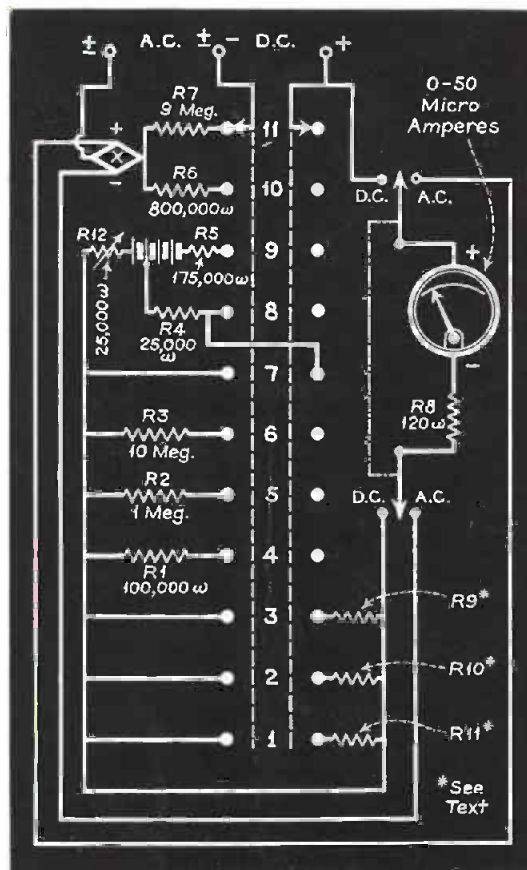


# SERVICE

A Monthly Digest of

# RADIO

and Allied Maintenance

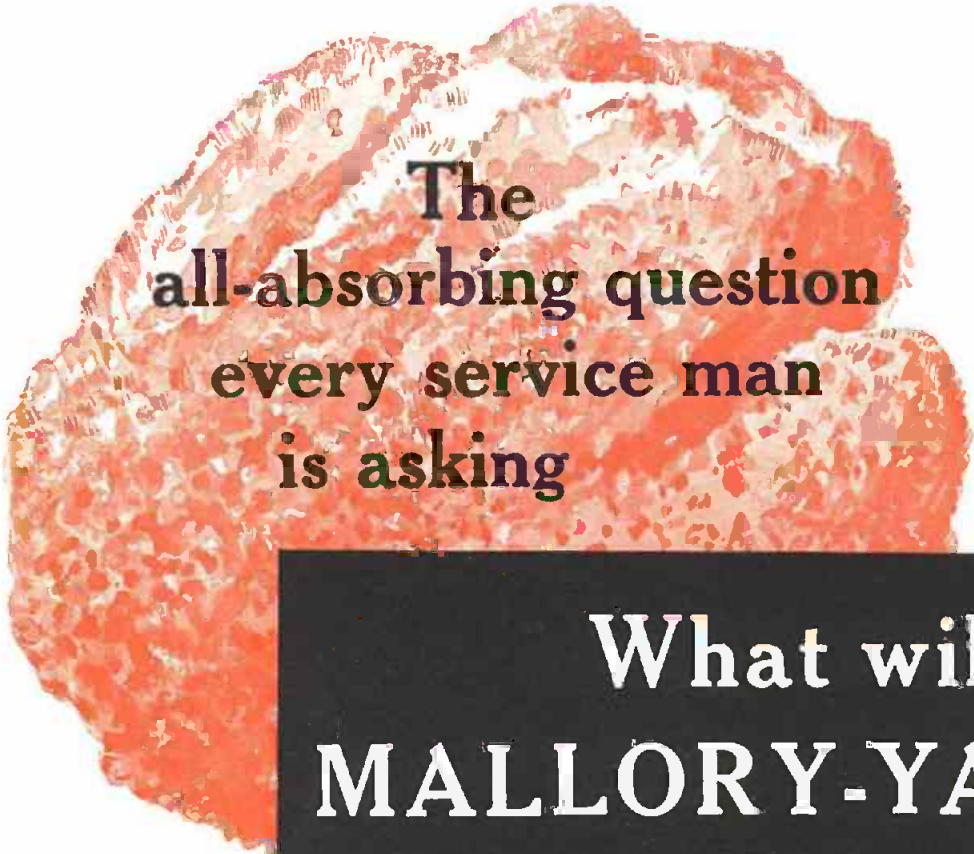


Combination Meter Circuit

(See page 20)

PER COPY  
25 CENTS






JANUARY  
1938



The  
all-absorbing question  
every service man  
is asking

# What will MALLORY-YAXLEY do next?

For years Mallory-Yaxley has answered the question with innovations that amazed the industry. And every time Mallory-Yaxley answers the question, it means a step forward in better servicing, better products and better profits.

Mallory-Yaxley has met the service man's question in the past with answers such as  the Mallory-Yaxley Radio Service Encyclopedia  Condensers that are universal in application  Volume Controls that are really silent  with "a mere handful" of Vibrators that service over 3,000,000 automobile radio sets  with perfect portable power, in the Mallory Vibrapack.

Now the question for 1938 is about to be answered! . . .

What will Mallory-Yaxley do next?

You will know mighty soon!

P. R. MALLORY & CO., Inc. • INDIANAPOLIS, INDIANA \* Cable Address — PELMALLO

Use  
P. R. MALLORY & CO. Inc.  
**MALLORY**  
REPLACEMENT  
CONDENSERS...VIBRATORS

Use  
**YAXLEY**  
REPLACEMENT  
VOLUME CONTROLS

# SERVICE

A Monthly Digest of Radio and Allied Maintenance  
Reg. U. S. Patent Office. Member, Audit Bureau of Circulations

EDITORS

JANUARY, 1938

Ray D. Rettenmeyer

W. W. Waltz

VOL. 7, NO. 1

## EDITORIAL CONTENTS

### FEATURES

- \$\$\$ in Auto Radio..... 5  
Getting On in Radio  
By Bernard H. Porter..... 9

### ANTENNA..... 2

### ASSOCIATION NEWS..... 38

### AUTO RADIO

- Arvin 1936 Car Radio..... 37  
\$\$\$ in Auto Radio..... 5  
\*DeWald 702..... 30  
Interference Source..... 30  
RCA and G. E..... 30  
Shielding..... 30

### GENERAL DATA

- \*Crosley 617..... 15  
\*Stewart-Warner R-180 Chassis (Models  
1801 to 1809)..... 18  
\*Stromberg-Carlson 260 (L, LB, P, PB)..... 10  
Technical Features of General Electric 1938  
Receivers..... 17

### HIGHLIGHTS..... 40-42-43

### MANUFACTURERS..... 45-46

### ON THE JOB

- Broom Holder Makes Neat Finger Guard  
for Panel..... 32  
Clamp from Discarded Curling Iron Makes  
Handy Rest for Small Soldering Iron... 37  
Founds Service Business by Propositioning  
Dealers to Turn Work Over to Him.... 36  
Handy Circuit Testing Device for Workbench 37

### RECEIVER CASE HISTORIES

- Colonial 32AC..... 37  
Philco..... 33  
Philco 60 and 66..... 33  
Philco 623..... 37  
Philco 1936 Models..... 37  
RCA Victor M-30..... 33  
RCA R-28-P..... 37  
Stromberg-Carlson 642..... 33

### SOUND SERVICE

- G. E. FM-41, FS-5 Handy-Phones..... 28  
Modern Theater Servicing, Part III  
By Sound Track..... 22

### TEST EQUIPMENT

- \*A 20,000 Ohm-per-Volt Universal Meter  
By G. F. Benkelman..... 20

\* Indicates that a circuit accompanies the text.

BRYAN S. DAVIS  
President

JAS. A. WALKER  
Secretary

Chicago Office—608 S. Dearborn St.—C. O. Stimpson, Mgr.  
Telephone: Wabash 1903

Published Monthly by the  
Bryan Davis Publishing Co., Inc.  
19 East 47th Street  
New York City

Telephone: PLaza 3-0483



SANFORD R. COWAN  
Manager

PAUL S. WEIL  
Advertising Manager

A. B. CARLSEN  
Circulation Manager

Wellington, New Zealand—Tearo Book Depot.  
Melbourne, Australia—McGill's Agency.

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.

# THE ANTENNA . . .

---

## "THE BOY AROUND THE CORNER"

THERE IS food for a great amount of thought contained in the leading item on the Association News page this month. The Spokane RSMA man who wrote that item has evidently come across several cases of the sort which we know to be all too prevalent—that is, many persons who have occasion to get in touch with their local Service Man consider that he (the Service Man) is just some youngster who is playing around in radio because he likes to. In other words, "Johnny Jones around the corner is a radio nut; call him in. He'll fix the set and won't charge much."

This is the kind of impression that all members of the servicing industry should be at great pains to change.

First of all, it certainly is no disgrace to be deeply interested in one's occupation. On the contrary, be thankful that you are in a business that can prove to be so interesting. As compared with the average merchant, mechanic, or other business man, the radio technician's job is so devoid of deadening routine that any number of men, if they knew of it, would be only too glad to exchange places with you. Consider, then, that your job is above the usual—and do your best to let your customers know it.

And if you don't think that this kind of an attitude will show results, look at the doctors! They are—generally—so high and mighty that one can't even get from them a simple explanation of a case of measles. We don't mean that Service Men should be that aloof, but don't ever forget that you are *trained* men, and as such are entitled to earn a fair return on your training.

## A GOOD YEAR FOR P-A

AMONG OTHER THINGS, 1938 will see another nation-wide election. All of the 435 members of the House of Representatives and 32 Senators will be up for re-election, and each of these is sure to be opposed by at least one aspirant to the place of honor.

Already, in some states, the primaries are under way.

As the year progresses, and especially after Congress adjourns, the various campaigns will gather momentum until, in November, we will probably see one of the greatest windups to any campaign in history.

All in all it looks like a good break for those of you who go in for public-address work.

## USING SERVICE

ONE MAN of our acquaintance, for whose opinions we have a vast respect, picked up a magazine the last time we were in his office and said, "I'm going to show you the source of a lot of extremely valuable information." He turned to the pages devoted to the items regarding the new catalogs and new products of the various manufacturers.

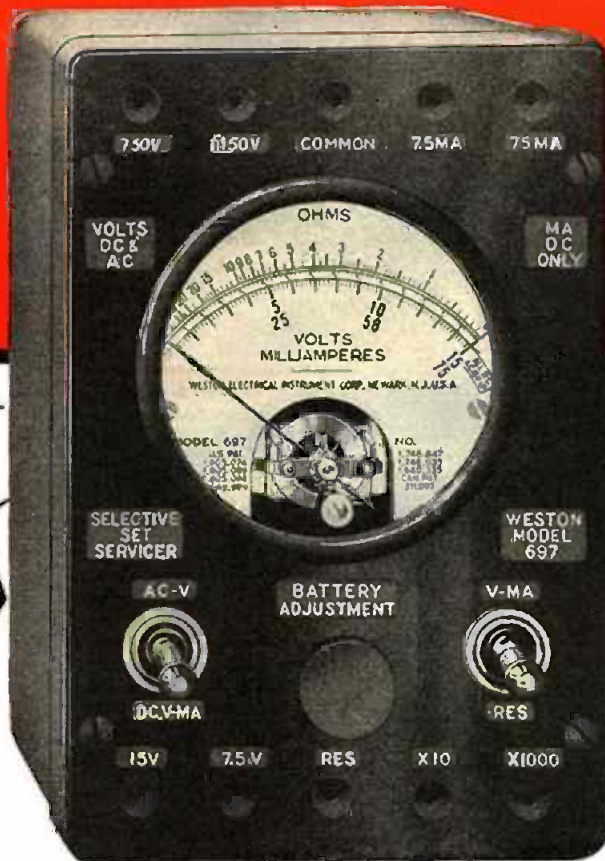
Continuing, he said, "We have had more than one tough problem here"—this man is chief engineer of a huge organization—"that has been 'cracked' because we always make it a point to look carefully at these pages in the various technical publications. Even with our staff we can't hope to know everything that is going on in our field of work. Consequently, and despite our numerous contacts with other organizations, we depend greatly upon these pages to learn what is being done elsewhere. It may surprise you to know how many times a little item about some device is the opening wedge to the solution of an important problem. It may be that the device is just what we were looking for—and couldn't find. Or, it may have been that we got a lead on some manufacturer who could make what it was we needed."

All of which adds up to this: There are plenty of ideas for the Service Man to be found in these items on the Highlights and Manufacturers pages—maybe a new piece of test equipment which you have been wondering about; maybe a notice about a catalog which may be of value to you. Or, you might find something which would open up an entirely new aspect of servicing.

These pages are important to you. Don't neglect them!

*Pocket Size... Yet Precise!*

**WESTON**  
 MODEL 697  
**VOLT-OHM-**  
**MILLIAMMETER**



Here's a convenient, pocket-size radio test instrument . . . but one that is made to the same standards of accuracy and dependability as the larger WESTON instruments. *Nothing has been sacrificed to achieve this small size.* The ranges provided, too, are complete for radio servicing:

- Voltage Ranges: AC and DC—0-7.5; 0-15; 0-150; 0-750.
- Current Ranges: DC only 0-7.5 and 0-75 milliamperes.

- Resistance Ranges: 5000-500,000 ohms full scale; 35-3500 ohms center scale.
- Size: 5-9/16" x 3-3/4" x 3-9/16".

Model 697 is a most convenient tester to carry on service calls . . . a cinch to handle on the bench or around the shop . . . yet it is extremely low-priced for a sturdy, dependable WESTON instrument. Model 697 and other pocket-size WESTON testers should be included in every serviceman's kit. Be sure you have full information. Return the coupon today.

**WESTON**  
*Instruments*

Weston Electrical Instrument Corporation  
 604 Frelinghuysen Ave., Newark, N. J.  
 Send complete information on Pocket-Size Testers.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

Consistent Leadership by  
**AMPERITE**  
 achieves another new development...  
**THE ACOUSTIC COMPENSATOR** (Pat. Pend.)

An exclusive Amperite feature available in new Models RBH (High Impedance) and RBMk (200 ohms)



PUSH UP TO INCREASE HIGHS  
 PUSH DOWN TO INCREASE LOWS

### 3 IMPORTANT USES

1. The Acoustic Compensator enables you to lower or raise the response of the microphone by the mere flip of the finger; Not a volume control—operation is similar in principle to the sliding panels in broadcast studios.
2. Makes the Velocity immediately adjustable to close talking or distant pickup.
3. Immediately adjustable to any room condition... or any type of job of occasion.

Increasing the quality, without increasing the price, is the keynote of the Amperite sales policy. In the new Amperite Velocity, with the Acoustic Compensator, the P.A. Industry has the last word in microphone perfection at a competitive price.

**MODELS RBHk, RBMk**, with acoustic compensator. Frequency range 40 to 11,000 CPS. Output, —65 db. Complete with switch, cable connector and 25' of cable. **\$42.00 LIST**

**MODELS RBHn, RBMn**, without acoustic compensator **\$42.00 LIST**

#### NEW! AMPERITE CONTACT MICROPHONE

A contact mike without distortion. Ideal for use on all string instruments. Flatters an ordinary fiddle by giving it the volume and depth of a "Strad"; makes a small piano sound like a "Grand". Unusual high output—can be used on radio sets.

No string changes, no drilling. Attached without tools. Operates with either high or low gain amplifiers. Frequency response, 40 to 9000 cps. Output, —40 db. 25' of cable.

MODEL KTH (Hi-imp); KTL (200 ohms)..... \$22.00 LIST  
 KTH or KTL with foot-operated volume control... \$30.00 LIST

#### NEW! AMPERITE "HAND-I-MIKE"

The smallest velocity made... but has an output equal to larger types, —68 db. Frequency range 60 to 7500 cps. Excellent for close talking, and can be used as hand, desk, or stand microphone. Unusually rugged. Size of head, 1" x 3/8" x 2 1/2".

MODELS HDH (Hi-imp); HDL (200 oms); with switch, \$22.00 LIST

#### AN EXCELLENT VELOCITY AT \$22.00 LIST

P.A. Men, you do not have to sacrifice quality on a "low-cost" job. This fine velocity, built to Amperite standards, is excellent for both speech and music. Gives flat response without peaks over entire audible range. Reduces feedback. Frequency range 60 to 7500 cps. Output, —68 db. Unusually rugged, not affected by temperature, pressure or humidity. Triple shielded, fitted with shock absorber and swivel bracket.

MODEL RAH (Hi-imp.) with 12' of cable; MODEL RAL (200 ohms) with 8' of cable..... ONLY \$22.00 LIST

#### BROADCASTING STUDIOS, please note :

**New Output, —56 db.**

The new Amperite Studio Velocity, model SR80n, has —56 db. output, highest in studio velocities available today. The SR80n is now accepted as the finest microphone for studio and recording; (Two weeks' free trial to established studios). Frequency range 40 to 15000 CPS. Triple shielded, fitted with switch (optional), cable connector, and 25' of cable. MODEL SR80Hn (Hi-imp.); SR80n (200 ohms)..... \$80.00 LIST

#### SALES AIDS FOR THE P.A. MAN

Amperite offers the following co-operation to P.A. Men

1. FREE: Window Decal advertising your Sound Service. Size 5 1/4 x 9 1/4, finished in 4 striking colors.
2. FREE: Window Display, 11 x 17.
3. Special Sound Equipment Letterheads. Samples and prices on request.

Write for these valuable sales helps, and new Illustrated Bulletins, today!



**AMPERITE CO.** 561 BROADWAY, N. Y. U.S.A. CABLE ADDRESS: ALKEM, NEW YORK

"Better Systems Specify Amperite"



VELOCITY

**AMPERITE**

MICROPHONES

# SERVICE

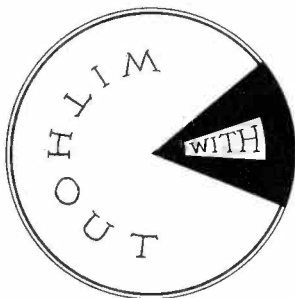
A Monthly Digest of Radio and Allied Maintenance

FOR JANUARY, 1938

## \$\$\$ in Auto-Radio

IT HAS BEEN forecast that radio receivers in use this past summer totaled 34,000,000 with 25,000,000 radio homes equipped, an increase of 2,000,000 more radio families than the previous season. According to this report 4,000,000 supplementary receivers were to be added to the 25,000,000 radio homes. On the whole these prospects have been most encouraging to the service industry, particularly as the predictions seem to have been realized, or nearly so, at this time.

Similarly, the prospects for auto-radio sales and service have been promising though not as auspicious as one might suppose. Briefly, every fourth person



in the United States owns or is paying for a car. Prompted by this fact, any curious and progressive Service Man will be led to investigate the statistics yet further. The figures he will find in such a search will not be unlike the following:

*Total automobiles in the United States .....	28,520,559
Private passenger cars .....	24,172,823
Government cars .....	200,230
Private buses .....	123,900
Private trucks .....	4,023,606

\*As of July 20th, 1937: Report No. 619, Department of Commerce, Washington, D. C.

---

**Progressive Service Men are realizing extra profits by combining auto-radio sales and service with home-receiver work.**

Statistics show their expansions into this field is more than justified owing to the great potential market yet to be developed.

Taking a cue from the automobile industry, now showing new models, Service Men will also find it advisable to make contacts presently.

---

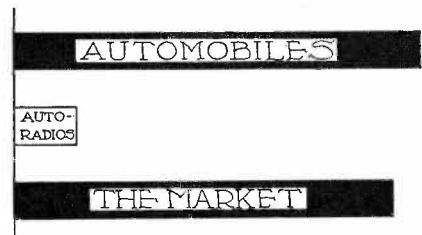
It will be further revealed that the United States has gained in registrations some 2,138,238 motor vehicles in 1937, a percentage advance of 8.1 over January 1st, 1936.

Contrasted with these rather overwhelming figures is the fact that some 4,500,000 car operators now can ride while regaled by radio's ever broadening entertainment. One half of these receivers are said to be more than two years old. With the aid of a little mathematics it becomes evident that the figure 26,520,559 is, theoretically speaking, the potential market for auto-radio receivers, excluding, of course, the continuous influx of new machines not yet equipped with sets. The situation is represented graphically in Figs. 1 and 2, whereby one may visualize readily that the auto-radio field yet offers manifold possibilities for sales and service.

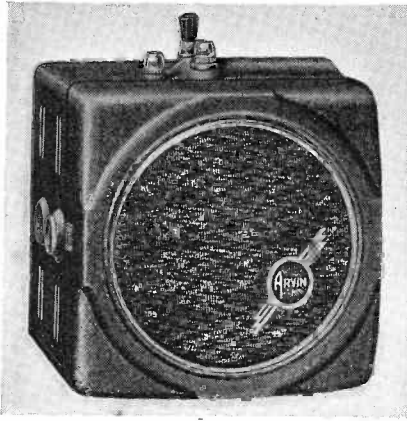
### THE PREVIOUS SITUATION

In the past, however, there have been complaints that a radio receiver in a passenger car constitutes a traffic hazard as the driver's attention is distracted and thereby may be indirectly the cause of a serious accident. Of those parts of the country taking the complaints earnestly, the proposed bill which was

before the senate of Idaho is typical. Had the drafted law been passed it would have been illegal for any person or persons, either driving in or operating a motor vehicle, to listen to any sound, voice, or music as received on a radio receiver. How the RMA cooperating with the automotive interests had the proposal scrapped is well known. On the quiet, police departments, safety and accident-prevention bureaus have investigated the matter only to find the complaint has little or no foundation. On the contrary, these groups, after due consideration, have absolved the auto radio from any part in traffic accidents; finding instead that a musical program received while on the road discourages conversation and any tendency for general "rough-housing" among the car occupants, induces a slower operating



*House-to-house canvassing often develops additional business.*



Arvin Master Sportsman Model 32.

speed to permit a possible improved reception and increased attention to the same, and, finally, subjects no distracting forces upon the drivers. With nerves somewhat steadied by the music, the operator is usually more prepared for an emergency than is otherwise the case. An analogous situation, incidentally, is the home-study periods of young students who claim they are unable to prepare their lessons until the radio is going full volume!

Moreover, in the case of car operators traveling long distances over monotonous country, the companionship of the auto-radio is considered a great factor in safety as it lessens both mental and physical fatigue and promotes a consciousness of driving in periods otherwise conducive of sleep.

With these important and widely publicized objections eliminated, for the self-evident reasons just presented, a gradual increase in auto sales has been evidenced among dealers and service shops.

#### TECHNICAL VIEWPOINT VERSUS PUBLIC

Skepticism and downright opposition have met the introduction of practically every invention we have. Indeed, the development of new products springs rarely from popular demand. It requires, on the contrary, persistent persuasion to bring individuals to accept a higher standard of living. Having overcome the initial resistance to the auto-radio—a typical example of a new application—the manufacturers continue to combat the insinuations of those people who “remember when,” or who recall some of the earlier sets and their minor shortcomings. Such complaints, usually outmoded at the time of expression, are registered without ever a gleaming of appreciation for progress in the admitted years of trial and error.

Be it known today, however, that no one need apologize for the quality of reception now obtainable on a standard model receiver as designed expressly for the motor vehicle. Any minor defects now present in auto-radio reception cannot be classed as real objections

when one collates the quality of reception over the wide range of conditions under which a motor car must of necessity operate. Just as proper filtering and shielding were developed to overcome inherent disturbances from the motor's ignition system, so too are the remaining problems to-day having the attention of the best engineering minds.

Now that new and improved receivers and antenna systems are providing the motorist more entertainment value than ever before, even the perfection-conscious individuals have less of which to complain. With increased sensitivity and further improved tone quality assisting in the gradual decrease of sales resistance, the future looks brighter. Clearly the manufacturers have done and are doing their part: it remains for Service Men to put over the sales and service work which will result thereby.

#### THE PROSPECTS

The average Service Man is well prepared to make auto-radio sales having, as he does, the added advantage over the usual dealers and garages of facilities for initial installation and future servicing. His position with respect to the public makes him the most logical contact man between user and producer.

In this connection, it has been said of one progressive Service Man that he keeps his auto-radio always at full volume when on the way to answer a call, thus attracting attention to his service truck and business. Upon approaching and stopping at a traffic light, he invariably modulates the tuning for the benefit of both pedestrians and any cars that might draw up at his side. Under these conditions at least two people out of every ten, whether walking or driving, would inquire for the maker's name. Should a major sports event be in progress at the time, they will inquire for the score. Obviously the next move on the part of the Service Man is to invite the newly-made and curious friends to see and hear the receiver by drawing up to the curb. According to his story, a sale usually results.

If the truth of this incident can be relied upon, it would appear that one's class of prospects includes all those owning a motor or intending to do so presently. Lacking the contact-on-the-go opportunities just described, one resorts to vehicle registration lists, gasoline stations, garages, friends, telephone directories, and previous clients, in compiling a prospects list.

Of one's potential customers the most likely individuals are those who spend long hours driving. They are called professionals and include traveling business men, salesmen, truck drivers, news and movie reporters, cross-country buses, long-distance commuters, doctors, and weekend travelers. The desire of these

people for an auto-radio evolves from their absence from home and their accompanying inability to hear a favorite program at a given hour. Too, they wish entertainment and some degree of relaxation during a long or monotonous run over much-traveled country. Commercial travelers forced to make calls during their client's office day and to cover the intervening territory outside of hours, appreciate the company provided by the auto-radio receiver.

The obvious attack, when preparing the ground work for sales and later service, is directed at executives of concerns owning truck, bus, and passenger fleets. The safety and employee's well-being factors are stressed in a sales message to this group. Failing here, one concentrates on the individual operators themselves, the while emphasizing entertainment value on the trip. From among them, one soon learns to classify those who are news fans, sports addicts, stock-quotation pursuers, and music lovers. From a single program interest grows a desire for an auto-radio. Detect that liking and the sale is half accomplished.

For the commuter group—those spending from one to three hours a day going to or coming from work between the periods 7:00 to 9:30 AM and 5:00 to 6:30 PM—there are many instructive features being broadcast at these times. In fact, it requires little argument to make such a motorist realize the value of exercising the mind and ears while occupied in otherwise unpleasant driving. With scores, quotations, and news available readily a man's day is complete.

Introductions to the groups of motorists mentioned above can also be made conveniently through garages and gasoline stations whose staffs come in daily contact with prospective auto-radio buyers. The sales technique here consists of canvassing the proprietors of such stations and offering them a commission on actual purchasers directed one's way. A demonstration set mounted appropriately on a suitable display rack, prominently situated in the station, assists



Philco 826.

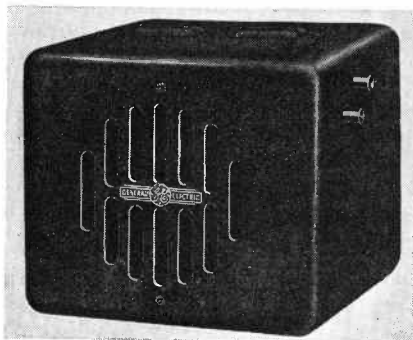


markedly in this direction. The usual forms of Service Man's literature can well be distributed by station attendants not only to the advantage of one's auto-radio business, but also for the publicity of the home-receiver servicing work. Service stations will be pleased to do this in return for the use of the demonstrator model which is at the same time suggesting its worth to persons stopping in for a change of oil or the like. Taxi drivers are also likely to be interested in a similar proposition.

#### FRIENDS AND CLIENTS

Just as a receiver can well be spared for advertising purposes at a nearby gasoline and repair station, so a demonstration model can be used to advantage in one's personal car, the better to exhibit a set's abilities to friends and clients. One Service Man of our acquaintance usually lets his car receiver continue playing as he parks it in a customer's yard and goes in to install an aerial system for the new home-radio. Before the installation and minor adjustments have been completed, the customer will be inquiring about the prices on the set operating outside. Already an interest has been cultivated. Similarly, the procedure works both ways, for when installing or servicing a customer's auto-receiver, the progressive Service Man will inquire how the home radio is functioning. Taking a by line from insurance salesmen's "How much of a policy do you carry?" the alert men in the service industry inquire "How many radios have you?" They argue that there is always room for one more.

When describing the virtues of the auto-receiver to a prospective client, one need not necessarily emphasize the quality of and need for reception as the automobile is in motion. Obviously the same features apply when the car is parked, a situation well illustrated by the man who has a workshop in the garage and who makes use of the radio in his car while engaged weekends on some odd job. Others claim it a fine sedative for mowing the lawn, hoeing the garden, or raking the leaves. In fact, when concentrating on friends, one plans to drive into the neighbor's yard

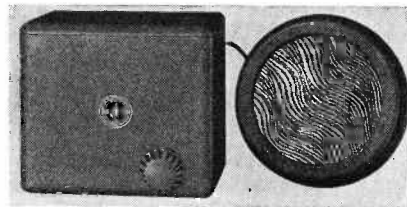


G.E. FA-60.

just about the same time the latter is working about the grounds. The ensuing conversation on flowers, gardening, and the weather usually concludes with said parties at the car side where the radio has been the while demonstrating quietly its tone quality of reception.

#### YEAR AROUND SALES AND SERVICE

In the past whenever similar recommendations have been made, the spring or summer periods have been advocated as the best time of year for concentration on auto-sales and service. Basing the claim, however, on a possible dullness of season at these times of the year is not entirely justified. Witness the radical changes made by the sales departments of automobile manufacturers who have found the erstwhile fall season the preferable period of the year in which to introduce and display their latest models. The Service Industry can do well to imitate them in this respect and make the winter a time in which to concentrate on auto as well as home-receivers. Perchance it will then be more convenient to contact the pur-



Emerson V-155.

chasers of new cars and the buyers of old ones.

One will rightly agree that the winter-buyer-for-spring-delivery customer can well expand his budget at the same time to include the radio. Those demanding immediate possession, moreover, will appreciate a demonstration of the new radio models. Finally, those setting aside their cars as demanded by a brief winter season can see the logic of having a receiver installed at this period to avoid the spring rush. Winter's drivers already have shown that the auto-radio is at its best for sheer entertainment value when travelling. Winter is also the most mutually beneficial time for servicing a car-owner's radio. In brief, then, Service Men adding the motor-radio to their present sales and service line of home equipment will find the winter as profitable a season as the spring and summer. Actually, climatic conditions in many parts of the country permit this extra revenue source for the service shop to be an all-year proposition.

#### TECHNICAL AIDS

It has been said the average service shop is well qualified and equipped to service the motor-radio. The very nature of the business necessitates a gen-



RCA-Victor 8M3.

eral knowledge of electrical principles that can be expanded readily to include the ignition systems of motor vehicles. This publication has long recognized the importance of the auto field and consequently devotes many of its monthly pages to service data and technical information on the auto-receivers as they have been introduced. The wiser shops have kept these in their files and now resort to them daily. Many of the prominent radio schools also devote some time to this worthwhile phase of servicing.

The auto-vibrator is an outstanding example of how the dissemination of information has become beneficial in this field. Interrupter and synchronous-rectifying types of vibrators for power packs have long been in use in automobiles; yet from the first, Service Men have regarded them with suspicion and uncertainty, feeling that all major receiver troubles in the motor-radio is attributable directly to them. Unaccountable noises, and low plate voltages are the symptoms, though later tests on the vibrator in question by the manufacturer have proved it normal in all respects. With more detailed information made available, Service Men have come to know the vibrator, its circuits, and characteristics. Where they worked once in ignorance, now confidence presides.

#### TWO SERVICE TIPS

Similarly it has been shown that highest gasoline using lead-tetraethyl breaks down into by-products which deposit on spark plugs and decrease their resistance appreciably. The lowering of resistance makes the spark suppressors installed in the car interfere with the proper functioning of both the engine and radio at certain speeds. In addition, then to checking the filters and shielding, one now makes a practice of cleaning spark plugs on every inspection job.

Current practice abroad offers an interesting solution to the accumulation of static charges built up on the brake drums of automobiles by friction. It has been found that a colloidal graphited grease of maximum graphite content, when injected into the existing hub grease with due care for adjacent brake  
(Continued on page 32)

# GETTING ON IN RADIO

By BERNARD H. PORTER

IN THE early days of radio self-styled technicians and engineers blossomed out in all degrees of professionalism only to be later adjudged by the advance of a highly competitive industry as inadequately trained and entirely incompetent to cope with the manifold problems. The changes in set design and the introduction of increasingly complicated circuits with multiple automatic features has placed the tinkerers and hobbyists on the spot. They have also weeded out the parasites attracted to radio servicing by the small investments required, the absence of state examinations or licenses, the semi-professional status of the work, and the apparently insatiable appetite of the public in purchasing receivers that will sooner or later need repair.

The technical ramifications of all-wave tuning with its numerous trimmers and padders for each band, high-fidelity design and construction, avc, delayed avc, noise suppression, afc, tuning-indicator circuits, quelch circuits, etc., are now in process of eliminating still others. In the race for survival two individuals stand out: the Service and the Radio Engineer. Who are they and how did they get that way?

## THE SERVICE ENGINEER

Consider definitions first. Briefly, the Service Engineer is no screw-driver mechanic or soldering-iron acrobat. While his radio education may not be as extensive as that of a radio engineer, or so comprehensive as that of a radio operator, his knowledge nevertheless represents intensive study and years of experience. In addition to knowing thoroughly the fundamentals of electricity, magnetism, and radio, he has an intimate acquaintance with the general characteristics of all receivers and a workable knowledge about the peculiarities of many individual models.

Knowing the basic principles of electricity—and they never change—the Service Engineer cultivates an analytical ability that enables him to separate causes and effects. Modern tools, including the cathode-ray oscillograph, assist him in the diagnosis. Having located the difficulty, the Service Engineer, through long experience and knowledge, coupled with natural ability and intuition, remedies the defects in a workmanlike manner without loss of time to himself or client. His business

sense, like his technical knowledge, is well developed. He is forthright, dependable, and honest. Recognizing his part in the community as a member of a profession, he acts accordingly. He offers his public the benefit of the same standards of training and learning as they expect from their local dentists or doctors.

When the need or opportunity arises, the Service Engineer is prepared, by his understanding of fundamentals, either to form a large organization designed exclusively for reconditioning, or to expand into side lines including public-address systems, motion picture and sound servicing, electrical appliance repairs and the establishment of a retail or wholesale business. Most important of all, he is in a position to continue his technical training to the point of qualifying for the next stage of engineering.

## THE RADIO ENGINEER

Dr. Alfred N. Goldsmith has said that "radio engineering is a state of mind coupled with the knowledge and ability that are the results of training and experience.

"The engineer, at his best, is an inquiring soul, analytic in his examination of problems and alleged facts presented to him, opposed to sham and pompous pretense no matter how portentous, and ever seeking and utilizing that inspiration through which progress comes.

While the Service Engineer knows thoroughly the "what," "how," and "when" phase of radio servicing, the Radio Engineer has the additional distinction of also knowing the "why" of the entire radio field. He is a practical technician possessing a theoretical insight of his own and closely related sciences. His is the broader scope embracing radio from present principle and design, to broadcast mechanics and development research. His temperament alone decides whether he will concern his investigating mind with future and radical developments, or address his plodding instincts to the improvement of existing knowledge and product. His training equips him for either.

Moreover, while the Service Man can expand, by study, into allied and more remunerative fields, the engineer has already passed through the sphere of the servicing range and is at once ready

for the advance positions with leading radio manufacturers. These jobs pertain to field service, theater sound equipment installation and service, lecturing engineer to other Service Men, broadcast transmitter equipment, sound recording, and the like. Few, indeed, are the sincere Service Engineers who do not aspire and make every effort towards attaining this stage.

## HOW ACHIEVED

The professions of Service and Radio Engineer are attained by study: a prosaic statement, perhaps for some, but to the engineers themselves a sober fact.

At least twenty-five percent of the radio engineers today have matured, via the route of self-training, from the ranks of commercial and amateur operators, or mere broadcast fans. "Hams," in their recreation, have taken large doses of learning without realizing it consciously. With this as a foundation they go into radio servicing for a few years, augment their training gradually, and pass on eventually as engineers. Others, having become competent Service Men, acquire the efficiency and knowledge that mark them as Service Engineers. They continue as such, both to the credit of themselves and the profession. Still others, with their minds focused definitely on an engineering career, pursue college and technical school training to graduate as radio or electrical engineers.

Whatever the goal, however, it has been attained only by concentrated effort and study. Such study implies not only a concentrated effort in mastering the principles underlying modern receiver design and servicing, but also continual improvement in knowledge by the assiduous reading of radio periodicals and technical releases, careful perusal of new service data and modern development, and frequent review of the entire field. Anyone failing to do less is not entitled to the name Service Man. Fooling the public is one thing, but deceiving one's self and the technicians in the shop around the block is something else again.

## Books

Having resolved to form or renew an acquaintance with radio fundamentals, one turns to possible texts.

The libraries in every neighborhood stock radio books. These institutions

**Use only standard nationally-known replacement parts on all service jobs.**

are your friends: use them. A perusal of their lists under the possible classifications Radio, Communications, Electricity, or Physics will suggest immediately the vast quantity of information one can never hope to know. Average intelligence, however, can separate the seemingly infinite mass of knowledge and glean the useful and necessary principles from a few given books. If a troublesome problem is not answered satisfactorily or clearly in one book, one will find it demonstrated and solved in another. Never depend on a single text as authors vary widely in their approach to and treatment of the same idea. This fact, apart from the usual expense involved, may be one reason why the average Service Man should not feel obliged to purchase every radio book published. Own a few good ones, yes, but in general depend on the libraries. A signed petition of a few radio men in a neighborhood will ensure that some portion of the institution's budget does not overlook the revised radio books and new servicing aids.

Obviously, any list of books for the Service Man must start with the Rider publications for without these it is practically impossible to get along. Dealing, as they do, with both the theoretical and practical aspects of modern radio receivers, the Rider books form a framework upon which all other radio knowledge can well be built. The reader, it is assumed, as a practicing Service Man—the Rider publications are, then, an essential part of his shop equipment and nothing said above with regard to the impracticability of purchasing all of the fundamental textbooks should be considered as applying to these operating necessities of the service business.

Service Men interested in self-training will find helpful the following books or indicated portions thereof:

(1) *Practical Electricity*, Terrell Croft, 674 pages, McGraw-Hill, N. Y., \$3.00. Anyone holding a public-school diploma can master this text and at the conclusion be as competent as any whose learning has been acquired in more formal ways. The mathematical approach is so presented that the student, starting with simple arithmetic, becomes acquainted gradually with all the principles of electricity. The section on alternating-current circuits is especially noteworthy in this respect and may be called the high point of the book.

(2) *Radio Physics Course*, A. A. Ghirardi, 961 pages, Radio Technical Publishing Company, N. Y., \$4.00. The average high-school pupil will find this presentation a fine introduction to the physics of radio. It is treated entirely from a Service Man's point of view. Moreover, it is replete with review questions at the end of each chapter, pro-

---

## There isn't such a great difference between Service Men and radio engineers. What each is, and how he gets that way is discussed here.

---

viding a desirable self check on progress. Incidentally, men long in the field have only to try a few of these quizz problems to demonstrate how readily one can forget the simplest of facts. A complete cross-reference index assists in the home-study of this work.

(3) *Foundations of Radio*, R. L. Duncan, 247 pages, John Wiley & Sons, N. Y., \$2.50. In many respects this book might well be the first one to prescribe to the beginner. It presents in simple and intelligent language those fundamentals of electricity and allied subjects that must be understood before a comprehensive knowledge of radio can be expected. The chapter headings are: Electrical Units, Electron Theory, Magnetism, Electromagnetism, Resistance and Conduction, Electrical Circuits, Primary Cells, Sound, and Preparatory Mathematics. Had Mr. Duncan continued his treatise to more advanced subjects in the same manner that he has covered these simpler topics, one might look no further for this information.

Of the chapters presented, experienced men will profit from the discussion entitled "Sound," a phenomenon frequently neglected in radio books. The last chapter on mathematics should be particularly helpful to the Service Man.

(4) *Principles of Radio*, K. Henney, 491 pages, John Wiley & Sons, N. Y., \$3.50. This text merits a place in the library of any radio technician as it combines admirably both theoretical and practical features of the fundamentals. The engineering point of view is stressed throughout. The first six chapters cover prime principles through alternating-current theory and continue logically to a discussion of receiving, amplifying, and oscillating circuits. The fact that the third revised edition (first published in 1928) of the text appears this month may be some indication of its general interest. Other comments about its special features appear later in these articles.

(5) *Elements of Radio Communications*, J. H. Morecroft, 286 pages, John Wiley & Sons, N. Y., \$3.00. The first two chapters constitute desirable reading as supplementary to Henney's "Principles," for the same topics are discussed in different and condensed forms. A knowledge of elementary algebra may be

needed in absorbing fully the forty-six sections (pages 1-49) of the heading "Simple Laws of Electric Circuits." These relations are reiterated in terms of radio in the following chapter called "Special Laws of Radio Circuits."

(6) *Principles of Radio Communications*, J. H. Morecroft, 1084 pages, John Wiley & Sons, N. Y., \$7.50. The first chapters covering Fundamental Ideas and Laws, Resistance, Inductance, Capacity, Shielding, and Laws for Oscillating Circuits give the Service Man a somewhat advanced treatment of principles. The later chapters border on radio engineering as a whole and serve as a valuable reference work. While a knowledge of higher mathematics is essential to its complete understanding, Morecroft has presented the greater part of the subject in such a way that it can be assimilated by the high-school graduate.

The more advanced texts listed below come in the province of radio engineering and should not be attempted by the Service Man until he has mastered thoroughly the foregoing works: *Radio Engineering Principles*, Lauer and Brown; *Radio Engineering*, F. E. Terman; *Radio Engineering Handbook*, K. Henney; *Theory of Thermionic Vacuum Tube Circuits*, L. J. Peters.

SERVICE and similar publications include a book-review department that describes in outline the contents of all valuable and newly released radio texts. Such reviews are dependable in determining the true value of a book to Service Men in the field.

### MANUFACTURER'S AIDS

Many radio manufacturers issue frequently technical bulletins, pamphlets, service notes and diagrams, booklets and special instruction folders. The majority of these are free to interested parties. Others, obtainable at small cost, are so inexpensive compared to the valuable contents that no Service Man should overlook them.

(1) *Tube Manual*, RCA-Radiotron, Harrison, N. J., \$0.25. Contains complete characteristic and application data of radio tubes plus data on their operation—all of which is helpful when servicing receivers whose service diagrams may not be available.

(2) *Tube Manual*, Hygrade, Sylvania, Emporium, Pa., \$0.10, also  
(Continued on page 33)

Do you know your operating costs? Fair profit is your due.

# General Data . . .

## Stromberg-Carlson 260 (L, LB, P, PB)

THE STROMBERG-CARLSON No. 260 Radio Receivers are 16 tube "Adjustable High Fidelity" receivers and are equipped with an Automatic Frequency Control Flash Tuning Circuit. This circuit is operative only in the standard broadcast range and the mechanical arrangement is such that seven favorite broadcast stations may be set up on the Flash Tuning Unit. (Local and other stations that give the best daytime and evening service should be selected).

With the a-f-c knob (located on the front of the panel) rotated to the "on" position, any one of these favorite stations may be easily selected; as the station selector knob is rotated, each lamp located behind one of the call letters of the stations set up in the Flash Tuner Unit will flash "on" whenever the receiver is tuned to the frequency of these stations. Between any of these stations no noise will be heard from the receiver while operating the Flash Tuning System. To properly set up the a-f-c Flash Tuning System read the section, "Instructions for Setting Up the A. F. C. Flash Tuning System."

In tuning this receiver (with the a-f-c control knob rotated to the "off" position) resonance with a signal is indicated by means of the tuning indicator tube which operates on the cathode-ray principle. The strength of a received signal may be determined by observing the size of the aperture appearing on the target of the tuning indicator tube. The stronger a received signal, the greater the reduction in the size of the aperture.

There are five tuning ranges in these receivers. The short-wave foreign spectrum is divided into two ranges in these receivers. Maximum selectivity between adjacent stations located in the standard broadcast range is obtained by the use of an additional tuned-radio-frequency ("Bi-resonator") circuit. When any of the other ranges are in operation, this additional tuned circuit is cut out of the receiver circuit. When either the aircraft or short-wave ranges are in operation the receiver functions as a three-gang tuning capacitor receiver, and when the ultra-short-wave range is in operation the receiver functions as a two-gang tuning capacitor receiver. When reception conditions warrant, the fidelity of these receivers can be increased by rotating the "Tone-Fidelity" control knob in a clockwise rotation from the "Normal" position of this control. High-fidelity reproduction is obtained by rotating this knob in a clockwise direction to the desired degree from the normal position of this control.

These receivers are also equipped with the Stromberg-Carlson Acoustical Labyrinth. Audio reproduction is further improved in these receivers by employing sound diffusing vanes in front of the opening for each loud speaker which distribute the higher pitched tones, thereby providing reproduction in all parts of the room by spreading out these directional frequencies. In order to make efficient use of the large available audio power output obtainable from these receivers, two high-fidelity loudspeakers are used. The maximum

undistorted power output of this receiver is 20 watts when working into the loudspeakers supplied with this receiver (P-26170 and P-27827 loudspeakers). The voice coil impedance of each of these speakers is 1½ ohms. The field coil resistance of the P-26170 speaker, when cold, is 1,050 ohms, and the field coil resistance of the P-27827 speaker, when cold is, 3,425 ohms.

These receivers are also provided with a low-level bass-frequency compensating circuit, which in conjunction with the volume control circuit, operates so that balanced reproduction is obtained for any setting of the volume control. A "Bass" control is also provided to increase the response at the lower (bass) audio frequencies if desired when operating at medium or low volume levels.

In addition to the above, a "full power quality" control circuit arrangement (distortion limiter) is also provided in these receivers which operates automatically to prevent distortion when operating at maximum audio power.

A metal guard frame is furnished on these receivers to prevent damage to the chassis components and also to facilitate ease of servicing should this become necessary. Do not turn the chassis over on its guard frame without first removing the tuning indicator unit which is secured to the metal guard frame. To remove the tuning indicator unit from the guard frame, first unscrew the knurled screw which holds the tuning indicator's clamp to the metal guard frame, which will then allow the tuning indicator unit to be removed from the guard frame.

A Stromberg-Carlson No. 7 Multi-Record, Automatic Changer, Phonograph Unit is also supplied in the No. 260-P Receivers. This unit is equipped with a crystal-type pickup which operates in conjunction with a specially equalized circuit.

A socket having three contacts is provided on the rear of the chassis base of the No. 260-L Receiver, and is wired to the "Off-On-Bass-Phonograph" switch assembly, the control knob of which is located on the front of the receiver. A three-prong plug is also inserted in the socket so that if at any time it is desired to use an electric pickup and phonograph unit in conjunction with this receiver, it may readily be accomplished. See section, "Procedure for Obtaining Reproduction from Phonograph Records."

The various tubes are used in these receivers as follows: One 6K7 tube is used in the r-f amplifier; two 6K7 tubes are used in the i-f amplifier; one 6K7 tube is used in the automatic-frequency-control amplifier; and the remaining 6K7 tube is used in the audio amplifier.

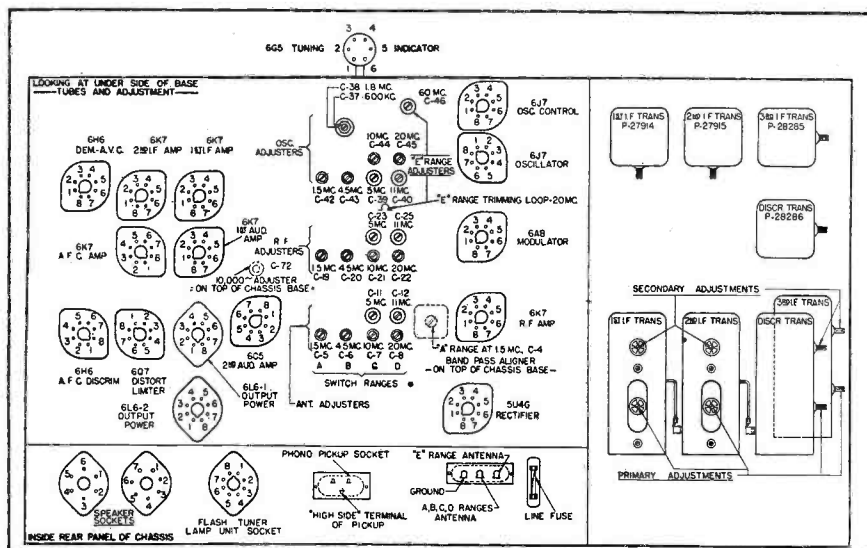


Fig. 1. Terminal layout and location of various alignment adjustments.

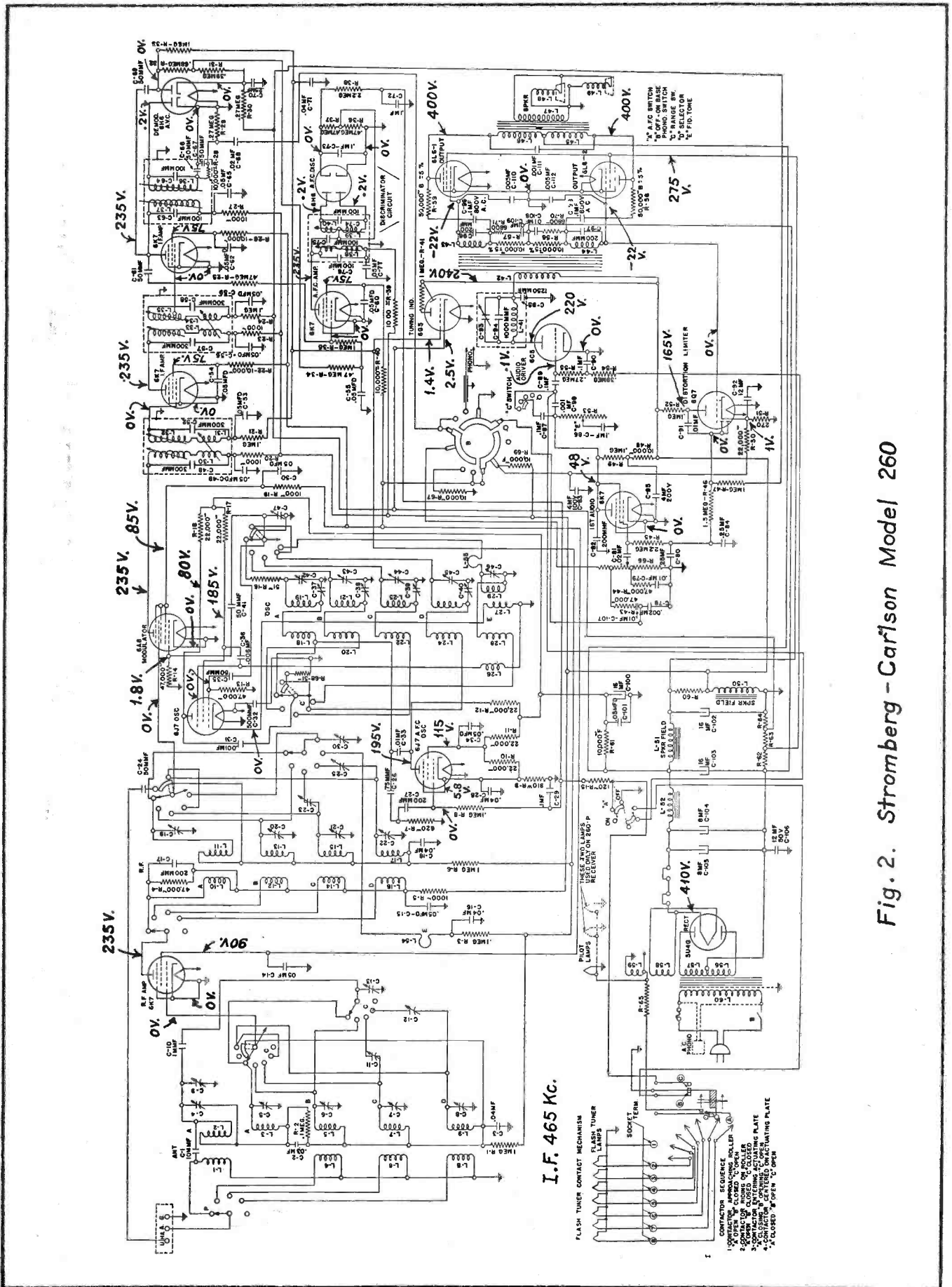


Fig. 2. Stromberg - Carlson Model 260

## GENERAL DATA—continued

The 6A8 tube is used as the modulator tube. One 6J7 tube is used as the oscillator, and the other 6J7 tube is used in the oscillator control circuit for automatic frequency control. One 6H6 tube is used as the demodulator—a-v-c tube, and the other 6H6 is the discriminator tube for the automatic-frequency-control circuit. The 6C5 tube is used as the audio driver tube of the audio amplifier. The 6Q7 tube is used in the "Full Power Quality" control circuit (distortion limiter). The two 6L6 tubes are used in the audio power output stage. The 5U4G tube is the rectifier of the power supply unit, and the 6G5 tube is used for indicating resonance in the tuning indicator system.

### ALIGNMENT DATA

All alignment adjustments are accurately made at the factory on these receivers, and ordinarily no readjustments are necessary. However, should it become necessary to make any readjustments, the procedure given in these instructions should be carefully followed. The preferred method of aligning these receivers is by the use of a suitable cathode-ray oscillograph and frequency-modulator unit in conjunction with the standard signal generator.

To accurately align circuits in these receivers, it is necessary to use a high grade signal generator capable of being modulated 30 percent and having an output voltage of at least 100,000 microvolts. It will also be necessary to have this output voltage controlled so that only a few microvolts may be fed into the receiver. In conjunction with the signal generator, a sensitive output meter should be used for determining

the maximum signal voltage developed across the voice coil of either loud speaker. In addition to this equipment, it will be necessary when making an adjustment of the "Discriminator" tuned circuits to use a milliammeter having a range of 0-10 milliamperes connected in series with the cathode of the 6J7 oscillator control tube by means of an adapter plug inserted between the tube and the socket. The leads to the meter should not be any longer than 15 inches and should be shunted at the socket connections by a capacitor of not less than 0.25 mfd. A high resistance voltmeter having a resistance of at least 1000 ohms per volt will also be needed when making an adjustment of the "Discriminator" tuned circuits.

In order to make the aligning adjustments in an easy and satisfactory manner, it is recommended that the Stromberg-Carlson P-27657 and P-27658 aligning tools be used.

Before proceeding with the alignment of any circuits in these receivers, except when specially directed, be sure that the fidelity control knob is set for the "Normal" position and that the automatic frequency control knob is set to the "Off" position. The "Off-On-Bass-Phonograph" control should also be set for the "Normal" position. In making any alignment adjustments always adjust the test oscillator's output voltage to the minimum value where a good alignment may still be obtained, except when specifically directed in these instructions. Fig. 1, shows the location of all the aligning capacitors or adjustments for these receivers. It will not be necessary to remove the chassis from its cabinet in order to make any

alignment adjustments. The alignment adjustments for the intermediate-frequency circuits are accessible from the rear of the receiver, and the adjustments for the radio-frequency circuits are accessible through the apertures located in the bottom metal base plate of the chassis. These apertures are easily accessible through the bottom of the cabinet shelf. *Never align any of these receivers without having the metal base plate fastened to the chassis base.*

### DIAL ADJUSTMENT

Before aligning the circuits of these receivers, the tuning dial must be properly aligned to "track" with the gang tuning capacitor. To check whether the dial is set correctly with respect to the gang tuning capacitor, rotate the "Rapid Station Selector" knob in a counter-clockwise direction so that the gang tuning capacitor is set to its maximum capacity position. Then, with the receiver turned "on", the illuminated dial indicator line should be exactly centered over the dial alignment lines (black lines) which are located at the extreme low frequency end of each scale on the dial. If these lines do not center over the illuminated dial indicator line, loosen the two set screws located on the hub of the dial. Then, rotate the dial so that these alignment lines are centered over the illuminated dial indicator line. The two set screws of the dial hub should then be securely tightened.

### INTERMEDIATE-FREQUENCY AND A-F-C CIRCUIT ADJUSTMENTS

The intermediate-frequency system employed in these receivers has a complex circuit arrangement. Because of

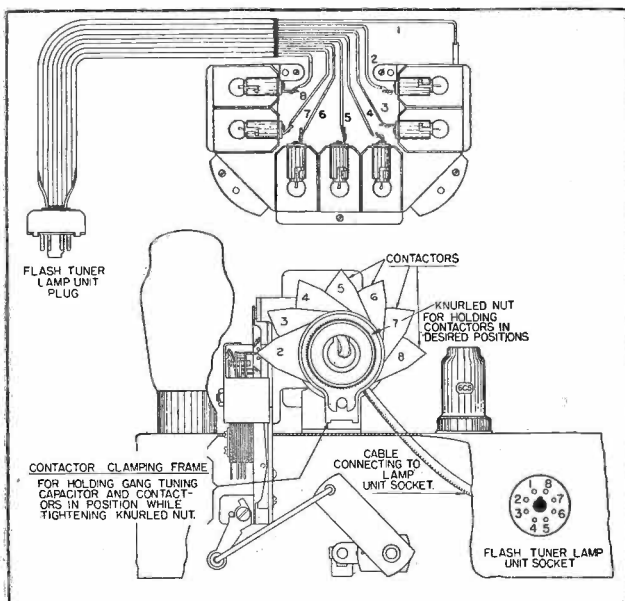
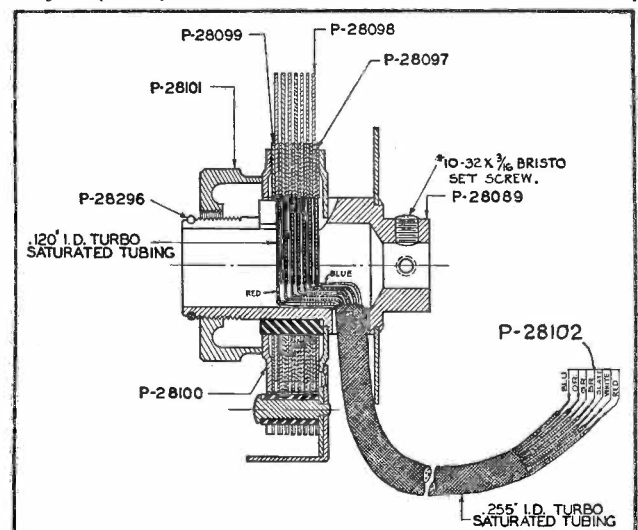


Fig. 3 (Left). Flash tuner lamp unit with escutcheon plate removed (top of diagram) and rear view of receiver showing flash tuner mechanism (bottom diagram).

Fig. 4 (Below). Section view of flash tuner contactor assembly.



the necessity of obtaining the proper shape of resonance curve of these stages in a high-fidelity receiver, it is recommended that unless it is absolutely essential, these i-f adjustments be untouched. In the factory these adjustments are made using a visual system which allows the operator to see the exact shape of the resonance curve; the following procedure should be followed:

1. Operate the Range Switch of the receiver to the "A" range position, and set the tuning dial to its extreme low frequency position. Set the Fidelity Control to its "Normal" position, the automatic-frequency-control knob to the "Off" position and the "Off-On-Bass-Phonograph" control knob to its "Normal" position. Never attempt to align the r-f or i-f circuits of these receivers with the Fidelity Control knob set at any position other than the "Normal Fidelity" position, and the automatic-frequency-control knob set at the "On" position unless specifically directed in the following paragraphs.

2. Apply between the chassis base (or ground binding post) of the receiver and the grid of the 6K7 tube used in the second i-f amplifier, a modulated signal of 465 kilocycles from the signal generator, using a 0.1 mfd capacitor in series with the connection between the output terminal of the signal generator and the grid of the 6K7 tube. Do not remove the chassis grid lead connecting to this tube. The ground (or low side) terminal of the signal generator should be connected to either the chassis base or ground binding post terminal.

3. Now, noting from Fig. 1, the alignment adjustments for the i-f circuits proceed in the following order:

Adjust the third i-f transformer primary circuit for maximum output.

Adjust the third i-f transformer secondary circuit for maximum output.

4. Remove the lead connecting the signal generator (through the 0.1 mfd capacitor) to the grid of the 6K7 tube of the second i-f amplifier and connect this lead to the grid of the 6K7 tube of the first i-f amplifier; then align in the following order:

Adjust the second i-f transformer secondary circuit for maximum output.

Adjust the second i-f transformer primary circuit for maximum output.

5. Remove the signal generator lead connecting to the grid of the 6K7 tube of the first i-f amplifier and connect it to the grid of the 6A8 modulator tube; then align in the following order:

Adjust the first i-f transformer secondary circuit for maximum output.

Adjust the first i-f primary circuit for maximum output.

6. Check all the above adjustments again with the signal generator lead connected to the grid of the 6A8 modulator tube and in the order as given above.

Carefully make all the above adjustments, carefully watching the output meter and reduce the output of the test oscillator as required.

#### ADJUSTMENT OF THE DISCRIMINATOR TUNED CIRCUITS

To properly adjust the tuned circuits of the discriminator transformer, check the position of the a-f-c control knob which should be set to the "off" position. Before making this circuit adjustment be sure that the i-f amplifier and signal generator are exactly in resonance at 465 kilocycles. Connect a high-resistance voltmeter having a resistance of at least 1000 ohms per volt across the junction of the resistors R-37, R-38 and the chassis base. It is preferable to use the 500-volt scale of this meter in order that the load imposed on the discriminator circuit will not be too great. The d-c milliammeter previously mentioned should be connected in series with the cathode of the 6J7 oscillator control tube exactly as described in the second paragraph of the alignment data. The signal generator should remain connected to the grid of the 6A8 modulator tube the same way as connected when making the aligning adjustments of the i-f amplifier circuits. The signal generator's output control should be adjusted so that a signal of 10,000 microvolts is fed into the modulator tube. Now, slightly detune the secondary circuit of the discriminator transformer so that a fair voltage indication is obtained on the high-resistance voltmeter connected across the junction of the resistors R-37, R-38, and the chassis base, and then adjust the primary circuit of the discriminator transformer until a maximum reading is obtained on the voltmeter. Now, again adjust the secondary circuit of the discriminator transformer so that zero reading is obtained on the voltmeter. Care should be taken that the meter does not read below zero.

CAUTION: In order to make sure that this adjustment of the secondary circuit of the discriminator transformer has been correctly made, the adjusting screw should be turned gradually so that the indicator of the voltmeter will first return to zero, and then while continuing to turn this screw in the same direction, will go slightly below the zero mark, after which the screw should be turned

in the opposite direction until the indicator is again brought back to the zero mark. If the above described condition cannot be obtained, this adjusting screw adjustment for the secondary circuit of the discriminator transformer has been rotated in the wrong direction, and it will be necessary to carefully turn it in the opposite direction. After this adjustment has been made, it will not be necessary to use the voltmeter any more and it can be removed from the receiver circuit.

When the above adjustments have been carefully made, the milliammeter connected in the cathode circuit of the 6J7 oscillator control tube should be observed, and if the tuned circuits of the discriminator transformer are correctly adjusted there should be no difference in the reading of this milliammeter when the a-f-c control knob is rotated from the "off" to the "on" position. If the above condition does not exist, the secondary circuit of the discriminator transformer should be readjusted until the milliammeter has the same value regardless of whether the a-f-c control knob is rotated to the "on" or "off" position.

#### RADIO-FREQUENCY ADJUSTMENTS

The alignment of the radio-frequency circuits in these receivers should be very carefully made and in the order specified.

When making any aligning adjustments of these circuits, the a-f-c control knob should be rotated to the "off" position, the fidelity control knob should be set for "Normal" operation, and the "Off-On-Bass-Phonograph" control knob should also be set for "Normal" operation.

#### ULTRA-SHORT WAVE RANGE ("E" BAND)

In order to align the circuits of this range, it is desirable to have a signal generator whose high-frequency range will go to 60 megacycles. Such equipment, however, is rare and costly, and in most cases it will be necessary to make use of a signal generator whose high-frequency range does not extend beyond 20 megacycles, using harmonics of 20 megacycles for aligning this range on 60 megacycles.

In aligning the radio-frequency circuits for this range, replace the 0.1 mfd capacitor which was placed in series with the signal generator's output lead for the i-f alignment with a 400-ohm carbon type resistor. This lead should then be connected to the antenna binding post marked "U. H. A." located on

## GENERAL DATA—continued

the rear of the receiver chassis. The ground terminal (or low side) of the signal generator should be connected to the ground binding post on the receiver.

1. Operate the Range Switch on the receiver chassis to the "E" range position and set the signal generator's frequency and the receiver's tuning dial to 60 megacycles.

2. Adjust the aligning capacitor C-46 until maximum voltage output is obtained on the output meter.

3. Set the signal generator's frequency and the receiver's tuning dial to 20 megacycles and adjust the "E" range trimming loop, L-54, until maximum voltage output is obtained on the output meter. The adjustment of this loop is obtained by distorting its normally circular shape until it offers the correct inductive effect. If the oscillator does not track with the tuning dial scale at this frequency, it will be necessary to also adjust the oscillator's tuning loop.

4. Reset both the signal generator's frequency and the receiver's tuning dial to 60 megacycles and repeat operation No. 2.

### SHORT-WAVE RANGE ("D" BAND)

In aligning the radio-frequency circuits for this range use the same artificial antenna (400-ohm carbon type resistor) in series with the output terminals of the signal generator as was used for aligning the ultra-short-wave range. Connect this lead to the antenna binding post marked "A" located on the rear of the receiver chassis, and align as follows:

1. Operate the Range Switch on the receiver chassis to the "D" range position and set the signal generator's frequency and the receiver's tuning dial to 20 megacycles.

2. Adjust aligning capacitors C-45, C-22, and C-8 respectively and at the same time rotate the gang tuning capacitor slightly back and forth through resonance until maximum voltage output is obtained on the output meter.

3. Set the signal generator's frequency and the receiver's tuning dial to 11 megacycles and adjust aligning capacitors C-40, C-25, and C-12 respectively and at the same time rotate the gang tuning capacitor back and forth through resonance until maximum voltage output is obtained on the output meter.

4. Reset both the signal generator's frequency and the receiver's tuning dial to 20 megacycles and repeat operation No. 2.

### SHORT-WAVE RANGE ("C" BAND)

In aligning the radio-frequency cir-

cuits for this range use the same artificial antenna and binding post on the receiver chassis as was used for aligning the "D" range.

1. Operate the Range Switch on the receiver chassis to the "C" range position and set the signal generator's frequency and the receiver's tuning dial to 10 megacycles.

2. Adjust the aligning capacitors C-44, C-21, and C-7 respectively; and at the same time rotate the gang tuning capacitor back and forth through resonance until maximum voltage output is obtained on the output meter.

3. Set the signal generator's frequency and the receiver's tuning dial to 5-megacycles and adjust the aligning capacitors C-39, C-23, and C-11 respectively; and at the same time rotate the gang tuning capacitor back and forth through resonance until maximum voltage output is obtained on the output meter.

4. Reset both the signal generator's frequency and the receiver's tuning dial to 10 megacycles and repeat operation No. 2.

### AIRCRAFT RANGE ("B" BAND)

In aligning the radio-frequency circuits for this range, use the same artificial antenna and antenna binding post as was used for aligning the "C" range, and align this range as follows:

1. Operate the Range Switch on the receiver chassis to the "B" range position and set the signal generator's frequency and the receiver's tuning dial to 4.5 megacycles.

2. