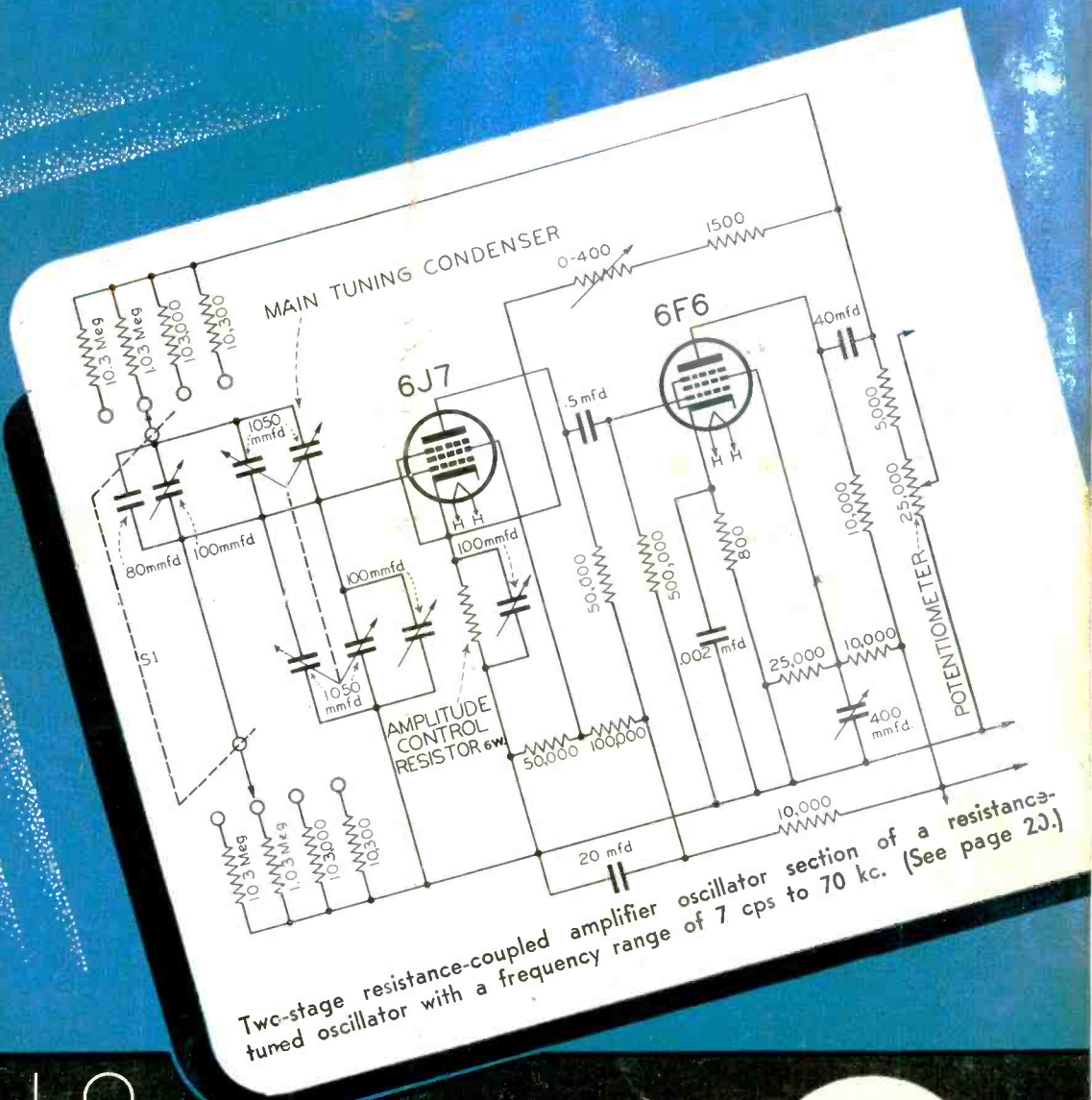


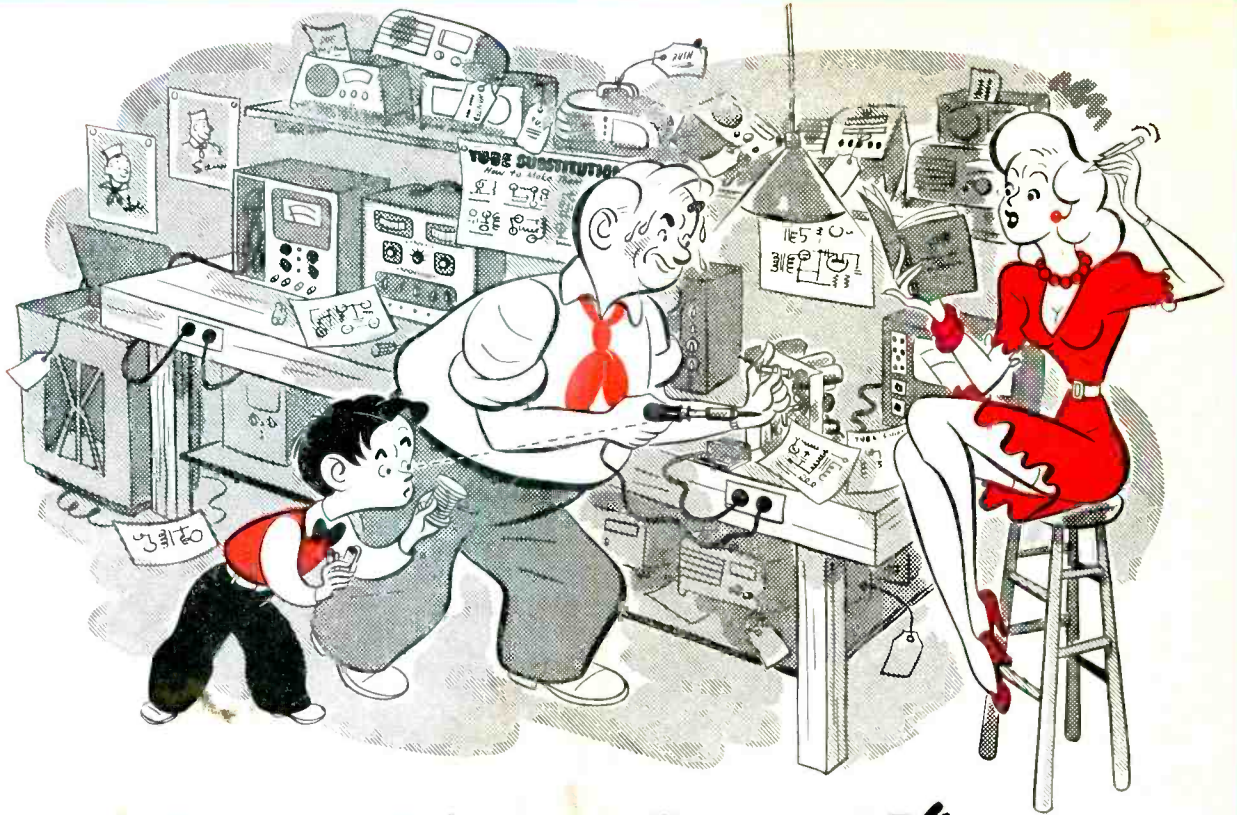
# SERVICE

A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE



★ RADIO  
★ TELEVISION  
★ ELECTRONICS

March  
1944



**"THE IMPOSSIBLE TAKES A LITTLE LONGER"**

"Pass the solder, Johnny. Is that right, Miss Jones; does it say, 'Substitute a 500-ohm cathode resistor'? Yes? Good! We'll have this one going in a few minutes."

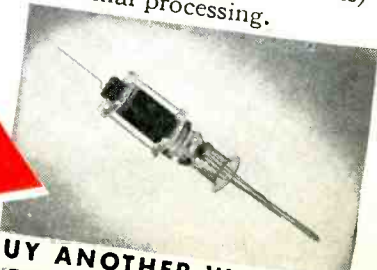
There are no medals for you fellows who—doubling in brass—transform the impossible into a daily possibility, who keep the home radios playing while your former radio servicemen slug it out with the Japs and Nazis. To you, no citations for making available tubes do for vanished types.

You can bet, though, that you have the admiration of your customers—and of Hytron. Although we can do little to help you now, the day is coming when war-proved Hytron tubes aplenty will be yours to keep your customers happy, and to bring you well-deserved profits.

### HYTRON HYLIGHTS

#### HYTRON STILL GROWING

Expansion at Salem and a large new plant at Newburyport were not enough. To meet the growing demand by the armed services for Hytron tubes, and to tap new sources of skilled female labor, Hytron has just added two new plants at Beverly and Lawrence, Massachusetts. These "feeder" plants will supply the parent plants with "mounts" (completed assemblies of internal parts) for final processing.



OLDEST EXCLUSIVE MANUFACTURER OF RADIO RECEIVING TUBES

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

BUY ANOTHER WAR BOND

# \$ 10,000

## WORTH OF HELP FOR YOU!

THE kind of practical, down-to-earth help busy servicemen need these days doesn't grow on trees. It takes plenty of time and money to produce! Actually, well over \$10,000 in cash plus months of work by A. A. Ghirardi, Radio's foremost servicing expert, went into this new 3rd Edition of A. A. Ghirardi's **RADIO TROUBLE-SHOOTER'S HANDBOOK**—before a single book was printed! Just think of it! Over \$10,000 of the finest time-saving servicing helps money can buy—and you get them all for only \$5 complete (\$5.50 foreign). What's more, you can see the book first! Our 5-Day Money-Back Guarantee is your absolute protection!

### Ghirardi Helps You SPEED UP! . . . DO MORE WORK in Less Time . . . MAKE MORE MONEY!

You don't have to spend hours of study before Ghirardi's **RADIO TROUBLE-SHOOTER'S HANDBOOK** starts working for you. It isn't a "study" book. It's a big 744-page manual-size, "on-the-job" data Handbook that you turn to **FIRST** whenever you start to fix some particular radio set, or handle a particular type of trouble, or parts or tube replacement.

#### TELLS YOU JUST WHAT TO DO—EXACTLY HOW TO DO IT

Mr. Ghirardi spent years in collecting the material it contains—plus months more in revising this new 3rd edition and bringing it strictly up-to-date to help busy wartime servicemen do better work in less time. He visited hundreds of service shops, contacted leading receiver and parts manufacturers, checked carefully on every available bit of useful servicing information—and prepared it in the most convenient possible form for quick, easy

reference . . . all thoroughly indexed!

Nine times out of ten, the Trouble Case Histories in Ghirardi's Handbook will tell you **exactly** what is wrong with an ailing receiver and **exactly** how to repair it promptly and directly—usually without any testing whatsoever. Over 400 pages are devoted to these Trouble Case History compilations alone! 4,820 models are covered!

Going far beyond this, however, you'll find hundreds of additional pages of charts, diagrams, compilations, tables, tube or part substitution data or bits of information you require in your daily work. Most servicing problems that you face are covered in this **ONE** convenient Handbook.

#### MONEY-BACK GUARANTEE

In brief, the Handbook is so extensive, so complete, we much prefer to have you see it and judge for yourself for 5 days. Send the coupon today! Then if you are not more than satisfied, we'll gladly return your money and no questions asked. What could be fairer than that?

### HERE'S PROOF!

"Ghirardi's **RADIO TROUBLE-SHOOTER'S HANDBOOK** paid for itself the very first day. Best book I ever bought!"  
C. G. ROBERT, NEW ORLEANS.

"Saved more than the price of the Handbook on two different jobs. Wouldn't be without it!" B. J. ABELL, DETROIT.

"It's a treasure storehouse for any serviceman! I quickly found information I had been looking for for two days and

Solved a tough job. Ghirardi is a star!"  
R. E. LOCKE, CALAIS, ME.

"Cuts servicing time in half!" C. VAN HOLLAN, SUPERIOR, WIS.

"The first day I got the Handbook, it helped me to repair four radios within 3 hours—radios which I couldn't ordinarily fix in 3 days."  
M. J. PENCZAK, LAWRENCE, MASS.

"This book is a 'MUST' for every serviceman—just what I have been searching for. It would take me years to accumulate the information that is now at my fingertips!" JOHN E. MORGAN, DORCHESTER, MASS.

### SPECIAL MONEY-SAVING COMBINATION!

How would you like to have Radio's most widely acclaimed servicing expert at your side to teach you everything you need to know to help make you an accomplished radio service man? Actually, ownership of Ghirardi's **MODERN RADIO SERVICING** means just about that!

#### The Only Complete Book of Its Kind

This famous 1300-page book is the only single, inexpensive volume giving a thorough course in modern Radio service work—explanation of the workings of all Test Instruments; Receiver Troubleshooting Procedure; Circuit Analysis; Testing and Repair of Component Parts; Installation; Adjusting; Maintenance, etc. Contains 706 illustrations, 720 self-testing review questions, 766 different topics. Sold singly for only \$5 (\$5.50 foreign)—or sold on our special Money-Saving Combination Offer with the above **RADIO TROUBLE-SHOOTER'S HANDBOOK**—a big \$10 value for only \$9.50 (\$10.50 foreign). Use coupon today before the paper shortage limits available supply!

FEATURED BY LEADING RADIO JOBBERS

### 5-DAY FREE TRIAL OFFER

RADIO & TECHNICAL DIVISION of  
Murray Hill Books, Inc.,  
Dept. S34, 232 Madison Ave., New York 16, N. Y.

Enclosed find \$5 (\$5.50 foreign) for Ghirardi's 3rd Edition **RADIO TROUBLE-SHOOTER'S HANDBOOK** postpaid; or  send C.O.D. (in U.S.A. only) for this amount plus postage. If dissatisfied in any way, I may return the book at the end of 5 days and receive my money back.

**MONEY-SAVING COMBINATION**—Check here if you wish to buy both the **RADIO TROUBLE-SHOOTER'S HANDBOOK** and **MODERN RADIO SERVICING**.  
 \$9.50 enclosed (\$10.50 foreign) or  send both books C.O.D. (in U.S.A. only).

Name .....  
Address ..... State .....  
City (and Dist. No.) .....

## REPAIR ANY KIND OF RADIO EQUIPMENT—Easier—Better—Faster!

# EDITORIAL

**A**LTHOUGH record-breaking battery production is in full swing, there will be a shortage of batteries for urban and suburban use in 1944. The increased use of mobile and portable equipment, requiring huge quantities of batteries by the Army and Navy, will cause this shortage, according to WPB. Rural area receivers and hearing aid units will receive, as they did last year, most of the batteries that will be available for the civilian market. Incidentally, last year over three million battery packs were sent to the farm market, and over a million and a half B units went to hearing aid users.

**I**N view of the important role industrial p-a systems play in increasing production, the WPB has issued a directive authorizing additional production and installation of industrial sound systems.

According to WPB, industrial p-a units boost morale, and serve to disseminate vital plant information to workers.

**B**LACK market trading of tubes has created an artificial shortage in many areas. In Bridgeport, Conn., for instance, we have learned that hundreds of receivers may soon be retired, not because the tubes required haven't been made available, but because these urgently needed tubes have been diverted into black market channels.

This practice must be stopped. And you can stop it. Watch your channels of supply. Be sure your supply source is an authorized one!

**T**HE SERVICE contest, which closed on March 1st, prompted so many interesting entries that it will be impossible to judge all the contributions fairly within the time limit announced. Accordingly, the names of the winners will appear in the April issue of SERVICE, and all winners will be notified before the end of March.

# SERVICE

A Monthly Digest of Radio and Allied Maintenance

Reg. U.S. Patent Office

Vol. 13. No. 3

March, 1944

**ALFRED A. GHIRARDI**

Advisory Editor

**LEWIS WINNER**

Consulting Editor

**F. WALEN**

Managing Editor

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## The FUTURE is Founded on TODAY

**L**ONG before Pearl Harbor, Raytheon tubes were serving in the Army and Navy. Many Raytheon dealer-servicemen joined the armed forces as expert technicians, and found Raytheons on the job giving the same "Plus-Extra" performance that they had known so well in civilian life.

After Victory manufacturers of radios and of industrial electronic equipment will reap the benefit of

Raytheon's wartime experience and exceptional production record. Indeed, this wartime experience is an extra assurance of the "Plus-Extra" performance of *postwar* Raytheon products.

Victory is first—but the future is a-building now.

**Raytheon Production Corporation**

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

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

ELECTRONICS

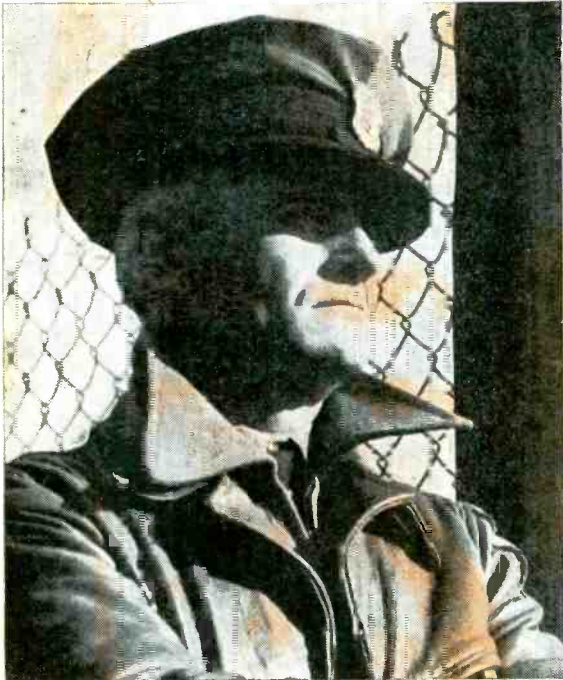


All Four Raytheon Divisions Have Been Awarded Army-Navy "E"—Plus Stars

**RAYTHEON**  
*High Fidelity*  
**RADIO & ELECTRONIC TUBES**



# ALL EYES ON MT. CARMEL!



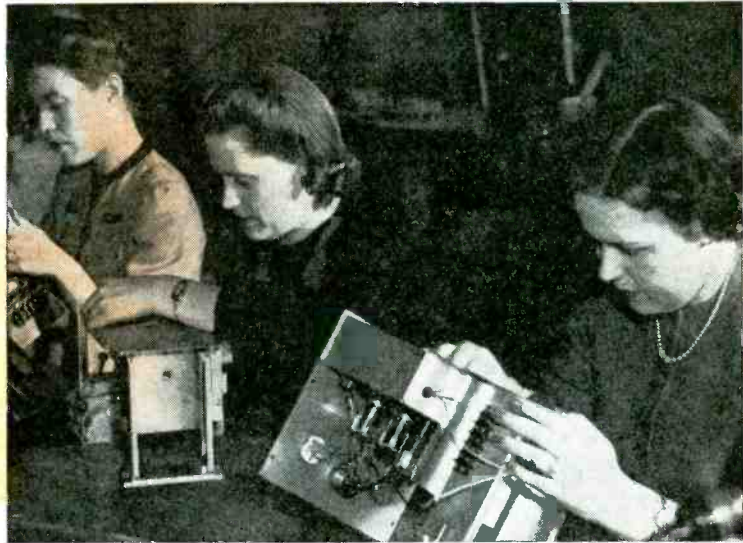
**On Guard!** School of watchfulness at the Meissner plant is this alert, keen-eyed sentinel. All prying eyes are kept at a safe distance, but there's no hiding the fact that great things are in the making here.



**Testing:** These two men pack a world of electronics knowledge behind youthful faces. They literally "grew up" in the business — thanks to the fact that there are more electronics technicians per thousand population in Mt. Carmel than in any other city.



**Meissner's "Precision-El":** Long experience, plus "home town" enthusiasm for the job, have so astonished visitors that they refer to Meissner's personnel as "precision-el." And Meissner's "precision-built" products prove the case!



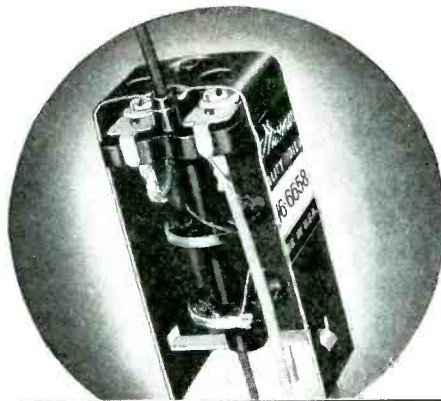
**What New Marvels** these girls have seen! They're on the inspecting line at the Meissner plant in Mt. Carmel, Illinois, source of numerous major war departments in the electronics field.

