bell, president.



Floyd Bell, left, and Earl Hosler with "E" flag won by Bell Sound.

J F D BELT AND BALLAST MANUAL

A 100-page guide describing woven fabric belts and their applications in practically all of the receivers; a-c/d-c adjustable ballasts with diagrams for applications; RMA base wiring diagrams and base wiring changes, has just been published by the J F D Manufacturing Co., 4111 Fort Hamilton Parkway, Brooklyn, New York. Included in this booklet also is a supplement with data on additions and corrections to the master belt and ballast book. Data also appears on harnesses and plugs. The price of the manual is \$1.00.

CENTRALAB CAPACITOR BULLETIN

To supplement bulletin 630 on Ceramic Capacitors, Centralab, division of Globe-Umon, Inc., 900 East Keefe Avenue, Milwaukee, Wisconsin, has just released a new 4-page folder, 721. It contains condensed information on special types of capacitors now in production.

Types illustrated and described are the 840, 841, 851, 850, 852 and 814-078.

HYTRON FACILITIES EXPANDED

The Hytron Corporation, Salem, Massachusetts, have quadrupled their productive facilities, according to latest production data.

NEW PHOTOTUBE APPLICATION

The phototube is now serving as a counter of motor armature revolutions at the Bridgeport laboratory of the General Electric Company.

H. C. Anderson of the laboratory developed the method.

The device which is plugged into an

frequency generator, provided that a synchronizing voltage of at least 0.1 volt is available. The synchronization can also be made with any other external frequency source.

The output impedances available are 100-200-500-600-1,000-2,000 ohms. Output voltage may be varied either in fixed steps or may be continuously varied by means of the variable voltage potentiometer. When the latter is used, the output impedance is from 0-2,000 ohms.

If the output voltage is varied in steps, the output impedance is indicated by the output voltage selector setting. The maximum voltage output is approximately 200 volts.

Operates on 110-120 volts, 60-cycles a-c; also available for other voltages or line frequency. Power consumption is 30 watts. It is 8" in height, 9" in depth, 15" in width and weighs 18 lbs.



* * *

SIGNALLING TIMER

A signalling timer providing visual and audible notice when a time interval has been completed is available from Industrial Timer Corporation, 117 Edison Place, Newark, New Jersey.

Operates on alternating current, 115 to 230 volts, 25, 50 and 60 cycles; 1,000 w; voltage and frequency to be specified.



* * *

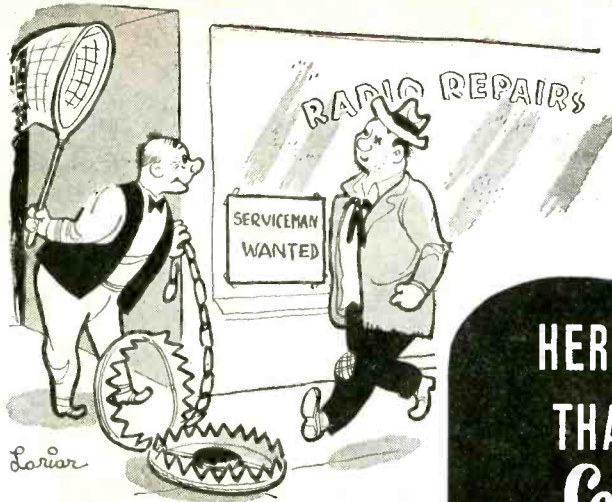
GENERAL ELECTRIC INSULATION-RESISTANCE METER

An electronic insulation-resistance meter for measuring the resistance of insulation in apparatus during the manufacturing process, has been announced by the special products division of the General Electric Company. The instrument is also useful for checking condition of insulation of apparatus in service, and in the laboratory for testing experimental samples.

The instrument consists of a conventional electronic rectifier, a Thyrite bridge circuit, and an electronic-tube voltmeter.

It is available in two types. One type has a scale calibrated from 1 to 50 meg-

"THE HELP SITUATION" by Lariat



Are you hungry for help? Are you desperately trying to find some means of turning out the huge volume of work in your shop?

Then increase the manPOWER of those men you already have in your shop by placing a complete set of Rider Manuals on every bench.

Rider Manuals provide "The Extra Hand" you need, supplying authoritative servicing data to speed up the location of defects in faulty radio receivers.

Volume XIV of these standard works is now in preparation and the date of its publication will be announced shortly. In the meantime be sure you are getting every available bit of the assistance offered by Rider Manuals—be sure you have all thirteen volumes.

—And while you're checking—check the list at the right. Here are other Rider Books that are being used for training in all branches of the Armed Service. They can speed your mission to "keep 'em playing" on the homefront.

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RIDER MANUALS (13 VOLUMES)

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

OTHER RIDER BOOKS YOU NEED

The Cathode Ray Tube at Work
 — Accepted authority on subject.....\$3.00
 Frequency Modulation
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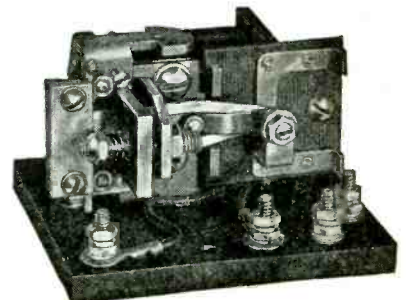
ohms and measures resistance at 500 volts d-c; the other type has a 0 to 20,000-megohm total range and measures resistance over four different resistance intervals—from 0-5 megohms at 0-250 volts d-c and 5-200, 50-2,000 and 500-20,000 megohms at 500 volts d-c.

* * *

STRUTHERS-DUNN SNAP-ACTION RELAY

A sensitive type relay, 79XAN, with snap-action contacts is now available from Struthers-Dunn, Inc., 1321 Arch St., Philadelphia, Pa. Contact pressure of this relay is said to remain constant despite slow variations in the coil current in which it is connected. Then, when the coil current reaches a certain point, the contacts operate with a positive snap action.

The relay is said to operate on as little as 10 milliwatts in its coil circuit. It is recommended for highly sensitive vacuum tube applications, as well as in detecting overloads at low current levels.



Radiart's PLEDGE for 1944



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★ Consistent with the above obligations to devote the unused part of our production to filling orders for our Service Men and Jobbers.

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NEW PRODUCTS

CLAROSTAT SMALLER WIRE-WOUND CONTROLS

A new space-saving wire-wound control, type 43, has been announced by Clarostat Mfg. Co., Inc., 285-7 N. 6th St., Brooklyn, N. Y. It is available now to manufacturers and government agencies subject to highest priorities cov-

ering wire-wound items. Ultimately, it will be a standard item for the trade generally.

This midget control measures 1 1/8" in diameter by 9/16" behind mounting surface. Body is bakelite, completely enclosed by a dust-tight metal cap, or by an attached switch. The control virtually matches in both size and general

appearance the type 37 or midget composition-element control. The wire winding is curved and held in a concentric slot in the molded bakelite body. The alloy contact arm presses against the inside surface of the winding. The control is supplied with or without switch; in resistance values up to 10,000 ohms; linear tapers only rated at 1 1/2 watts.

RCA MULTIPLIER PHOTOTUBE 1P21

A 9-stage multiplier phototube 1P21 has been developed by RCA.

The 1P21 is similar to the recently announced 931-A but features a sensitivity almost three times as great. Because of this sensitivity, the 1P21 is intended only for those special applications in which extremely low light levels are involved, such as may be encountered in astronomical measurements or in various kinds of scientific research. For the more usual applications which do not require so much amplification, the 931-A is recommended.

The new tube is small in size, has low noise level, extremely low dark current and freedom from distortion.

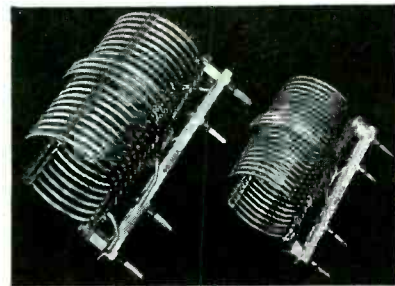
HAINES CALIBRATED SIGNAL GENERATOR

A wide range calibrated signal generator, HF-73, for u-h-f use has been announced by the Haines Manufacturing Company, 248-274 McKibbin Street, Brooklyn, N. Y. It is said to be continuously variable from 200 to 800 megacycles. It is hand calibrated and frequency is read in both megacycles and centimeters directly. Complete with power supply; housed in steel cabinet 15" x 7" x 7 1/2".

B & W COILS FOR ELECTRONIC HEATING

An assortment of standard coils for electronic heating applications has been developed by Barker & Williamson, 235 Fairfield Ave., Upper Darby, Pa.

Standard heavy duty coils are said to be adaptable for application up to 1 kw.



REINER SQUARE-WAVE GENERATOR

A square-wave generator, Model 530, designed for production testing, is announced by the newly organized Reiner Electronics Company, 152-6 West 25th Street, New York City.

This model has a hand-calibrated frequency scale reading from below 10 cycles to more than 100 kilocycles. The decade multiplier has four steps. The actual frequency of the output is the dial reading multiplied by the setting of the frequency multiplier. The accuracy of the frequency calibration is said to be 5% over extended periods.

In cases where great accuracy of frequency is desired, the instrument can be made to synchronize with any standard

SERVICING HELPS

by **BARRY KASSIN**

MANY people frequently place their wrist watches close to radio set and often permit their watches to remain on top of the radio cabinet for a length of time. Since most of the small radio sets have p-m speakers, the watches are magnetized in a short period of time.

Demagnetizing Watches

To demagnetize watches, and other objects as well, a very simple affair using the field coil of an electro-dynamic speaker can be used. Simply remove the field coil from speaker and connect it to a line cord. Then plug into an a-c line. The watch should be held about one inch away from the coil and drawn away slowly.

Tool Demagnetization

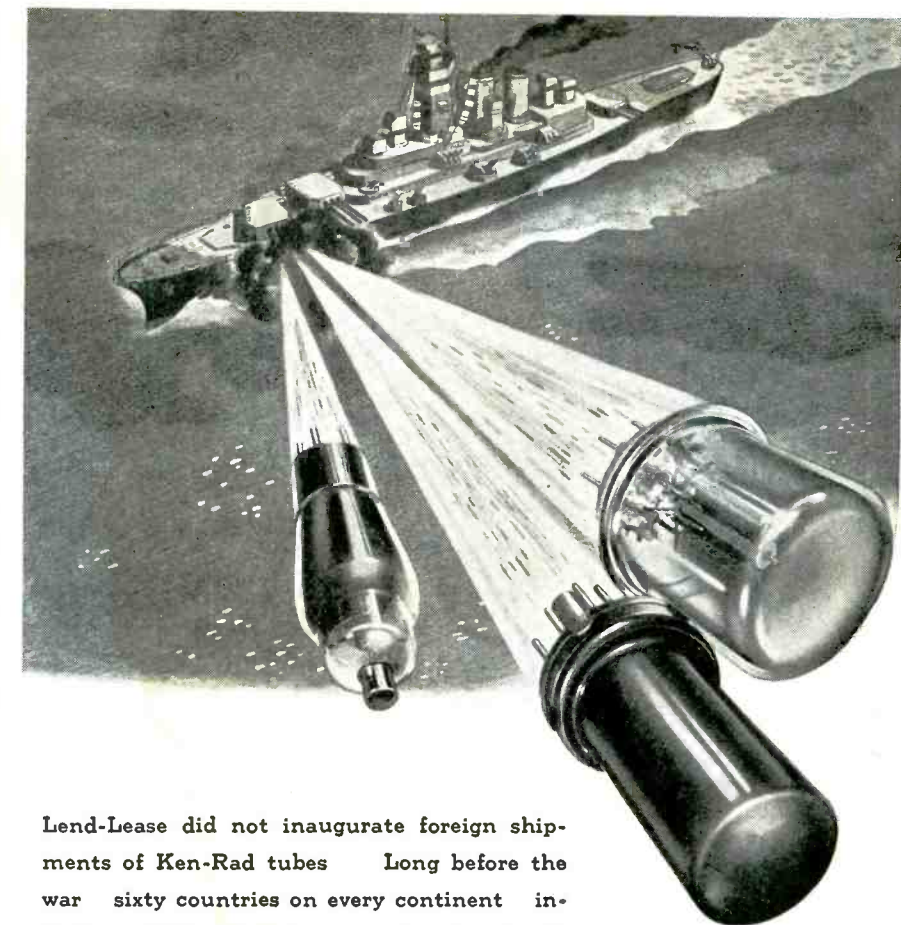
In the event the object to be demagnetized is a tool, having no delicate mechanism as found in a watch, the object may be actually inserted in the center of the coil. The fixed coils should have a resistance of 450 ohms or more for this service.

