

# "Portables" Speed-Up War Production Testing

Triplet Portables speed up electrical testing with the dependable accuracy that is a vital part of war production.

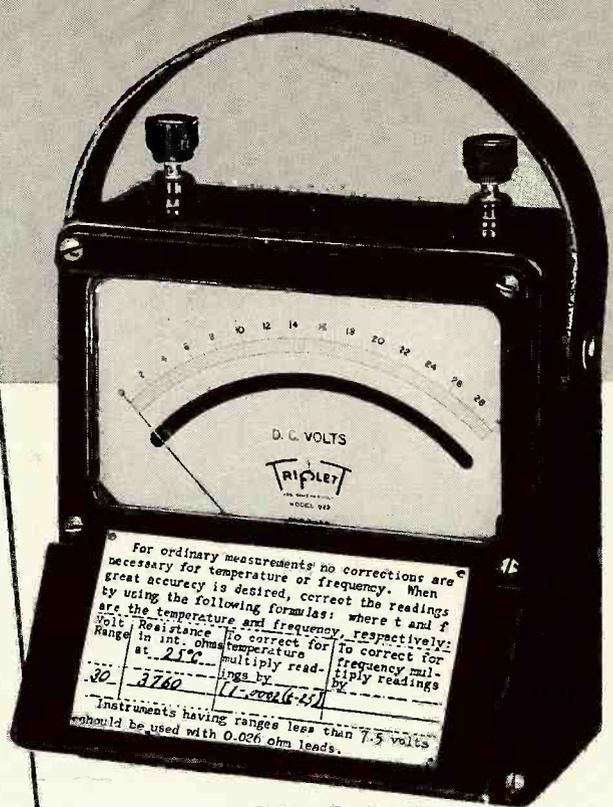
And whether your particular interest lies in laboratory service, production line testing, experimental work, field service, or plant maintenance, you will find your need provided for, with exacting and lasting accuracy in the expanded line of Triplet Portables.

In the drive of production-line testing, Triplet Portables supply the full-scale accuracy, the consistent performance, the hair-trigger answers that result from the Triplet method of safe-guarding quality, by making every essential part in the Triplet plant.

If you, like the writer of the letter quoted below, want to back up our armed forces with time-saving production practices, write for complete details on other Triplet Portables, panel electrical measuring and test equipment.

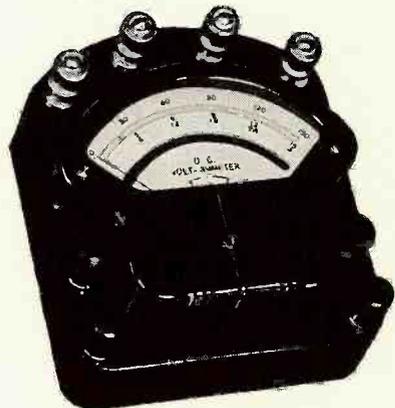
→ →  
Excerpt from letter of a prominent manufacturer (original in our files):

"With the Ohm Meter we have on order we can do in . . . seconds, what now takes a couple of hours."



Model 625

Models 625 D.C. and 635 A.C. Portables are unequalled for today's rush in production testing or the rigid requirements of laboratory checking. These highly attractive molded case instruments have long 4.58" hand calibrated mirror scales. The hinged cover closes when instrument is not in use, for added protection. Black molded case for D.C. instruments; A.C. is red. Size is 6" x 5 1/2" x 2 1/2". Has detachable leather strap handle.

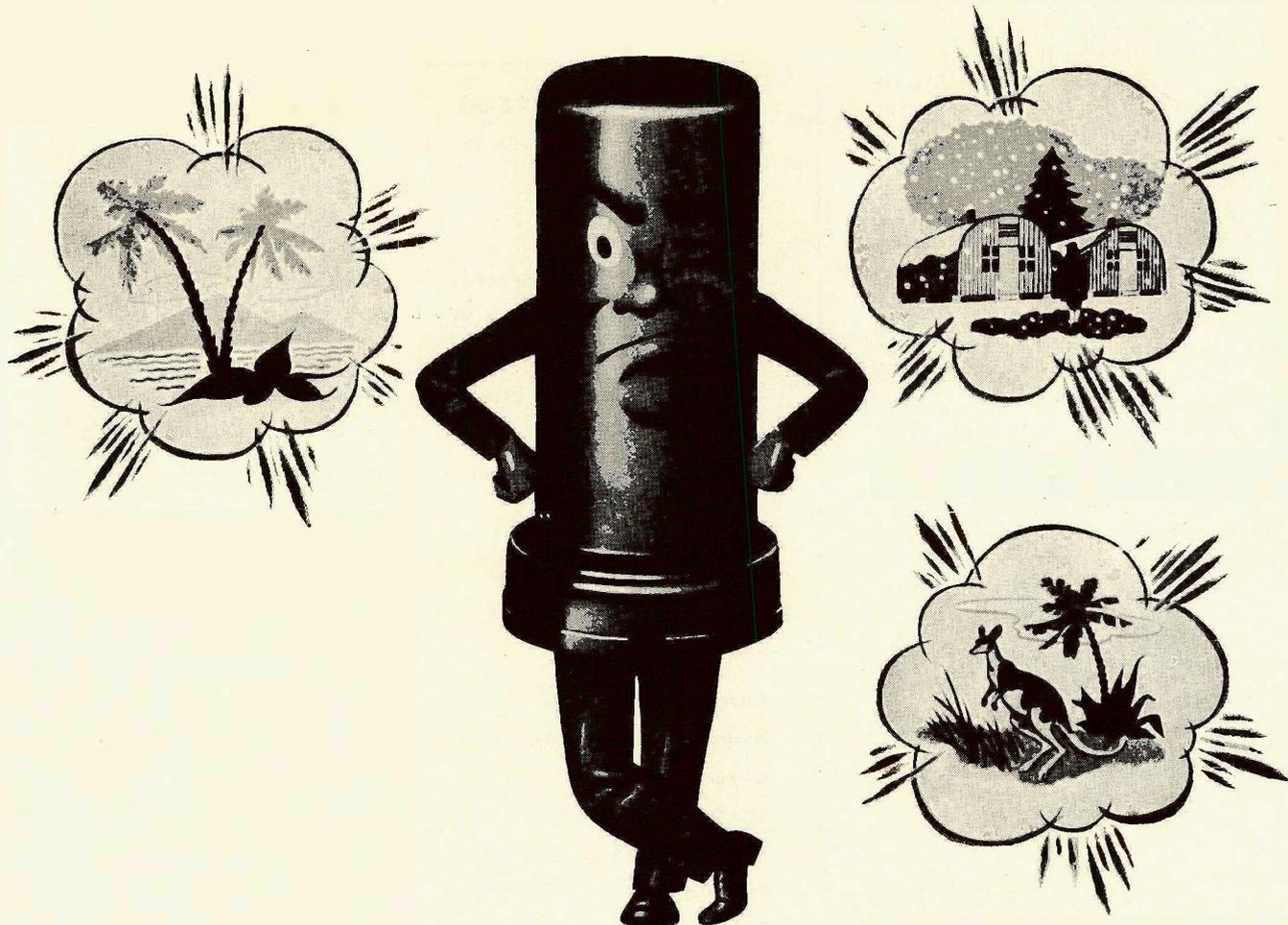


Model 425

Another new Portable combining attractive symmetrical case proportions, a long readable scale, and requiring a minimum of bench space when in use. A real beauty in design for those preferring something different. Case and base are molded; base size 5" x 4 3/8". Model 425 D.C. (3.12" hand calibrated mirror scale); Model 435 A.C. (2.88" hand calibrated mirror scale.)

**THE TRIPLET ELECTRICAL INSTRUMENT CO.**  
BLUFFTON, OHIO

# YOU CAN'T SCARE ME



★ Ken-Rad Tubes are being used in fighting equipment of our armed forces in almost every corner of the earth. They can't be bluffed by the roughest, toughest assignments our military men can give them in planes, tanks, naval vessels and signal equipment.

Because almost all of our tube production is helping to equip our men in the army, navy and air forces, you may have difficulty in securing Ken-Rad Tubes. But there are some available and there may be more. We are sure you will agree that we have a big task to accomplish before we can again fulfill all civilian requirements.

**KEN-RAD TUBE & LAMP CORPORATION**  
Owensboro, Kentucky

# KEN-RAD RADIO TUBES

SERVICE, JANUARY, 1943 • 1

# EDITORIAL

**W**ITH the ration programs rapidly assuming full control of our daily mode of living, many customary practices will, of necessity, become obsolete. This is particularly true in the business of Servicing.

It will not, for instance, be possible to maintain every receiver in every home. But it will be possible to maintain at least one receiver in every home. Receiver owners, aware of shortages of material and manpower, will not balk at this "service rationing." It may be that junior or sis, or that uncle from out West, will be inconvenienced, for they may not have the use of the set in their room, but war isn't much of a convenience, either. And certainly such a sacrifice is small. It may be difficult to maintain even that single set because of transportation problems. It may be necessary to have the customer bring the chassis to the shop. Where the units are large and such carting is impossible, yet repair shop attendance is imperative, there are the local merchants with their delivery services to lend a hand. Friendly cooperation is always possible.

But whatever the problem, receivers must be maintained, *particularly one in every home!*

**A** NEW Service Man deferment ruling has just been issued. It is completely analyzed on page 5 of this issue. The exact procedures a Service Man must follow, if he seeks deferment, are carefully explained and illustrated with a sample form completely filled out.

**E**VERY week sees the introduction of training programs preparing women for repair work. Authorities say that thousands will soon be ready for this field. Because of the limited experience and knowledge of these newcomers, their type of work will be restricted. Nevertheless they will be able to alleviate the crowded service schedules and improve service facilities, so essential today. In many shops throughout the nation they have already shown their value. Women will become important factors in Servicing.

# SERVICE

A Monthly Digest of Radio and Allied Maintenance

Reg. U.S. Patent Office

Vol. 12. No. 1

January, 1943

**ROBERT G. HERZOG**

Editor (On Leave)

**ALFRED A. GHIRARDI**

Advisory Editor

	Page
Instantaneous Sound Recorder Wartime Servicing. By Alfred A. Ghirardi (Part 4) . . . . .	16
Ser-cuits. By Henry Howard . . . . .	9
Service Men Declared Essential in Deferment Ruling. By Elliott Marshall . . . . .	5
Solving Electrolytic Condenser Replacement Problems. By M. E. Heller . . . . .	13
<b>Case Histories</b>	
Philco Models . . . . .	8
Philco Chrysler 1908 . . . . .	8
RCA RP-360 . . . . .	20
<b>Charts</b>	
Electrolytic Condenser Applications . . . . .	13
<b>Circuits</b>	
RCA Victor RP-151 (Front Cover) . . . . .	8
RCA Victor CV-112X . . . . .	9
RCA Victor 36X . . . . .	9
RCA Victor IX, 12X, 14X . . . . .	9
RCA Victor 55X . . . . .	10
RCA Victor Q-136, etc. . . . .	10
Silvertone 7167 . . . . .	12
Traveler TB-512 . . . . .	12
Westinghouse WR-12X4 . . . . .	10
<b>Cover Diagram</b>	
RCA Victor RP-151 (Two-side record player) . . . . .	Front Cover
<b>Index to Advertisers</b> . . . . .	28
<b>Manufacturers</b>	
New Products . . . . .	21
News . . . . .	22
Jots and Flashes . . . . .	28

Copyright, 1943, Bryan Davis Publishing Co., Inc.



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



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

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

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

This advertisement  
is appearing in:

THE SATURDAY EVENING POST,  
(On sale Jan. 13) Jan. 16

LIFE, Jan. 11  
(On sale Jan. 8)

COLLIER'S, Dec. 19  
(On sale Dec. 11)

LOOK, Jan. 12  
(On sale Dec. 29)

FARM JOURNAL & FARMER'S WIFE, Jan.  
(On sale Dec. 14)

AMERICAN MAGAZINE, Feb.  
(On sale Jan. 5)

FORTUNE, Jan.  
(On sale Dec. 25)

NATIONAL GEOGRAPHIC, Jan.  
(On sale 1st week in Jan.)



On the beach in the Pacific a soldier sends a message to his family in London and Paris. The soldier's handclasp and the waves of the radio waves are the same. The soldier's handclasp is the same as the waves of the radio waves. The soldier's handclasp is the same as the waves of the radio waves.

With a handclasp of waves, three times as many people as before. To the far East, the West, the South, stations speak in Malay, Dutch, Japanese, Russian, Korean, Thai, and other languages.

That means the great General Electric radio receiver is being sold in the radio field by General Electric for the home.

General Electric short wave stations are the best in the world. They are in London, Paris, New York, San Francisco, and Station WGLD and WGEN, Schenectady.

The handclasp from a free people to another free people in their hearts is a language of electronics. It is the electronic link that lets the spoken word travel the air, and the electronic link that carries the word and gives it a voice in your radio. And the engineering skill that

has made the great General Electric radio receiver is being sold in the radio field by General Electric for the home. The handclasp of waves is sold in a new way. It is being sold in a new way. It is being sold in a new way. It is being sold in a new way.

GENERAL ELECTRIC  
RADIO • TELEVISION • ELECTRONICS

## HERE'S WHAT GENERAL ELECTRIC IS DOING TO MAKE G-E RADIO YOUR FRONT LINE LEADER AFTER THE WAR!

The highly readable, informative G-E radio advertisement above is appearing in nearly 19 million copies of national magazines this January. Many more like it — equally readable and informative—are in preparation for coming issues of these same consumer magazines.

Like Frazier Hunt's thrice-weekly G-E nation-wide newscast, they are telling the public about G-E radios, television, and electronics.

It is a simple, yet a compelling, story:

G.E. has always built fine radios. At this moment, it is building radio equipment for war only! After the war, the skill and experience of G-E electronics engineers, plus the G-E mass-production facilities, will provide radio sets such as you have never seen or heard. Radios that are of

incomparable outward beauty and utility! Radios designed and built to yield the finest tonal excellence!

There will be a complete line of radios and phonograph combinations, many combining FM and AM, and an outstanding line of portables. And the new visual clarity of G-E television receivers will be a thrill to watch!

G.E.'s goal is to send a public long deprived of any kind of new radio to the showrooms of department and furniture stores and radio dealers displaying General Electric radios. And General Electric will see to it — through advertising — that this will be a buying public so well informed that it will prefer and want G-E radios! . . . Radio, Television, and Electronics Department, General Electric, Schenectady, New York.

GENERAL  ELECTRIC

175-B1

RADIO • TELEVISION • ELECTRONICS

## The Technical Help You Need . . . WHEN YOU NEED IT!

Read these comments from servicemen who are using Ghirardi's Radio Troubleshooter's Handbook regularly:

### "PAID FOR ITSELF IN A DAY"

"Has saved me enough time in a day to more than pay for itself . . . a gold mine of servicing information."  
—R. W. Wheeler, Towanda, Kansas.  
"It speeds the tough jobs up 50%!"—L. L. Donovan, Beatrice, Nebr.

### "SAVES 25% OF TIME"

"The Troubleshooter's Handbook has saved me up to 25% in time formerly taken to locate data and troubles in my service work."—Norman Hendry, Portland, Mich.

### "SAVES TIME AND MONEY"

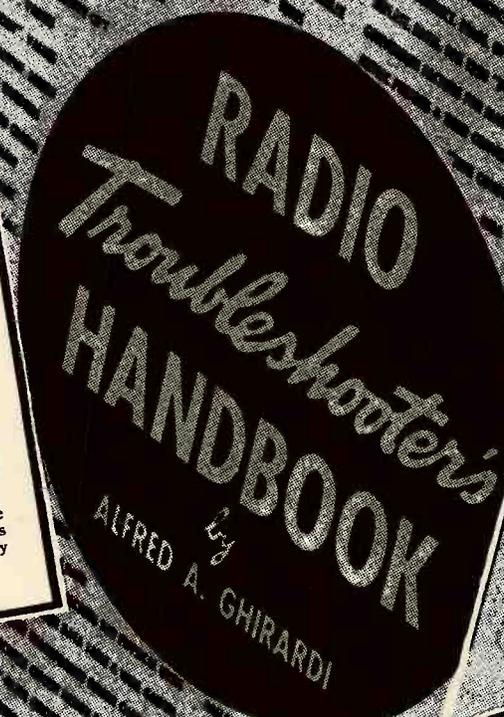
"Fills all my needs. Saves me time and money. It's indispensable!"—C. H. Preston, Sr., Delano, Calif.  
"It's the most active service data source in my shop. I use it dozens of times every day. It can't be beat!"—R. O. Daly, Brooklyn, N. Y.



Alfred A. Ghirardi  
"Radio's Most Widely Read Technical Author"

### "CUTS TESTING IN HALF"

"The new 2nd edition Troubleshooter's Handbook cuts down my shooting time about one half. On some models, no testing is required."  
—R. C. Hammel, Davenport, Iowa.  
"I'm extremely satisfied with the Handbook. It's everything it's cracked up to be—and more."—Leroy Mehr, Camden, N. J.



MANUAL  
SIZE  
710  
Pages

# HERE'S HOW TO "TEST" A RADIO in two minutes . . . or less!

Absolute  
**MONEY-BACK GUARANTEE**  
... You  
Cannot Lose!

The way to make more money these days is to be able to handle more radio repair jobs in less time—and here's the book to help you do exactly that! It is a book that will pay for itself the first time you use it—then help you make bigger profits and do better work for years to come.

When an ailing radio comes in for repairs, first turn to Ghirardi's Radio Troubleshooter's Handbook and look up the Trouble Case History data on that particular model. Chances are you'll find exactly the clue you need to repair it promptly—and, often, without any elaborate testing whatsoever.

### CUTS TIME IN HALF!

Containing common trouble Case Histories for 4,607 receivers, the Handbook is geared to help you directly on 9 out of 10 of the radios you are likely to be called upon to repair. On countless jobs—even the toughest ones—it can speed up your work as much as 50% or 75%, a fact borne out by actual users of the book.

But that is only the beginning! There is a wealth of

additional material to make the Handbook the most valuable publication on the market today for busy servicemen.

Included in this is over 400 pages of new, factory-checked receiver data never before published. There are I-F alignment "peaks" for 20,173 superhets—a feature which many claim is worth the entire price of the book itself. There are dozens of pages of data and practical tips on interchangeable tube types and modernizing old receivers—just what you need these wartime days when you've got to make old outfits last for the duration.

### PRACTICAL DATA for TODAY'S JOBS

Also included is a 20-page tube chart (the most complete tube chart ever assembled anywhere) that tells what you want to know about any tube type in a jiffy; plug-in and ballast resistor replacement charts; a tabulation of those pesky I-F transformer troubles with numerous servicing and replacement tips; condenser and resistor charts; wire tables; coil and transformer formulae; trade directories—and dozens of other charts, tips, and helps that will enable you to do almost every job quicker and better.

### NO OTHER BOOK LIKE IT

Don't confuse Ghirardi's Radio Troubleshooter's Handbook with any other book on the market. There is no other one like it—none that gives the wide variety of time-saving, down-to-earth information that is so genuinely helpful especially today when tubes and parts are so scarce that it is up to the servicemen to have good, practical data that will help him do whatever may prove necessary to keep radios working on the home front during this time of national emergency.

Send direct to us—or, better yet, go to your local dealer and get a copy for only \$5. If you are not more than satisfied, return the Handbook within 5 days and your money will be cheerfully refunded and no questions asked. Nothing could be fairer! You've everything to gain—and not one cent to lose!

DO IT NOW!

## PREPARE NOW FOR A POST-WAR FUTURE IN ELECTRONICS!

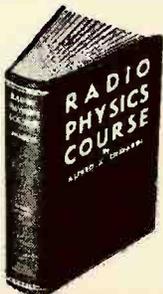
On all sides, you've been hearing about the great, rapidly-growing Electronics Industry. You've been reading about the mysterious war jobs that are being done by Electronic Methods. And you've been hearing much about the vast Electronic developments that will surely make the post-war period known as the "Electronic Age."

### OPPORTUNITY KNOCKS

This means a big opportunity for the alert serviceman who believes in looking ahead—for "Electronics" is really Radio grown up, expanded, and applied to a lot of other different problems aside from that of Communications. But the basic principles are the same—and the man who really knows them

from the ground up is the man who will cash in on tomorrow's golden opportunity.

That is why hundreds of servicemen are looking to Ghirardi's famous RADIO PHYSICS COURSE—the one, big 972-page book that is a complete guide to Radio fundamentals, theories, and principles—as the ideal way of brushing up on basic technical facts and data that will prove invaluable in the Electronic World of Tomorrow. Used by U. S. Army Signal Corps, Navy, and civilian schools and colleges more than any other basic radio text book published; perfect for home study. Literature free. Only \$5 complete, direct or from your local dealer. Absolute 5-Day money-back Guarantee on this book also.



RADIO & TECHNICAL PUBLISHING COMPANY, 45 Astor Place, New York City

# SERVICE MEN DECLARED ESSENTIAL IN DEFERMENT RULING

By ELLIOTT MARSHALL

ON DECEMBER 22, 1942, the National headquarters of the Selective Service System in Washington, D. C., issued an important bulletin for the Service Man. Known as occupational bulletin number 42, it states that the War Manpower Commission has certified that repair and hand trade services is an activity essential to the support of the war effort. And in the essential activities included, we find *radio*.

Thus, the Government has now declared that it is vital that home radio sets must be maintained during wartime, and requests all local boards to give radio repairmen immediate consideration for deferment.

The idea of deferring Service Men will be new to many local boards. All local board members may not realize the importance of this new maintenance directive. The following data, therefore, should be read carefully so that you will become familiar with the order and know how to comply with it correctly, when and if necessary.

Under this new manpower order, a radio repairman is a critical occupation eligible for occupational deferment until a replacement can be trained. Whenever a Service Man is a "necessary man" to his employer, or self, if self-employed; or in any case where his induction would cause the services he has been rendering to be seriously impaired or possibly stopped entirely, the Selective Service form 42-A should now be filled out and filed with the registrant's local draft board. This form is the basis for consideration for occupational deferment for Class 2-A by local boards. If the registrant is employed, the employer should make out and file the form. If the registrant owns and operates his own business (self-employed), he should fill out and file the form himself, as illustrated on the model form on the following pages.

#### **"Radio Repairman" Definition**

To every form, a copy of the United States Employment Service dictionary

title of "Radio Repairman" should be attached. The exact phrasing of this title appears below on this page. Read it and be sure to use it.

#### **Appeal Data**

Form 42-A should be filed when the registrant files his questionnaire or as soon as possible thereafter. Upon receipt of notice that the registrant has been classified as 1-A, appeal may be taken within 10 days to the Board of Appeals. If the registrant has already been classified as 1-A or 3-A and the 10-day period has expired, a request that the case be reopened, should be made. If the local board reopens the case, and classifies the registrant as 1-A, appeal may be taken within 10-days to the Board of Appeals.

In the event that the appeal period of a registrant now classified 3-A has expired, and his local board refuses to reclassify him, no further action should be taken, until he is classified as 1-A.

*(Continued on pages 6, 7, 8)*

The United States Employment Service dictionary definition of Radio Repairman, that should be included with every deferment form filed.

**"Radio Repairman (1) (Any Ind.) radio mechanic; radio serviceman; radio technician; radiotrician; trouble shooter, radio. Code 5-83.411. Repairs defective radios: tests circuits, tubes, and other parts, using various testing meters and devices; isolates defects, and either fixes them or replaces defective parts with new ones: resolders loose connections. May install radios in automobiles. May install radio aeriats."**

SELECTIVE SERVICE SYSTEM

AFFIDAVIT—OCCUPATIONAL CLASSIFICATION (Industrial)

(Affidavit—Occupational Classification (General), Form 42, is provided for use in activities where the items on this form are not applicable)

Name of registrant John Doe

Selective Service Order No. 10001 Age 33

Local Board 1 Norfolk County Brookline Mass. (Number) (County) (City) (State)

Title of present job Radio Repairman (The United States Employment Service "Dictionary of Occupational Titles" applicable title is: "Radio Repairman (I)". See job description attached.)

State whether journeyman, apprentice, helper, certificated, licensed, professional engineer, etc.: Journeyman

Describe duties actually performed Determines the cause of failure of home radio receivers to function; removes and replaces defective parts; may repair defective parts; sometimes modifies receiver to restore operation without replacing parts. Effects general repairs and adjustments necessary to put receiver in good working order to receive radio broadcasts.

Date employed (self-employed) Date entered present job October, 1938

Average weekly rate of pay, \$ 60.00 Average hours worked per week 60

Prior work experience Electrician's helper, --1 yr.; automobile electrician, --2 yrs.; installer of new radios, --2 yrs.; radio service apprentice, --2 yrs.; delivery truck driver, --5 years.

Educational background High School graduate, including electricity and general science; Correspondence course in radio principles and repairing; home study of radio from text books. Keeps abreast of new developments and equipment by reading trade publications.

How long will it take you to replace this employee? Assuming knowledge of fundamentals of radio and a natural aptitude, at least one year's experience in practical service work.

What specific steps have you taken to secure or train a replacement for this registrant? United States Employment Service advises no replacement available. Registrant is trying to secure female apprentice with aptitude for mechanical and electrical work.

**AFFIDAVIT—OCCUPATIONAL CLASSIFICATION (Industrial)—Continued.**

Name of company Acme Radio Service (John Doe, proprietor)  
(Corporation, partnership, individual—if self-employed, so state)

Address of company 1234 Commonwealth Ave., Brookline, Mass.  
(Location of plant, office, or division where registrant is employed)

Description of the activities of this company registrant is in business for himself in the  
repair and adjustment of radio receivers. (See Occupational Bulletin No. 42,  
designating Radio Repairman an activity essential to the support of the war effort.)  
Our service is vital to the maintenance of existing radio broadcast receivers,  
and therefore to radio broadcasting as a means of mass communication in war time.

State specifically what proportion of your products currently produced are:  
(a) for use in the war effort Not applicable. Radio receiver repairing is a service.  
(b) for civilian use \_\_\_\_\_

Is expansion or further conversion contemplated in war production? Not applicable.

Number employees now self only Number additional needed in next 6 months 2 Number additional needed in next year 4

Explain Registrant able to handle only a portion of business offered, and calls  
for service increasing daily owing to the limited service facilities now available  
in this community.

Is a replacement training program in operation? No Contemplated? Yes

Explain Registrant is seeking female apprentice for training.

This form was completed at the plant or office of the company located at

1234 Commonwealth Ave., Brookline, Mass.

and all correspondence relative to this affidavit should be so addressed.

I, John Doe, do solemnly swear (or affirm)

that I am the proprietor of the above-named company, and that the  
(Official position)

foregoing statements are true to the best of my knowledge and belief.

(Sgd.) John Doe  
(Signature)

Subscribed and sworn to before me this 4th day of January, 19 43

Richard Roe  
(Signature of official administering oath)

Notary Public  
(Official designation of official administering oath)

**INSTRUCTIONS:** This form is to be filled out by an employer or other person who has knowledge of the registrant's eligibility for Class II deferment as a necessary man in his civilian occupation or activity. *If the registrant is deferred, the employer must notify the Local Board promptly of any change in the registrant's job status, or if his employment is terminated.*

## DEFERMENT RULING

(Continued from page 5)

Then appeal may be taken within 10-days for reclassification in 2-A.

If the Board of Appeals affirms the classification of 1-A, the employer or registrant may contact the State Director of Selective Service, requesting a review of the case.

If you are an employer, be sure that you have checked with the local United States Employment Service office, as to the availability of replacements. Results should then be certified on the form. And if possible, a letter from the USES office, should be attached.

The requesting of deferment is an important project. It should be treated with the utmost of thought and care. Every detail in the procedure should be studied. Do not attempt to file a form in a haphazard manner.

### Radio's Importance Stressed

With the governmental declaration that the maintenance of home radios is vital to the home front, has come many complementary comments by the nation's leading war administrators.

For instance, Paul V. McNutt, chairman of the War Manpower Commission, has said, "The War Manpower Commission realizes the vital role that radio broadcasting is playing in the welfare and defense of our country. Radio communications has been classified as an essential war activity."

D. W. Bell, Acting Secretary of the Treasury, said, "Since the inception of our War Savings campaign, radio has been one of the most important lines of communication between the Treasury Department and the wage earners of America."

Pointing out the importance of radio, Claude R. Wickard, Secretary of the Department of Agriculture said, "... such services are of inestimable value not only to the Department, but to the effective prosecution of the farm part in the war effort."

Chairman James Lawrence Fly, of the Federal Communications Commission and the BWC, said recently, "It seems to me that the importance of radio broadcasting in the national war effort is self-evident and can hardly be overstated..."

The dynamic value of radio and its maintenance were also effectively presented in a statement by William B. Lewis, chief of the Radio Bureau of the OWI, which read in part "... it is one of the most important media for the conveyance of war information in general to the people, and may become of still greater importance when there is occasion for emergency messages from the national leadership. . . . The

maintenance of radio as an essential industry, so classified by the War Manpower Commission, is of utmost importance to the prosecution of the war."

Maintenance and Servicing are vital links in the V chain. Keep 'em playing!

\* \* \*

## TWO-SIDE RECORD PLAYER

(See Front Cover)

THE RCA RP-151 automatic record changer, providing two-side record playing, without turning over, features many electrical and mechanical innovations. For instance, two high impedance crystal pickups are used. One is of the usual type above the record, and one is mounted in a needle-up position below the record. The changer also has two motors, one for driving the turntable and one for cycling. To provide this service the turntable motor must be reversible so as to afford clockwise rotation for the pickup underneath the record. The cycling motor is operated by a mercury switch.

For proper unattended operation, the output levels of the two pickups must be alike. This is accomplished with two trimmer condensers; the method being to set the trimmers at maximum capacity and then reduce the capacity connected to the higher level pickup until the output voltages are equal. The only way to get a reasonable adjustment is to use a constant frequency record and measure the voltages across the voice coil. The pressure on the bottom pickup is adjustable and may be changed slightly if the trimmed capacitor range is insufficient to obtain equal outputs. A shorting switch is provided for shorting the output of both pickups.

\* \* \*

## CASE HISTORIES

### PHILCO MODELS

*PT-2, 3, 10 and 12; dial slipping:* Can be easily cured by bending the dial bracket mounted on the elliptical speaker frame, so the pulley on the right end is directly over the large dial pulley.

*PT-91 to 96; intermittent sharp scratching sounds:* This is either due to the filter condenser or the 35Z3 being noisy.

*PT-87 portable (latest type); speaker rattle:* Loosen two screws of the speaker and remove armature while applying iron to the soldered connection of the armature bar and the bone bar. Disassemble armature and file the corrosion on the laminated magnets and laminated vibrating block. Coat with a thin coat of machine oil, to prevent

further corrosion and then reassemble.

*PT-87; dead:* Check connections on the external loop socket and if the customer does not use an external loop, solder the two bent spring contacts together.

*PT-26 and 28; oscillates at the low frequency end of the dial:* Carefully realign the i-f at 455 kc and if this does not cure it, try another 7A8 tube.

*PT-89 portable; weak:* Braid the broken-in shoulder strap.

*1002; hum:* Connect either a 10 mfd. condenser across the speaker field or separate the a-c lead that is close to the 7C6 grid terminal.

*350; oscillator dead:* Check the short on the f-m sector and regular stator section of the variable condenser.

*40-185, 195, 41-255, 265, 287, 296 and other '40 and '41 models with push buttons; dead on push buttons:* Replace the dual 370 mmfd. silver mica condenser, which is wired on the band switch. Do not use a rubber band to hold it in place. The chemical action between the rubber and the condenser originally caused the failure.

*Beam of light-models, phono weak:* Try different oscillator and rectifier tubes. See that beam is properly reflected on photoelectric cell. If tone arm head is slightly microphonic, change bulb.

*322. . . set slightly weak with oscillation in center of dial:* Secondary of r-f coil open, set will still play as secondary is shunted by 15000 ohm resistance.

*640. . . fades:* ABC filter condensers intermittent.

*350, 490, 1012, 1015, 1016. . . f-m sets. . . slow putt putt:* Check for positive voltage on XXFM diodes, indicating coil short.

*1001, 1002, 1003. . . slow phono motor:* Remove turn-table spindle; polish with crocus cloth; clean out old oil and lubricate with clean thin oil.

*Auto radio ARI0. . . dial trouble:* If scale is warped, replace. If cable frays, bend the U-shaped bracket that has the two bars that cables ride on in mild S shapes, so that cable does not rub on U bracket.

*395. . . microphonic on f-m:* Put tape on chassis edge that is nearest push button bars. Although the bars are at ground potential, their rubbing on chassis causes microphonics. Suggest felt or adjust so it doesn't hit.

### PHILCO CHRYSLER 1908

*Intermittent oscillator:* Not necessary to change entire tuning unit. Replace oscillator shunt coil with oscillator coil for 1808 (year earlier model), mounting coil in hole in chassis toward back of set near 7B8 tube.

Al Knickiner

# SER-CUITS!

By HENRY HOWARD

**L**OOP circuit design, 1.5 volt set conversion, speaker phasing and portable developments are among the highlights of circuit design discussed this month. In the RCA Victor 36X, 5-tube and rectifier, single band unit, (Fig. 1), we have an interesting case of loop circuit design. It will be noted that all of the L/C tuning components, including variable condensers and loop are returned to the avc bus, eliminating the usual .03 to .06 mfd. series bypass condensers. This makes the receiver more stable; also it aids floating chassis design for Underwriter's approval. A single .035 mfd. bypass condenser is connected from the avc bus to chassis at the low side of the oscillator tank circuit. In the oscillator arrangement there is the usual cathode tickler and 22000-ohm grid leak, but with a 10 megohm additional resistor from grid to avc bus to give the

bus an initial negative bias. With such a bias, the cathodes of the r-f and i-f stages are directly grounded, there being no need for cathode resistors.

The loop primary shorting link for loop operation and the chassis ground from the primary is unusual, for the link uses the same .1 mfd isolation (blocking) condenser as the phono

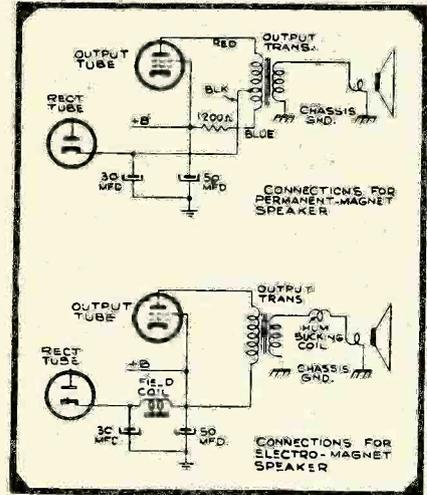
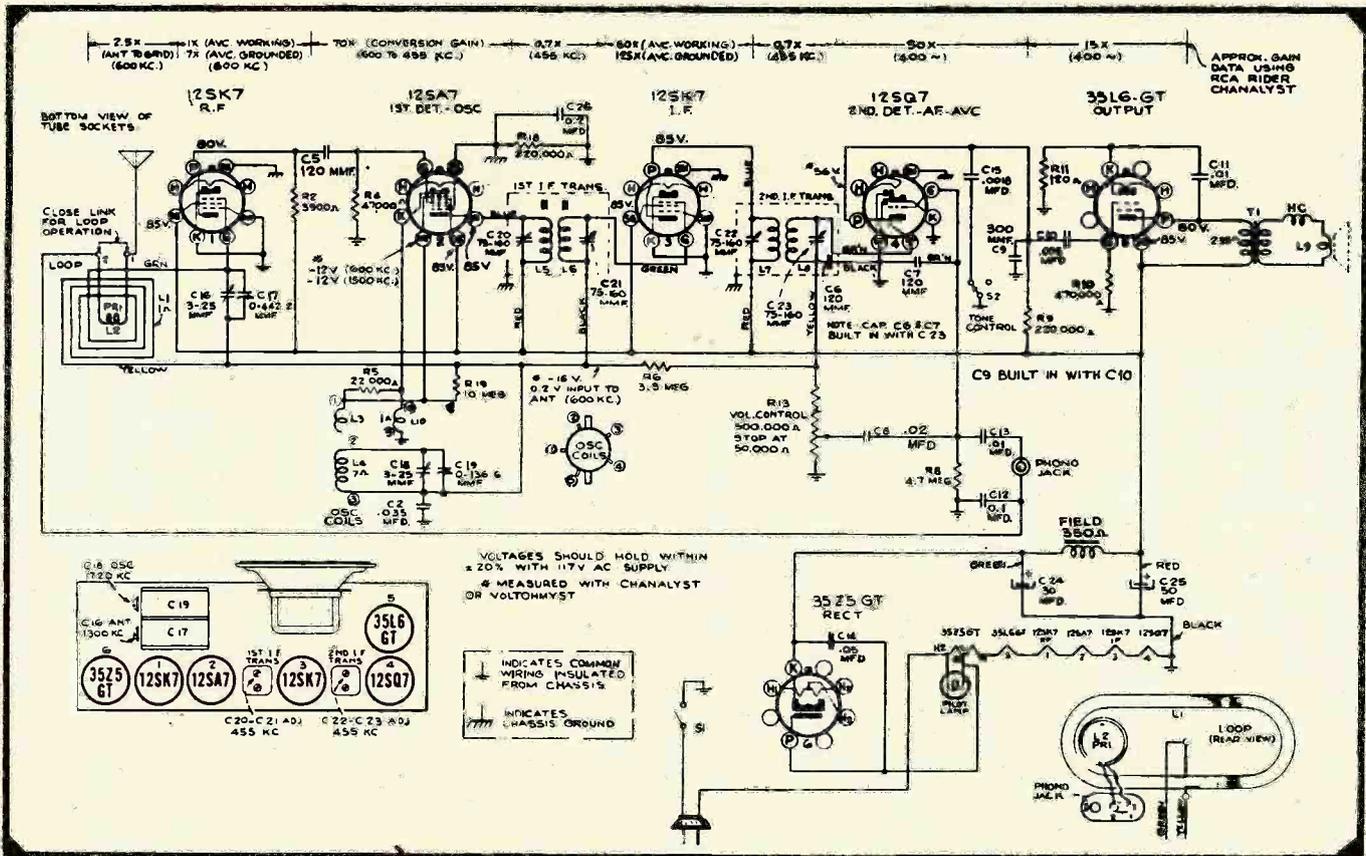
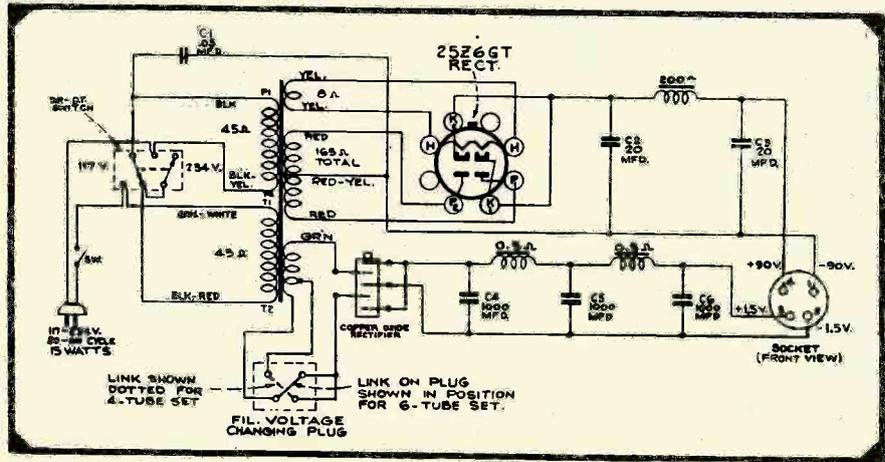


Fig. 3. Circuit changes in RCA Victor 1X, 12X and 14X for p-m replacement.

Fig. 1 (below). RCA Victor 36X. Fig. 2 (right). RCA Victor CV-112X.



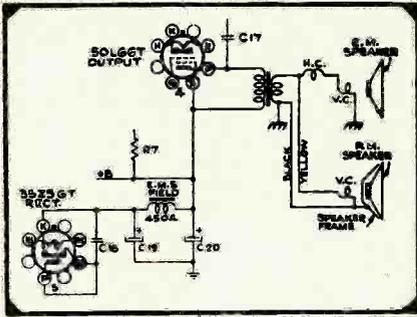


Fig. 4. RCA Victor 55X with e-m and p-m speaker units.

pickup jack. Looking a bit to the future, this connection could cause interference from a local u-h-f station (such as a modern amateur transmitter) as this type of bypassing is ineffective at these high frequencies. The signal would get through the phono jack by virtue of its capacity and directly into the 1st audio amplifier where, because of the non-linearity that always exists, it would be detected and passed on to the speaker. An additional condenser would then be required to prevent such interference.

#### RCA Victor CV-112X

For converting 1.5 volt battery sets to a-c operation, RCA Victor has developed the CV-112X converter, (Fig. 2). This model is designed specifically for models QB2, QB5 and QB6 although it may be used with many receivers. The transformer secondary for filament supply is provided with a

tap so that the converter may be used with 4, 5 or 6-tube sets. Four and five-tubers are operated from the tap; six-tubers from the full secondary. For providing the correct tap there is a special plug which fits into a socket on the side of the unit. A dual transformer primary winding is also a feature which permits either 115 or 230-volt operation, a d-p-d-t switch serving to connect the windings in series or parallel.

#### Dynamic Speaker Conversions

Following the trend of the times (and the same as in many other cases) RCA series 1X, 12X and 14X have converted late production units for electrodynamic speakers which replace the p-m units used in earlier production. Fig. 3 shows the circuit changes involved.

Talking about speakers, let us not neglect RCA Victor model 55X which uses both a p-m and e-m speaker, both 5-inch, and both having 4-ohm voice coils. They are connected in parallel across the output transformer, as shown in Fig. 4. For correct performance, it is imperative that the phasing of the speakers be alike, both cones moving in and out together. To check the phasing, a 1.5-volt dry cell may be used as a voltage source.

Simply connect the dry cell across the output transformer secondary and note

Fig. 7. Typical 1942 compact set; the Westinghouse WR-12X4.

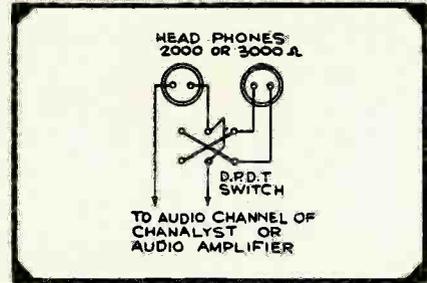
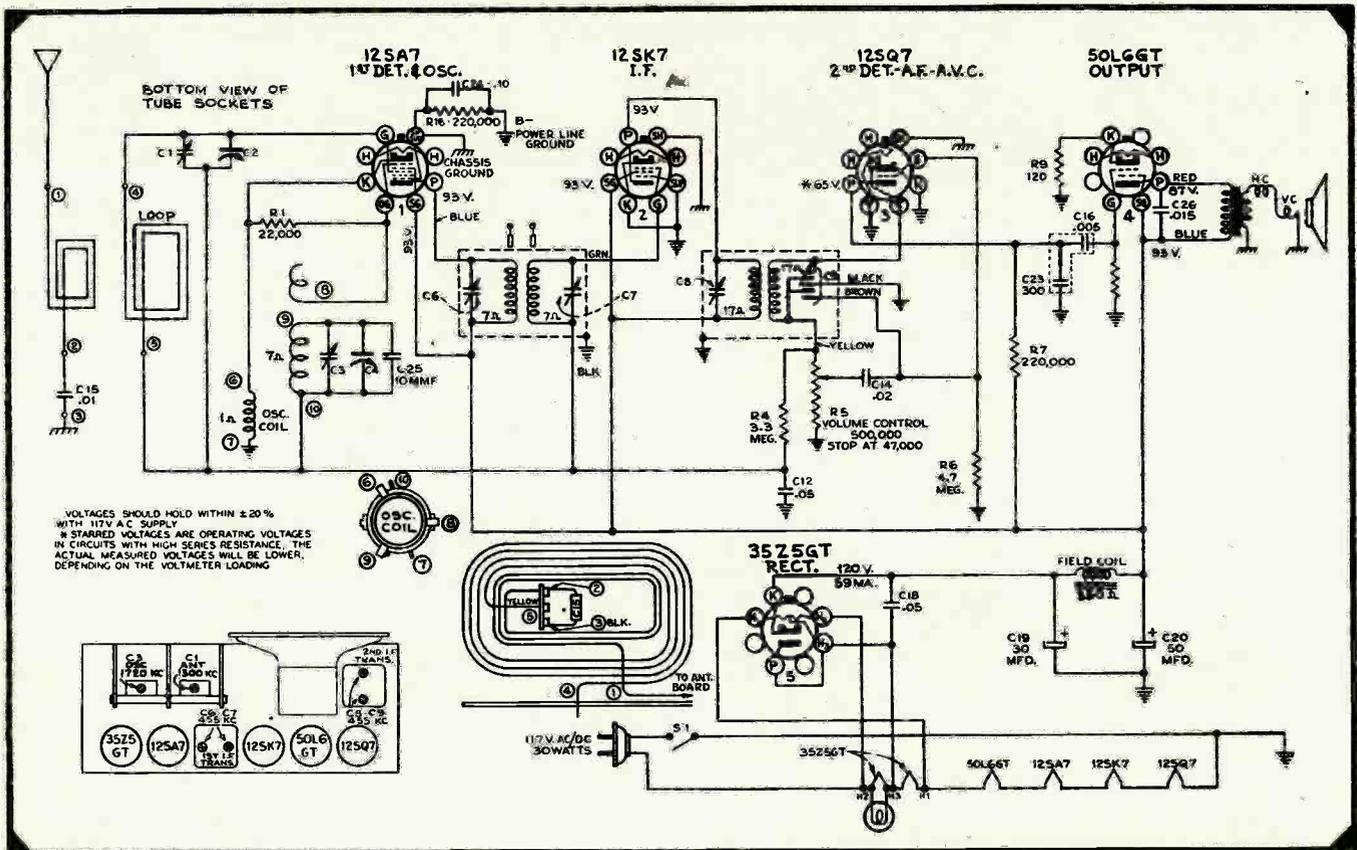


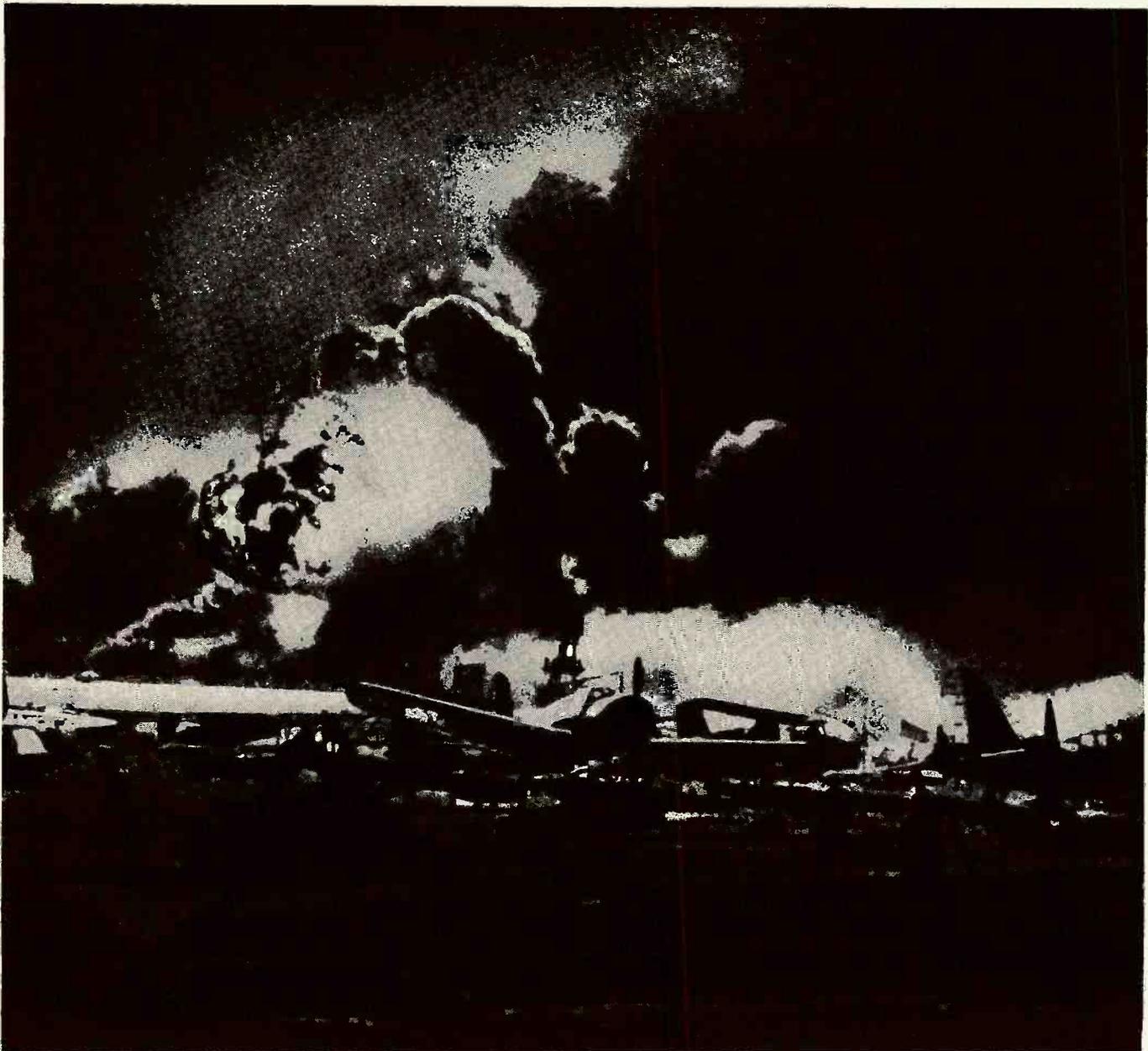
Fig. 5. Using headphones as mikes to check phasing.

the movement of the cones by feeling them. They should move in the same direction. If one moves out while the other moves in, reverse the external connections to the voice coil of the p-m speaker. The reason the p-m is chosen is that the hum-bucking action of the e-m may be disturbed when transposing leads. The receiver must be turned on, of course, to provide field excitation for the e-m speaker.

#### Other Phasing Methods

There are other methods of phasing speakers using the sound output to actuate some sort of microphone (two being required) in conjunction with any type of voltmeter to measure addition or subtraction of the audio frequency voltages coming from the two microphones. An oscilloscope or output meter is very satisfactory. A d-p-d-t switch is used to check for addition (in-phase) or subtraction (phase opposition) as shown in Fig. 5 (taken from





U. S. Navy Official Photo

## Minus Sound Effects

If you were receiving radio broadcasts from men in the midst of ear-splitting battle noises, you'd hear crisp speech undistorted by background sound effects.

Electro-Voice Microphones, in military service, are helping to make it possible. Similar microphones, designed to achieve such results, will be available for specific commercial applications . . . after our wartime job is done.

*Electro-Voice* MICROPHONES

ELECTRO-VOICE MANUFACTURING CO., INC.

1239 SOUTH BEND AVENUE, SOUTH BEND, INDIANA

SERVICE, JANUARY, 1943 • 11

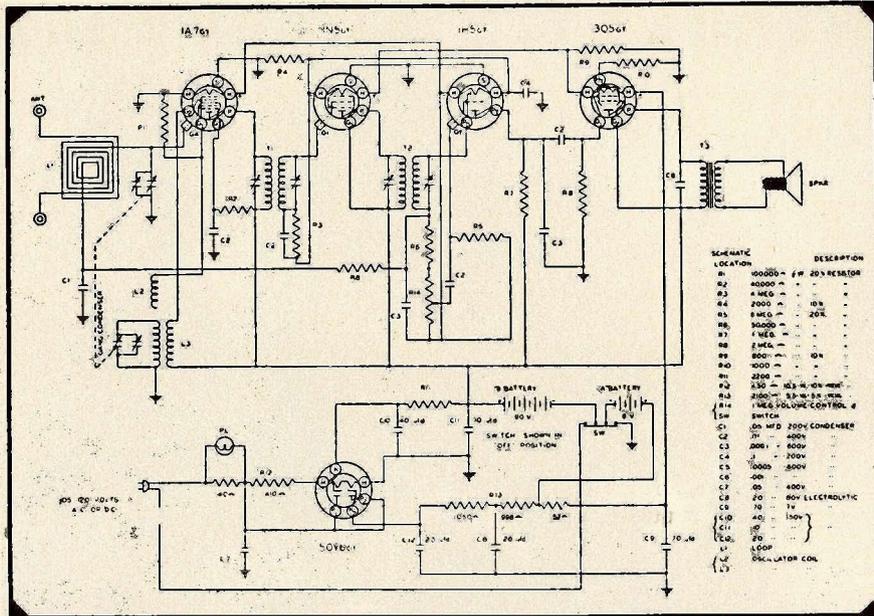


Fig. 6. Trav-ler TB-512 with floating battery circuit.

RCA Victor supplementary information). Here, two headphones are used as mikes, their output being fed into an a-f amplifier and output meter. The procedure follows:

A 400-cycle modulated signal is fed to the receiver. Both phones are held close together in front of one speaker and the volume control adjusted to give a convenient indication on the output meter. The switch is thrown in both positions, the position giving the greater output being marked "in phase." Now we are ready for the phasing check. One phone is held in front of each speaker, the volume control adjusted and the switch thrown to both positions, again noting which position gives greater output. If this is the same as before (the "in-phase" position), all is well. If not, one speaker must be reversed. Where both speak-

ers are e-m units it is generally preferable to reverse the treble speaker (or smaller one) as this will have the least effect on hum.

**Trav-Ler TB-512**

Fig. 6 shows the Trav-Ler portable TB-512 which has an extremely simple "on-off" power switch. This switching scheme connects the chassis to "A", "B" and the line cord simultaneously and depends for its simplicity on two items, the isolation (or insulation) provided by the rectifier tube when cold and the "floating" of both batteries on the line supply. Instead of the usual

Fig. 8. Silvertone 7167 with tuned pre-selection.

"Battery"-Line dual switch, then, only the single switch is required. For battery operation, the line plug is out of the receptacle. There is nothing unusual about connecting the "B" battery but note that the "A" battery positive connection runs through a 52-ohm resistor. This really "wastes" 1.5 volts, but makes provision for floating the battery when operating on the line. There is no drain on either battery (assuming no leaky condensers) through the power circuit as both "A" and "B" circuits are isolated by their own diode. Simply supplying line power converts to power operation.

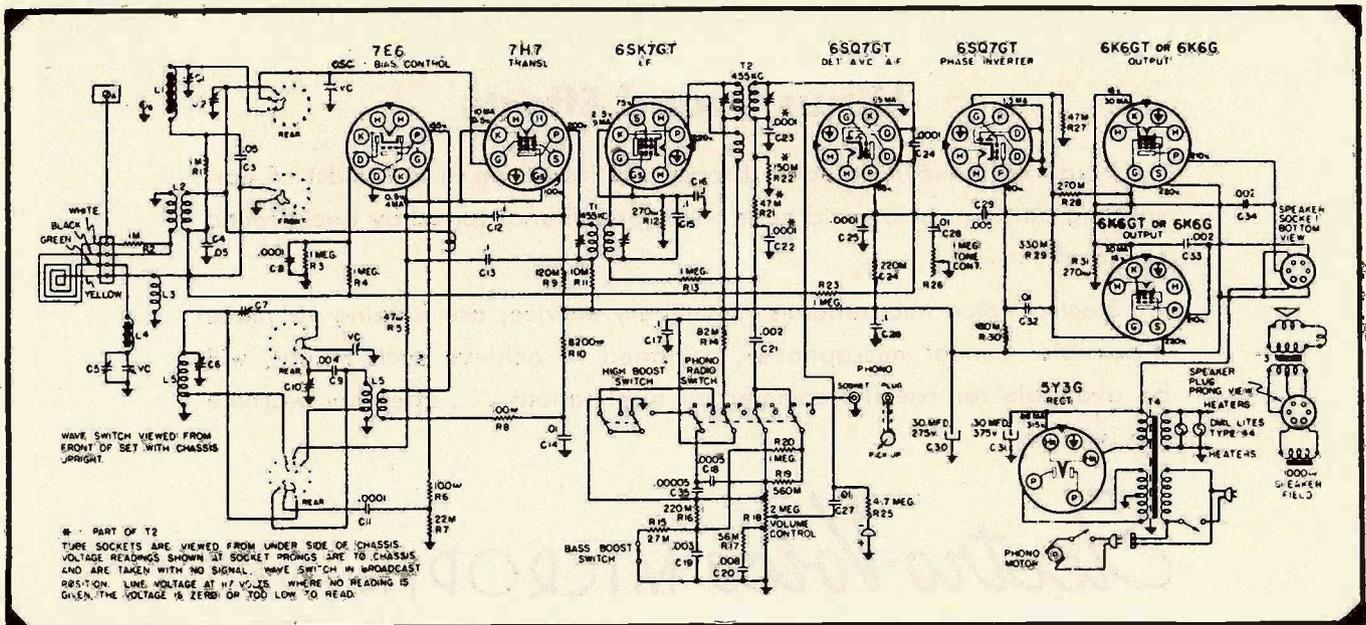
**Westinghouse WR-12X4**

For the sake of posterity, as well as a year-end note, we have picked a typical 4-tube and rectifier 1942 compact; a foolproof, standard design. This is the Westinghouse model WR-12X4, shown in Fig. 7. The tubes, loop, pilot lamp, filter, 2nd i-f transformer with combined tuning and r-f bypass condensers inside, volume control with stop at about 1/10 full value are all typical of the past year's design.

**Silvertone 7167**

In Fig. 8 appears an unusual and interesting receiver, the Silvertone 7167. It is an 8-tube, 2-band automatic changer combination. Featured is tuned pre-selection with a 3-gang condenser, but without an r-f stage. (The typical 1942 r-f stage doesn't amount to much anyway but we have genuine respect for every 3-gang unit!). A built-in rotatable loop acts as antenna for shortwaves. Note the inductive coupling employed between antenna and 1st detector tuning in which the reactance drop across  $L_s$  is used for coupling. A 1000 ohm resistor shunts the loop pri-

(Continued on page 23)



# SOLVING ELECTROLYTIC CONDENSER REPLACEMENT PROBLEMS

By M. E. HELLER

**E**LECTROLYTIC condensers are so important to popular priced receivers that their introduction around 1930 might be considered the beginning of a new era for the radio manufacturer. They haven't done the Service Man any harm, either! There has been a rather high percentage of service calls because of failure of electrolytics (mostly the cheaper varieties) due to breakdown or drying out. But this should not condemn the whole art of electrolytic design and manufacture. In the late '20s and early '30s, paper condensers went even more often, it seemed. Electrolytics of high quality used

sensibly with a reasonable safety factor are thoroughly reliable components.

The low cost and small size for high capacitance, as well as the variety of shapes and types as compared to other types of condensers, are responsible for their hold on the industry. Their application, as far as radio is concerned, is limited to d-c or pulsating d-c. With a back-to-back connection, they may be used for limited a-c applications, such as motor starting.

Aluminum or tantalum used as anodes in a suitable electrolyte become coated with a film which has the properties of a rectifier, conducting more freely in

one direction than the other. This film has a critical breakdown potential and is extremely thin, permitting a high capacity with small area electrodes. Electrolytics are made in two types, wet and dry.

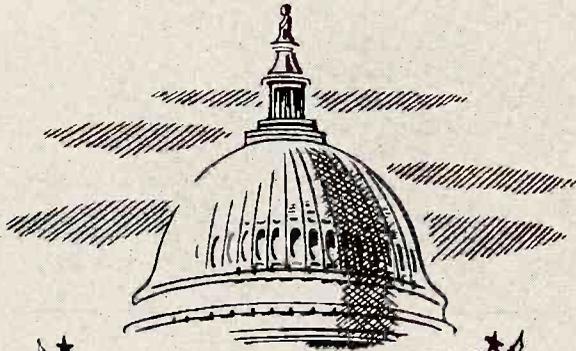
Wets are not very popular any more although they have some characteristics not possessed by drys. They are self-sealing when ruptured by overload and, due to their ability to pass sizeable d-c currents for short periods, are useful for improving voltage regulation. For instance, in a receiver designed for high voltage, the peak voltage between the

(Continued on page 25)

Chart A Showing Most Common Applications of Electrolytics

Fig.	C	Capacity	Working Volt- age	Peak Volt- age	Circuit Use and Function	Tolerance	Voltage Applied	Remarks
1	C1	8- 16 mfd	400	500	1st filter section	- 20% + 50%	Pulsating d-c	Select low leakage.
1	C2	8- 16 mfd	350	450	2nd section of filter	- 20% +100%	Mostly d-c	Power factor important if used as a-f and r-f bypass.
2	C1	20- 80 mfd	150	175	1st filter section	- 20% + 50%	Pulsating d-c	Output voltage dependent of capacitor.
2	C2	20- 40 mfd	135	150	2nd filter section	- 30% +100%	Mostly d-c	
3	C1	10- 25 mfd	20	35	A-F by-pass	Not critical	A-F and d-c	
4	C1	5- 20 mfd	150	150	Screen bypass	- 30% +200%	Small amount r-f; mostly d-c	In large receivers this condenser is bypassed with a paper unit; output voltage dependent on capacitor. Power factor important if not bypassed by paper.
5	C1	20- 40 mfd	150	175	Common filter input for "B" and "A" supply	Better than - 20% + 50%	Pulsating d-c	
5	C2	20- 40 mfd	135	150	"B" filter	Not critical...	Mostly d-c	
5	C3	20-100 mfd	50-75	100	"A" filter	-20% +50%	Mostly d-c	
5	C4	20-100 mfd	10	25	"A" final filter	Not critical	D-C	
6	C1	8- 16 mfd	90	100	"B" bypass	- 20% + 50%	D-C and a-f	The older the batteries the more a-f on condenser.
6	C2	10- 25 mfd	6	25	"C" bypass	20% +100%	D-C and a-f	The older the batteries the more a-f on condenser.
7	C1	10- 25 mfd	20	35	Output tube "C" minus bypass	- 20% + 50%	D-C and some hum voltage	
7	C2	10- 25 mfd	10	25	1st a-f "C" minus bypass	- 20% + 50%	D-C and some hum voltage	
8	C1	20-100 mfd	6-9	25	A-F bypass prevents common coupling through filament at loud signals.	Not critical	A-F and d-c	
8	C2	20-100 mfd	1.5	15	A-F by-pass prevents common coupling through filament at loud signals	Not critical	A-C and d-c	

# America honors its top ...and Two are membe



Stanley Crawford, Woodlynne, N. J., honored by the President for suggesting a new type of caliper used at RCA Victor. This caliper salvages 13 out of 16 castings previously rejected, thus saving valuable semi-finished material and many skilled man-hours. It has been adopted by war plants throughout the country.



Edwin C. Tracy, Rockville Center, N. Y., received a WPB award from the President for suggesting an oscillator to test radio equipment designed for fighting planes. Testing time was thus cut down from 8 hours to 3 minutes. Mr. Tracy's oscillators are now installed, or on their way to every American flying field.

# 10 Production Heroes of the RCA Family

The President of the United States has personally honored ten American workers for contributing outstanding suggestions to further the war effort.

Two of these ten heroes of the home front—chosen from the nation's millions of war workers—are skilled craftsmen at RCA. As a war plant, we are proud to have two winners.

In addition, the War Production Board has selected a total of 148 workers from the entire country as meriting special honor for their suggestions to increase and improve America's war output.

22 of that grand total were men and women who were doing their share at RCA!

To radio dealers, servicemen, amateurs, and radio engineers everywhere, this comes as no surprise. They have seen in a hundred ways over dozens of years, what RCA initiative, imagination, and skill can mean to radio. They have learned that from top to bottom—from engineering to production, from designing to packaging, from construction to pioneering—RCA leads the way in all branches of radio and electronics.

When peace returns, they can be certain that RCA will once again prove its leadership—in the development of new and better radio tubes, radio-phonographs, broadcast equipment, and electronic devices, in the perfecting of new production techniques, in the creation of new radio products to serve America's industries and America's homes.



## Other RCA Workers Honored by the War Production Board

C. F. Bartlam	Miss Victoria Kocher
L. J. Cronin	Mrs. Bonny Lee Smith Lewis
Joseph F. Eckert, Jr.	James G. McKelvie
Charles I. Elliott	Leon Morrell
A. S. Fish	Andrew Rau
Thomas Flynn	Fred F. Rimmler
Frank E. Giessen	Albert P. Ruggieri
Jason Harris	Thomas H. Shelling
Charles W. Hear	Arthur Waggoner
Edward S. Hoffman	Benjamin Willett



## RCA LEADS THE WAY

IN RADIO • IN TELEVISION • IN ELECTRONICS

RCA Manufacturing Co., Inc., Camden, N. J.

# INSTANTANEOUS SOUND-RECORDER WARTIME SERVICE

By **ALFRED A. GHIRARDI**

Advisory Editor

## PART 4

**T**HE accompanying guide is intended to serve as a helpful summary, and Service Man's guide for quick reference to acquaint him with the various common recording troubles and to teach him to recognize them by their visual and aural symptoms. It also presents the various effective remedies for them. It applies in a general way to all types of "semi-professional" and "home" recording equipment. Of course, special troubles common to specific models of recorders, and special adjustments to be made in these recorders can best be learned by referring to the manufacturer's service sheets covering them.

### TYPICAL RECORDING TROUBLE SYMPTOMS, CAUSES, AND REMEDIES

#### No Sound on Playback

- (1) Check amplifier and loudspeaker operation by playing "radio" if one is provided. Otherwise, check microphone, amplifier and speaker operation by speaking into microphone, with speaker connected to amplifier output.
- (2) If microphones, amplifier and speaker are okeh, check playback pickup, switch and wiring operation by playing a good commercial record.

#### Weak Playback

- (1) Check microphone, amplifier, speak-

er and playback as above. Correct any defective unit.

- (2) If these units are all right, and a commercial record plays back with good volume, cut a test record at normal recording "level." If the stylus cuts quietly and the blank is good it is likely that a good record will result and that insufficient volume recording "level" was being used in the previous recordings. If weak playback is experienced on the test record just cut, check the recording head. The output of some types of recording heads decreases with age.

#### Excessive Surface Noise

- (1) See that good grade recording blanks are being used. Blanks that contain grit, uneven recording surface, surface scratches, etc., are unsatisfactory.
- (2) Dust on records. Clean thoroughly.
- (3) Wrong stylus cutting angle.
- (4) Worn or defective stylus. Examine under magnifying glass. Try new stylus.
- (5) Too much weight in the playback pickup.
- (6) Too much room noise when recording was done. Cut another record under better conditions.
- (7) Record was cut at too low a volume level, making it necessary to use excessive amplification on playback. Make a test out on center of the blank and play back.
- (8) Noisy amplifier due to leaky condensers, defective resistors, noisy tube, loose connection, or run down batteries.
- (9) Shavings hitting the stylus during recording.

#### Stylus Hiss, or High-pitched Squeal

- (1) Wrong stylus vertical angle. Re-adjust slightly.

- (2) Dull or defective stylus.
- (3) Blanks used are too hard for ready cutting.

#### Amplifier Squeal or Acoustic Howl

- (1) Leaky condensers in amplifier.
- (2) Faulty tubes (worn out, defective, microphonic).
- (3) Run down batteries (in battery-operated amplifier).
- (4) Acoustic feedback between microphone and speaker.
- (5) Mechanical feedback when recording head and loudspeaker (as monitor) are operated simultaneously.

#### Tone Thin (flinny, high-pitched, reedy, raspy)

- (1) Wrong stylus vertical angle; re-adjust.
- (2) Dull or defective stylus.
- (3) Over-equalization of the high frequencies.
- (4) Poor overall low-frequency response.
- (5) Improper microphone placement.
- (6) Excessive depth of cut, putting too great a load on motor during recording, and slowing it down. Check turntable speed with stroboscope disc while recording. Reduce stylus pressure for less depth of cut.

#### Distortion (Ragged Reproduction)

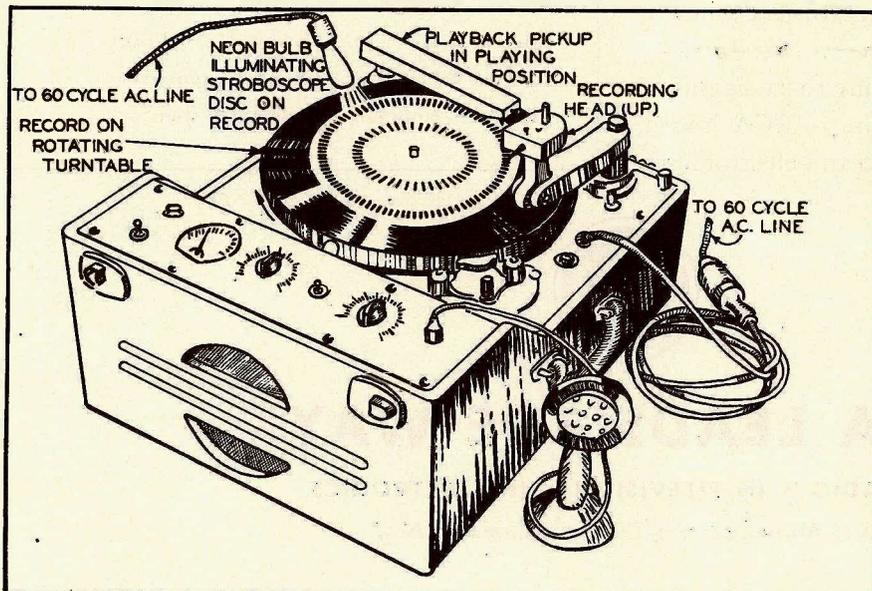
- (1) Instrument not properly grounded.
- (2) Check audio equipment for usual causes of distortion.
- (3) Check for defective stylus, or improper adjustment.
- (4) Check recording head (if magnetic) for off-center armature.
- (5) Recording at too high a "level," causing overmodulation of grooves.
- (6) Running amplifier too near its peak undistorted output point.
- (7) Often caused by speaking too close to the microphone, or shouting. Speak into the microphone in a natural tone of voice, keeping the microphone between 6 inches and 18 inches away from your face. If it is necessary to raise your voice, move away from the microphone. In recording a group of singers or musical instruments, care must be taken to place the various members of the group at the proper distances from the microphone, otherwise certain instruments or voices will predominate. The proper balance is best obtained by listening to the group on a loudspeaker placed in an adjacent room where the direct sound can not be heard. Make the record only after the proper balance has been obtained.
- (8) Cutting too near center of disc.
- (9) Discs recorded on another recorder and being played back on a different machine which has special frequency compensation matched to its own recorder. In such cases, discs should be played back on the machine they were recorded on.

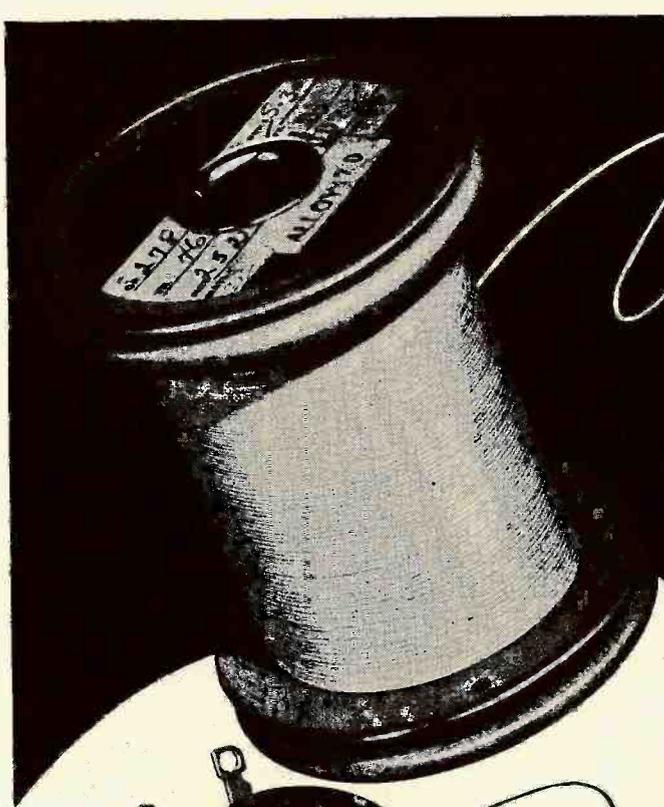
#### Over-Emphasis on Certain Instruments

- (1) Sound waves of instrument resonating mechanically with some part of record-

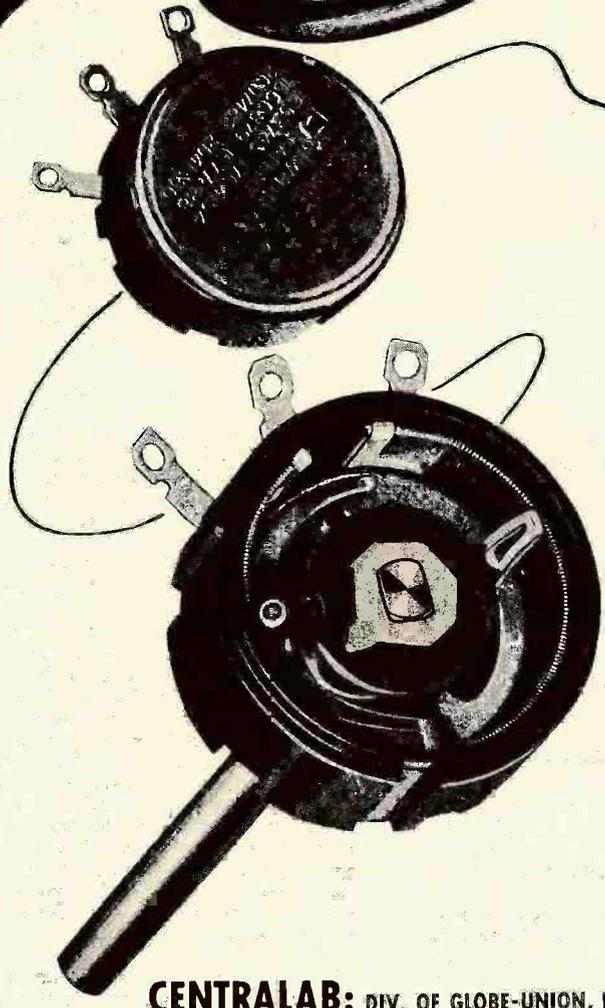
(Continued on page 18)

Fig. 1. Checking turntable speed with stroboscope disc illuminated directly by light from a neon.



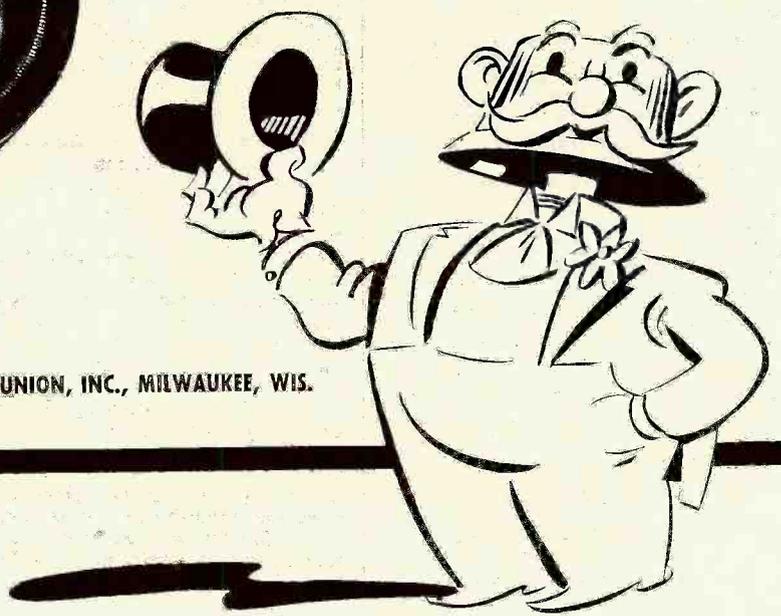


# Wire Wound Radiohms by Centralab



Our Army, Navy and Air Force is using electronic equipment in which Centralab Wire Wound Radiohms play an important part. Available in single or tandem type . . . with or without switch . . . for use as potentiometer or rheostat . . . in resistance values up to 10,000 ohms, Total rotation 300°. Switch type requires 40° for switch throw. Linear taper only . . . rated conservatively at 3 watts . . . temperature rise of 100 ohm unit is 28°C. at 3 watts, 40°C. at 4 watts . . . with load carried over total resistor.

**CENTRALAB:** DIV. OF GLOBE-UNION, INC., MILWAUKEE, WIS.



"HOT OFF  
THE PRESS"

# SYLVANIA SERVICEMAN SERVICE

by  
**FRANK FAX**



As you know, we've been busy revising and improving our technical data to help you keep radios informing and entertaining the home front.

Hot off the press is a new revised edition of the Technical Manual on Sylvania Radio Tubes. This is the basic up-to-the-minute stuff—in detail. You'll want it just as much as the Correlation for Substitution Chart, the Characteristics Sheet and other free technical helps. I can recommend it even to those who already have earlier editions of the same publication.

For only 35 cents you get 275 pages of technical "know how." More than 400 types of tubes—their characteristics, operating conditions and circuit application—are covered. In addition, there are definitions, typical circuits, charts, graphs and illustrations.

Before you send for it, you might take a look at what is offered below. Maybe your jobber was unable to supply you with this or that free technical or sales help. For a full shipment, write to Frank Fax, Dept. S-I, Sylvania Electric Products Inc., Emporium, Pa.

#### WARTIME PROMOTION ITEMS



A winner of the 1942 American Direct Mail Association Contest for the best wartime jobs.

- |                         |  |
|-------------------------|--|
| 1. Blackout button      | hints for the housewife                          |
| 2. First aid index      | 5. Air raid precautions folder and window poster |
| 3. War Bond poster      | 6. Direct mail letter                            |
| 4. Radio and caretaking |  |

#### REGULAR ITEMS

- |  |  |
|--|--|
| 1. Window displays, timely window streamers, etc. (From your Sylvania jobber only) | 14. Technical Manual—New Revised Edition (35c) |
| 2. Electric clock signs  | 15. Tube base charts                           |
| 3. Electric window signs   | 16. Price cards                                |
| 4. Outdoor metal signs   | 17. Sylvania News                              |
| 5. Window cards  | 18. Characteristics sheets                     |
| 6. Imprinted match books   | 19. Interchangeable tube charts                |
| 7. Imprinted tube stickers   | 20. Tube complement books (35c)                |
| 8. Business cards  | 21. Large and small service carrying kits      |
| 9. Doorknob hangers  | 22. Service garments                           |
| 10. Newspaper mats   | 23. 3-in-1 business forms                      |
| 11. Store stationery   | 24. Job record cards (with customer receipt)   |
| 12. Billheads  |  |
| 13. Service hints booklets   |  |

**SYLVANIA**  
ELECTRIC PRODUCTS INC.  
RADIO TUBE DIVISION  
Formerly Hygrade Sylvania Corporation

(Continued from page 16)

ing equipment. Move recorder to room isolated from sound to be recorded.

- (2) Poor equalization.
- (3) Poor regulation in the amplifier power supply.
- (4) Incorrect bias.
- (5) Amplifier operating too near its peak undistorted power output.
- (6) Recording head setting incorrect.

#### "Echoes," "Ghosts"

- (1) Poor grade recording blanks that are too soft.
- (2) Recording at too high a volume level, leaving too thin a wall between grooves and resulting in reproduction from adjacent groove.

#### Hum (60- or 120-cycle)

- (1) Connect earphones or speaker across recording head. If hum is heard, check amplifier for faulty filter, poor regulation of power supply, pickup from adjacent power lines, chassis not grounded, etc.
- (2) If hum is not heard in foregoing test, hum is due to turntable rumble or vibration. Refer to "Turntable Rumble" here.

#### Excessive Vibration

- (1) Remove turntable. Check all shock absorber mountings for free movement.
- (2) Inspect turntable rim and driving wheel for visible damage.
- (3) Bent motor shaft.

#### Turntable Rumble

- (1) Make certain turntable is at fault by disconnecting recording head leads and recording a "silent" record. Now play it back. If rumble is present, check as follows:
  - (2) Make sure recording head is free to move on its pivots without binding, or excessive play.
  - (3) Check for drive wheel slippage (if turntable is rim-drive type).
  - (4) Make sure all moving parts requiring lubrication are lubricated.
  - (5) Check all shock absorber mountings for free movement.

#### Flutter

- (1) "Flutter" is evidenced by a ripple or flutter in the playback reproduction. Stylus digs into record material. In this event record will have a herringbone pattern across its face. Adjust vertical angle setting of stylus.

- (2) Recording head or arm loosened in its pivots or hinges, permitting sidewise motion of the head. Grasp head between thumb and forefinger and move it from side to side to ascertain whether there is any looseness or play. Take up all play so head can move freely up and down, with no play or wobble from side to side.

#### Waver or "Wow" in Pitch of Musical Tones

("Wows" usually are evidenced by a "wavering" in the reproduced sound. The recordings will have a wavering, unsteady sound, particularly on sustained musical notes. "Wows" are troublesome mostly when making musical recordings because sustained notes are present most frequently in such recordings. For example, a sustained piano note will sound like that of a guitar.

"Wows" are commonly known to be caused by variations in the turntable speed due to mechanical causes. But they may also be caused by conditions which produce a varying depth of cut, since this causes a varying intensity in volume level.)

- (1) The "wow" may be caused by variation in output level due to badly warped recording blanks, or to variations in hard-

ness and softness over the surface of inferior grades of blanks. Cut a "fresh" flat blank, and play it back to check this possibility.

- (2) Check also for a worn or oversized center hole in the record.

(3) The blank may have slipped during recording because the offset depressable or removable pin on the turntable was not engaged with the offset hole on the record while cutting.

- (4) "Dampener" bearing against recording head with too much pressure during recording.

(5) The more common causes of "wow" are due to momentary variations in the turntable speed. These may occur only during cutting of the record, or both during the cutting and the playback. In either case, they will appear in the reproduced sound. To determine whether the "wow" is actually cut into an instantaneous recording, or whether a variation in turntable speed exists during all functions of the turntable, play an especially selected commercial piano record known to be entirely free from "wow." If this record plays satisfactorily but "wow" is noticed in playing instantaneous recordings made on the same instrument, this gives evidences of some mechanical fault in the turntable and drive mechanism.

(6) The various types of turntable speed variation usually fall under two distinct classifications—*variation synchronized with the turntable rotation*, and *intermittent variation*. Consequently, diagnosis is simplified if the trouble is immediately classified.

#### (a) Synchronized Speed Variation:

If the "wow" is noticed to occur regularly once per turntable revolution, it indicates that a dent or other irregularity is present in the rim of the turntable (for rim-driven turntables). Running the finger tips lightly over the inside surface of the turntable rim will reveal any irregularity sufficient to cause "wow." This surface does not necessarily have to be perfectly smooth, as the effect of minute irregularities are absorbed by the rubber rim of the drive wheel. As a badly warped record, or oversize center hole may also cause this symptom, they should be checked for.

If the "wow" appears regularly more than once per turntable revolution, it indicates a bump, flat spot, or warp in the rubber rimmed drive wheel.

#### (b) Intermittent Speed Variation:

If the "wow" does not occur at any regular intervals, it may be caused by the turntable not being level; by something dragging on the motor drive shaft, turntable or spindle; by "binding" the lateral feed screw bearing; by slippage or binding somewhere on the driving mechanism (especially during recording, when greater power demand is being placed upon the driving source due to work involved in cutting the record groove). In recorders employing a synchronous motor, line voltage much below the normal 110 volts may result in the motor not developing enough torque to pull into synchronism.

Remove all record shavings and other dirt particles that may have gotten anywhere under the turntable and around the cutting feed screw worms, threads and bearing, as such foreign material may interfere seriously with smooth operation of this mechanism. Also check for any "binding" of the cutting feed screw.

If turntable is friction-driven, check for worn or oily ("slick") rubber

rimmed idler or drive wheels, or insufficient tension in idler wheel tension spring. "Slick" rubber rims may be cleaned with carbon tetrachloride and renewed with sand board. Use fine grade emery paper on inside rim of turntable. In some types of machines, the driving motor suspension screws must be loosened, and the entire motor mounting shifted. Thus the pressure of the motor pulley against the rubber idler is sufficient to drive the table with enough torque so that a heavy pressure of the thumb against the rim of the table is required to stop it. When the correct adjustment is obtained the screws should be tightened. If gear driven, clean out motor and gears and lubricate all moving parts to prevent binding. Also check the cutting feed screw bearing for excessive end play, or binding. Check turntable by applying pressure with thumb against the rim. If it stops easily, excessive slippage of driving or idler wheels—or excessive binding of wheel shafts or gears—is responsible. The torque should be such that a heavy pressure of the thumb against the rim is required to stop the turntable.

See to it that no wire leads from the recording arm or head drag on the turntable as this will produce an intermittent braking effect.

If the recorder has been stored in a cold location, or just brought in from cold outdoors, allow it to warm up to room temperature so that the lubricating oil will warm and thin enough to reduce the load to normal.

Use a stroboscope disc to set the turntable to proper speed (while cutting a record) and constancy as explained later, after making all necessary repairs or adjustments.

#### **Jerky, Intermittent Recording**

- (1) Loose stylus. Tighten stylus screw.
- (2) Collapsed armature in magnetic type recording head. If of single-action type (single coil and armature) remove stylus screw and cover from head and inspect to see if armature is leaning over to one side. Place a stout steel "keeper" across magnet and remove magnet from recording head, taking care to keep keeper across magnet. Slightly loosen screws holding damper housing and shift this housing slightly to left or right until armature is centered between pole pieces. Tighten screws. Replace magnet and holding strap remove keeper, and replace cover and stylus screw.

#### **"Muddled" Recording in One Groove**

- (1) Feed driving segment or split nut not properly engaged with thread of cutting feed screw at beginning of recording. Teeth of segment or nut engaged only with top of thread of feed screw at first, and after a few revolutions they fall into perfect mesh, with result that it falls back one groove, and the previously modulated groove gets modulated again. This causes "muddled" recording in this groove.

#### **Cutting Stylus Stays in Single Groove, Cutting Through Disc Coating**

- (1) Cutting feed mechanism not engaged properly for feeding recording head laterally across disc. Likely due to driving segment or split nut failing to engage with thread of cutting feed screw. Cutting stylus breaks into adjacent groove.

#### **Playback Pickup Repeats a Single Groove on the Record**

- (1) Thread from recording stylus be-



## **THE CONDENSERS YOU NEED**

*When You Need Them*

You can handle 90% of all dry electrolytic condenser replacements with Sprague ATOM Midget Drys and Sprague El Prong-Base Drys. They fit anywhere. They're more dependable than the big condensers they replace. Equally important, your Sprague jobber has them in stock in a full line of voltages and capacities, as well as in dual and triple combinations.

Speed up your work—insure greater customer satisfaction by using Sprague ATOMS on every job!

SPRAGUE PRODUCTS CO., North Adams, Mass.

# **SPRAGUE ATOMS**

*"Mightiest Midgets of All"*

came entangled under the cutting stylus, lifting it from the disc and causing it to break into adjacent groove. Watch the thread carefully and brush it to the disc center more often.

- (2) Pickup arm not "free" in its movement.

(3) Pickup cartridge not of sufficiently high compliance to properly track the comparatively soft instantaneous records.

#### **Playback Needle "Skates" Across Record**

- (1) If the playback needle does not stay in the groove, it may be so worn that the point is too large to fit properly in the groove. This condition can usually be detected by bad quality of the reproduced sound (distortion). Replacing the reproducing needle will clear this up.

(2) Groove was not cut deep enough. Inspect grooves under a 20 power magnifying glass. When groove is not deep

enough, ratio of width of "land" to width of groove will be much greater than correct 40:60 value. This proportion is naturally subject to slight variation. Depth of cut may be increased by adjusting pressure spring to increase the pressure on recording head.

(3) Groove not cut deep enough because recording head does not have free up-and-down motion. Lift head up and down by picking it up by stylus screw with forefinger. If movement is sluggish, loosen the pivots.

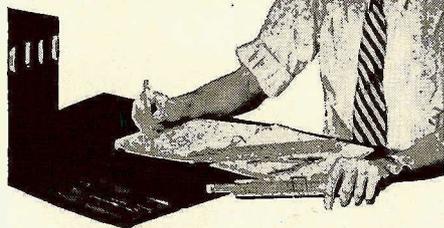
- (4) Playback arm binds.
- (5) Turntable is not level.

#### **Records Wear Rapidly**

- (1) Poor quality blanks used.
- (2) Pickup unit too heavy or too stiff.
- (3) Pickup arm not free in its mounting.

*(Continued on page 20)*

## Can You Use These Radio Tools?



CREI Technical Training Equips You  
With the Ability to Go After and Get a

### NEW RADIO JOB!

These "tools" are the symbol of the trained radio engineer. Knowing how to use and apply them as a radio engineer is an important part of the training you enjoy as a CREI student . . . and an indication that you are equipped for the better-paying jobs that lead to secure futures in all branches of radio.

In this practical radio engineering course, you learn not only *how* . . . but *why*! Your ability to solve tough problems on paper and then follow up with the necessary mechanical operation is a true indication that you have the *confidence* born of *knowledge* . . . confidence in your ability to get and hold the new, better radio jobs that are crying for good, well-trained technical radiomen *today*.

#### Here is what the typical CREI student has to say:

"Being employed in the radio industry at the time of my enrollment, I had constant opportunities to apply my training to my daily work, with gratifying results both to myself and my employer."  
39-29-12—H. B. SEABROOK, Station CJOR

"I have been helped by the course far beyond my expectation and the lessons have been particularly timely for me."  
42-9-5—K. M. HOLLINGSWORTH,  
General Electric Co.

#### • WRITE FOR FREE 32-PAGE BOOKLET

If you have had professional or amateur radio experience and want to make more money — let us prove to you we have something you need to qualify for a better radio job. To help us intelligently answer your inquiry — please state briefly your background of experience, education and present position.



#### CREI Students, Graduates—ATTENTION!

The CREI Placement Bureau is flooded with requests for radiomen. Employers in all branches of radio want trained men. Your Government wants every man to perform his job, or be placed in a job, that will allow him to work at maximum productivity. If you are or will be in need of re-employment write your CREI Placement Bureau at once.

## CAPITOL RADIO ENGINEERING INSTITUTE

Home Study Courses in Practical Radio  
Engineering for Professional Self-Improvement

Dept. S-1 3224 — 16th Street, N. W.  
WASHINGTON, D. C.

Contractors to the U.S. Signal Corps—U.S. Coast Guard  
Producers of Well-trained Technical Radiomen for Industry

(Continued from page 19)

(4) Poor grade of playback needles used.

#### "Spoked Wheel" Effect on Record (breaking up of the "highs")

(1) An a-c ripple either from too high a hum level in the amplifier, or by actual mechanical coupling from the motor.

(2) Unbalanced motor armature or a bent motor shaft.

#### Turntable Speed Too Low

- (1) Motor trouble.
- (2) Line voltage fluctuations.
- (3) Old or damaged cutting stylus.
- (4) Dry (old) or inferior blanks.
- (5) Too much, or too little, pressure by motor spindle against idler wheel.
- (6) Drive or idler wheels slipping.
- (7) Excessive friction caused by lack of oil in any of the movable parts.

#### Checking Turntable Speed with Stroboscope

Turntable speed should be checked for the correct  $33\frac{1}{3}$  or 78.26 rpm value with a stroboscope disc illuminated directly by light from a neon tube energized from the 60-cycle line, as illustrated in Fig. 1.

In using the stroboscope disc, always place a normal load on the turntable so that normal operating conditions are simulated while checking the speed. When checking recording speed place the stroboscope disc on *top* of the recording disc that is on the turntable, and lower the cutting stylus to the "cutting" position on the outer portion of record in the usual way. When checking playback speed, lower the playback needle into place on the outer grooves of the record instead.

Most stroboscope discs have an inner set of 92 radial black segments to indicate the 78.26 rpm speed, and an outer set of 216 black segments to indicate  $33\frac{1}{3}$  rpm speed when illuminated by a light that flashes 120 times per second.

With the turntable in motion and the stroboscope disc in place with the neon light shining on it, the speed may be judged as follows:

(1) If *inside* set of segments of disc appear to be *stationary*, turntable speed is exactly 78.26 rpm.

(2) If *inside* segments appear to *move in the direction of rotation* of the turntable, the turntable speed is *faster* than 78.26 rpm and the proper adjustment should be made.

(3) If *inside* segments appear to *move against the direction of rotation* of turntable, the turntable speed is *slower* than 78.26 rpm; adjust.

(4) If they move so slowly (in either direction) that their movement is easily followed with the eye, the turntable speed is not more than about 3 rpm off the 78.26 rpm standard speed. This error is allowable in ordinary recording and reproducing.

(5) If the outside set of segments

appear to be stationary, the turntable speed is exactly  $33\frac{1}{3}$  rpm.

(6) Movement in the *same* direction as that of the turntable indicates a faster speed; movement *against* the direction of the turntable indicates a *slower* speed. Adjust.

#### Lubricating the Recorder

All rotating parts of a recorder must rotate smoothly without indication of variable or excessive friction. Periodic lubrication is necessary. It is best to refer to the service sheets of the manufacturer for specific lubrication instructions for any recorder. In the absence of these, the following general instructions and visual inspection of the recorder mechanism itself to determine which parts have previously been lubricated and also which of these have had grease or vaseline and which a light oil, will be helpful.

The turntable should be removed first. The main turntable bearing usually requires lubrication with white vaseline. The motor bearings usually require a few drops of light oil once every few months. Do not oil the motor too much, as too frequent oiling of most home-recorder motors eventually causes trouble in the motor windings. The turntable shaft worm and gears usually require white vaseline.

The idler wheels on many recorders are equipped with Oilite bearings and require only a drop or two of light oil. Care should be taken in oiling to prevent the oil from coming in contact with the rubber rims on the wheels. Always wipe off all excess oil so it does not eventually find its way to the rubber rims.

A general lubrication service is usually necessary on all of the bearings and engaging surfaces of the cutting feed mechanism. Vaseline or light oil is usually employed, wiping off all excess to prevent the later accumulation of dust.

The pivot bearings on the recording head and arm, and on the pickup arm should be lubricated occasionally with a drop of oil. Oiling and other lubrication is essential, but use all lubricants sparingly. Too much oil or vaseline is just as bad as too little because it will accumulate abrasive dust, dirt and shavings later. Keep all moving and engaging parts clean and free of dust, dirt and shavings always.

#### RCA RP 160

*Jams, continues tripping, etc.:* Replace trip lever and trip cam pawl. With mechanism apart to replace lever, check the shaft that lever turns on to see that it is perpendicular to base it is riveted to. If lever has too much play, shim at C washer end with thin washer.

Al Knuckiner

# NEW PRODUCTS

## R.C.P. CATHODE-RAY OSCILLOSCOPE

Radio City Products Company, Inc., 127 W. 26th Street, New York City, has announced a cathode-ray oscilloscope, model 555. The oscilloscope uses a 5" cathode-ray tube operating on 2,000 volts. Maximum d-c voltage at input terminals of amplifier is 600 volts and direct to deflection plates 500 volts, rms. Input resistance is 3 megohms. Frequency response is  $\pm 3$  db from 20 cycles to 2 megacycles. Voltage gain is approximately 275 times. Ultra wide



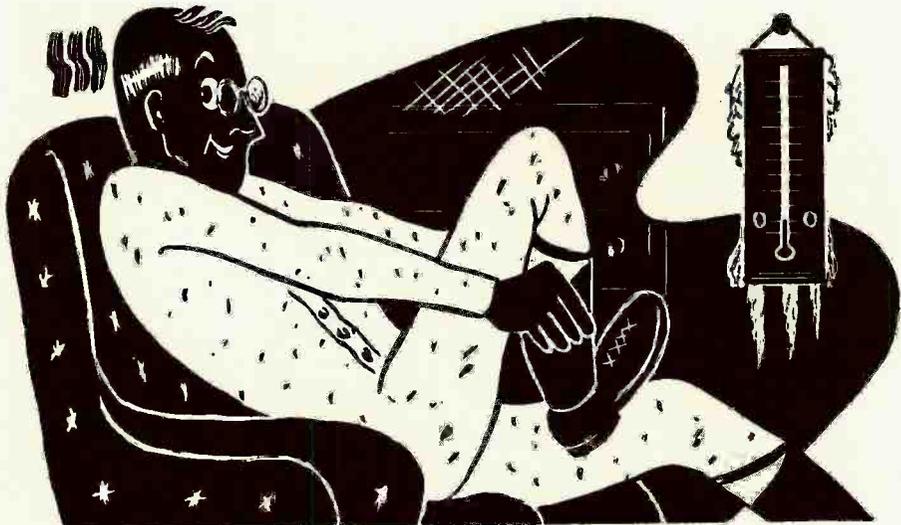
frequency range of sweep signal generator from 30 cycles to 350 kc; linear from 50 cycles. Unknown peak input voltage can be read on a direct indicating multirange voltmeter. Instrument operates from stand- and 115 to 230 volt, 50 to 60 cycle a-c power supply.

Model 555 is housed in a black crackle, non-corrosive, steel case, 14" high, 12" wide, and 19" deep with convenient carrying handle.

Further details may be obtained from the manufacturer.

## TALK-A-PHONE INTER-COMMUNICATION SYSTEM

A new line of inter-communication systems are announced by Talk-A-Phone Mfg. Co., 1203 W. Van Buren St., Chicago, Ill. Among the features of one of the units is "Conference Traffic Control." This permits a number of stations to hold a private conference without interruption of eavesdropping from other stations outside of the conference group. When one of the conference group is being called, he is sig-



## "Sure, I'd Rather Wear Shorts..."

★ ... certainly, I'd rather have the house heated to 75, but if those fighting planes need the oil, I'll do with less."

★ That's the patriotic attitude your customers will take if you explain how the armed forces need radio parts. They'll be grateful you got their sets into operation; willing to accept that occasional repair job that might be a little less than perfect.

★ For, there will be jobs where the shortage of duplicate replacements will make it necessary for you to improvise, in order to get a set operating at all. This will be most frequent with those 8-10-12 year old sets coming to your shop today.

★ To improvise efficiently—to know what sections of a set can be eliminated, what parts can be substituted for—you must have complete information on what's in the set.

★ That's where Rider Manuals help you. They guide you quickly to the cause of receiver failure and furnish the data necessary for a quick repair.

★ Don't waste time guessing out defects and experimenting with "possible" ways to improvise repairs. Reach for one of your thirteen Rider Manuals when you begin every job. It's your duty today to service more sets—"Keep 'em playing" in more homes.

### RIDER MANUALS

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

### OTHER RIDER BOOKS YOU NEED

The Cathode Ray Tube at Work.....\$3.00  
 Frequency Modulation..... 1.50  
 Servicing by Signal Tracing..... 3.00  
 Meter at Work..... 1.50  
 Oscillator at Work..... 2.00  
 Vacuum Tube Voltmeters..... 1.25  
 AFC Systems..... 1.25

★ HOUR-A-DAY-WITH-RIDER SERIES—on "Alternating Currents in Radio Receivers"—on "Resonance & Alignment"—on "Automatic Volume Control"—on "D-C Voltage Distribution," 30c each

### JUST OUT!

★ A-C CALCULATION CHARTS—Two to five times as fast as a slide rule—and more fool-proof. All direct reading—operative over a frequency range of from 10 cycles to 1000 megacycles. 160 Pages—2 colors—9 1/2 x 12 inches.....\$7.50

### FOR EARLY PUBLICATION

★ Inside the Vacuum Tube—complete elementary explanation of fundamentals of vacuum tubes.

★ **John F. Rider Publisher, Inc.**  
 404 Fourth Avenue, New York City  
 Export Division: Rocke-International Electric Corp.  
 100 Varick St., New York City Cable: ARLAB

## YOU NEED ALL THIRTEEN RIDER MANUALS TO "CARRY ON"

nalled by a light so that he knows that the call is waiting. Working in conjunction with the Traffic Control is the "Busy Signal Light." This light is illuminated when the line on another station is busy. It remains lighted until that station is ready for a new conversation.

Other new features include "Uni-Trans" or one way automatic transmission, especially effective for the dictation of letters and the complete recording of conferences. When "Uni-Trans" is used, the "Talk-Listen Switch" does not have to be operated.

Units have five watts of power. This unit, known as Super-Chief, is available for from 2 to 10 or 20, 30, 40, 60, 80, etc. stations.

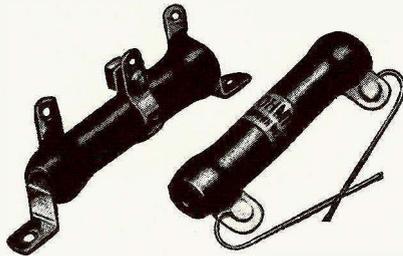
An 8-page catalog is available gratis.

## COMBINATION INSULATOR AND WIRE MARKER

Short lengths of extruded plastic tubing clearly marked with identification symbols are available from Irvington Varnish and Insulator Company, 6 Argyle Terrace, Irvington, N. J.

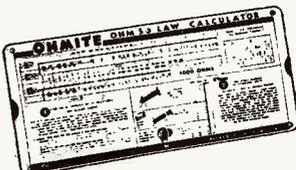
The tubing from which these new combination insulator-markers are made is said to have very high dielectric strength. Smooth inside surfaces permit quick application over wires and lugs. Legible numerals of the customer's choice are printed on the tubing with an ink that has resistance to chemicals, water and oils equal to that of the tubing itself. Available in colored tubing with either black or yellow symbols, in ASTM sizes from No. 9 up to 3/8" I-D.

# OHMITE RESISTORS for Permanent Performance



It's the way Ohmite Resistors are designed and built that makes them so reliable for today's critical service on the war front, and the home front. These sturdy, wire-wound units stay accurate, prevent burnouts and failures—insure permanent performance under the toughest operating conditions from the arctic to the tropics. This is your best assurance in maintaining the service of existing equipment or in developing new devices to defeat the enemy and build for tomorrow's peace.

## Send for These Handy Aids

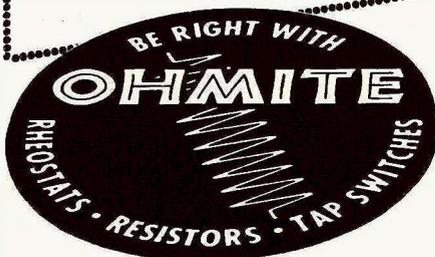


**Ohm's Law Calculator**—Helps you figure ohms, watts, volts, amperes—quickly, easily. Solves any Ohm's Law problem with one setting of the slide. All values are direct reading. Available for only 10c. (Also available in quantities.)

**Quick-Reference Catalog** 18. Free—Gives helpful information on Ohmite stock resistors, rheostats, chokes and tap switches for all types of applications.



Authorized Distributors Everywhere  
Ohmite Mfg. Co., 4877 Flournoy St., Chicago



# NEWS

## SOLAR'S NEW SALES UNIT

To assist their jobbers, the Solar Manufacturing Corporation, Bayonne, New Jersey, has transferred all jobber sales activities to a new subsidiary organization, which will be known as the Solar Capacitor Sales Corporation.

Solar Capacitor Sales Corporation, like its parent company, will be located at Bayonne, New Jersey, and will operate under the guidance of the same management, including W. C. Harter as general sales manager. Syl Wolin as sales manager, and A. Prosdociami as manager of the Export Division.

\* \* \*

## NATIONAL UNION'S HUBER BROTHERS IN SERVICE

Ed Huber, U. S. M. C., former assistant office manager of National Union Radio Corp., Newark, N. J., and brother Sergeant George, formerly manager of N. U. contract department, are several thousand miles apart now. Ed is doing communications work somewhere on a California desert while George sports a Red Cross armband, with the Medical Corps on the African front.

\* \* \*

## MEISSNER AWARDED ARMY-NAVY "E"

The Meissner Manufacturing Company, Mt. Carmel, Illinois, has been awarded the Army and Navy "E" for excellence in production.

Among those who participated in the award were Major W. G. Mee and Major Robert Orr representing the United States Army; Captain Robert Henderson and Lt. Crabtree representing the United States Navy; James Watson, president, and Vincent Rockey of Meissner.



\* \* \*

## KEN-RAD TUBES IN GREENLAND

Ken-Rad tubes are being used in Greenland and doing a good job for the armed forces according to a letter received from an Army sergeant stationed in Greenland by a Ken-Rad jobber.

\* \* \*

## RCA MANUFACTURING MERGED WITH PARENT CORP.

The RCA Manufacturing Company, Inc., has been merged into its parent corporation, Radio Corporation of America. Under this merger the Radio Corporation of America succeeds to all the rights and assumes all the

obligations of RCA Manufacturing Company, Inc. The merger is being effected for purposes of efficiency in corporate organization and it simply means that, instead of continuing as a wholly-owned subsidiary of Radio Corporation of America, the organization of RCA Manufacturing Company, Inc., will continue as the manufacturing division, to be known as RCA Victor Division, Radio Corporation of America. The same personnel will continue.

\* \* \*

## FCC. NEEDS RADIO INSPECTORS

Radio Inspectors are being sought for employment in the Federal Communications Commission. The positions pay \$2,000 and \$2,600 a year, and are located throughout the United States. An inspector's duties include such work as the inspection of radio equipment on ships and aircraft, or at land stations, the making of frequency runs and harmonic analyses, and the examination of radio operators.

No written test will be given to applicants. They will be rated on education and experience as shown in their applications, as soon as possible after the applications are received at the U. S. Civil Service Commission, Washington, D. C. To qualify for Radio Inspector, \$2,600 a year, applicants must have had education and experience as described in one of the following:

(1) full 4-year course in electrical or communications engineering at a recognized college or university, (2) a full 4-year college course with major study consisting of at least 24 semester hours in physics, (3) 4 years of technical experience in radio work, or (4) any time equivalent combination of (1), (2), or (3). Amateur radio experience under a class A license may be substituted for 2 years or less of experience. For Assistant Radio Inspector, \$2,000 a year, only 3 years of this education and experience are required.

In addition to the above, applicants must hold a valid second-class radiotelegraph operator's license, or must demonstrate during the first 6 months of service their ability to transmit and receive 16 code groups per minute in International Morse Code. They must also be able to drive an automobile, as they may be required to do considerable traveling and to drive inspection cars and mobile laboratories.

The examination will be open until further notice, but qualified persons are urged to apply at once. Full information, and application forms, may be obtained at first

# FADA SERVICE DEPT.

has replacement parts for all FADA models manufactured during the last 10 years. Call, write, phone or send 10c for our latest Replacement Parts Catalog.

## FADA OF NEW YORK

30-20 Thomson Ave., L. I. City, N. Y.  
Tel.: IRonsides 6-5400

and second-class post offices, except in regional headquarters' cities where they are available only at the civil service regional offices, or from the U. S. Civil Service Commission at Washington, D. C.

\* \* \*

**BULLOCK NOW KEN-RAD ASSISTANT LAMP SALES MANAGER**

Thomas W. Bullock has been appointed assistant sales manager, in charge of lamp sales of the Ken-Rad Tube & Lamp Corporation, Owensboro, Kentucky.

\* \* \*

**MAC ARTHUR SENDS GREETINGS TO HALLICRAFTERS**

General Douglas MacArthur wired a Christmas message to the Hallicrafters employees commending them for their war effort and asking for their continued support. The message was read over the public address system to all the employees.

\* \* \*

**HIT RELEASES**

New hit record releases have been announced by the Classic Record Co. They include: When The Lights Go On Again; Praise The Lord And Pass The Ammunition; Here Comes The Navy, and Ten Little Soldiers, all recorded by Peter Piper and his Orchestra. Recorded by Emil Davis and his Society Orchestra are: You'd Be So Nice To Come Home To and The Steam Is On The Beam, while releases by Arthur Fields include Der Fueher's Face and Gee But It's Great To Meet A Friend.

\* \* \*

**INSTRUCTORS NEEDED**

There is an urgent need for men and women to serve as civilian instructors in radio at the Army Air Forces Technical School, Sioux Falls, South Dakota. Starting salaries range from \$1620 to \$2600 per annum, depending upon the education and experience of the applicant. Minimum requirements include a high school education (which may be waived in some cases), plus one of the following: (1) Holds, or has recently held an amateur or commercial radio operator's license. (2) One year's experience as radio operator, radio engineer, or radio repairman. (3) Successful completion of a six months' resident course in radio or an ESMDT radio course. (4) One year of college work in a recognized institution.