## ILLINOIS ELECTRONICS CENTER HUMS WITH FUTURE PROMISE

Nearly everywhere you look these days — in America's newspapers or magazines — you're apt to find a glowing reference to Mt. Carmel, or to the Meissner Manufacturing Company. That's because the little Illinois city and its largest industry are both in the forefront of important postwar thinking. Hub of much of this activity is the Meissner laboratory, which occupies an entire floor of the main office building. There are so many closely guarded secrets here, in fact, that no photographer dares set tripod inside!

### Wide Range, High Gain

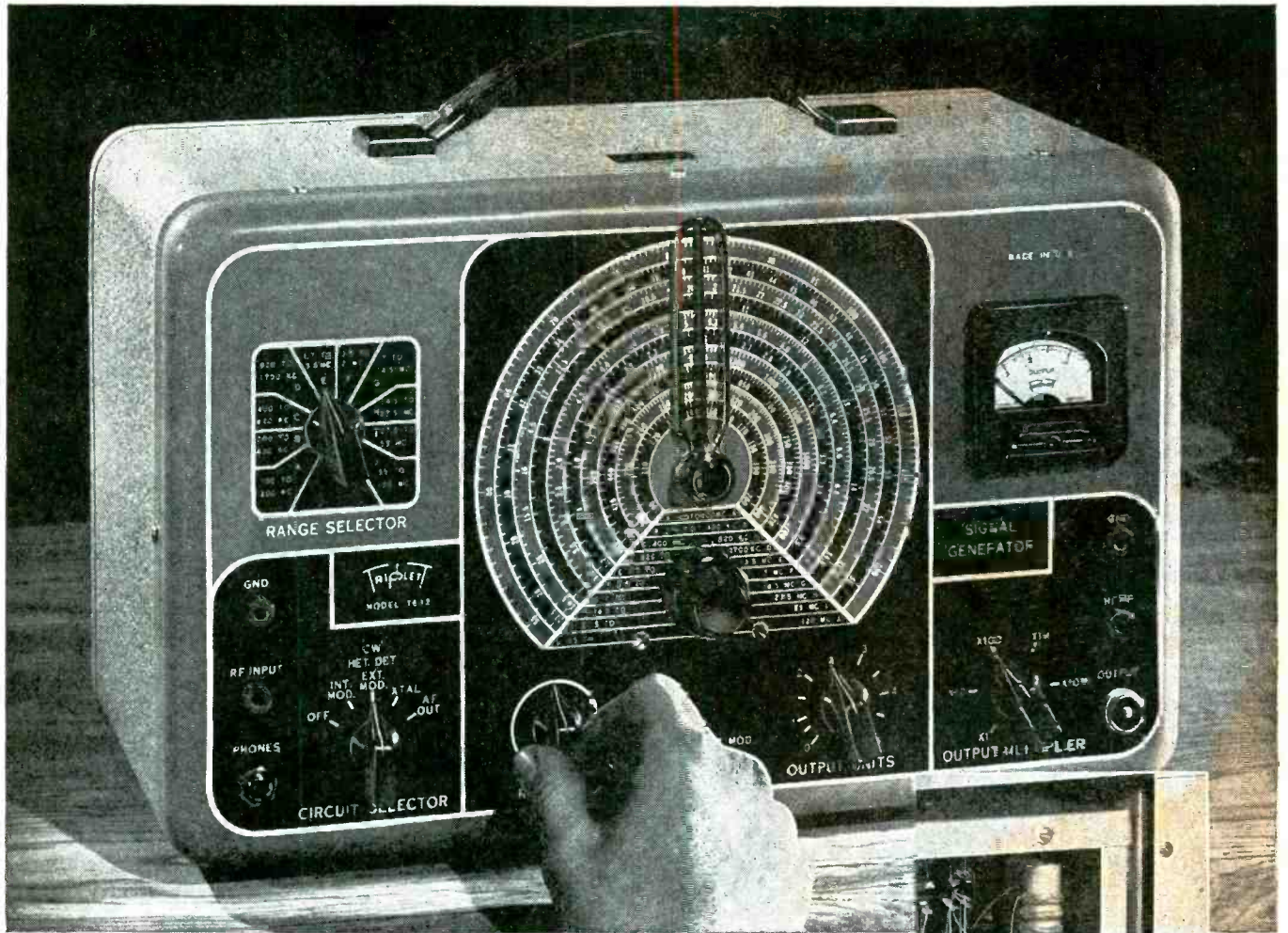
Here are the famous "big four" benefits of Meissner "Plastic" I.F. Transformers: (1) wide range; (2) high gain; (3) remarkable stability; (4) double tuning. They're particularly suitable for use in small receivers, where space is at a premium, yet superior performance is required. Only  $1\frac{1}{4}$ " square x  $2\frac{1}{2}$ ", yet are not affected by temperature, humidity or vibration. Complete with specially served Litz wire and one-piece molded plastic coil-form and trimmer base. Now ready for delivery, but order promptly.



# MEISSNER

MANUFACTURING COMPANY • MT. CARMEL, ILL.

**ADVANCED ELECTRONIC RESEARCH AND MANUFACTURE**



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.

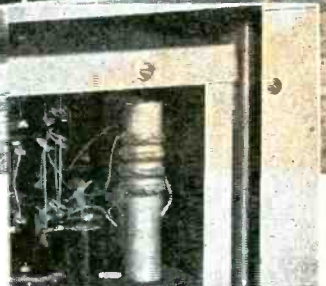
Of course today's production of this and other models go for war needs, but you will find the complete Triplet line the answer to your problems when you add to your post-war equipment.

# Triplet

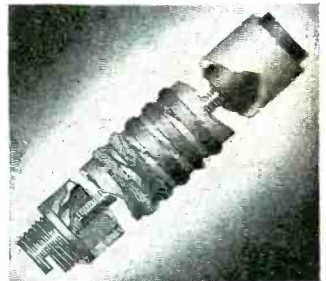
ELECTRICAL  
BLUFFTON



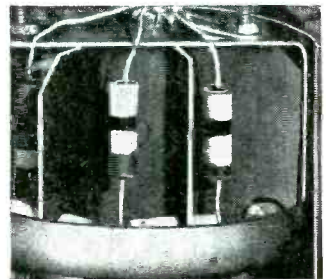
INSTRUMENT CO.  
OHIO ★ ★ ★



• Triple shielding through out. 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.



# Congratulations

## ON A FINE JOB, WELL DONE!



**T**HE Treasury "Star" Flag—the bond-buying counterpart of the Army-Navy "E"—marks plants with at least 90% of personnel participating in the Payroll Savings Plan to at least 10% of gross payroll, and also having reached, or topped, a War Loan Drive quota!

The successful close of the 4th War Loan Drive finds many more "Star" Flags than ever before flying over the industrial plants of America. To all these, go the heartiest thanks of the nation, and the deep appreciation of the Treasury Department for a great job! And to those who may not quite have qualified for the "Star," go equally sincere thanks—and the confidence that soon they, too, will join the ranks of the "Star" fliers.

One thought that many concerns have

found helpful in stepping up the intake from their Payroll Savings Plans is this. In many cases the Treasury Representative in a plant has been able to point out the fact that during *Loan Drive periods* the employees have found it possible to spare much more than they had counted on when setting up their original subscription, and that—*when properly approached*—a very substantial fraction of such employees will decide they can well afford a distinct increase in their current Payroll Savings Plan.

Talk this over with your Treasury Representative—it offers important possibilities when correctly handled. And again accept the Treasury Department's congratulations for your fine work in helping to put over the 4th War Loan.

*The Treasury Department acknowledges with appreciation the publication of this message by*

**LET'S ALL KEEP  
BACKING THE ATTACK  
WITH WAR BONDS**

**S E R V I C E**

*This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council.*



# "The World's Best Tube Makers"

AND WHAT THEY ARE DOING TO MAKE

MORE TUBES AVAILABLE

Workers at RCA's Harrison Plant attend noonday rally

**I**N August, 1943, the thousands of workers in RCA tube factories organized themselves, through their War Production Drive Committee, into the "World's Best Tube Makers."

They resolved to do their job better than it had ever been done before.

They began a drive to reduce tube "shrinkage"—tubes "lost" in the manufacturing process. Knowing that a poor tube takes just as much material, just as much time, just as much labor as a good tube, these "World's Best Tube Makers" set about making more of their tube production *good* production.

Now look at their record:

During the first month of their campaign *tens of thousands* of tubes were made available which

formerly would have been scrapped. During the second month the *gain* had reached the hundred thousand mark. And this astounding performance is still going on.

To all of us, this means that war quotas are being filled faster and faster.

*To those who sell RCA tubes, it means that because war needs are being filled faster, the day when civilian needs can be met may come sooner.*

And in Peace, it will mean finer RCA tubes than ever.

That is why they pride themselves on being the "World's Best Tube Makers," these women and men of RCA. And that's why you, as an RCA tube and equipment sales outlet, can be proud, too!

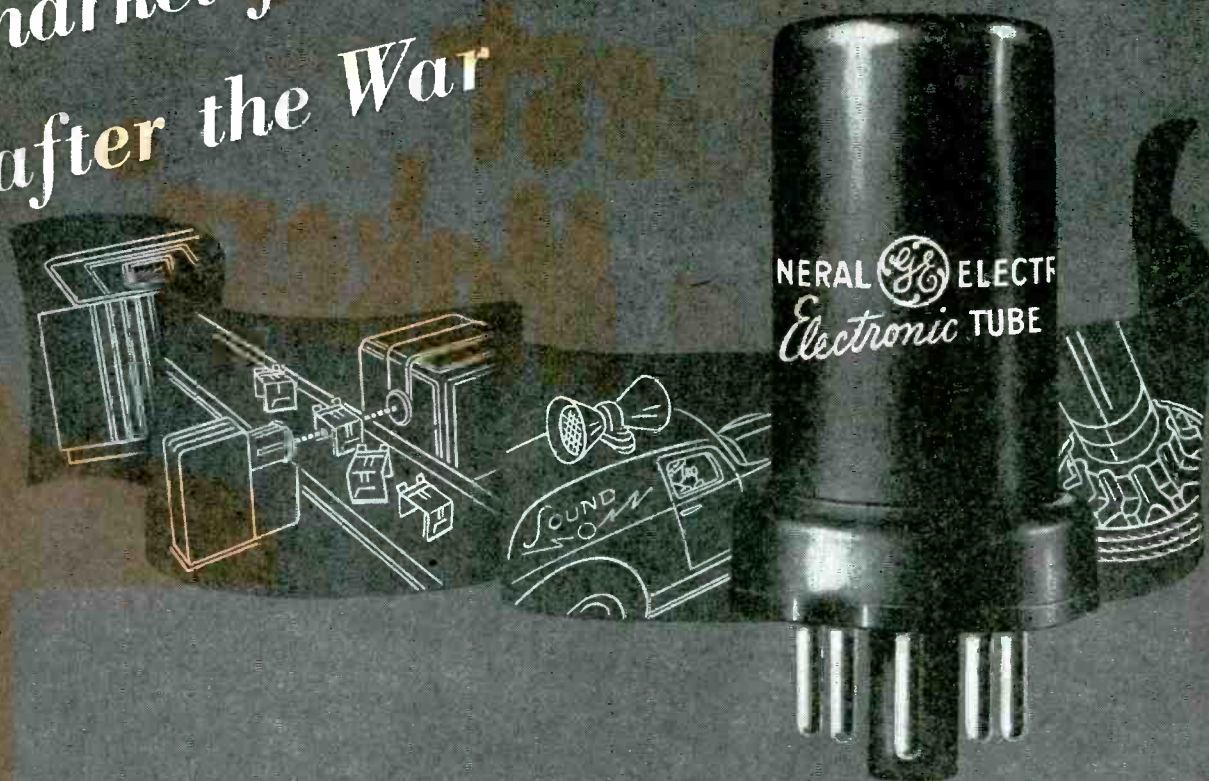


**RADIO CORPORATION OF AMERICA**

Camden, N. J.



You will have a much bigger  
market for Electronic Tubes  
after the War



## GENERAL ELECTRIC IS HELPING YOU BUILD THAT MARKET **NOW**

Besides serving at the fighting fronts, the famous G-E electronic tube is being used in every major war plant—for resistance welding, motor control, inspection, timing and counting devices, measurement, electronic heating and scores of other vital uses.

When victory is won, and these plants are converted back to peacetime production, the G-E electronic tube will have greater use than ever before. This means a bigger post-war market is being built for you right now . . . and you, the radio service man of today, will

be the electronic maintenance man of tomorrow serving both industry and the expanded radio receiver market.

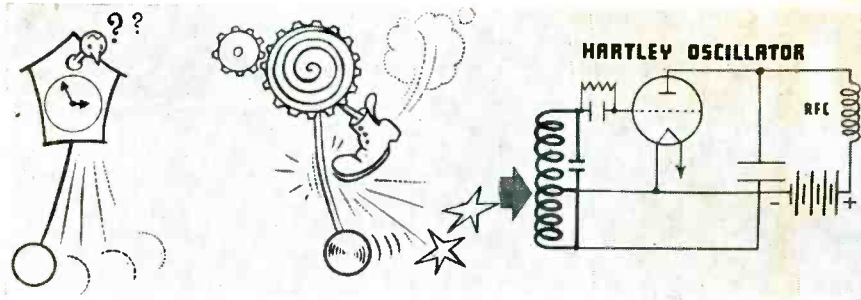
G-E tubes are scarce today because of the demands of war. But tomorrow you will have an abundant supply. *Electronics Department, General Electric, Schenectady, N. Y.*

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

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

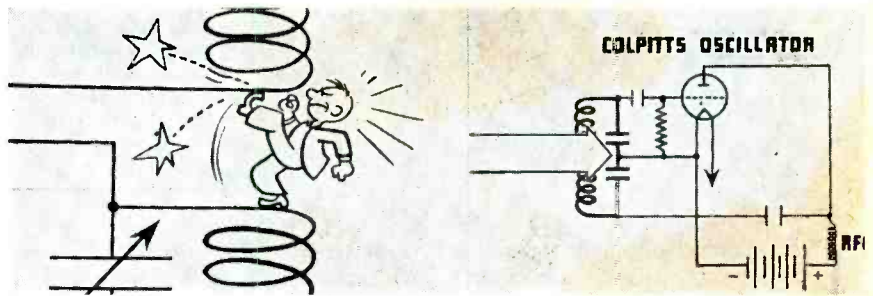
**GENERAL  ELECTRIC**

178-C2



Left and below, slide-film views from electronics course prepared by Westinghouse. At left, sustained oscillator action (feedback characteristic) explained by a clock pendulum analogy. The clock pendulum maintains a constant width of swing. At every half cycle, however, a balance wheel gives the pendulum a bit of a "kick" to compensate for energy loss during that half cycle. The familiar Hartley oscillator is also included in the sustained oscillation analysis.

At right, another interesting sustained-oscillation analogy. At every half cycle of a-c, an electric balance wheel (resonant circuit) provides the "kick" to the oscillating circuit to maintain sustained voltage. The Colpitts' oscillator, another in the types included in the sustained oscillation discussion, is shown at the right of this view. Note that a capacitor is used instead of a reactor to divide the circuit into two parts.



## FILM AND SOUND IN TRAINING TODAY

MOTION pictures have always been a useful tool for training. The introduction of the sound track improved its value immeasurably. And recently, a new procedure of sound and sight projection was introduced, to further increase the instructional usefulness of the film medium. In this new method a combination slide-film projector and phono unit, no larger than a portable radio, are used. The film does not move continuously. Instead, an operator rotates a knob providing projection of one frame on a miniature screen for as long as a minute or two, while a recorded explanation of the subject on the screen is heard.

### Wide Appeal of Method

Both military and civilian have adopted this system to provide instruction on a variety of subjects. The visual-sound courses are complemented by a home-study course, so that the student may become completely familiar with the subject. The courses run from a few weeks to six months in length. Each visual-sound lecture is usually repeated in the

by J. M. LEE

home-study course and accompanied by questions and answers.

Above appear views taken from a course on "Electronic Generation of H-F Alternating Currents" prepared by Westinghouse. This course is part of a complete course on "Electronics At Work." While the subject of oscillators is not a simple one, it is obvious from the illustrations that every effort has been made to simplify the analysis. In the course, slide-films cover the basic theory of vacuum tube oscillators, basic theory of sustained oscillations at constant amplitudes, classification of oscillators by circuit types, classification of oscillators by frequency range, radio frequency oscillators, applications of h-f oscillating circuits to induction heating, and applications of h-f oscillating circuits to dielectric heating.

### Unique Illustrations

The illustrations shown, appear in the section covering the basic theory of sustained oscillations at constant

amplitudes. In addition to the two types of oscillators shown, the tuned grid and tuned plate-tuned grid oscillators are also analyzed effectively.

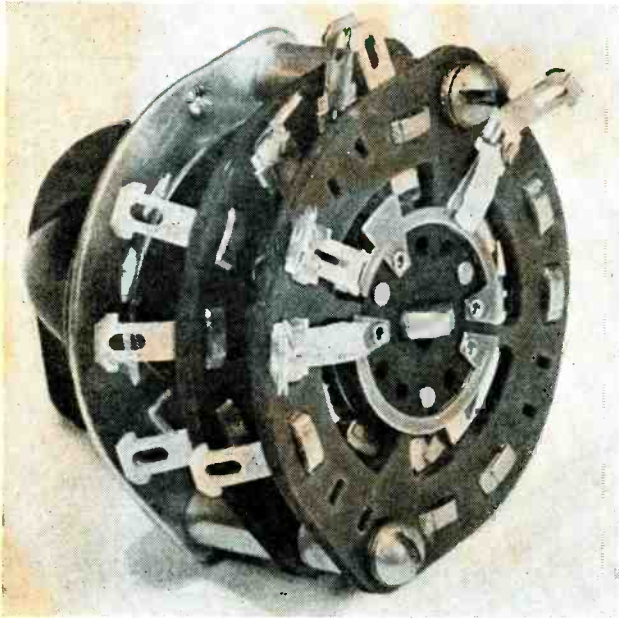
### Other Slide-Film Applications

Another visual-sound course recently introduced covers wire-photo transmission. Here again, simplification plays the all-important role. For instance, the basic principle of wire-photo transmission is explained by an analogy. A coil of rope wound about a drum with an image painted on it, is shown on a slide. As the rope is wound on to a second drum, the image moves naturally and appears on the second drum. This analogy of course is further explained by a commentary from the recording. Another sequence shows a photograph being scanned by a photoelectric eye into lines which correspond to those on the length of rope used on the drum models. The scanned lines are transmitted as an electric current of varying intensity. In the concluding scene we see how the current is received at a newspaper office where it is changed back to light values and printed as a picture.

# ANTENNA COUPLING AND

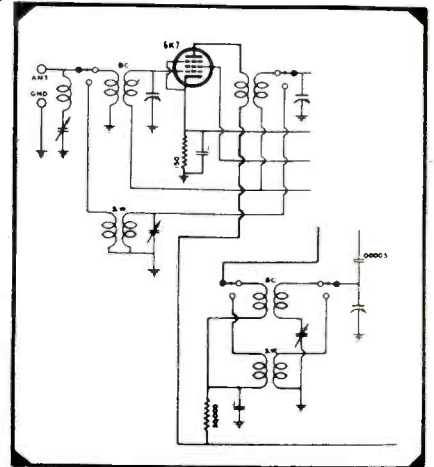
by M. E. HELLER

## PART ONE



Figs. 1 (right) and 1a (left). In Fig. 1, circuit diagram of the input system of a Wilcox-Gay Recordio A-89, 91 and 92. Switching in this system accommodates antenna and band coverage requisites. An i-f wave trap is used for shunting signals of approximately 456 kc to ground. In Fig. 1a, a switch with a shorting shoe, used in input switching systems.

(Photo Courtesy Mallory)



THE subject of antenna coupling has been of interest to many experimenters and radio bugs since the days of coherers and crystal detectors when it was of utmost importance to squeeze every last bit of signal from the antenna. Of the great number of radio receivers in use today, only a few demand such a squeezing process. In the majority of cases there is signal energy to throw away. And sometimes we deliberately throw some away to prevent overloading or to improve selectivity.

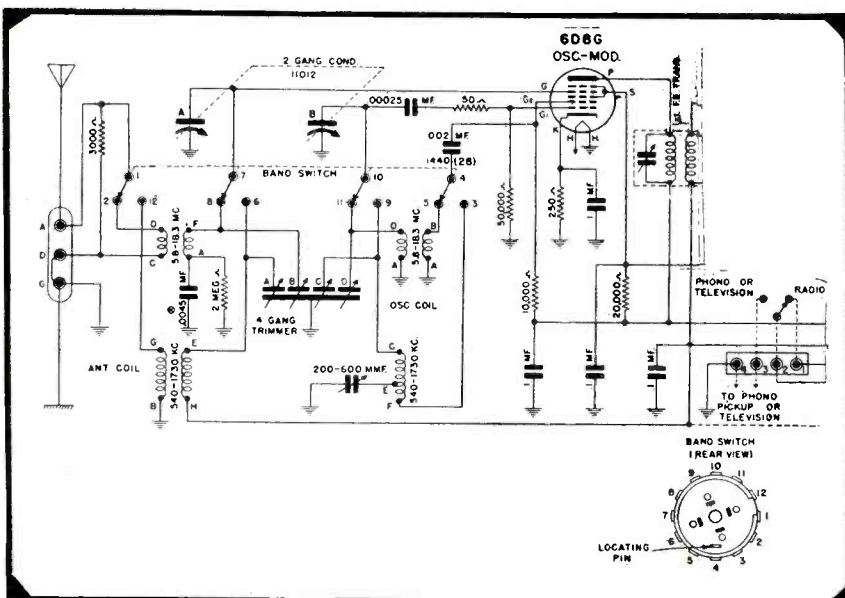
The antenna system, which usually includes the ground, has definite effective resistance, inductance and

capacitance. The resistance varies with the frequency to which it must respond. When this antenna system is coupled to a receiver, some of the R, L and C is transferred to the input circuit along with the signal, though not necessarily in the same proportion. If the coupling is too tight, beyond critical coupling, some signal will be lost due to the excessive loading of the circuit, or due to the loss in  $Q$ .

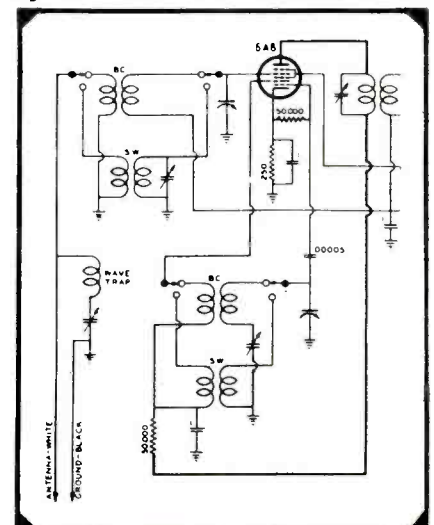
The best method of antenna coupling depends upon many factors, including the type of antenna, type of receiver, (t-r-f, superhet, superregenerative, etc.), frequency range covered

by the receiver, sensitivity and selectivity of receiver, signal bandwidth required, prevailing signal levels, etc.

Impedance matching presents an important consideration in coupling. A very high impedance antenna, such as a 10' wire on the broadcast band, may be attached directly to the input grid; a longer antenna, but a small fraction of a wavelength, may be connected to the grid through a small capacitor, say 10 to 30 mmfd. A still longer antenna, approaching  $\frac{1}{4}$  wavelength, however, has a low impedance and cannot be coupled satisfactorily by means of a condenser but requires



Figs. 2 (below) and 3 (left). Fig. 2, Wilcox-Gay A-85, 87, 88 and 90 tuning system. Fig. 3, Sentinel 168-B switching system.



# SWITCHING METHODS

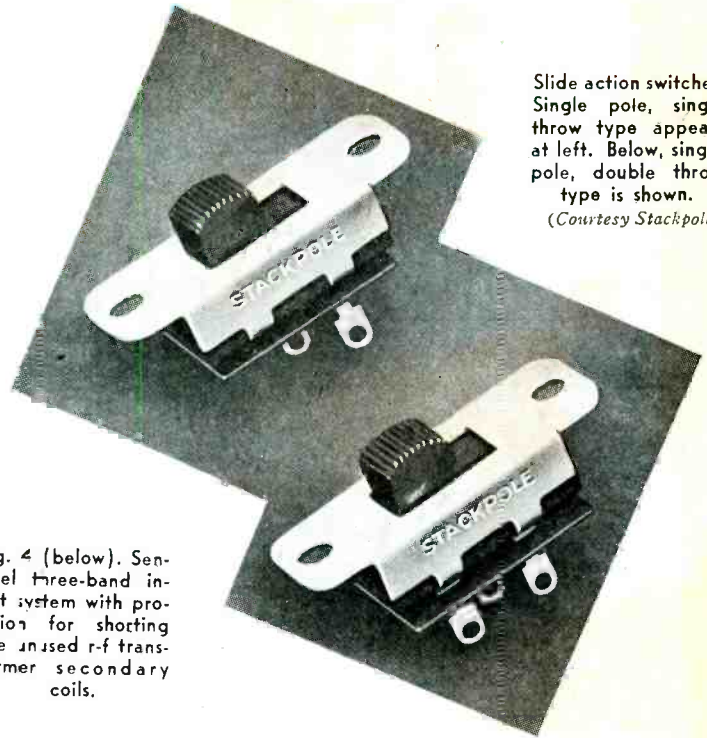
magnetic coupling through a primary coil. As the length approaches  $\frac{1}{2}$  wavelength, capacity coupling again becomes superior. Hence the necessity for switching the antenna to change the type or degree of coupling in receivers covering more than one waveband.

Doublet or dipole antennae are always magnetically coupled to prevent capacity pickup which introduces noise and extraneous signals. Loop antennae, because of the low signal voltages picked up, are usually connected directly in the grid circuit of the first tube. All these problems are involved in waveband switching of antenna circuits.

In Fig. 1 we have an interesting example of switching to accommodate antennae and band coverage requirements. This circuit, taken from Wilcox-Gay Recordio models A-89, 91 and 92, shows the most obvious method of switching an external aerial from one r-f transformer to another by means of a spdt switch. Note the i-f wave trap for shunting signals of approximately 456 kc to ground. It should also be noted that the 6K7 r-f amplifier is in the circuit on the b-c band only, the s-w transformer being switched directly to the converter stage. Fig. 2 shows a similar arrangement where the antenna transformer feeds the converter tube directly, both the antenna and signal grid being switched in the simplest manner.

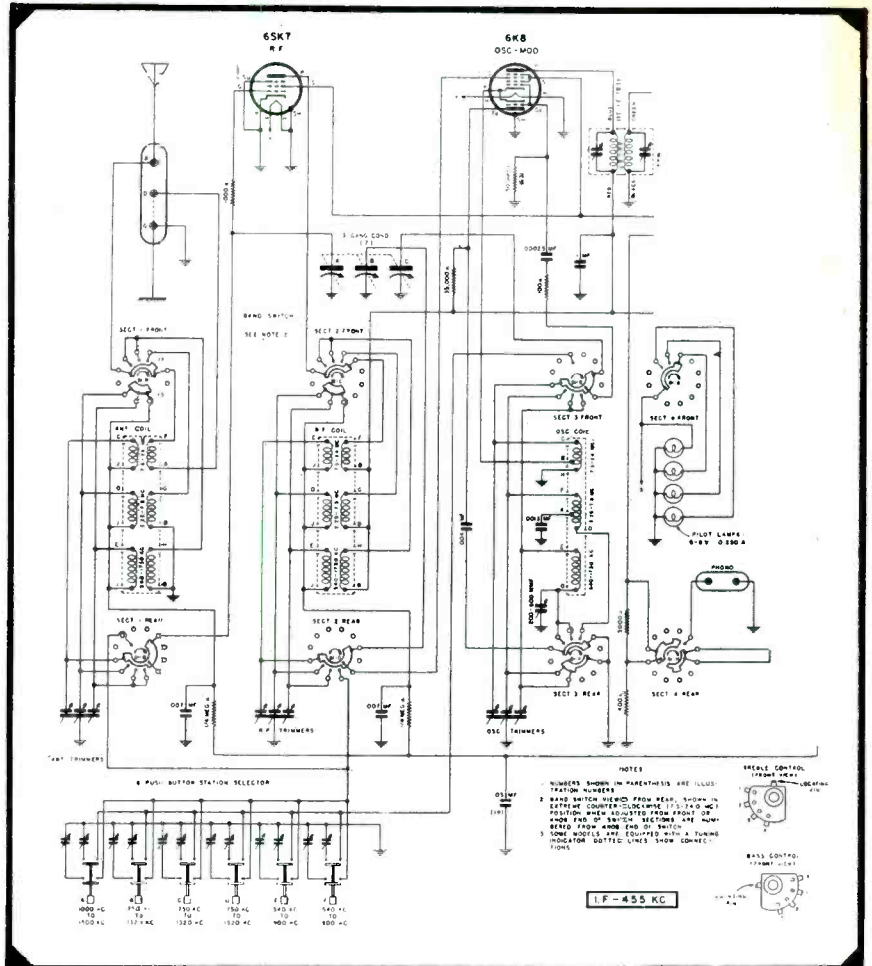
## Dipole Antennae

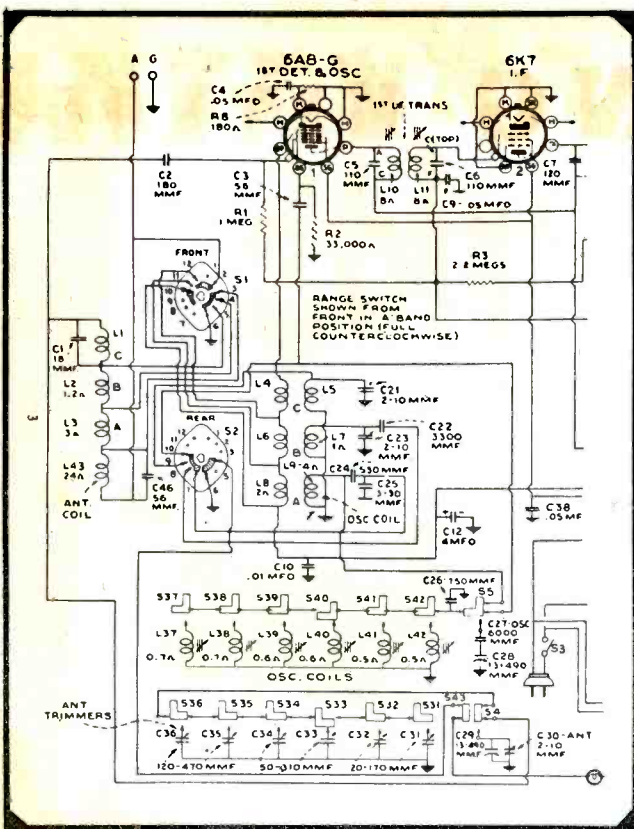
Provision for either a single wire lead or a dipole antenna is made in Sentinel models 186B and 186BE, Fig. 3. A damping resistor of 3000 ohms is used in parallel with the s-w primary to prevent peaking within the band. When the receiver is on b-c, the resistor ties the two halves of the doublet together to act as a T antenna, provided the link from D to G posts is removed. If not removed, the resistor shunts the input, which is the proper arrangement for a single lead antenna. In Fig. 4 appears another Sentinel circuit, a 3-band set with provision for shorting the unused r-f transformer secondary coils. The b-c and medium s-w primaries are grounded while the highest frequency primary is arranged for a doublet antenna. The top switch is in two parts; one switches the antenna to the appropriate primary, the other short circuits the unused secondaries to prevent absorption at certain resonant frequencies.



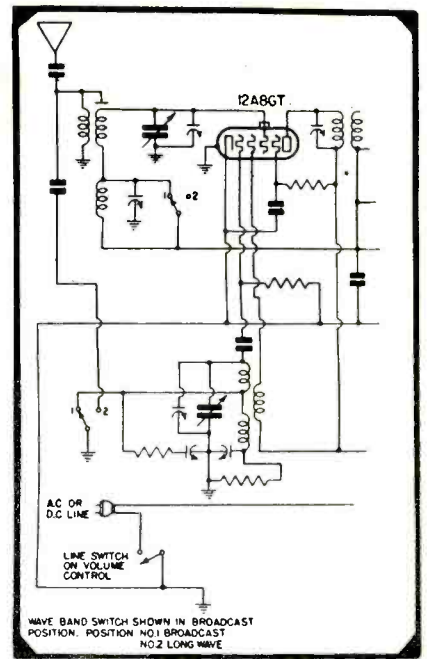
Slide action switches. Single pole, single throw type appears at left. Below, single pole, double throw type is shown. (Courtesy Stackpole)

Fig. 4 (below). Sentinel three-band input system with provision for shorting the unused r-f transformer secondary coils.





Figs. 5 (left) and 8 (right). In Fig. 5 appear the direct switching circuits used in the RCA Victor models U25 and U26. Four coils are mutually coupled in this system, with the bottom coil directly connected to the external antenna. In Fig. 8 appears the input system of the Emerson CRLW 261, 262, and 274. A combination inductive and capacitive coupling system for both long-waves and short-waves is used. On broadcast bands the lower secondary is shorted, and the antenna shunt condenser is disconnected. On long-waves both secondary coils are used.



The lower switch connects the r-f amplifier grid to the correct secondary or to the push button tuner.

An interesting idea in direct switching circuits is shown in Fig. 5, RCA-Victor models U25 and U26. Four coils are mutually coupled, the top coil being connected directly to the converter grid, the bottom coil directly to the external antenna. The top wafer switch connects the ground to one of three intermediate taps for three-band operation so the coil acts like an autotransformer. Note that this scheme minimizes stray capacity coupling by bringing the low potential side of the primary next to the low potential side of the secondary. The switch also shorts out the b-c primary when operating on the next band.

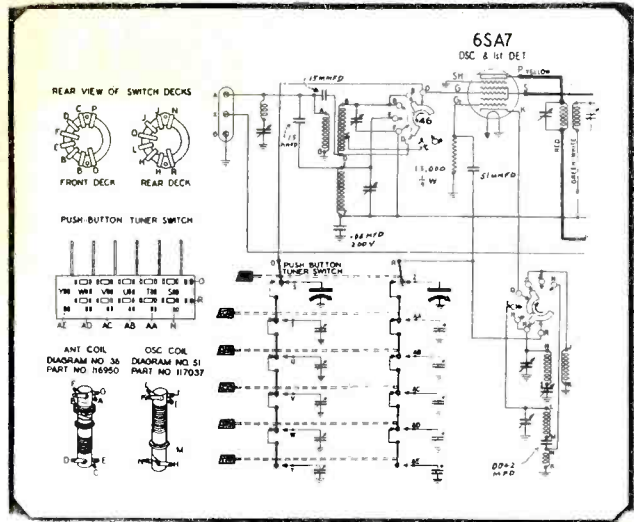


Fig. 6. Stewart-Warner 01-5H chassis tuning arrangement with the broadcast coil on top inductively coupled only when the bandswitch is in a position designated as *V*. On short-waves, capacitive coupling is used.

### Inductive and Capacitive Coupling Methods

Different types of coupling are used in the Stewart-Warner model 01-5H chassis, shown in Fig. 6. The b-c coil on top is inductively coupled only when the bandswitch is in position 1. The bottom of the secondary is grounded. In position 2, the tap on the secondary is grounded, allowing a 15-mmfd condenser to capacity-couple some antenna voltage, aiding the magnetic coupling. On s-w, only capacity coupling is used. Note also the i-f wave trap and binding post X which is connected to the a-c line through a 260-mmfd condenser for use as an antenna, in an emergency. Fig. 7 shows the Stewart-Warner 02-5T chassis which uses inductive coupling on b-c and combined inductive and capacitive coupling on s-w. The coupling condenser is again a 15-mmfd unit. A 10,000-ohm resistor shunts the antenna and ground.

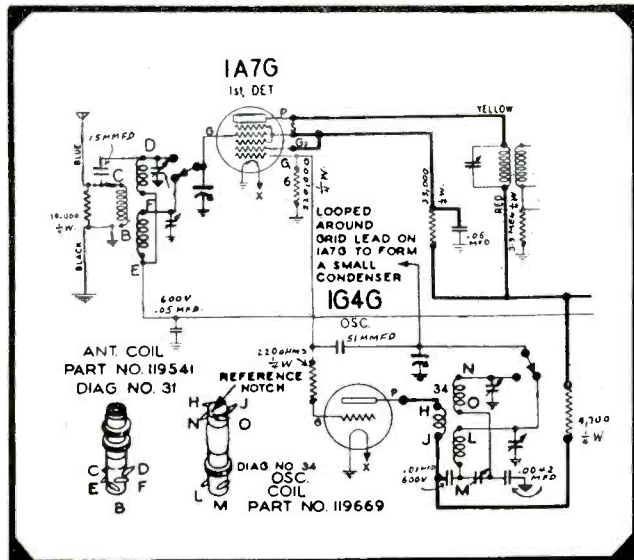
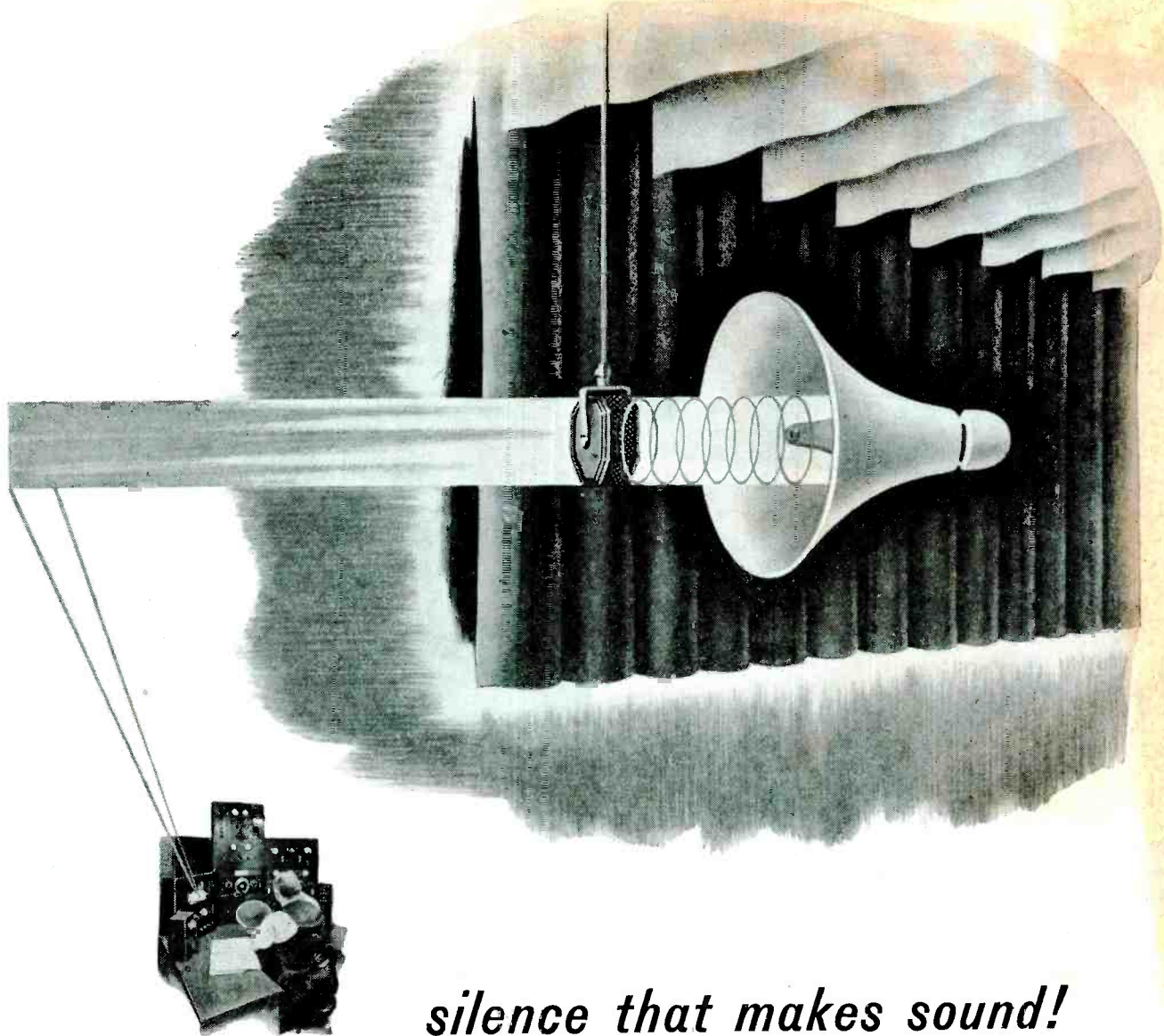


Fig. 7. Stewart-Warner 02-5T model using inductive coupling when the broadcast coil on top inductively coupled only when the bandswitch is in position 1. The bottom of the secondary is grounded. In position 2, the tap on the secondary is grounded, allowing a 15-mmfd condenser to capacity-couple some antenna voltage, aiding the magnetic coupling. On s-w, only capacity coupling is used. Note also the i-f wave trap and binding post X which is connected to the a-c line through a 260-mmfd condenser for use as an antenna, in an emergency. Fig. 7 shows the Stewart-Warner 02-5T chassis which uses inductive coupling on b-c and combined inductive and capacitive coupling on s-w. The coupling condenser is again a 15-mmfd unit. A 10,000-ohm resistor shunts the antenna and ground.



## *silence that makes sound!*

In this "dead" room only the sounds which come out of the speakers are recorded. Sounds which would otherwise bounce back from the walls, ceilings or other objects are trapped and lost forever. The absence of reverberation permits scientifically accurate testing in the sound absorbing room

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methods and have instituted new, more comprehensive testing techniques.

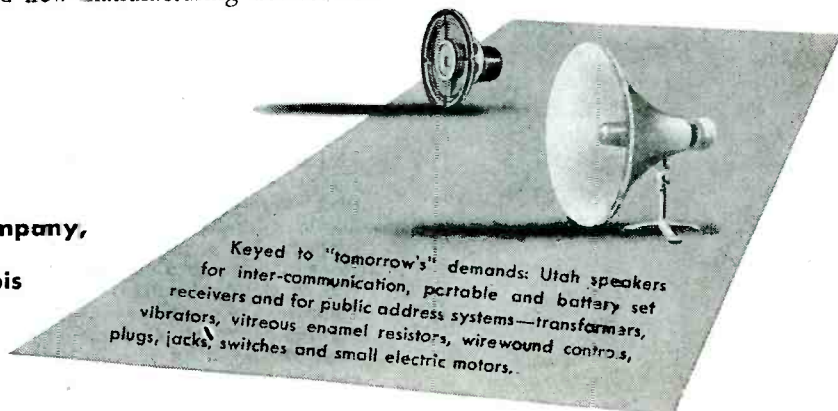
★ ★ ★

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# Utah

**Radio Products Company,**

**816 Orleans Street, Chicago 10, Illinois**



Keyed to "tomorrow's" demands: Utah speakers for inter-communication, portable and battery set receivers and for public address systems—transformers, vibrators, vitreous enamel resistors, wirewound controls, plugs, jacks, switches and small electric motors.

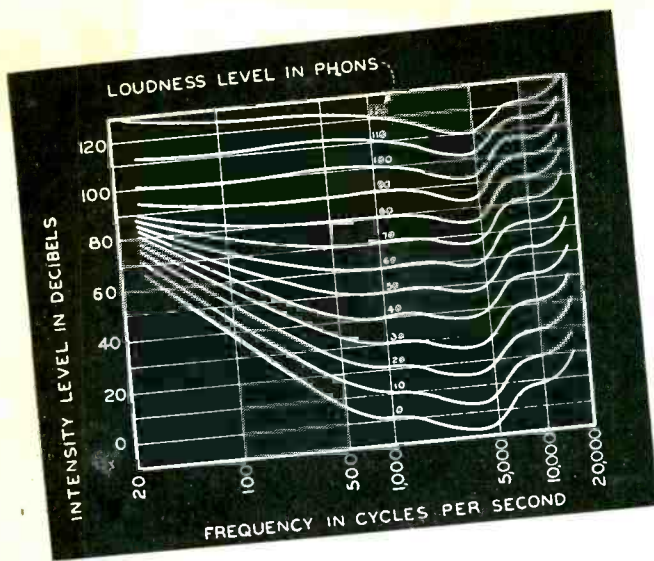
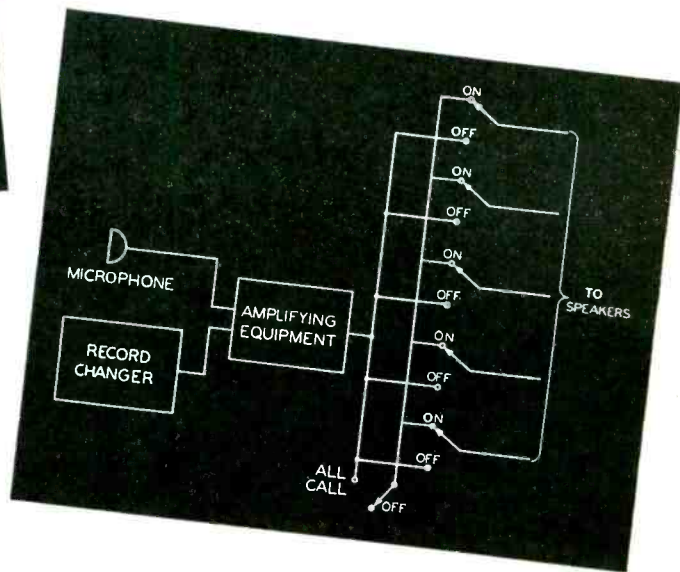


Fig. 1 (left). Fletcher-Munson curves showing response of human ear at different levels of sound intensity. The phon is a relatively recent unit of measurement, developed in Britain, which is really a true measure of loudness. It is directly related to the logarithmic response of the ear, so that a value of 40 phons is equal to +50 db at 250 cycles and +40 db at 5000 cycles; 1000 cycles has been used as a reference point, and therefore it is that frequency only at which phon is always equal to db.

(Fletcher-Munson, J.A.S.A., Oct., 1933)

Fig. 2. Functional drawing of public address system with five selector switches and emergency all call switch.



# SOUND SYSTEM PLANNING

by **SIDNEY HARMAN**

David Bogen Co., Inc.

**E**SSENTIALLY, the public address system can be divided into two types; indoor and outdoor. Included in the former are installations in theatres, skating rinks, schools, bus and railroad terminals, factories, halls, hangars and hospitals. Outdoor public address systems cover shipyards, stadia, airfields, rallies, and many outdoor work and play areas. Combination systems are used aboard ships and in church belfries for the playing of music and chimes.

The war has, of course, resulted in a far wider use of public address systems in factories, and has developed many new applications such as soldier training, battle-announcing, beach landing and troop control systems. There will undoubtedly be many new applications after the war.

Intercommunication systems are not as flexible, of course, but their use today has spread into thousands of war offices and plants, and into many schools and hospitals. Practically every ship in the Navy has some type of system aboard today.

It may be mentioned, at this point, that public address systems are used

today for many purposes beyond the limited and simple microphone speech or announcement of years past. Factories alone, for example, use today's grown-up p-a system for pep talks, production announcements and paging calls, for the distribution of phonograph music and radio programs, and for various manual or automatic signals such as lunch, fire alarm or all clear.

Many a factory or hospital system has been purchased to remedy the problems created by the shortage of

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**This and a subsequent article will consider the problems involved in surveying, "laying out" and installing the public address or intercommunication system. For those who have actively worked in the field of sound, a compilation of the applications of this type of equipment is quite unnecessary. For the Service Man and dealer who has confined his activities to other fields, however, it may prove of interest.**

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help. Recently, a hospital requested permission from the War Production Board to purchase a complete intercommunication system so that nurses would "know why they were being called before they went"—thus cutting down on the number of trips and permitting a fewer number of nurses to attend to more patients more efficiently. Authority for the purchase was granted.

The biggest opportunity for the dealer or Service Man today is in the war plant. The need for complete sound coverage exists in practically every one, and the man who is familiar with the problems involved and knows how to solve them has a large and still only partially tapped market awaiting him.

## Functions of System

The first step in making the survey is to establish the functions of the system: exactly what is it to do? It is essential that a definition of the areas to be covered be established. It is necessary to know whether those areas are all to receive a program simultaneously or whether selective





# Keep an electric eye on your radio future

by don herold

The present has plenty of irritations for any radio service man. There are such pains in the neck as shortages of help, shortages of parts, shortages of things to sell ... and a surplus of impatient customers.

But no business in America has a brighter future than radio.

Just try to keep your electric eye on the future.

There may not be the miracles that some folks expect in radio. Some people think radio will bring them pretty girls on toast for breakfast every morning, robots to do all the housework, and electronic relief for hangovers. Well, radio's future is not that bright—but it is bright.



Even now, the radio industry has enough practical advancements on tap to make most families want new receiving sets when peace arrives. Television is pretty sure to come down to within reach of millions of pocketbooks. And there'll be

important doctoring to do even on the old sets that live on.

Why not begin now to build lists of prospective customers in your territory? When you do a job, write down names of customers and makes and condition of sets they own. And reach out for other names. Be ready to spring when Victory comes and, with it, Opportunity.



## Make a note of it

Include International Resistance units in your plans. As a radio user, I'll say that it bucks up my confidence in a service shop to know that it uses top parts in servicing my sets.

No. 2 in a series of special messages prepared by America's famous business writer, humorist and cartoonist, Don Herold... In sponsoring these Don Herold "broadcasts," IRC pays tribute to the thousands of Radio Service Men who, whenever possible, specify and use IRC resistance units in their work.



# INTERNATIONAL RESISTANCE CO.

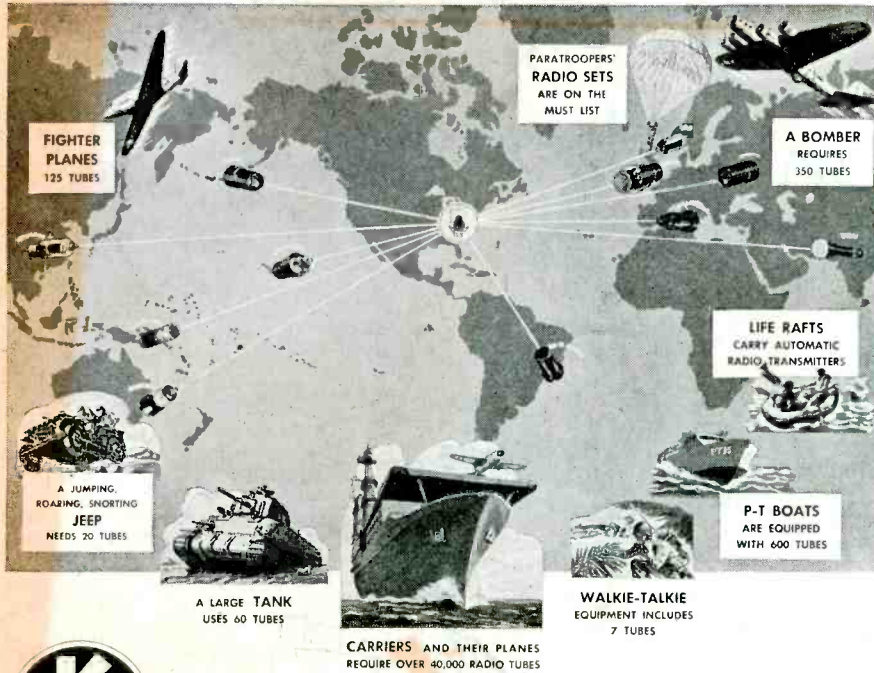
401 N. Broad St. • Philadelphia 8, Pa.

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



# KEN-RAD

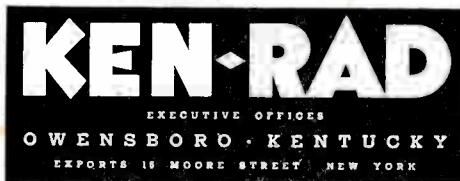
## ELECTRON TUBES



Every ship that sails the sea every plane that flies the air every tank in every terrain must first have its full complement of electron tubes

Years before Pearl Harbor Ken-Rad tubes were shipped to sixty countries on every continent and to major islands in every sea In war or peace Ken-Rad serves the world

TRANSMITTING TUBES  
CATHODE RAY TUBES  
SPECIAL PURPOSE TUBES



RECEIVING TUBES  
INCANDESCENT LAMPS  
FLUORESCENT LAMPS

## SOUND SYSTEMS

(Continued from page 14)

calling of various areas is necessary or desirable.

When these facts have been determined, we must establish the types of programs which are to be transmitted over the system. Then we are ready to proceed. It is often desirable to set up a simple block diagram of the system as soon as the factors referred to above have been settled.

Let us assume a plant with five separate departments. Let us also assume that the system is to provide phono-

graph programs and paging calls from the main office. (An automatic record changer will provide at least 50 minutes of continuous music.) In addition, let us suppose that provision for the selection of any one of the five departments is desired, with the added provision for calling all departments simultaneously. The functional plan of such a system is shown in Fig. 2.

The block diagram tells the basic story of the system, and it tells it simply. Before it can tell it fully, however, the survey must be completed, and the sound man must be familiar with the equipment at his

disposal. For example, it is only after the summary of the survey has been made that the total audio power requirements of the system can be determined.

### System Inputs

It should be remembered that few systems will be exactly the same. The requirements of different plants will vary considerably. In most cases it will be found that this is not a result of differences in size and noise conditions only, but also the result of differences in operation and management. In some plants the input functions will be limited to a single microphone only, or to a microphone and record player, as shown in Fig. 2. Others will require considerably more complex input arrangements. A number of microphones may be necessary. One may be located at the telephone switchboard, another at the main gate, a third in the president's office, etc. A radio tuner may be desired in addition to the phonograph. Because so many inputs are involved, it may be necessary also, to establish a list of precedence; an arrangement which provides right of way to the more important microphone over the lesser. In this respect, let us consider Fig. 3, a block diagram showing five inputs: (a)—fire alarm signal; (b)—all clear signal; (c)—main gate microphone; (d)—switchboard microphone; (e)—record changer.

When a call is issued from the main gate it is probably emergency in character, and must take precedence over any other call. The system is so arranged, therefore, that depressing the talk-switch at the main gate microphone closes the main gate relay, automatically opening the operator's relay circuit. Number 1 precedence is given to fire alarm, number 2 to all clear, number 3 to main gate, and number 4 to telephone operator. The record changer would be built into the rack containing the amplifier and control equipment. It would be operated directly at the rack, and would be momentarily interrupted each time an alarm or speech signal were transmitted.

It is of interest that in systems of this type, the alarm signals are normally provided by a simple audio-oscillator. The fire alarm is a warbled signal of 800 to 1000 cycles. When the all clear switch is thrown, the circuit controlling the warbled signal is eliminated, providing a constant tone.

Microphone lines in this type of system are usually quite long and are run at low impedance. These lines (2-conductor, shielded) are usually run along with the control lines. It is most desirable to run them at 200 or

500 ohms to eliminate the possibility of pickup, as well as to minimize line losses and frequency discrimination.

### Basic Principles

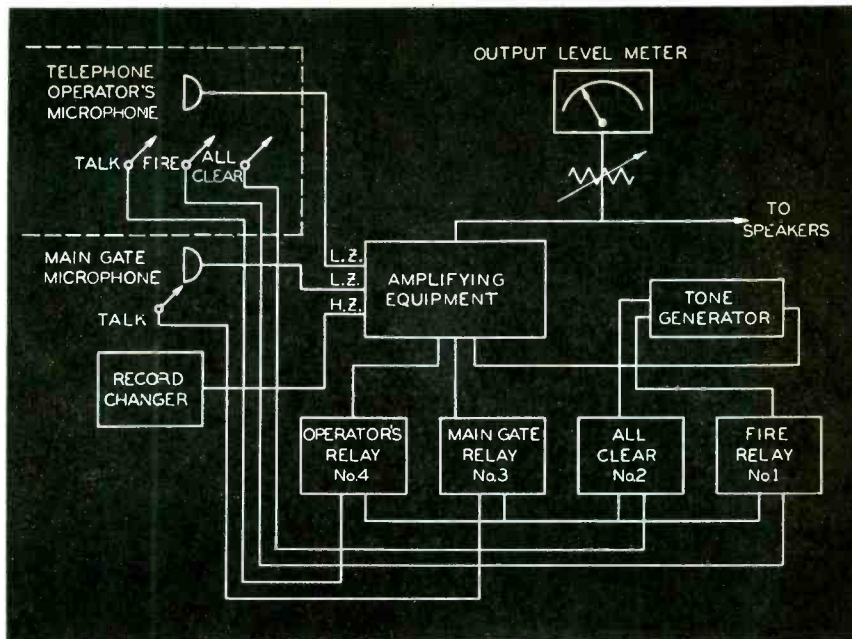
Once the functions of the system have been established it is necessary to determine the speaker layout and the amount of audio power required. From this determination, the size of the amplifiers to be used is derived. Laying out the speakers is the real "trick" in the efficient planning of a public address system, regardless of the size. The one who develops an intelligent and reliable method for arriving at speaker and power requirements can make a survey and quote a price with full confidence that he has neither overestimated nor underestimated. By avoiding the former evil he can offer a better competitive quotation, and by avoiding the latter, he eliminates the possibility of "taking a licking" on the job.

Regardless of the specific technique employed, the principles involved are: (a)—determine the existant noise level; (b)—determine the combination of speakers and power required to overcome it. (By overcoming the noise level, we mean, riding above it by 10 db.)

### The Noise Level Meter

The noise level meter is a device for measuring the amplitude of variations in sound pressure. It is designed to obtain measurements which can be correlated with the response of the human ear; Fig. 1 (Fletcher-Munson curves). It will be seen that the frequency response characteristics of the ear are not constant. At low sound levels, for example, the ear is relatively insensitive to low frequencies (it requires an intensity of +50 db at 90 cps to produce a loudness level equivalent to that produced by +20 db at 1000 cycles and +15 db at 3000 cycles). At high sound levels the ear responds almost equally to all frequencies. Sound level meters are designed to make the necessary compensation for the response of the ear dependent upon the general level of sound which is being measured. The General Radio 759-B meter, for example, has three "weighting curves": a—(40 db) for a sound level range of 24-55 db; b—(70 db) for a sound level range of 55-85 db; c—(flat response over the whole range) for a sound level range of 85-140 db.

Practically all measurements with which we are concerned will be of levels at or above +70 db, which is, roughly, the noise level of a relatively quiet factory area. Thus any good



Figs. 3 (above) and 4 (right). Fig. 3 shows a block diagram of multiple input sound system, employing call precedence. Fig. 4 shows a plot layout of radial speakers, based upon level readings of plant noise and output level readings of speakers.

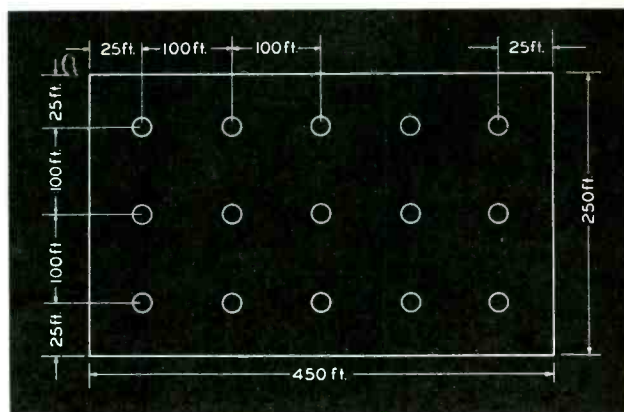
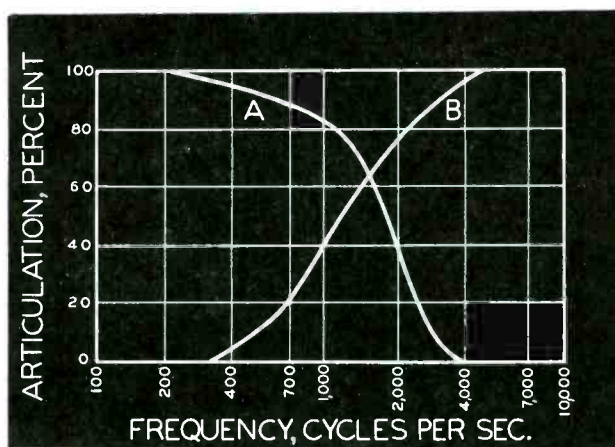


Fig. 5. Variation in percentage of articulation with the elimination of frequency bands. Curve A shows percentage of articulation with all frequencies below the abscissa removed. Curve B shows percentage of articulation with all frequencies above the abscissa removed.



noise level meter, weighted for the B and C curves listed above will prove fully satisfactory.

The use of a noise level meter is quickly mastered, and for our purposes it is quite satisfactory to take three or four readings in an area where work of one type or work cre-

ating approximately the same level of noise is being done. A simple mathematical average of the readings can be used as the final result.

### Noise Level Approximations

For those sound men who are un-  
(Continued on page 28)



# SPRAGUE

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### IMPORTANT NOTICE!

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**WANTED**—RCA "Personal" radio BP-10 with chassis RC-544 less tubes and battery. Also want NRI or Sprayberry radio course only (no equipment). Lewis C. Chapman, Rt. 1, Columbus, Miss.

**FOR SALE**—Tubes, radios, electric pick-ups, parts, transformers, projectors (8, 16 and 35 mm.) and films, sound and silent, also dynamic speakers, any size. Meyers Radio Electric Co., 59 So. Erie St., S.W., Massillon, Ohio.

**TUBES FOR SALE**—New sealed-carton types 1A4, 12A5, 12A7, 6N7, 6P6GT, 78, 77, 75, 45, and 32. Will swap for battery types or sell at 40% off. Need tube checker. Will swap used Wilcox-Gay perfect recorder for Hickok 510X or similar. Domanque Radio, Houma, La.

**FOR SALE**—RCA-Rider Chanalyst complete, used very little. Also #35 Supreme tube tester, and Confidence tube tester 0-1 meter. Paul Grauer, Wilson, Kansas.

**WANTED**—A vac. tube volt meter in good condition. Describe fully. W. F. Ragland Radio-Sound Service, 205 Gaires St., McKinney, Texas.

**WANTED**—Zenith 7G605 or Echophone EC-1 or Sentinel 231P, or National SW-3 for army captain overseas. Any condition, with or without tubes. Cash. Lt. Monroe Block, 1718 Grand Ave., New York 53, N. Y.

**WANTED**—Simpson #320 set tester or #260; also tube tester, and tube and set tester, C-D BF-50 capacitor analyzer, or what have you? Also want 35Z5, 50L6, 70L7, 6F6, 6SA7, 12SA7, 6SK7, 14A7, and 5X4 tubes. Akron Radio Sales Co., 306 Spicer St., Akron, Ohio.

**FOR SALE**—RCP #663 electronic multi-tester in original carton, used once. 36-watt amplifier, Astatic mike T-3 with stand and cable, 2 Rola G-12 speakers 1000 hm field in 4' fibre board and wood trumpets with cables, one phono Green Flyer motor

crystal pickup in portable case. All perfect. Will sell complete or in part. Norman Jacobson, 1697 Andrews Ave., Bronx, New York, N. Y.

**FOR SALE**—Stancor amplifier, 60-watt model 460 with tubes and cabinet; Dayrad tube tester #38K in cabinet; Hickok portable tube tester #38; UTC output transformer S17; new 10" Jensen speaker; new 12" ditto in wood cabinet; new Astatic #30 crystal mike; Sangamo watt-hour meter a. 110 v., 2-wire; one push-button new car radio. Want Argus C-3 camera with flash. Write for complete list. Jim Umstadd, 1318 N. Linden St., Bloomington, Ill.

**WANTED**—Late model Hickok or Simpson tube tester; also Simpson #260 volt-ohmmeter, and #510 signal tracer. D. B. Murray, 502 West Colorado Ave., Colorado Springs, Col.

**WANTED**—Hallierafter S20R with tubes. Cash. A. A. Gardiner, 74 Monterey, Highland Park, Mich.

**WANTED**—Anygood make 'scope, 3" or 5". Cash. Lindsey D. Louton, General Del., Ft. Lauderdale, Fla.

**URGENTLY NEEDED**—Late model tube tester; multimeter or analyzer; and late electric signal generator. Art's Radio Service, 23-15 1/2 Broadway, Fair Lawn, N. J.

**TUBES WANTED**—One of each: 12SQ7; 12SK7; 50L6GT. Chester Wagran, 41 Beck St., Buffalo 12, N. Y.

**WANTED**—New or slightly used 12" C.R. television tube, 6-pin base (1803-P4). Will pay cash or swap for the following: 10-12SA7; 10-1A7; 10-50L6; 10-35Z5; 10-35L6; 10-12SK7, or other tube nos. or 3 new midjet radios. 5 tube supers. France Radio, 104-06 150th St., Jamaica, N. Y.

**URGENTLY NEEDED**—Late model AC sig. generator, also a condenser checker. Have 024 and 6SK7 tubes for sale. John Urban, Warren, Mich.

**WILL SWAP** following tubes for miniature port. radio with or without battery and using tubes such as 1T4, 1S4, 1S5, 1R5, etc. I have: 2-11Z6; 1-6SA7; 1-1A7; 1-1N5; 1-1C5; 1-1E7; 1-6V6; 1-25A6; 1-6SD7; 1-6N7; 1-12SC7; 1-12Q7; 1-32L7; 1-12F5; 1-12J5; 1-25B8; 1-12B8; 1-6A7; 1-3Q5; 1-1Q5; 1-12SQ7 and a few used ones. Al Dillashaw, 2118 Santa Ana St., San Antonio 1, Tex.

**WANTED**—Hallierafter SX-2 receiver with crystal 10", 12" or 16" speaker, in good condition. Have Rem. auto shot-gun, 12 ga. to trade. Ray Melton, Fortville, Ind.

**FOR SALE**—Triplet #326 sq. case R-F ammeter with external couple, 0-2.5 amps, \$6; UTC S-70 fil transformer, 105, 115 volts AC to two 6.3 VCT 5 amp. secondaries, 2.50. Both new. Albert J. Meyer, Tonganoxie, Kans.

**WANTED FOR CASH**—Used all-wave sig. generator in good working condition. Raul Matees, Int. Fab. #10, Rio Blanco, Ver., Mexico.

**WANTED**—Good set analyzer such as Weston, Hickok, Precision or Supreme. Will buy outright, or can trade Triumph #420 tube tester with cash difference. Tomalino Radio Service, 303 1/2 N. Merrill, Glendive, Mont.

**FOR SALE**—5 new power transformers for Majestic #334 at \$2.50 ea.; 1 used Jensen Mod & Tweeter, 1000 ohm field at \$3; 1-14 Utah 15-20 watt dynam. heavy duty speaker 3M ohm field, 8 ohm V.C., \$12; 3-12" 12-15 watt dynamic speakers (Utah) 1000-1200-2400 ohm fields, 6-8 ohm V.C., at \$8; 1 field supply less 80 tube. \$3; 2 prs. new 6" Klein comb. cutters and long-nose pliers at \$3; 1 pr. ditto sidecutters, \$3. M. A. Porter, 1713 Larrabee St., Chicago, Ill.

**WILL SWAP**—ARRL publications "Defense Ed. Amateur Handbook"; "Learning Radiotelegraph Code"; "Radio Fundamentals" or "License Manuals." What have you? Charles L. Culley, Melville, La.

**WANTED**—Triplet 1220-A tester and good std. model sig. generator. Will trade G-E mirror type precision D-C millivolt meter 0-60. 5" scale portable, almost new, cost \$85. Also have Thordarson T-19F99 fil. trans. and ditto T-74C30 choke; also following tubes: 2-77; 2-41; 2-26; 2-6K8GT; 1-UX868; P.c.; 2 Cetron photo cells, and one exciter tube for Cetrons. All new. Also have slightly used tubes: 2-200; 3-50; 1-81; and 8-01A. Manassas Radio & Elec Repair Co., Box 298, Manassas, Va.

**URGENTLY NEEDED**—Late signal generator; AC-DC V-O-M, and tube tester to test loc., oct., banam tubes, or comb. tube & set tester. Chas. H. Sprague, 31 Sheldon St., Gardiner, Me.

**FOR SALE**—One #101 MacKlyn set analyzer and 47, 75, 2A5, 58, 2A7, and 2B7 tubes. Wm. Maurer, 436 E. Guilford, Lebanon, Pa.

**WANTED**—Two National S.T.H. 250 mmf. variable condensers; four 140 mmf. midjet variable condensers; two sets of 2 windings, 4-prong short-wave coils. Ray Gabik, Carrollville, Wisc.

**WANTED FOR CASH**—A good communication receiver, compl. with tubes and speaker. Ted E. Matzen, 523 E. 3rd St., Anaconda, Mont.

**WANTED**—Hickok 155 or RCA chanalyst or Meissner analyst. City Radio, 41 Castro St., Hayward, Calif.

**WANTED AT ONCE**—V-O-M in good condition. Cash or trade. What do you want? Ralph Johnson, Box 273, Greenville, Ga.

**WANTED**—Late model tube tester for cash—or will trade Weston 0-5 milliammeter and 0-100 voltmeter, type 301. Also have Superior signal generator. J. Simrin, 1555 Odell St., Bronx, New York 62, N. Y.

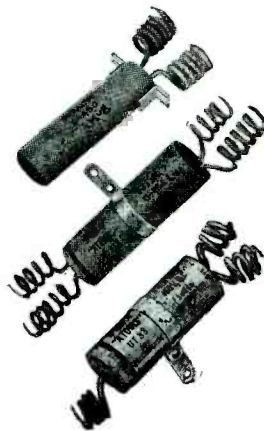
**FOR SALE**—240 radio tubes; Rider manuals 1-13 incl.; Solar CB condenser tester; Supreme oscillator #189; Supreme #1385 analyzer and tube tester. M. A. Farrow, 124 Adams St., Waltham, Mass.

**WANTED**—For new radio business: testers of all kinds. Joseph Spear, 22 Dietz St., Oneonta, N. Y.

**WANTED**—All-band signal generator and a comb. set and tube tester. G. & T. Shell Service, Broadway and Stebbins, Toledo, Ohio.

**WANTED**—EC-1 Echophone receiver, also small port. typewriter. W. H. Weiss, ART 2/C, Brks. 9. NATTC, Ward Island, Corpus Christi, Texas.

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# SPRAGUE CONDENSERS

# TRADING POST

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**WANTED FOR CASH**—Good 0-1 mill. meter. Donald Keever, Box 612, Asheboro, N. C.

**TRADE**—Have a Hickok RF04 oscillograph in perfect condition with all connections to trade for a Meissner P.A. tuner or similar instrument. Grote's Radio & Sound Service, 33 Ave. D, Latrobe, Pa.

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**FOR SALE**—Rec-O-Kut dual speed recording motor assembly with RM-12 overhead feed cutter, monitor meter and extra M-41 cutter, Shure 55-B mike with A86A matching trans. and H.D. floor stand, Astatic lapel mike, \$155. Also singing tower phono amplifier with 18" dyn. speaker, \$60. Excellent cond., used approx. 25 hrs. Will trade all for S-27 FM-AM receiver. J. B. Pepper, 2114 Lincoln St., Savannah, Ga.

**WANTED**—Hallicrafters SX-28 or 32; 12" record changer complete; and small 0-1 millimeter. Oscar M. Tupaney, 2036 25th St., Detroit 16, Mich.

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**URGENTLY NEEDED**—Superior #1240 or 1280 tube tester or Readrite 432-A. New or used. Robert Freed, 1140 Fifth Ave., New York 28, N. Y.

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**URGENTLY NEEDED**—All-wave sig. gen.; V-O-M; tube tester or comb. such as chanalyst; Rider's manuals; and other eqpt. for new shop. Jos. T. Lawman, 1957 Snyder Ave., Baltimore 22, Md.

**FOR SALE**—#642 Jackson, 20,000 ohm per volt sensitivity, compl. with batteries, \$48.50; also substantial quantities of 36, 39/41, 57, 53, 71-A, 85, 89, 81, 210, 250, 301-A, 46, 2A7, 6B7, and 77 tubes and limited quantities of other types, also some condensers, resistors, chokes, trans., etc. Write for list. Sonoret Radio, 36 Woodbury St., Wilkes-Barre, Pa.

**FOR SALE**—Fada portable superhet PL-72 series, 1942 model, battery or electric operation. Has collapsible ant., jacks, aerial, ground, and head-set included. A-1 condition. Albert L. Cummings, 51 Hancock St., Auburndale, Mass.

**WANTED**—Echophone EC-1 receiver. A/C Robt. F. Chambers, Sq. 72—Grp. H; Class 44J; SAACC, San Antonio, Texas.

**WANTED**—Late tube tester, or tube and set tester—also other test eqpt. and all kinds of parts and tubes. Cash. Milford Thomas, Sr., P. O. Box 31, Canebrake, W. Va.

**WANTED FOR CASH**—Tube tester, tube and set tester, and popular type tubes. Describe fully. Brown's Radio Service, 1212 S. Caldwell St., Charlotte 2, N. C.

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**WANTED**—Jackson #660 signal analyzer, or Superior channel analyzer. Fitzgerald Radio Service, Hebron, Ind.

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**FOR SALE OR TRADE**—Two Philco di-pole outdoor FM antennas, new with couplings, in sealed cartons. \$4 ea. or will trade for tubes. A. Brindley, c/o Radio Technical Service, 2821 W. Girard Ave., Philadelphia, Pa.

**WANTED**—Superior V-O-M in good working condition. Red's Radio Service, 3729 N.W. 17th Ave., Miami 37, Fla.

**URGENTLY NEEDED**—One 35Z5 tube. Cash. John Meldrum, East Sikeston, Mo.

**WANTED**—Superior set tester #1280 or similar V-O-M. Forest Park Radio Service, 29 So. Euclid Ave., St. Louis 8, Mo.

**FOR SALE OR TRADE**—35-watt amp. with mike, two 10" P-M speakers and baffles, crystal mike with stand. Want late model Sky Buddy or similar. Raymond Niver, 1554 S. 32nd St., Milwaukee 4, Wis.

**WANTED**—Any one of the following analyzers: Weston #663, 697, or 763; Hickok #4922; or Simson analyzer. Cash if offer is reasonable. S/Sgt. Frank F. Toth, Projection Supervisor, War Dept. Theatres, Camp Edwards, Mass.

**URGENTLY NEEDED**—Set tester, Superior #1280 preferred; also #1240 Superior tube tester (or other late model); and Superior #1230 signal generator. Cpl. G. A. Puckett, 35289289, Med. Det., 1878th Unit, Camp Claiborne, La.

**FOR SALE OR TRADE**—Terman's Radio Engineering; Cooke's Mathematics for Electricians and Radiomen; Ultra-High Frequency Techniques; 1940 Radio and 1942 A.R.R.L. Handbooks. Want Hallicrafters S-29 receiver. L. W. Pleasant, D.S.T.C. 108A, Dickinson, N. D.

**WANTED**—3" scope, AC-DC VTVM, V-O-M extended range AC-DC, and signal generator. A. F. Sprague, 116 St. Andrews Lane, Glen Cove, N. Y.

**FOR SALE**—AC-DC radio design Universal V-O-M, 1000 ohms per volt, \$15. Set Rider's manuals 3 to 13 like new, \$90. Triplett DC 0-150 milliammeter, sq. front. Biley var. xtal 7229 to 7241 kc. Thor. trans. 350-0-350 volts. National xmitter condensers. IRC vol control kit, 1/2-watt and 1-watt resistor kits, electrolytic condensers, by-pass tubulars and tubes. Everything new. Write for list. John Sulim, Box 291, Oakfield, N. Y.

**FOR SALE**—Pr. matched filter chokes, Polymet 61028E; pr. matched 8" speakers P-P trans.; 1 universal output trans.; 1 universal s.b. hand mike; 1 p.p. output trans. Polymet TRA-161; 1 power trans. fls. 7-5-2-5s; 1 power trans. fls. 5-2-5; 1-2" Weston 0-7 V. D.C. 506; 1-2" Jewel 0-50 V. D.C.; tubes: 4-45; 1-2A7; 1-46; 2-56; 1-53; 2-6A4; 2-24; 1-35. Most used, but in good condition. Bob Wright, 57 Howard Ave., Brooklyn, N. Y.

**WANTED**—Panel mount tuning milliamp. meter in good condition. 0-80 or 0-100 scale. Raymond G. Grob, Jr., 528 So. Wood St., Fremont, Ohio.

**URGENTLY NEEDED**—Signal generator in A-1 condition. Cash. Harold Eshom, 6046 50th S.W., Seattle 6, Wash.

**WANTED**—Hallicrafters S-29 Sky Traveler comm. receiver. Cash. S. E. Diller, E.M. 1/c (Tel), U. S. Coast Guard, P. O. Box 32, Wrightsville Beach, N. C.

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**WANTED**—One type C Nathaniel Baldwin headset. H. L. Baker, 807 Franklin St., Natchez, Miss.

**WANTED**—Combination tube and meters tester. Wm. E. Hartman, 18 S. Castle St., Baltimore 31, Md.

**WANTED**—Used cabinet radios and combinations from 1930 on up. Cash. Send name and model no. Smith Music Shoppe, 16 E. North St., Danville, Ill.

**WANTED**—Will pay cash for 12SA7GT, 12SF5GT, and 35Z4GT tubes. C. Goodman, 4415 Esplanade Ave., Montreal, Que., Canada.

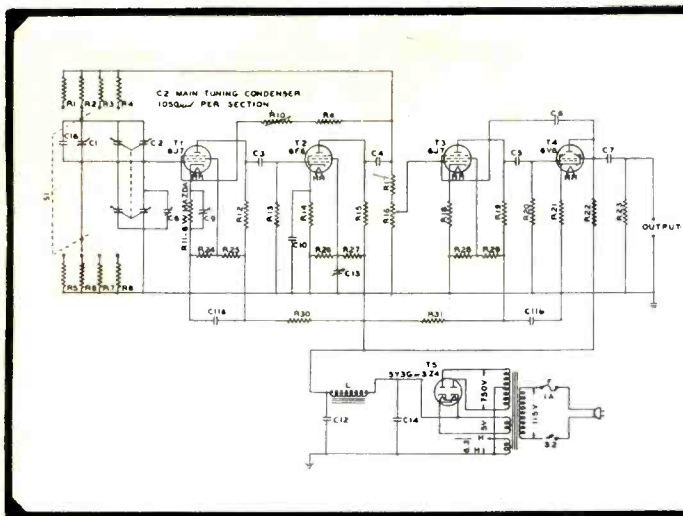
**WANTED**—Power transformer 110/220 primary; 450-0-450 high voltage secondary (225 ma. or better); filament #1 6.3 v. 2.5 amp.; #2 6.3 v. 2.5 amp.; #3 5 v. 2.5 amp., Arthur J. Cummings, 33-43 60th Place, Woodside, L. I., N. Y.

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# KOOLOHM RESISTORS



R1, R2, R3, R4	Frequency determining resistors	R31	10,000 ohms
R5, R6, R7, R8	Frequency determining resistors	C1	100 ufd. adjusted at factory
R9	1500 ohms	C2	Main tuning condenser
R10	0-400 ohms	C3	0.5 ufd.
R11	Amplitude control resistor	C4	40 ufd.
R12	50,000 ohms	C5	0.1 ufd.
R13	500,000 ohms	C6	10 ufd.
R14	800 ohms	C7	40 ufd.
R15	10,000 ohms	C8	100 ufd. adjusted at factory
R16	25,000 ohms potentiometer	C9	100 ufd. adjusted at factory
R17	5000 ohms	C10	.002 ufd.
R18	5000 ohms	C11a	20 ufd.
R19	50,000 ohms	C11b	10 ufd.
R20	500,000 ohms	C12	40 ufd.
R21	500 ohms	C13	400 ufd. adjusted at factory
R22	5000 ohms	C14	4 ufd.
R23	10,000 ohms	C16	80 ufd.
R24	50,000 ohms	T1	6J7 metal
R25	100,000 ohms	T2	6F6 metal
R26	25,000 ohms	T3	6J7 metal or glass
R27	10,000 ohms	T4	6V6 metal or glass
R28	50,000 ohms	T5	5Z4 metal or 5Y3G
R29	100,000 ohms	Tr1	Power transformer
R30	10,000 ohms	L1	Filter choke

Complete circuit of the Hewlett-Packard 200D resistance-tuned oscillator.

# RESISTANCE-TUNED OSCILLATORS

**R**ESISTANCE coupled amplification is featured in this test instrument produced by Hewlett-Packard (series 200). Two stages of r-c amplification are used in the oscillator section, with the output of the second stage coupled back to the input of the first stage. And a resistance-capacity frequency determining network based upon the Wein bridge is inserted in the feedback circuit. This consists of a condenser and resistor in series, and an equal condenser and resistor in parallel and across the input to the first tube.

## Four-Gang Variable Condenser

A 4-gang variable condenser of 1050 mmfd per section is used as the continuously variable tuning element, while a decade range selector switch selects four sets of resistors for four frequency ranges. Note that the resistors differ by 10 to 1. The capacity ratio is greater than 10 to 1. Hence, a continuous frequency range is possible because, in this type of oscillator,

the frequency is equal to  $\frac{1}{2\pi RC}$ ,

instead of being proportional to the square root of the capacitance. This latter condition prevails in the more familiar oscillators and radio receivers.

## Four Models Available

There are four models in the 200 series: 200 A, B, C and D. The 200A

[See Front Cover]

has a frequency range of 35 to 35,000 cps, and an output of 1.0 watt. Model 200B has a frequency range of 20 to 20,000 cps, and an output of 1.0 watt. Model 200C has a frequency range of from 20 to 200,000 cps, and an output of .1 watt. And model 200D has a range of from 7 to 70,000 cps, with an output of .1 watt.

## Cover Diagram Analysis

In the cover diagram, 200D is shown. In this model degeneration is used to provide linear frequency response. A dual degenerative circuit is used in the oscillator itself. A 6-watt mazda lamp has been included in the first cathode. The lamp provides automatic feedback control, increasing the amount of degeneration with increased amplitudes of oscillation, thereby maintaining the proper operating point of the oscillator.

## Use of Cathode-Bias Resistors

Degeneration in the amplifier is provided by the unbypassed cathode bias resistors and by the 10-mfd condenser from the output plate to the first cathode. A 50,000-ohm load is used for the 6J7 and a 5000-ohm load is used for the 6V6. These low values permit the favoring of the high frequencies by minimizing the stray shunt capacity. Another unusual item

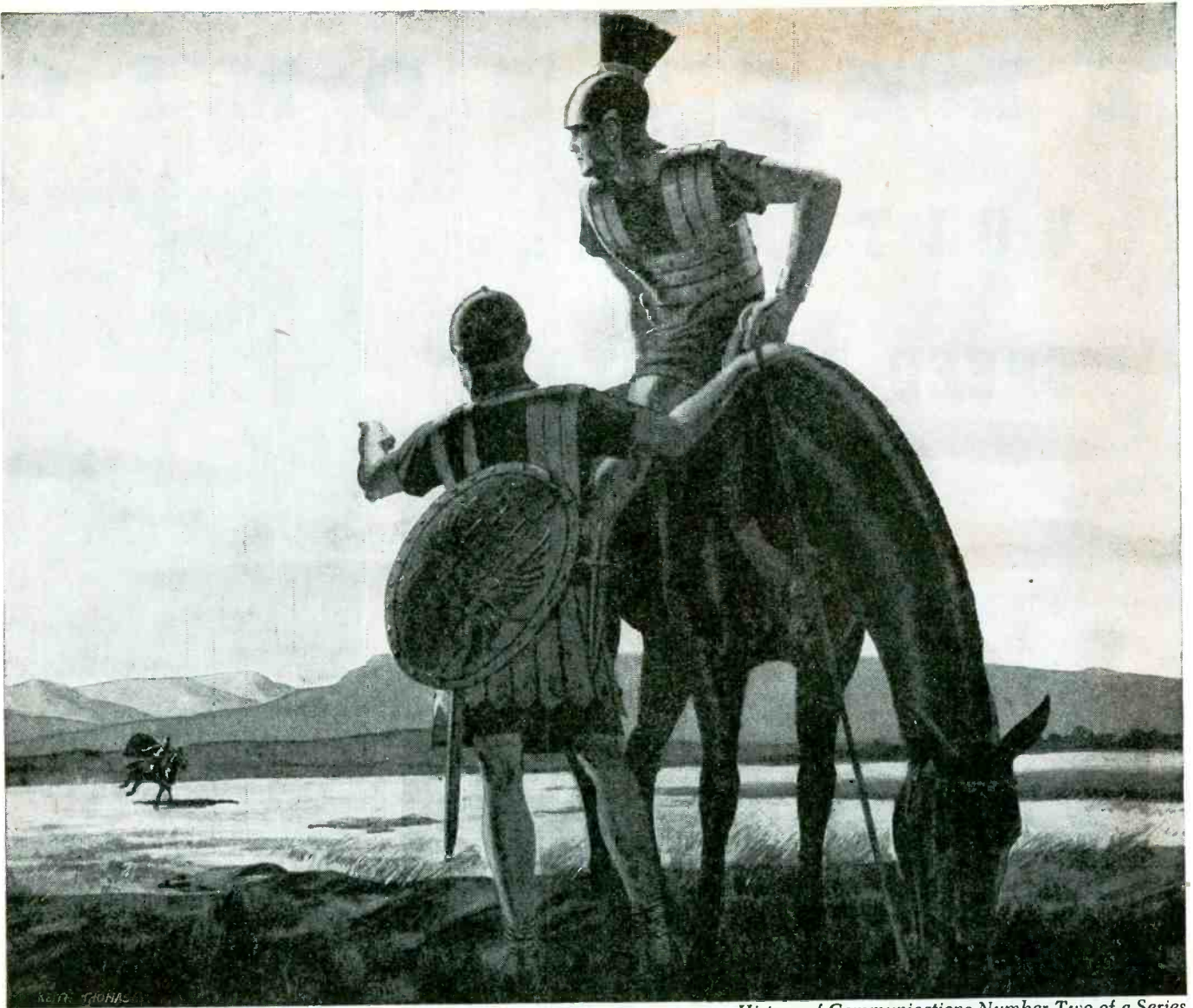
is the plate decoupling filter of the 6F6 second oscillator tube, using a 400-mmfd adjustable trimmer. This trimmer and also C<sub>8</sub> and C<sub>9</sub> are set at the factory.

## Loads

The internal impedance of this amplifier is approximately 50 ohms at 400 cycles which allows load resistances of over 1000 ohms to be used with negligible distortion; the actual figure is less than 1/2 of 1%. Loads of less than 1000 ohms will tend to increase distortion at full output. A poor tube may materially increase the distortion without otherwise affecting the operation of the unit. Hence, when changing tubes, it is desirable to check the distortion. When very small audio voltages are required, it is desirable to insert an attenuator between the oscillator and the equipment being fed. This will prevent the hum level from being bothersome.

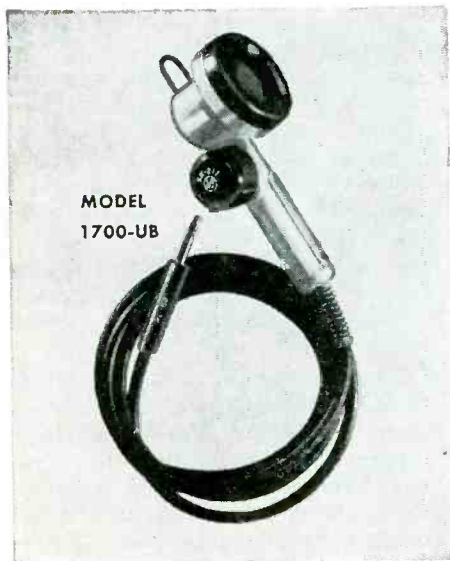
## The 200A and B Models

A two-stage power amplifier with a transformer-coupled output following the oscillator section is used in the 200A and 200B models. To eliminate distortion and provide satisfactory frequency response, feedback is used in this amplifier. Over the major portion of the frequency range, one watt of audio power is delivered into a 500-ohm resistance load.



*History of Communications Number Two of a Series*

## COMMUNICATIONS BY ROMAN POST RIDERS



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Today Universal microphones and voice communication components are being used throughout the world on every battle front filling a vital need and "getting the message through."

< Model 1700-UB, illustrated at left, is but one of several military type microphones now available to priority users through local radio jobbers.

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# ELECTRONIC

## VOLTAGE AND

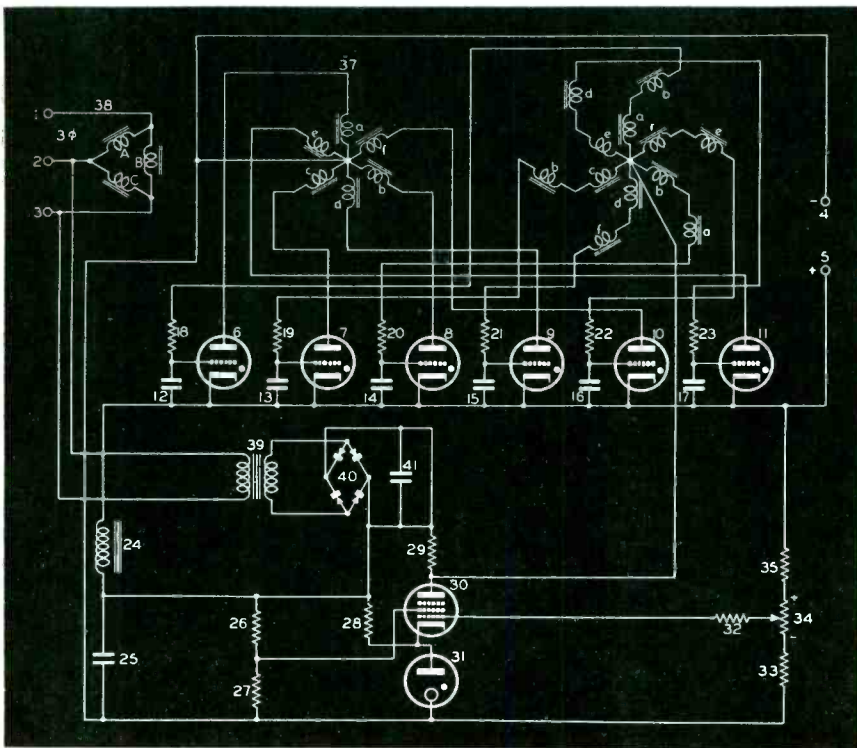
## SPEED REGULATORS

PART TWO

by S. J. MURCEK



Figs. 4 (left) and 4a (above). In Fig. 4 we have a three-phase full-wave circuit with six thyratrons. Fig. 4a shows an a-c voltage indicator unit used in electronic voltage regulation systems.



**S**ELF-REGULATED d-c power supplies, consisting of thyatron or ignitron polyphase rectifier systems and associated regulating apparatus, are not rare in commerce. Since the controlled rectifier is replacing rotary equipment, such as motor generator sets, as sources of d-c power, let us consider such a system.

Fundamental circuits usually incor-

porated into polyphase rectifier-controlled and regulated systems are well represented by the three-phase full-wave system of Fig. 4. The system incorporates a thyatron rectifier applying six thyratrons, 6, 7, 8, 9, 10 and 11 in conjunction with a voltage regulation circuit associated with pentode 30.

In such a rectifier system, the tube

filaments are heated from a separate transformer for three-hundred seconds before the three phase a-c power can be applied to the thyatron anodes. This delay is accomplished by an electro-mechanical time delay switching system.

On initial application of the three-phase supply voltage to the anodes of the rectifier thyratrons, maximum d-c output appears across the d-c terminals 4 and 5. This voltage is also impressed, with ripple filtration, across the filter capacitor 25, and the voltage measuring divider circuit 33, 34 and 35. Here, the voltage pilot or standard tube 31 ionizes and conducts, providing a stable arc drop voltage between its anode and cathode. The d-c voltage divider impresses the correct voltage between the screen and cathode of the pentode 30, the cathode of this tube being positive with respect to the negative terminal of the d-c voltage divider, by the voltage existing across the pilot tube 31.

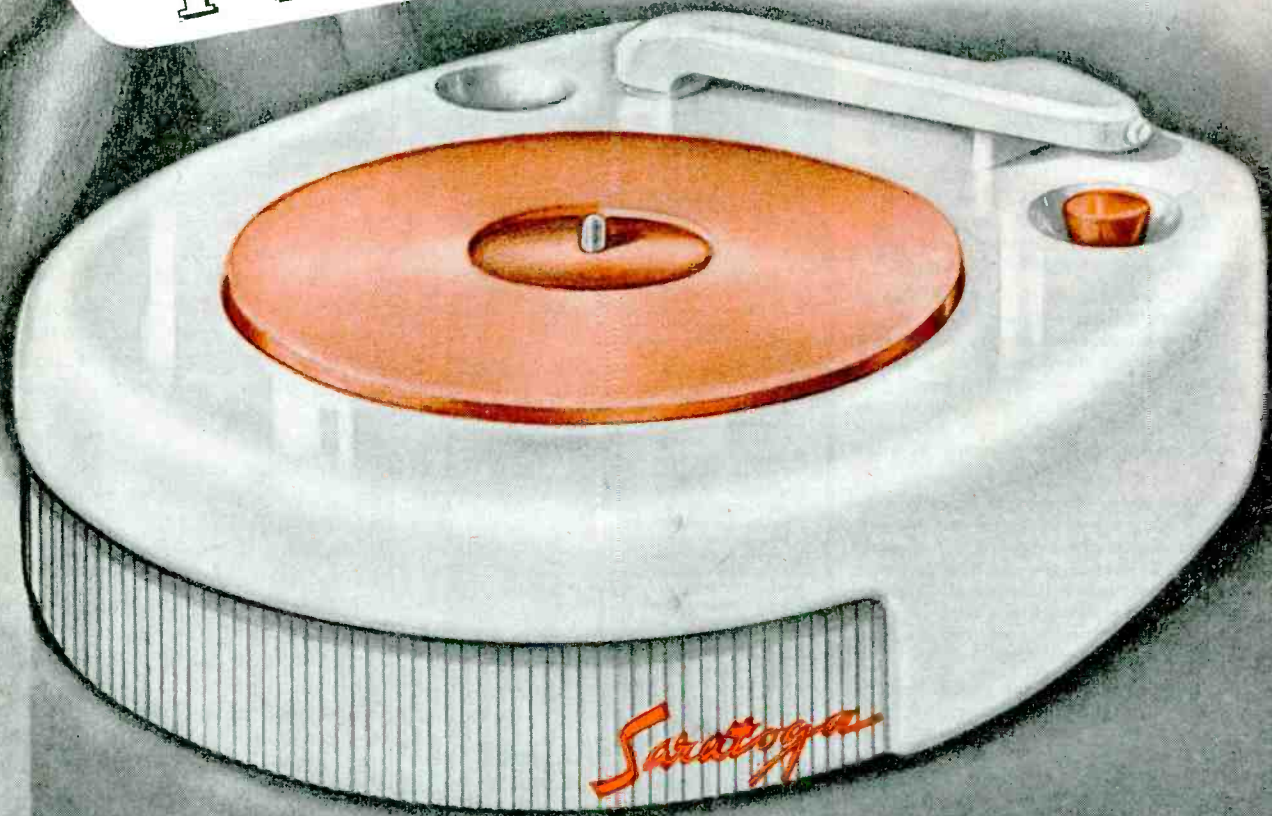
Since the voltage across the voltage divider terminals is the maximum rectifier d-c output voltage, the voltage between the slider arm and the negative terminal of the voltage control potentiometer 34 exceeds that which exists across the pilot tube. Hence, the control grid of the pentode 30,

(Continued on page 24)



YOUR POST WAR PORTABLE

# PHONOGRAPH



## THE *Saratoga* MIRROR-TONE

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# RIDER MANUALS

GIVE YOU THE HELP YOU NEED!



## ELECTRONIC VOLTAGE AND SPEED REGULATORS

(Continued from page 22)

which is connected to the voltage control potentiometer slider arm in series with the grid current limiting resistor 32, is positive with respect to its cathode. Therefore, the pentode plate resistance is low in comparison to that of the plate-loading resistor 29, and the voltage across this resistor is

nearly equal to that which exists across resistors 26 and 27 in the d-c voltage divider system. The plate of the pentode 30 is, then, negative with respect to the thyatron cathodes.

The grids of the thyatron rectifier tubes are effectively common with the plate of the pentode. In series with

each thyatron grid is an a-c voltage which lags the anode voltage wave by 90°. These grid voltage components are secured from the grid windings on the three-phase anode transformers, two such windings being connected in series as a single voltage source. The a-c voltage across each of these individual windings is such that the series connection of two suitable voltages will provide the a-c grid voltage which lags the anode voltage of the thyatron which it controls, by 90°. To provide such voltages, the angular direction and the voltage magnitude characterizing each winding, must be as is indicated in the instance of the system grid windings 36 of Fig. 4.

Control of the thyatron conduction, in this system, is therefore, of phase-shift nature, the a-c modulation of the grid voltage preventing conduction by any thyatron over a full positive half-cycle, unless the d-c grid voltage component is positive with respect to the tube cathode.

We have mentioned in this description of circuit operation, that the plate of the pentode is negative with respect to the thyatron cathodes, because of the positive swing in voltage between the grid and cathode of this pentode. Under these conditions, the grid of the rectifier thyatrons remain negative over the complete positive half-cycle, with the result that these tubes do not conduct. The output voltage across terminals 4 and 5, and the voltage between the slider arm and the negative terminal of potentiometer 34, falls off.

The grid of the pentode 30 is now negative with respect to its cathode. This places its plate less negative with respect to the cathodes of the thyatron rectifiers, thus permitting these tubes to conduct late in each positive half-cycle, the a-c grid modulation preventing conduction of the complete positive half-cycle. Despite this conduction by the thyatrons, however, the d-c output voltage is still so great that the pentode, 30, control grid continues quite negative with respect to the cathode. This condition permits, by reason of the pentode plate current, the thyatron rectifiers to conduct even more early in each positive a-c half-cycle. This correction continues until the d-c voltage across the terminals 4 and 5 causes the voltage between the slider arm and the negative d-c terminal of potentiometer 34 to rise to a value somewhat less than that existing across the pilot voltage tube 31. At this time, the system will stabilize, or cease correction. For a further correction in the pentode plate current, occasioned by a less negative grid bias voltage would cause the more negative thyatron d-c voltage

grid component to begin decreasing the duration of conduction by each tube. This is termed the *equilibrium limit*.

Due to the source impedance, the impedance of the rectifier anode transformer, and the circuit impedance, any variation in the load current drawn from the rectifier varies its output voltage, much of this voltage variation being the result of the change in the load current conducted through the circuit resistance alone. However, the variation in the rectifier output voltage is compensated for, very closely, by the regulating system.

Circuit regulation becomes evident on either decrease or increase of the rectifier output voltage. An increase in the rectifier load current decreases the rectifier output voltage, which decreases the voltage between the slider arm and negative terminal of the potentiometer 34. This swings the control grid of the pentode 30 more negative with respect to its cathode. The resultant reduction in the pentode plate current increases the voltage between the plate and cathode of this tube. Therefore, the plate of this tube is less negative with respect to the cathodes of the thyatron rectifiers. This permits these tubes to conduct earlier in each positive a-c half-cycle and raises the d-c output voltage.

It should be observed here that the overall circuit amplification is very high. If the circuit voltage gain is, for the purpose of this discussion, assumed to be 100, a change of one-tenth of one volt in the rectifier d-c output voltage is so amplified by the regulation system, that this change of voltage appears as the product of this voltage change and the regulation system gain, or a ten-volt change in the thyatron grid-to-cathode d-c voltage component. This, in turn, if the a-c grid voltage component is twenty volts, is fifty per cent of the grid control phase shift, or approximately a fifty per cent change in the d-c output of the rectifier system. Obviously, this regulation is effective with either a small increase or decrease in the rectifier output voltage.

Resistors 33 and 35, in series with the voltage level control potentiometer 34 provide a means for limiting the control range over which this potentiometer is effective. The negative terminal of the potentiometer resistance element is, in operation, positive with respect to the negative d-c lead, by the voltage appearing across resistor 33. If the slider arm of the potentiometer is at its negative terminal, then, the maximum voltage output of the system is dependent on the

(Continued on page 30)



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600	.002 mfd.
600	.005 mfd.
600	.01 mfd.
600	.02 mfd.
600	.05 mfd.
600	.1 mfd.
600	.25 mfd.

Aerovox Dandees Type PRS-V electrolytics. Individually tested. Extra-wax-sealed.

D.C.W.V.	CAPACITY
25	25 mfd.
50	10 mfd.
150	20 mfd.
150	20-20 mfd.
150	50 mfd.
250	20 mfd.
450	10 mfd.
450	10-10 mfd.
450	40 mfd.

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# SER-CUITS

by HENRY HOWARD

A 5-tube battery pack set, featuring a pair of pilot lamps operating from two separate flashlight cells, independent of the *A* battery, is shown in Fig. 1. The lamps are lighted with a switch on the tone control, by pushing the knob forward. Two IN5 i-f stages are used and the second stage is coupled to the detector by means of resistance coupling. Note the resistance values used; 25,000 ohms for the i-f plate load and 50,000 ohms for the detector input.

### Farnsworth CT-43

The Farnsworth CT-43, 4-tube and rectifier, battery-line portable also features an unusual oscillator system. The grid circuit returns to the *avc* bus instead of B—or filament. A 5-megohm grid leak is used for bias in the IN5G i-f stage. The bypass condenser is only a .001-mfd unit. A 50-mmfd r-f equalizing condenser shunts the antenna coil to favor the low frequency end.

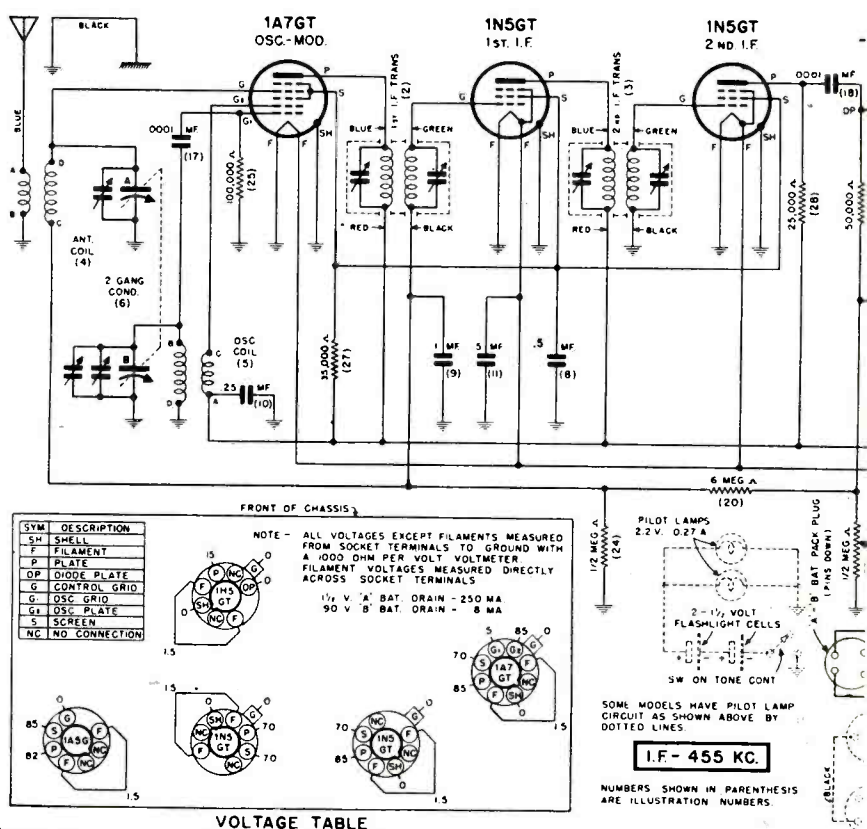
### Sentinel 230

The Sentinel 230 receiver is an 8-tube

superheterodyne with a tuned r-f stage, a 3-gang tuning condenser and a dual condenser push-button unit. On push-button operation the t-r-f stage is cut out. The oscillator circuit is quite unusual. Shunt fed with a cathode tapped Hartley circuit, it is used on short-waves; a grounded cathode and bypass from the tap on the intermediate frequency band, and an ultra-audion circuit without any tap at all, on broadcast. Note the large trimmer or padding condenser (200-600 mmfd) from the plate end to ground. A 100-ohm grid suppressor is connected between grid condenser and bandpass switch.

Separate diodes are used for detection and *avc*, delayed *avc* being obtained from a voltage divider and filtered in the B—leg. No *avc* is supplied to the i-f stage and a sensitivity switch is incorporated in the cathode which increases the gain of this stage on the short-wave band by decreasing the bias. The switch shorts a 5,000-ohm resistor, changing the value from 5,400 to 400 ohms.

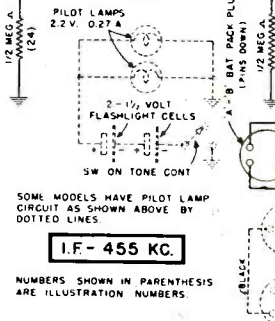
Fig. 1. Sentinel 242, with dual flashlight cells lighting pilot lamps.



SYM.	DESCRIPTION
SH	SHIELD
F	FILAMENT
P	PLATE
DP	DIODE PLATE
G	CONTROL GRID
G1	OSC. GRID
G2	OSC. PLATE
S	SCREEN
NC	NO CONNECTION

NOTE - ALL VOLTAGES EXCEPT FILAMENTS MEASURED FROM SOCKET TERMINALS TO GROUND WITH A 1,000 OHM PER VOLT VOLT METER. FILAMENT VOLTAGES MEASURED DIRECTLY ACROSS SOCKET TERMINALS.

1 1/2 V. 'A' BAT. DRAIN - 250 MA  
90 V. 'B' BAT. DRAIN - 8 MA



I.F. - 455 KC.

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VOLTAGE TABLE (BOTTOM VIEW OF CHASSIS)

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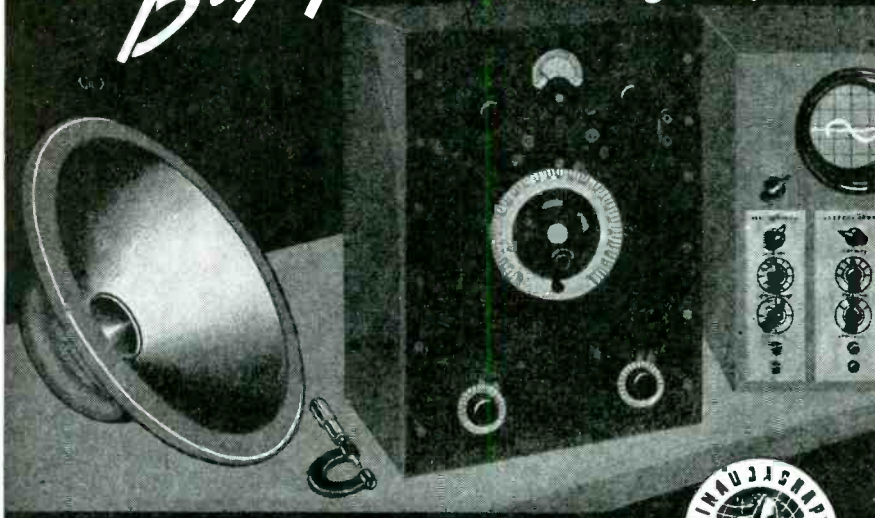
We maintain a network of distributors throughout the country. If your limited quantity needs can be filled by any of our Standard Model Microphones, with or without minor modifications, we suggest that you contact your nearest radio parts distributor.



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*"No Finer Speaker Made in all the World"*



## SOUND SYSTEMS

(Continued from page 17)

able to obtain the use of a meter, or as a rough check, for those who will be putting this very useful instrument to its first use, the following rough table of noise levels should prove quite helpful:

Quiet office: +45 db  
Average office: +55 db  
Department store: +65 db  
Quiet factory: +70 db  
Average factory: +75 db  
Heavy traffic at 15 feet: +85 db  
Elevated train at 15 feet: +95 db  
Subway express passing station: +102 db  
Boiler factory: +110 db  
Threshold of pain: +130 db

### Speaker Layout

Earlier in the article, it was stated as a general rule, that to overcome the existing noise level, a speaker should provide an acoustic output 10 db higher. Manufacturers of various kinds of speakers make output readings available for different driving powers. Thus, the manufacturer of one type of reflex trumpet advises that with an input of 25 watts, the speaker produces a level of +120 db at five feet along the axis, and +70 db at 500 feet.

A radial reflex trumpet, of the same manufacturer provides a sound dispersion which is roughly 360° on an inclined plane 30° off the perpendicular and when driven with 10 watts of audio power, it produces a level of +80 db on a 100-foot center. Thus, if it has been determined that a level of +70 db exists in a factory which is 250' wide x 450' long (with a 14' ceiling to permit the hanging of the radial trumpet), an ideal speaker arrangement would be that shown in Fig. 4.

A total of fifteen speakers is required, and since 10 watts is necessary to drive each speaker, a total of 150 audio watts will be required. Adding the conventional 20% for reserve indicates that the amplifier part of the system must provide approximately 180 watts. Most manufacturers make 100-watt booster amplifiers available for high-power work. Two such amplifiers with a suitable driver will answer the requirements of this installation very nicely.

### Acoustic Feedback

A final essential consideration in the placement of speakers involves a phenomenon, known as acoustic feedback. If the sound from any loud-speaker reaches the microphone, it will be passed into the amplifier, will be reamplified and reproduced by all speakers in the system. When the acoustic coupling between the speaker and microphone reaches a critical value, a sustained howl results which



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renders normal operation of the system impossible.

There are a number of possible methods for eliminating this hazard. The simplest involves the physical relocation of the microphone in relation to the offending speaker so that the output of the speaker does not readily reach the microphone. This method is the most obvious and there are few situations for which it does not offer a simple solution.

In most cases, acoustic feedback is caused by only one speaker, and since that speaker often covers the area in which the operator of the microphone works, another solution offers itself. A single-pole-double-throw switch in the voice coil circuit of the speaker, can be used to cut it out of the circuit whenever the operator of the related microphone makes an announcement. When the speaker is disconnected, the switch connects a dummy load, equivalent to the voice coil impedance across the line. This function can also be accomplished remotely (that is, at the microphone) through relay control.

#### Evaluating Results

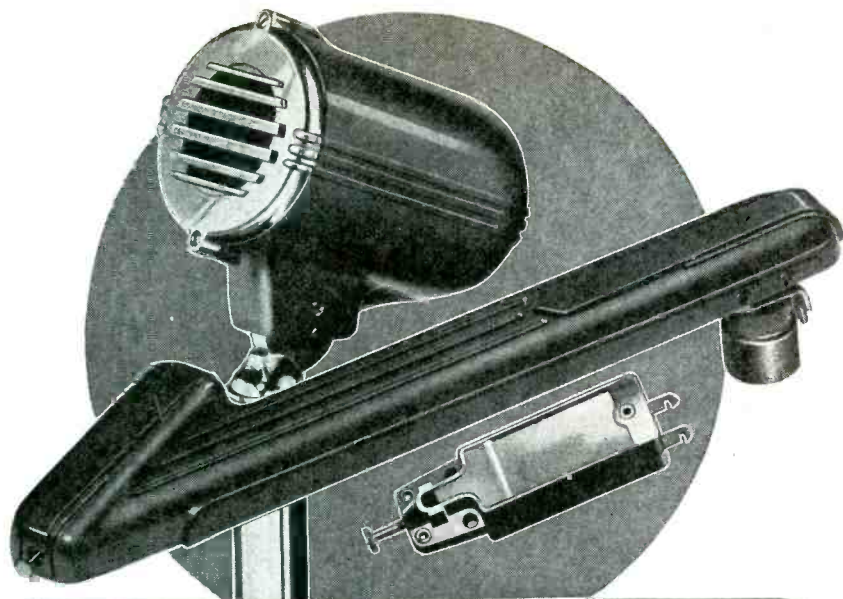
In the above analysis we have deliberately limited the discussion of speakers and the results achieved, to permit a simple and unambiguous exposition of one of the basic and most important speaker layouts. In the judgment of how successfully the sound system has been layed out there are two criteria: articulation and intelligibility.

Articulation is a measure of the recognizability of sounds. The percentage of unrelated individual sounds which are recognized is the percentage of articulation.

Intelligibility is a measure of understanding of related sounds or words; for example, complete sentences.

These two criteria, though often confused, are actually very different; 35% articulation is roughly equivalent to 90% intellegibility. The wide differential emphasizes the importance of connected words in understanding speech.

It has been determined that the elimination of all frequencies below 400 cycles reduces articulation by less than 5% (Fig. 5). Since 50% of the power output of an amplifying system is required to reproduce frequencies below 400 cycles, it can be seen that in many cases, limiting the *amplified band* to 400 cycles as the lowest frequency to be amplified, will permit the use of lower powered amplifiers for larger installations.



## SUPPLY YOUR JOBBER NECESSARY INFORMATION WITH ALL ORDERS

● In placing an order with your Radio Parts Jobber for Astatic Microphones, Pickups and Pickup Cartridges, it is important that you supply him with necessary priority ratings, signed certificates, contract numbers, and such other information as may be helpful to him in having your order go into production. Above all else, do not neglect to give the ultimate use for which the part or parts desired are intended. These facts are demanded from your jobber and he must depend upon you for this information. Your cooperation eliminates waste motion and insures earlier deliveries.

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RADIO CIRCUIT  
HINTS

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by  
**FRANK FAX**



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Check the table of contents, reproduced below.

## Radio Circuit Hints

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## ELECTRONIC REGULATORS

(Continued from page 25)

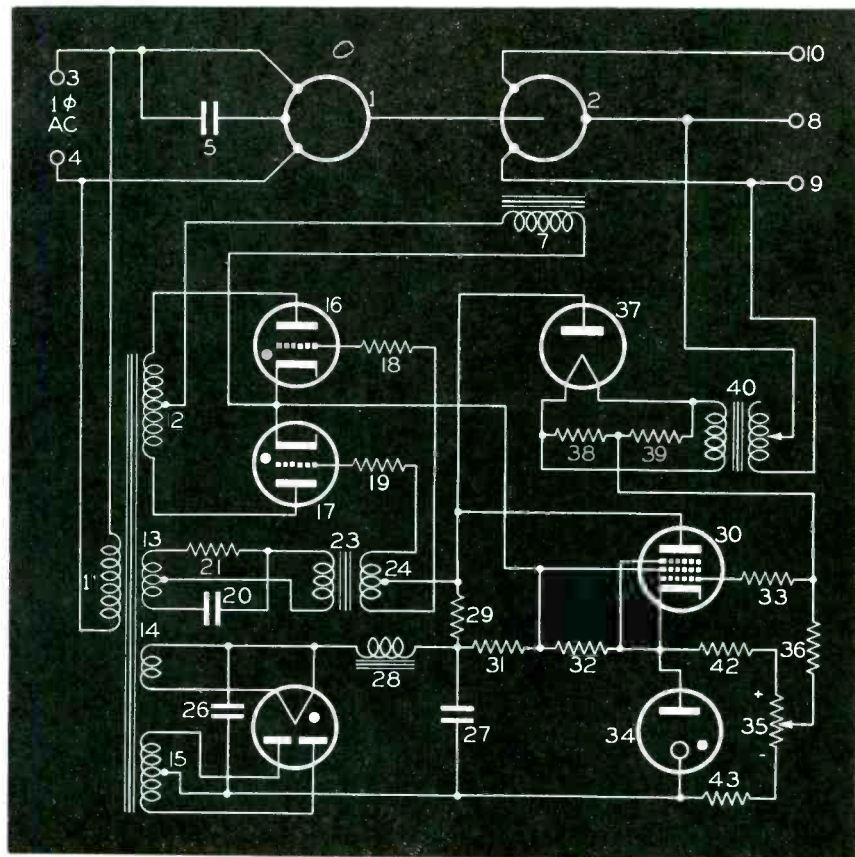


Fig. 5. A conventional a-c electronic voltage regulation system.

ratio of the voltage across the d c output terminals to that which appears across resistor 33. With the potentiometer slider arm at its positive terminal, the minimum output voltage setting, the latter is determined by the ratio of the output voltage to that developed across the resistance 33 and that of the potentiometer 34. In no event may the system output voltage be reduced to zero or increased above the regulation limits.

In addition, such a measuring system facilitates close adjustment of the regulated output voltage, in that the full rotation of the potentiometer con-

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of shaft effects only a partial change in the system-regulated output voltage.

The high degree of flexibility afforded through the use of the system in Fig. 4, despite its fundamental simplicity, is a striking example of the versatility inherent in electronic control systems.

Electronic regulation of a-c voltages is carried out in much the same manner as with d-c potentials. Under practical considerations, the only existing difference between a-c and d-c systems is the manner in which the a-c equivalent of the a-c regulated voltage is obtained.

A conventional electronic a-c voltage regulation system is shown in Fig. 3.

This system is, except for tube 37 and its associated components, nearly identical with the system of Fig. 1.

In Fig. 5, the single phase capacitor-operated motor 1 drives the three-phase alternator 2, having a d-c exciting field winding, 7. It is this winding on which the regulation system operates, the latter being similar, in this respect, to the d-c type of regulation system.

Voltage indication for the system of Fig. 5 is taken from the loading resistor 36 which is in series with the a-c indicator tube 37. This tube is a tungsten filament diode, having a tungsten filament. A characteristic of tube 37 is that its plate current varies directly with the filament temperature, the latter varying as the square of the filament current. Thus

$$W = I^2R, \text{ where}$$

$W$  is the power expended in heat,  $I$  is the filament current, and  $R$  the resistance of the filament at operating temperature. Hence, the plate current of tube 37 is a true indication of the d-c equivalent, in power value, of the filament current. Since the amplifier tube, 30, amplifies a-c as well as d-c, it is necessary to eliminate a-c modulation from the plate current to as great a degree as may be practicable. Therefore, in order to eliminate the introduction of the indicator-tube filament voltage in series with the tube plate voltage, the tube filament is provided with a filament center tapping resistor, 38-39. Finally, the filament receives its power from a single phase of the alternator 2, a-c output, through a calibrated step-down transformer 40.

Generally, commercial forms of voltage regulation systems incorporate the diode, 37, the filament center tap resistor, 38-39, and the calibrated transformer, 40, into a separate unit, known as an a-c voltage indicator unit. Such an indicator unit is shown in Fig. 4-a.

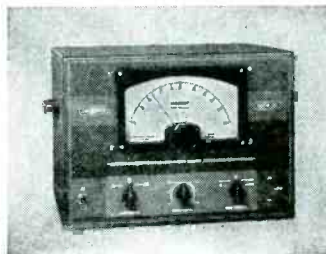


It's an act of bravery to possess a radio receiver in any country occupied by the Nazi or the Jap today. It's an act of heroism to operate a transmitter.

What could prove more convincingly the total value of radio than the frantic haste with which it is silenced or controlled by the Totalitarian? Or its use by the Free Peoples in directing their offensives . . . and in keeping their will for victory living and single-purposed?

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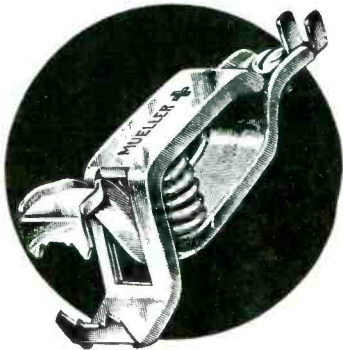
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## RADIO CLUB HEARS WHITE ON V-H-

S. Young White, consulting engineer with General Communication Company of Boston, gave a talk on v-h-f tuning systems recently before the Radio Club of America at Columbia University. His paper covered the theory and economics of tuning by parallel and concentric lines, cups, sliding contact coils, variable condensers of special design, and core tuning by iron and conductive cores in relation to their performance under temperature, voltage, humidity and vibration conditions. Mr. White also discussed the range of 50 to 500 mc, with emphasis on post war problems.

\* \* \*

## N.U. C-R TUBE PACKING

New compact cartons for cathode-ray tubes, have been designed by Perrin Belden of the material control department of National Radio Corporation's Lansdale Pennsylvania plant. Feature of the carton is a corrugated board filler, folded and die cut from one piece of board. Four filler pieces were formerly used.

\* \* \*

## AERO NEEDLE EXPANDS

Larger quarters have been acquired by the Aero Needle Company, 208 East Erie Street, Chicago, Ill.

\* \* \*

## WILSON ELECTED AAC V-P

Ira S. Wilson has been elected vice president in charge of finance of Aircraft Accessories Corporation. He will maintain his headquarters at the electronic division of AAC in Kansas City, Kansas.

\* \* \*

## SYLVANIA EXPANSION

Sylvania Electric Products' industrial apparatus plant at Emporium, Pennsylvania, has transferred its operations to plant two at Williamsport. Virgil M. Graham will continue as manager.

The Emporium plants' radio division has a new building under construction which will be used by the mechanical design and equipment development section.

\* \* \*

## RAYTHEON HONORS "TYPICAL WAR WORKER"

Mrs. Sue Fowler, an assistant foreman of radio tube production at Raytheon

## SHURE WINS WHITE STAR



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6SL7	to	6SC7
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Production Corporation, Newton, Massachusetts, was honored recently at a ceremony in which she was named a typical war worker.

### DU MONT FIVE-YEAR CLUB

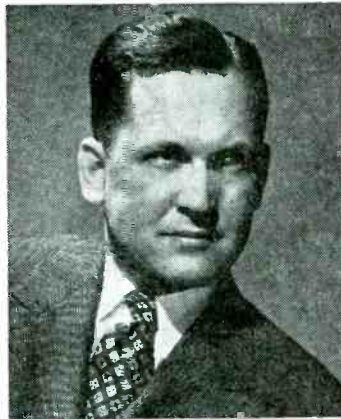
Forty-eight employees and directors were elected to membership in the DuMont Five-Year Club at its inaugural meeting recently. Allen B. DuMont, president of the Allen B. DuMont Laboratories Inc., Passaic, New Jersey, presided over the ceremonies. Ten-year gold pins were presented to A. J. Hinck, Stanley J. Koch, and Harry Gawler, the three men who worked with Mr. DuMont in the latter's home basement in 1932, making the first DuMont tubes.

### NEW ARHCO PLANT IN MT. VERNON

A new plant has been opened by American Radio Hardware Company at 152 MacQuesten Parkway, South Mount Vernon, New York.

### UTAH APPOINTS PUGH AS REP.

C. L. Pugh has been appointed representative of Utah Radio Products Corporation, in the states of Ohio, West Virginia and western Pennsylvania, according to R. M. Karet, sales manager of Utah's wholesale and sound divisions. Mr. Pugh was formerly connected with Hughes Peters Inc., RCA, and Standard Transformer Company. His offices are at 2009 Elinwood, Columbus 8, Ohio.



### UNIVERSAL MICROPHONE REORGANIZED

Universal Microphone Company, Ltd., Inglewood, California, will hereafter be known as the Universal Microphone Company. James L. Fouch and Cecil L. Sly, will continue as president and vice president respectively, with Durwood Allen as secretary.

### G-E REPEATED-SCRAPE ABRASION TESTER BULLETIN

A bulletin describing the repeated-scrrape abrasion tester, a device for comparing the toughness of insulation on film-coated magnet wires, has been issued by G-E. Copies of the publication GEA-4166, are available from the Schenectady, New York office.

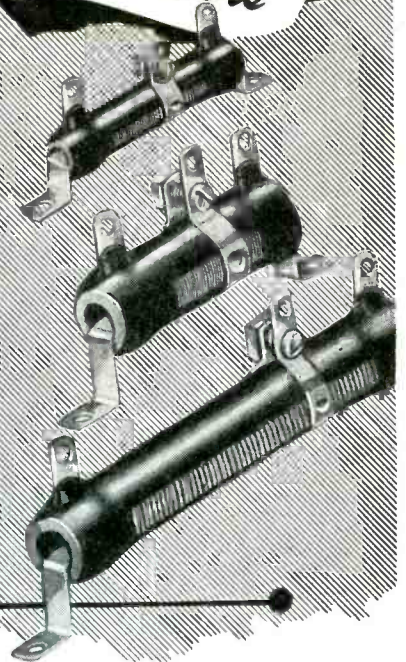
### "IMMEDIATE DELIVERY" FOLDER

A four-page "immediate delivery" folder covering Army-Navy type bathtub condensers, oil filled oil-impregnated can type capacitors and various micas, has been announced by Sprague Products Company

*(Continued on page 34)*

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of North Adams, Massachusetts.

The bathtub type metal rectangular units are available in single and dual capacities and in voltages from 50 to 1750 volts d-c; tolerance is -20%, +30%. The oil-filled, oil-impregnated can type units range in capacities from 1.0 to 17 mfd. and in a-c/d-c voltages. Mica condensers available include units in d-c test voltages of 1000, 2500, and 5000.

\* \* \*

**ELECTRONICS BULLETIN ON POSTWAR  
 JOBS**

A six-page bulletin, titled "Occupations in Electronics" by Forrest H. Kirkpatrick of Bethany College, and John E. Crawford of RCA, has been released by Occupational Index Inc. The bulletin contains information on the nature of electronics, abilities and training required, earnings, methods of entrance and advancement, geographical distribution of employment, postwar prospects, and other advantages and disadvantages. Copies at 25c apiece are available from Occupational Index, Inc., New York University, New York 3; New York.

\* \* \*

**NEWS OF THE REPRESENTATIVES**

The Mid-Lantic chapter of the Reps have just elected Sam Jeffries, president; W. S. Trinkle, vice president; Norman Sewell, secretary; and J. H. McKinley, treasurer.

The following officers were recently elected by the Southern California chapter; Harry A. Lasure, president; Vern T. Rupp, vice president; and Charles Silvey, secretary-treasurer.

Two new members were recently elected by the Mid-Lantic chapter. A. S. Van

**NEWS**

*(Continued from page 33)*

Osten, 109 Erie St., Camden, N. J. and D. M. Gawthrop, 3108 W. Penn St., Phila., Pa. Associate membership was conferred on Lester B. Free, 522 Drexel Bldg., R. H. Williams, 1338 Lincoln-Liberty Bldg., James C. Muggleworth, 1343 Arch St., and J. J. Mahoney, 1343 Arch St., all in Philadelphia, Pa.

A. S. Detsch, 245 Security Bldg., Portland, Ore., has just been elected member-at-large of the representatives. F. W. Taylor, 146 Braintown Road, Syracuse 5, New York recently became an associate member-at-large.

Jack Grand, 10 Murray Street, N. Y. City has become a member of the New York chapter. G. L. Koenig, 2600 Grand Ave., Kansas City, Mo. has just joined the Missouri Valley chapter and L. W. Beier, 600 S. Michigan Ave., Chicago, has joined the Chicago chapter.

The Southwestern chapter recently elected Hal Corry, president; A. L. Berthold, vice president and E. L. Wilks, secretary-treasurer. The Wolverine chapter gave the honors to R. C. Merchant, president; J. P. Davenport, vice president, and Robert Milsk, secretary-treasurer.

M. D. Ealy of the Los Angeles chapter has moved his office to 4826 Tyrone Ave., Van Nuys, Cal.

\* \* \*

**SOLAR PUBLISHES EMPLOYEE  
 MAGAZINE**

Activities of the employees of Solar Manufacturing Corporation, appear in a

new monthly magazine. Sylvan A. Wolin is editor of the journal known as the *Solar System*.

\* \* \*

**KEN-RAD WINDOW DISPLAY**

A window display, showing the number of radio tubes necessary in the function of war implements, is being distributed nationally, by Ken-Rad Tube and Lamp Corporation, Owensboro, Kentucky.

As shown in the display, 40,000 tubes and replacements are required by large aircraft carriers and their planes; PT boats need 600 tubes and replacements; bombers, 350; fighter planes, 125; large tanks, 60; jeeps, 20; walkie-talkies, 5 to 7; life rafts, 5 to 7; and paratroopers carrying communication equipment, 5 to 7.

\* \* \*

**POSTWAR ELECTRONICS DISCUSSED  
 BY FINN OF RCA**

Advantages offered by electronics in manufacturing and merchandising fields to meet postwar competitive conditions, were discussed recently by David J. Finn, sales manager of the industrial and sound department of RCA Victor Division, Camden, New Jersey. Mr. Finn, speaking before the monthly dinner meeting of the Philadelphia Sales Managers Association, reviewed the probable postwar merchandising uses of wired television, facsimile, and wire recordings.

\* \* \*

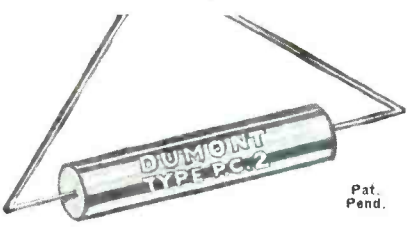
**L-183 DISCUSSED IN J F D BULLETIN**

A 4-page bulletin reviewing L-183 has been released by the J F D Manufacturing Co., 4111 Fort Hamilton Parkway, Brooklyn, New York. The bulletin also contains priority data on J F D products.

# DUMONT

OIL-FILLED  
Ceramic  
SEALED  
CAPACITORS

For  
Dependable  
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Pat. Pend.

For long life in repairs for those expensive high-class service jobs on amplifiers, public address, police and school systems and all good electronics equipment.

All capacitors from .0001 to .25 from 600 volts to 2000 volts.

It is your duty to buy war bonds

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**DUMONT ELECTRIC CO.**  
MFR'S OF CAPACITORS FOR EVERY REQUIREMENT  
34 HUBERT STREET  
NEW YORK, N. Y.

# NEW PRODUCTS

## REINER 5" OSCILLOSCOPE

An oscilloscope to permit the study of square waves and pulses encountered in television work has been developed by Reiner Electronics Company, 152 West 25 Street, N. Y. 1, N. Y. The instrument known as RCP 550A, is said to reproduce square-wave signals from 40 cycles per second to 50 kc per second. The vertical amplifier is said to have a sine wave frequency response of 500 kc per second  $\pm 1$  db.

This oscilloscope is equipped with a detachable coaxial cable with input capacity of 8 mmfd. A compensated 4 step attenuator permits observation of voltages up to 175 volts, with a variable gain control on the second stage providing continuous variation of gain, without changing frequency characteristic.

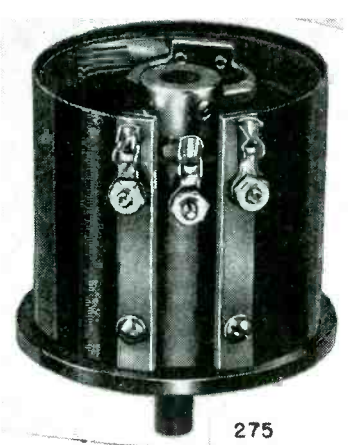
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## DE JUR POTENTIOMETERS

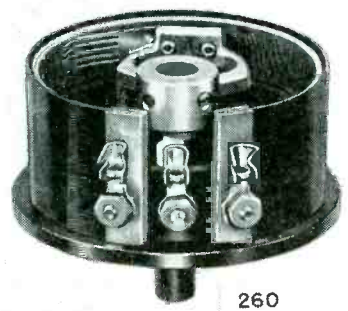
Potentiometers which are said to operate for 2,500,000 revolutions at 360° continuous rotation in both directions, for 24 hours a day, have been announced by DeJur-Amsco Corporation, Shelton, Conn.

Resistance wire on these potentiometers is space-wound on a strip of fabric base bakelite on special machines. Constant contact resistance and low noise level are said to be maintained for any position of the knob through the use of separate wiping fingers.

Types 261, 281, 291, 276, 292, and 296 have top wipers. Designed as low operating temperature type, as defined by the American Standards Association.

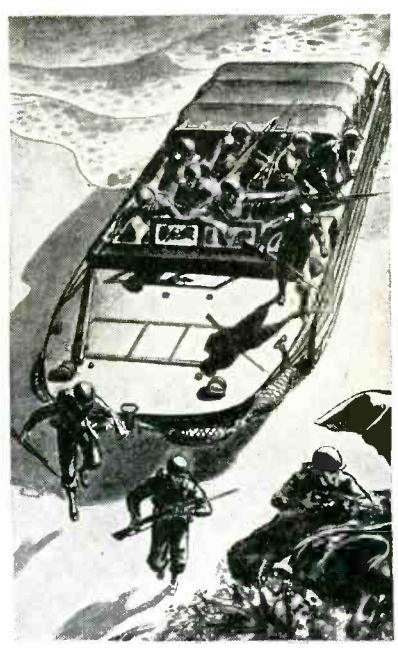


275



260

# MULTIPLE UTILITY

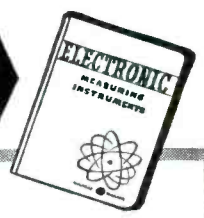


**MULTIPLE** utility is one of the many outstanding features that makes General Electric SERVICE TESTING EQUIPMENT practically pay for itself in added service. Sturdy, compact . . . designed for hard every-day use, this new line offers a wide choice of portable, accurate apparatus for maintenance and testing work in the field or service shop.

G-E unimeters, tube checkers, audio oscillators, oscilloscopes, condenser resistance bridges, signal generators—all give radio service men and service dealers rapid, dependable equipment for testing radio and electronic circuits and component parts.

While these sturdy, shock-resistant units are now in production primarily for the Armed Forces, they may be purchased on priority if you are engaged in war work. After victory, of course, the full line will again be available to everybody. . . . *General Electric, Schenectady, New York.*

FREE CATALOG

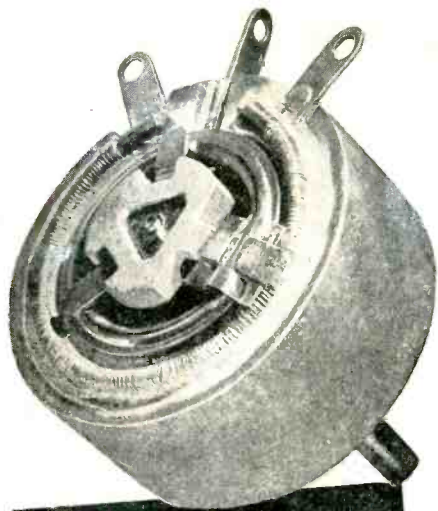


**ELECTRONICS DEPARTMENT**  
**GENERAL ELECTRIC CO.**  
Schenectady, N. Y.

Please send, without obligation to me, the General Electric Testing Instrument Catalog, S-3 (loose-leaf), for my information and files.

Name \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_

**GENERAL ELECTRIC**  
Electronic Measuring Instruments



**Tougher  
POWER  
RHEOSTATS**

★ Our armed forces have first call on these tougher power rheostats. After the war, however, these rugged Clarostat components will be available to you for your radio, electronic and industrial jobs. They're worth waiting for. Meanwhile, note these features:

- ★ Insulated metal core supports resistance winding. Element imbedded in cold-setting inorganic cement. Maximum heat conduction and radiation.
- ★ Normal current rating may be exceeded by 50% at any setting up to 1/3 total rotation without damage or excessive temperature rise.
- ★ Tripod-type rotor provides smooth operation and positive conduction at all settings.
- ★ Exceptionally rugged mechanically and electrically, for dependable, long, economical service.
- ★ Standard units: 25- and 50-watt. 1 to 5,000 ohms, and 0.5 to 10,000 ohms. Other resistances, taps, tapers, special bushings, shafts, knobs, to order.

★ Consult local Clarostat jobber regarding your wartime servicing requirements.



CLAROSTAT MFG. CO., Inc. • 285-7 N. 6th St., Brooklyn, N. Y.

## JOTS & FLASHES

**N**EW Hytron factory opened at Beverly, Mass . . . five now in operation . . . Southern California chapter of The Representatives elects Harry A. Lasure president . . . General Electric names R. L. Hanks sales-manager of receiver sales . . . Army-Navy "E" awards for outstanding production to Tung-Sol Lamp Works, Newark, N. J.; Allen B. DuMont Labs., Passaic, N. J.; Erco Radio Labs, Hempstead, N. Y. . . . Marconi Memorial Medal of Achievement awarded to Ludwig Arnson, president of Radio Receptor Co., Inc. for forty years service to radio communications development . . . Dial Light Co. of America moves to larger quarters at 900 Broadway, N. Y. C. . . . Philco elects Larry F. Hardy vice president in charge of Home Radio Division . . . three Sylvania factories, two in Salem, Mass., and the Danvers, Mass. plant awarded Army-Navy "E" on March 1 . . . multiple presentation ceremonies were held . . . Donald McDiarmid appointed materials inspection supervisor by Universal Microphone Co., Inglewood, Cal. . . . Leslie F. Muter, president of the Muter Co., Chicago, announces appointment of Paul J. Pfohl as sales manager . . . radio industry may well be proud of its record of War Bond purchases in 4th War Loan Drive . . . quotas exceeded in all parts of the country . . . Zenith Radionics Corp. of New York formed to distribute Zenith products in Metropolitan area . . . offices in Empire State Bldg. with H. J. Wines in charge. . . . John C. Clayton, advertising director of General Radio, back at his desk after being "on loan" to Navy Department for almost two years. . . . new catalog on electronic tubes just issued by Continental Electric Co., Geneva, Ill. . . . Electronic Specialty Co., Los Angeles 26, Cal., offers a Procedure Manual for Aircraft Radiotelephone Communication to all members of Civilian Air Patrol . . . we like *The Solar System*, new employee organ produced by Solar Mfg. Corp., capacitor manufacturers . . . both Zenith and Stromberg-Carlson report that February showed the greatest production in their history . . . Hallicrafter's personnel, including E. G. Brown, advertising director, and their advertising agent, Burton Browne, tendered a reception to eastern trade press at Commodore Hotel, N. Y. . . . Sylvania starts work on addition to its tungsten plant at Towanda, Pa. . . . have you contributed your pint of blood to the Red Cross . . . it's urgently needed to save lives of wounded men who are fighting your battles.

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# Thanks

## MR. TROUBLE-SHOOTER

Thanks, Mr. G. I. You're close to our thoughts. All of us in radio know the world-wide job you're doing in the Signal Corps.

We know who you are. You're the radio ham across the street, the boy home from college who burned the midnight oil in the attic and rigged his aerial from the highest mast. You're the telephone man. You're the obliging young fellow from the lighting company. You're the serviceman who fixed our radio set the day before the World's Series. You're the radio engineer who added brains to that set.

We don't know where you're *seeing* action but we know that you are *helping* it. Crawling out ahead of artillery. Scrambling from one fox-hole to another. Rolling up telephone wire almost to the muzzles of enemy guns. Operating and servicing communication systems so that the attack may roll forward. Hunting booby traps. Saving lives.


Come back, Mr. G. I., just as soon as your trouble-shooting is done. Radio will need you—your skill—your sureness. Radio will not forget your part in victory. Solar Manufacturing Corp., 285 Madison Ave., New York 17, N. Y.



CAPACITORS AND RADIO NOISE-SUPPRESSION FILTERS



## ART AND SCIENCE...BOTH

 Little wonder that tube making is often referred to as an *art*. For much of the work is by hand. To fashion these complex assemblies of filaments, grids, plates and wires; to position the parts within such close space limitations—parts, mind you, that often are so fragile, flimsy and elusive, *tweezers* are required to handle them—calls for a high degree of skill, a steady hand and an eye for accuracy. Art is right!

Yet, today, guiding every move of every N. U. production worker's hands is the "know how" of many scientists and engineers. Here are

chemists, physicists, metallurgists, and men high in the sciences of electronics and mechanics—all teamed up in a scientific tube development and production program recognized as a model throughout this industry.

It takes a lot of *both* science and art to make the advanced-design, high performance N. U. tubes now being produced for combat service. Today they are being battle-tested for the greatly expanded post-war needs of service engineers. *Count on National Union.*

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



# NATIONAL UNION

## RADIO AND ELECTRONIC TUBES

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