Magnetized Screw Driver

Often a magnetized screw driver will aid greatly when working in a *hard to get at place*. The same gadget can be used as a magnetizer by either plugging the line cord into a d-c line or by connecting it to a B supply for a short time and then placing the screw driver in the center of the coil.

Load Antenna Problems

We ran into an interesting interference type service job recently. The customer complained of station interference over several sections of the dial. After a careful check, the receiver was found to be aligned properly with good sensitivity and excellent selectivity. The set was demonstrated in the shop to the customer who seemingly satisfied took it home with him. The following day back came the customer with the set and a renewal of the original complaint. Upon inquiry as to the installation of this midget receiver, we found that it had been



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placed on a shelf up against the wall. This position had caused the complete detuning of the loop antenna due to the metal lathe in the wall. The absorption due to the lathe had the same effect as short circuiting turns on the loop thus affecting the inductance and the Q.

This experience is important to remember because any metal ornamentation such as book ends, placed close to or against a midget receiver, may affect its performance.

Ser-Cuits

(Continued from page 18)

transformers with fixed tuning condensers. The filaments are operated in parallel for battery operation on a 1.5-volt battery and in series for line operation. Note the 2-deck switch. The 1H5GT first audio stage uses a 10-megohm grid leak for bias.

**SHARE THE PRINTED WORD!
YOUR FRIENDS WILL APPRECIATE THIS COURTESY AND SO WILL UNCLE SAM!**



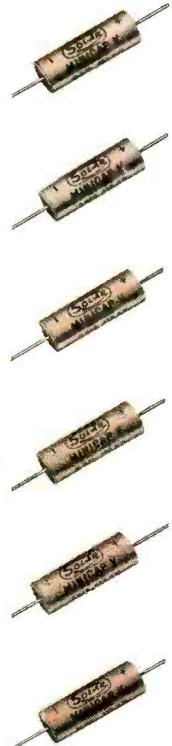
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50 VOLTS WORKING

- 10 Mfd.
 PART NO. MV-5010 List Price \$.55
 Diameter 9/16" Length 2 1/4"

150 VOLTS WORKING

- 20 Mfd.
 PART NO. MV-220 List Price \$.75
 Diameter 11/16" Length 2 1/4"
- 20 + 20 Mfd. Negative Common
 PART NO. MV-2020 List Price \$1.30
 Diameter 13/16" Length 2 1/4"
- 50 Mfd.
 PART NO. MV-250 List Price \$1.10
 Diameter 15/16" Length 2 1/4"

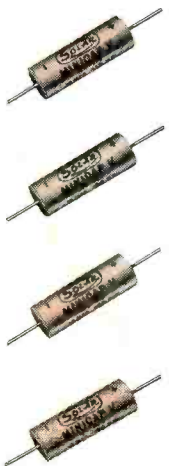
250 VOLTS WORKING

- 20 Mfd.
 PART NO. MV-2520 List Price \$1.00
 Diameter 13/16" Length 2 1/4"

450 VOLTS WORKING

- 10 Mfd.
 PART NO. MV-410 List Price \$.85
 Diameter 13/16" Length 2 1/4"
- 10 - 10 Mfd. Negative Common
 PART NO. MV-41010 List Price \$1.40
 Diameter 1" Length 2 1/4"
- 40 Mfd.
 PART NO. MV-440 List Price \$1.75
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NOTE: Government regulations prohibit the former practice of supplying metal mounting straps with these capacitors. However, the small size and light weight of Minicap "Vees" make them truly "self-mounting."



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tion with the engineers of our Equipment Division, designed, built and put into production a new type automatic coating machine. Operating in an air-conditioned chamber, this equipment provides exact control of both the coating operation and the chemical processing of the emission coating—free from all extraneous elements.

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