Applicants who have had at least six months' experience in advanced and difficult radio work, who have taught radio or allied subjects for at least six months or who have a degree in electrical or radio engineering or the equivalent, will qualify for a starting salary of \$2,000. Those with certain additional experience may qualify for a starting salary of \$2600.

For full particulars write to . . . A. A. F. Employment Officer, Army Air Forces Technical School, Sioux Falls, South Dakota.

\* \* \*

**SER-CUITS**

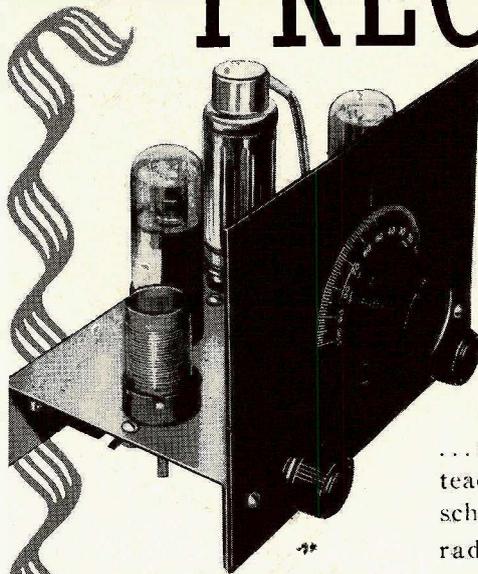
(Continued from page 12)

mary coil to prevent antenna peaking at resonance.

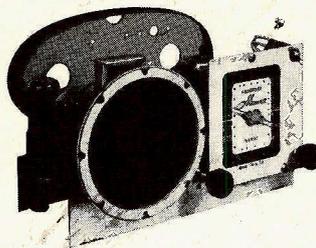
In waveband switching, the oscillator grid and cathode are switched from coil to coil. The plate tickler has been included in one oscillation transformer only and the 100-ohm resistors are in

# PRECISION BUILT

## RADIO SCHOOL KITS!



Front view of three tube assembled kit.

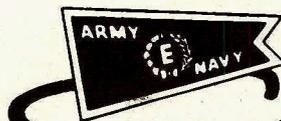


Front view of five tube assembled kit.

... especially engineered for classroom teaching . . . widely used by Military schools for faster and more efficient radio training. Meissner radio kits contain every essential operating part (except tubes). Carefully prepared wiring diagrams assist the student in quicker assembly.

Meissner one, two and three tube kits are ideal for the beginner in classroom work . . . starting with a one tube kit, students can, with the add-on features, construct two and three tube receivers which are available for both AC and DC operation. For the advanced student five, six and nine tube kits are available. Tubes and batteries not furnished with one, two or three tube kits.

For further details see your Meissner distributor or write



*Meissner*

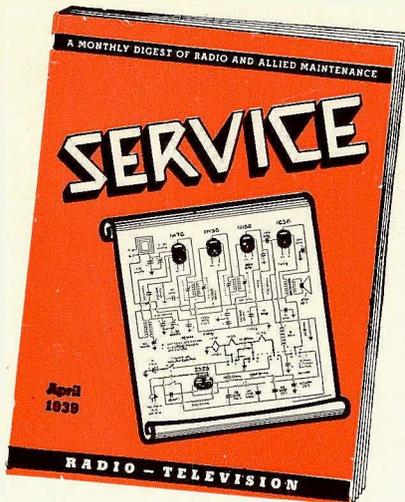
MT. CARMEL, ILLINOIS

PRECISION-BUILT PRODUCTS

series with both grid and plate to flatten the output with frequency variation. The 7H7 translator cathode is directly connected to the 7E6 oscillator cathode for oscillator injection. All translator bypass condensers are returned to the hot cathode. A 47-ohm cathode bias resistor takes care of both tubes although the oscillator derives additional bias from the 22,000-ohm grid leak, of course. One 6SQ7 diode supplies standard avc bias to the i-f stage while the other supplies the 7H7 translator, aided by one of the diodes from the 7E6 oscillator tube. The oscillator diode provides some negative bias due to

electron flow within the oscillator tube, this being independent of the signal amplitude.

In the a-f circuit, we have a 2 meg-ohm volume control with two taps for providing tone compensation and bass and treble boost. A 50 mmfd. condenser is placed across the high end to the high tap section of the control for high boost. This condenser and a .0005 mfd. condenser ties in on the phono-radio switch to cut highs for reduction of needle scratch. The bass boost circuit also operates from the top tap. A bias cell has also been included on the first a-f.



# Geared to the Wartime Needs of Radio Service

SERVICE—19 E. 47th St., N. Y. C.

Please enter annual subscription (12 issues) for each of the undersigned for which payment is enclosed at the rate of \$1.00 each; foreign \$2.00. (This rate applies only on 4 or more subscriptions when occupations are given.)

Name .....

Address .....

City-State .....

Occupation .....

Title (Service Mgr., etc.) .....

Employed by .....

State whether Employer is a Service Organization, Dealer, Jobber or Manufacturer .....

Name .....

Address .....

City-State .....

Occupation .....

Title (Service Mgr., etc.) .....

Employed by .....

State whether Employer is a Service Organization, Dealer, Jobber or Manufacturer .....

Name .....

Address .....

City-State .....

Occupation .....

Title (Service Mgr., etc.) .....

Employed by .....

State whether Employer is a Service Organization, Dealer, Jobber or Manufacturer .....

Name .....

Address .....

City-State .....

Occupation .....

Title (Service Mgr., etc.) .....

Employed by .....

State whether Employer is a Service Organization, Dealer, Jobber or Manufacturer .....

## —When Exact Duplicates are Unavailable

Data prepared by a group of leading receiver design engineers discussing various circuits and procedure necessary for making component substitutions.

## —When even Substitutes are Unavailable

Articles by outstanding engineers from parts companies and laboratories dealing with repairs of components and accessories.

## —When Industrial Electronic Service is Required

Technical discussions by Alfred A. Ghirardi and other engineers who specialize in electronic development—for industry, for control, for protective use.

## —When the latest Data on Circuits are Needed

Henry Howard's circuit analyses each month with diagrams and parts values.

## —Sound—Case Histories—Shop Notes . . . . .



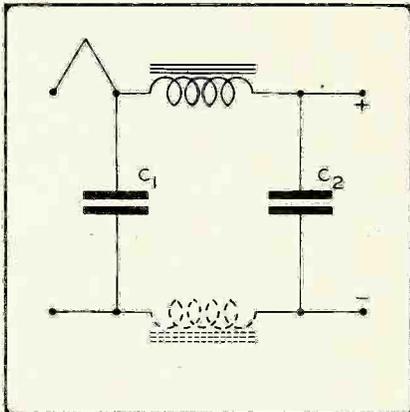
Remember that until further notice the Group Rate (**\$1.00 Yearly instead of the regular \$2.00 Yearly**) is still in effect.

(Continued from page 13)

period of throwing the switch and the warming up of the tubes might be excessive for some of the components. The voltage-current curve of wets allows a rather heavy surge current to flow during the warming up period which tends to hold down the peak voltage, preventing overloading these other components. Wets have a higher power factor than dries. Thus they are not as useful for bypassing action. Shunting them with a small tubular paper condenser will take care of all but audio bypassing jobs.

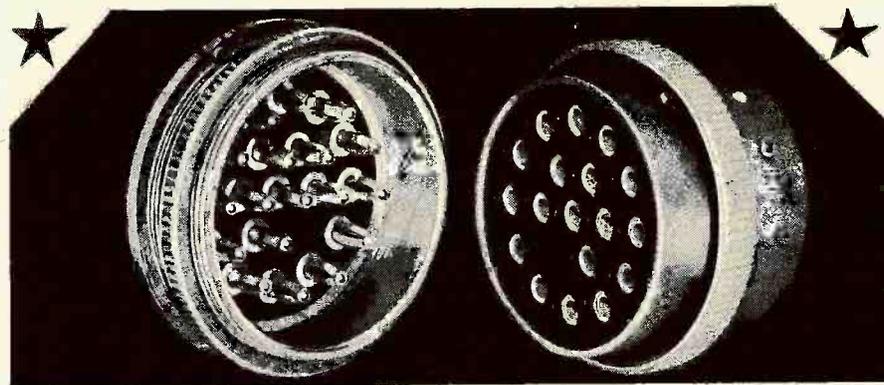
Drys usually have two thin metal sheets, one being coated with an oxide film. Between the sheets is placed one or two layers of gauze which is impregnated with electrolyte; the double gauze

Fig. 1. Common type filter circuit for a-c sets; either common plus or minus.



being for high voltage (600-volt peak). They are wound similar to a paper condenser, in rolls. Any waterproof container may be used; hence, we see metal being replaced with cardboard and plastics. In wets, the metal container acted as the cathode as well as container for the electrolyte but, when used with dries, it had no active purpose. When properly formed, dries have an insulation resistance of many thousand megohms per square centimeter area.

When standing idle, the oxide film will slowly dissolve, the rate depending upon the anode metal, the type of electrolyte and the temperature. The film being thinner, then, the capacity increases and more leakage current will flow until a chemical balance takes place. To restore the original conditions, it is necessary to reform the oxide with a small polarizing current. If a constant capacity is desired, such a polarizing current must flow continually. When a condenser is to be reformed after a long period of idleness, it should be connected to a source of d-c equal to its rated voltage in series with a high resistance; 50,000 ohms or so. This limits



## "Right Down Our Alley"

Contributing to the war effort, Astatic Corporation facilities are being utilized today mainly in the manufacture of essential products requiring special engineering skill and precision. Among these are Air-

craft Radio Plugs and Sockets, as illustrated, along with complete Co-axial Cable (concentric) connectors, and similar equipment for the U. S. Army Air Corps and the Navy. The tooling and assembly of delicate, precision products of this type comes naturally to Astatic workers, long experienced in the manufacture of Microphones and Pickups for radio, public address and phonograph equipment. War-time production of this kind is "right down our alley."

# ASTATIC

## THE ASTATIC CORPORATION

Licensed Under Patent  
Development Co. Patents

YOUNGSTOWN, OHIO

In Canada  
Canadian Astatic Ltd  
Toronto, Ontario

THERE'S A  
**STANCOR**  
TRANSFORMER  
For Every Practical Application!



## STANDARD TRANSFORMER

CORPORATION

1500 NORTH HALSTED STREET . . . CHICAGO

the current that can flow and will prevent overheating. Also, as the film forms, the internal resistance will increase, the current will drop and the actual terminal voltage will rise until, when completely formed, the terminal voltage should be almost equal to the source voltage. The actual resistance used should be inversely proportional to the capacity, or 50,000 ohms for a 10 mfd; 1/2 megohm for 1 mfd. or 5,000 ohms for 100 mfd. When the condenser is almost completely back to its original characteristics, the resistor may be removed, or another of about 1/10 the

value substituted for the final stage of forming. The time involved will depend upon the make, age and condition of the condenser.

If the condenser has been formed at a higher voltage than that used during operation, the capacity will gradually increase. It also increases with temperature. At low temperatures the capacity drops. This accounts for the increase in hum in auto sets during winter months.

It must be accepted that electrolytic

(Continued on page 26)

condensers deteriorate with time as a result of destructive chemical action and, therefore, their life is limited. But the life of cheaper grades of radio sets is also limited and, undoubtedly, many condensers outlast other parts. Premature failure of electrolytics may be due to a variety of causes. It may be due to the manufacturer's carelessness, improper application as well as the customer's ignorance or obstinacy in placing the receiver where, for instance, there may be too much heat. Since we have no control over manufacturing, all we can work on is in application.

Constant overloading in peak voltage or working voltage ruins many units. This usually happens during the warm-up period and is aggravated by high-line voltage and surges of one kind or another. The cure is obvious: use a condenser of higher rating or add a bleeder or voltage divider to hold down the voltage. At least a 10% safety factor should be allowed between the rating and highest voltage expected. Another enemy of electrolytics is high temperature . . . no matter what the source. Many an engineer who knew better has been forced by the powers that be to crowd parts together to fit in a certain size cabinet with little or

Fig. 2. An a-c/d-c filter. May use resistance or choke; either common plus or minus.

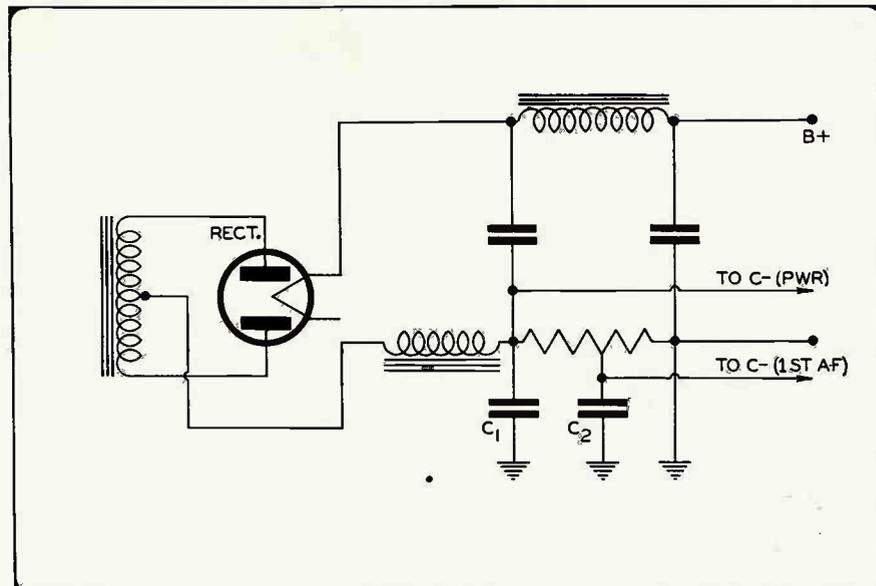
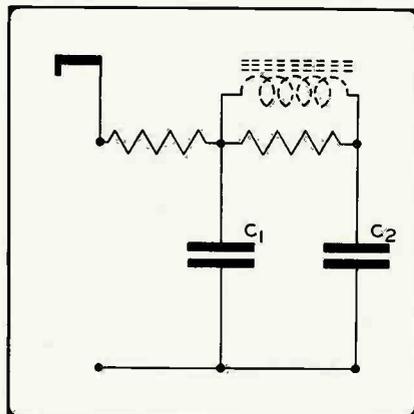


Fig. 7. Large receiver bias bypass system.

no ventilation. Early a-c/d-c sets were notorious for this, and their electrolytics were often gone within a year. The 150 mil series helped this situation considerably, as only about half the wattage had to be dissipated. The combination of high ambient temperature and cheap, leaky containers acts to dry

out condensers so that they gradually quit filtering.

One set of typical specifications for dry electrolytics follows . . .

d-c working voltage	% rated capacity
6 to 90	-10 to plus 100
100-200	-10 to plus 50
over 200, up to 3 mfd.	-10 to plus 50
over 200, over 3 mfd.	-10 to plus 20

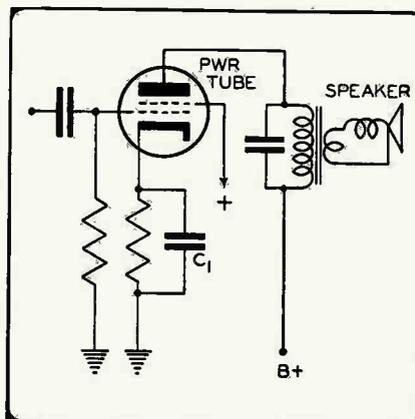
\*Power factor: Not over 10% for single gauze. Not over 15% for double gauze.

Leakage: less than 0.1 ma. per mfd.

We have prepared a chart, A, listing most common applications of electrolytics. In this chart, condensers in circuits shown here, are analyzed. Figs. 1 and 2 deal with the common low-pass ripple filters. In the second section, when used as a bypass condenser as well as a filter, condensers should have a low power

\*See notes on power factor, November SERVICE, M. E. Heller.

Fig. 3. A-F cathode bypass arrangement.



## PROTECTING THE VOICE AND EARS OF OUR FIGHTING FORCES

Lives—Victories—depend on the proper performance of the radio equipment which is the voice and ears of our fighting forces. Army and Navy technicians depend on the same accuracy, dependability and ease of operation which have made the name Supreme famous for over 14 years.

Supreme Radio Testing Instruments keep communications open.

**SUPREME** GREENWOOD, MISSISSIPPI U. S. A.  
TESTING INSTRUMENTS

## WHEN YOU CHANGE YOUR ADDRESS

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

A "LAB" to fit your pocket

Readrite  
RANGER

MODEL  
739

\$10.89

Dealer Net Price



**A.C. D.C.  
VOLT-OHM-MILLIAMMETER**

Pocket Volt-Ohm-Milliammeter with Selector Switch Molded Case. Precision 3-inch Meter with 2 Genuine Sapphire Jewel Bearings. AC and DC Volts 0-15-150-750-1500; DC MA. 0-1-15-150; High and Low Ohm Scales. Dealer Net Price, including all accessories, \$10.89. MODEL 739. DC Pocket Volt-Ohm-Milliammeter. Dealer Net Price.....\$8.25

WRITE FOR CATALOG

SECTION 117 COLLEGE DRIVE

READRITE METER WORKS, Bluffton, Ohio

factor. If it does not have a low power factor and serves well enough as a filter, a paper tubular 0.1 to 0.5 mfd. could be shunted across the electrolytic to get by.

Fig. 3 shows the common type of a-f cathode bypass condenser. In Fig. 4, the screen grid bypass condenser is illustrated. Fig. 5 depicts a "B" filter and voltage dropping "A" supply as used in line-powered portables. Fig. 6 shows the C- and B+ battery bypasses which become more and more important as the batteries get older. With age, their internal resistance rises

which, without the bypassing, would allow high resistance coupling between all the stages. Fig. 7 concerns the "C" supply of large sets which usually have a voltage divider amply bypassed for a-f.

Fig. 8 shows the bypasses that are necessary for a series filament arrangement where a substantial condenser must be used between the power and 1st a-f stages to prevent audio oscillation. The second audio signal must pass through the filament string to return to B- which would cause a common coupling but for the bypassing.

Fig. 4. Screen bypass condenser.

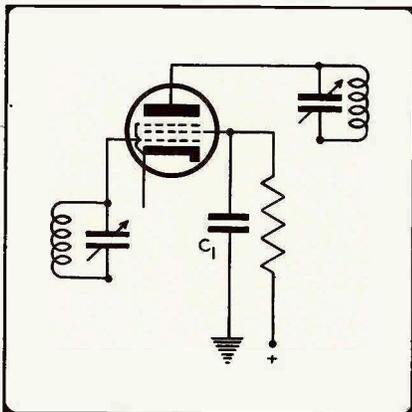


Fig. 5. Filter system for a-c/dc battery portables.

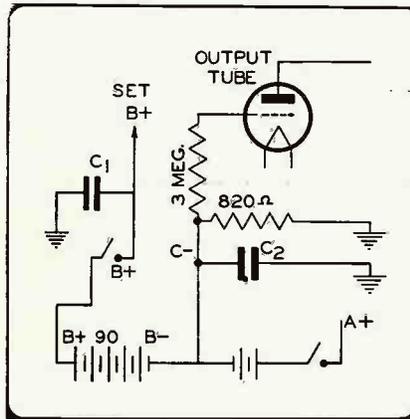
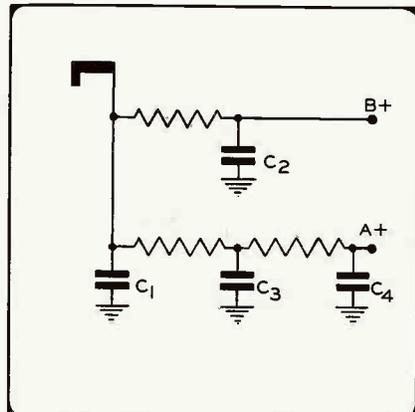
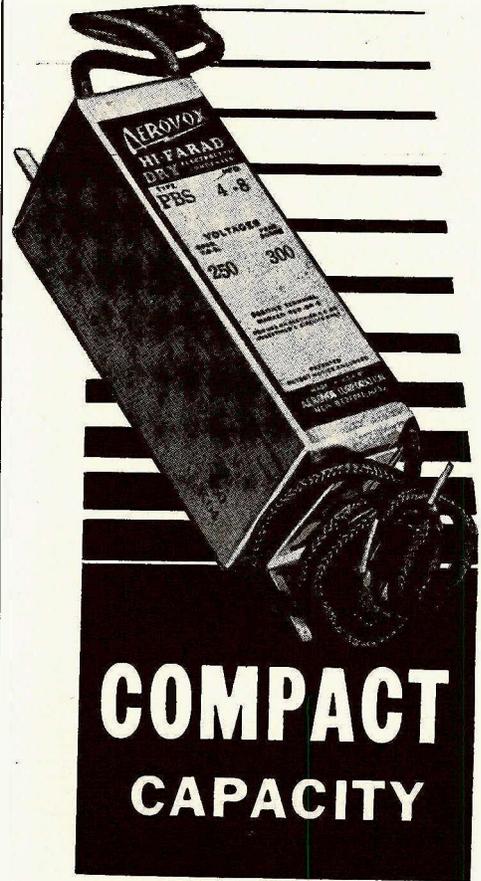
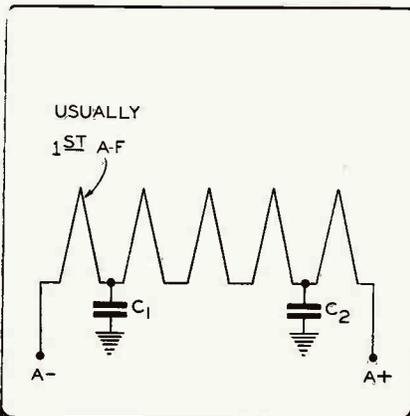


Fig. 6 (top). Battery bypasses. Fig. 8 (bottom). Battery a-c/d-c fil. circuit and a-f bypasses.



**COMPACT  
CAPACITY**

● Priorities and rationing notwithstanding, you can still get high-grade electrolytic capacitance in these Type PBS condensers. Compact dimensions. Sturdy cardboard-case construction. Adjustable metal mounting flanges for single or stacked mounting. Separate polarity-indicating colored leads. Dependable condensers in every way — at low cost.

**CARDBOARD-CASE  
ELECTROLYTICS:**

- 800 v. Surge Peak — 800 v. D.C.W.
- 4 and 8 mfd.
- 525 v. Surge Peak — 450 v. D.C.W.
- 2 to 16 mfd.
- 450 v. D.C.W. Double Section
- 4-4 to 8-16
- 300 v. Surge Peak — 250 v. D.C.W.
- 2 to 30 mfd.
- 250 v. D.C.W. Double Section
- 4-4 to 16-16
- 250 v. D.C.W. Triple Section
- 8-8-8 and 8-8-16
- 150 v. Surge Peak — 100 v. D.C.W.
- 5 and 10 mfd.
- 75 v. Surge Peak — 50 v. D.C.W.
- 5, 10 and 25 mfd.
- 40 v. Surge Peak — 25 v. D.C.W.
- 5, 10 and 25 mfd.

● See Our Jobber . . .

Order these handy PBS Aerovox electrolytics from him. Ask for latest "Victory" catalog. Or write us direct.



QUALITY  
ABOVE ALL...



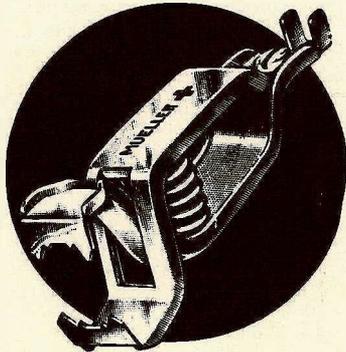
CAPACITORS

DRY ELECTROLYTICS  
WET ELECTROLYTICS  
PAPER CAPACITORS  
MICA CAPACITORS  
"ELIM-O-STAT" SUPPRESSORS  
CAPACITOR ANALYZERS

SOLAR

CAPACITOR SALES CORP.  
Bayonne • New Jersey

MUELLER



CLIPS

ARE ON THE FIRING LINE  
WITH RADIO EVERYWHERE

- Made in 10 sizes—from the tiny wee-pee-wee to the 300 ampere Big Brute
- Offered in both steel and solid copper.
- Red and black rubber insulators to fit each size.
- A complete line with

A CLIP FOR EVERY PURPOSE

Stock deliveries on  
practically all items.

Send for free samples and catalog 810

*Mueller Electric Co.*

1565 E. 31st St. Cleveland, Ohio

## JOTS & FLASHES

ARMY-NAVY "E" to Stromberg-Carlson on January 12 . . . congratulations. . . Fred Somers, 2015 Grand Ave., Kansas City, Mo. appointed district representative for University Laboratories, manufacturers of acoustic reproducers. . . *Ohmite News*, a newsy bulletin, yours for the asking . . . write to Ohmite Mfg. Co., 4835 Flournoy St., Chicago. . . American Institute of Electrical Engineering awards Edison Medal for 1942 to Major Edwin H. Armstrong. . . Detrola Corp., Detroit radio set manufacturers, sold to Strong, Carlisle & Hammond Co. of Cleveland. . . Westinghouse reports orders for war equipment exceeding \$1,000,000 in 1942. . . Ellis Travers appointed director of advertising and public relations by Crosley. . . *Sylvania News* is a monthly bulletin you can't afford to miss . . . write to Sylvania Electric Products, Inc., 500 Fifth Ave., New York City . . . how's the War Bond buying situation . . . hope all you Service Men are maintaining a buying ratio of at least 10% of your income . . . spend a bit of spare time studying up on television . . . looks as if it will be THE big thing right after the war. . . General Electric, Bridgeport, Conn. offers a corking 32-page book called "Electronics" to all accredited Service Men . . . brilliantly written and printed in full color . . . write for your copy. . . Leslie J Woods named vice-pres. and general manager of National Union . . . had been associated with Philco for 20 years. . . Roger M. Wise appointed Director of Engineering at Sylvania . . . congratulations to DeJur-Amsco . . . will be awarded Army-Navy "E" on February 6. . . Service Men—be certain to read the article relative to your draft status in this issue . . . our thanks to the many manufacturers, distributors and Service Men for their thoughtful Holiday Greetings . . . keep 'em playing . . . save your scrap . . . buy bonds.—P. S. W.

\* \* \*

### WANTS EQUIPMENT DATA

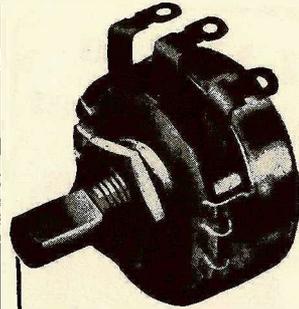
J. C. S. Hellyer, 224 Mayplace Road, Barneshurst, Kent, England, would like to receive data on sound and general equipment.

\* \* \*

### SNAPSHOTS IN SOUND

A recording booth has been placed in the gifts-for-men section at Franklin Simon, one of the leading New York department stores, to provide "snapshots in sound."

These vocal gift-cards are used for mailing with packages to men in the armed services. Printed mailing cartons make it possible to send the recording anywhere. The blanks are manufactured by the Record-Disc Corp., 395 Broadway, New York, N. Y.



50 ohms to  
5 megohms.

★

Choice of taps  
and tapers to  
meet replace-  
ment needs.

★

## Stabilized!

★ The new Clarostat composition element is fully stabilized. The resistance is accurate to begin with. It stays that way in constant usage. Relatively unaffected by humidity, temperature and other climatic conditions. Really dependable. That's why controls with this new resistance element are now found in fine instruments, critical electronic assemblies, and quality radio receivers.

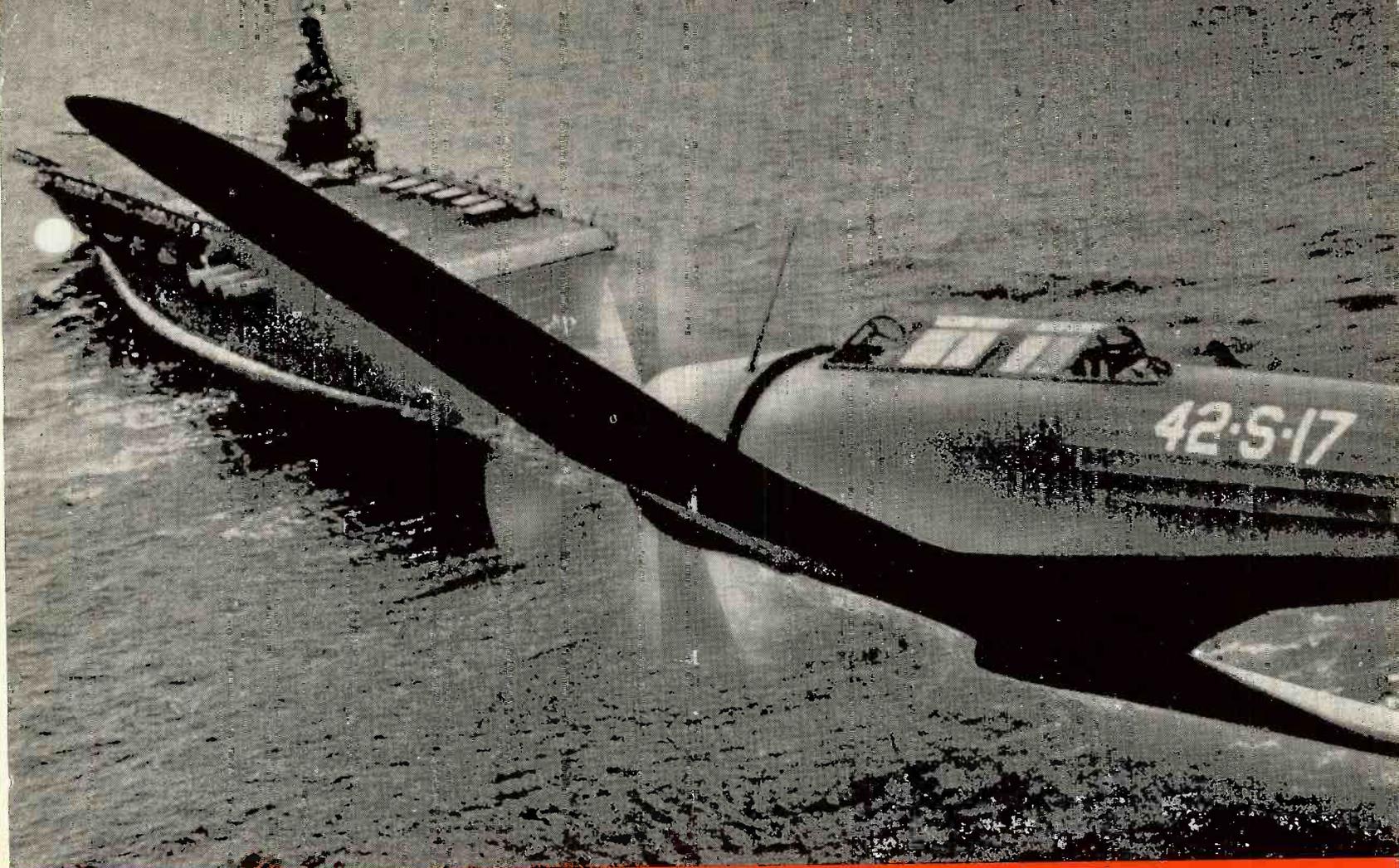
★ Ask your jobber for Clarostat controls!



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

## Index to Advertisers

	A	
Aerovox Corp. . . . .	27	
Astatic Corp. . . . .	25	
	C	
Capitol Radio Engineering Inst. . . . .	20	
Centralab . . . . .	17	
Clarostat Mfg. Co., Inc. . . . .	28	
	E	
Electro-Voice Mfg. Co., Inc. . . . .	11	
	F	
Fada of New York . . . . .	22	
	G	
General Electric . . . . .	3	
	K	
Ken-Rad Tube & Lamp Corp. . . . .	1	
	M	
Meissner Mfg. Co. . . . .	23	
Mueller Electric Co. . . . .	28	
	N	
National Union Radio Corp. . . . .	Back Cover	
	O	
Ohmite Mfg. Co. . . . .	22	
	R	
Radio & Technical Publishing Co. . . . .	4	
RCA Mfg. Co., Inc. . . . .	14, 15	
Readrite Meter Works . . . . .	27	
Rider Publisher, Inc., John F. . . . .	21	
	S	
Solar Mfg. Corp. . . . .	28	
Sprague Products Co. . . . .	19	
Standard Transformer Corp. . . . .	25	
Supreme Instruments Corp. . . . .	26	
Sylvania Electric Products, Inc. . . . .	18	
	T	
Triplet Electrical Instr. Co. . . . .	Second Cover	
	U	
United Transformer Co. . . . .	Third Cover	



## DESIGNED FOR SPECIFIC APPLICATIONS

The bulk of U.T.C. production is on special units constructed to precise customers' requirements. It is naturally impossible to describe all of these thousands of designs as they become available. Many of them are unique.

In most cases, today, a major design factor is the conservation of material, or provision of substitutes for critical materials. All in all, it is significant that the difficult transformer jobs find their way to U.T.C.

MAY WE ASSIST YOU IN YOUR PROBLEM?

U. S. NAVY OFFICIAL PHOTO

# UNITED TRANSFORMER CO.

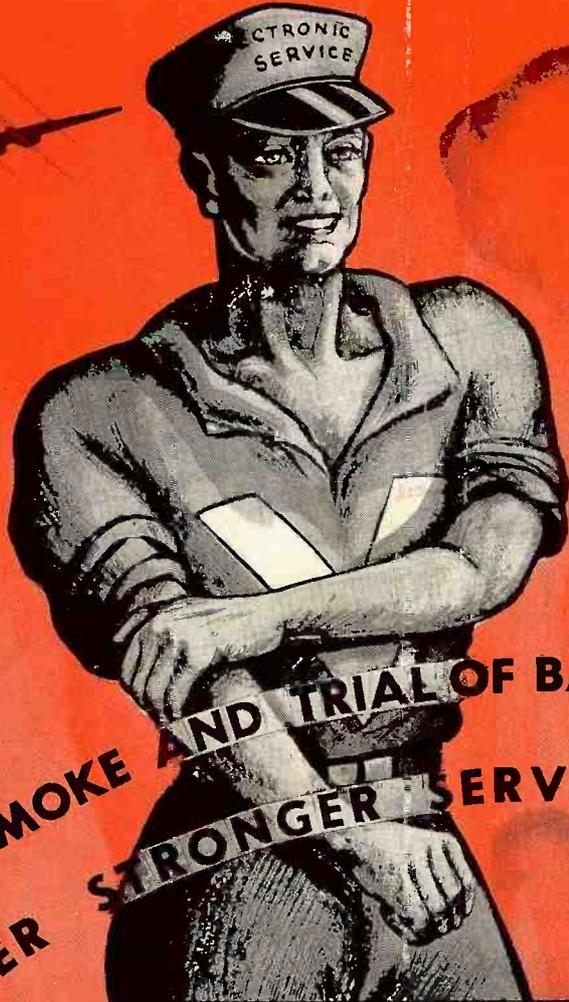
150 VARICK STREET



NEW YORK, N. Y.

EXPORT DIVISION: 100 VARICK STREET NEW YORK, N. Y. CABLES: "ARLAB"

# NATIONAL UNION IS READY TO GREET ELECTRONIC SERVICE MEN



FROM THE SMOKE AND TRIAL OF BATTLE SHALL ARISE  
A GREATER STRONGER SERVICE INDUSTRY

Every ounce of National Union energy is thrown into the battle for victory. Our engineering, our production, our manpower and machinery are in the fight. As we battle on the research and production front we see the dawn of great new horizons as new products, new and better methods develop; we see the Radio Service man to whom we have devoted ourselves through the years standing on the threshold of a greater opportunity than he has ever known. National Union is deeply grateful for the loyalty of the service profession to National Union products. National Union is learning, watching every advancement in the electronic art, so when the day of Victory comes, the many thousands of service men who have grown with us in the past shall benefit in the future.

NATIONAL UNION RADIO

*Corp.*

57 STATE STREET, NEWARK, NEW JERSEY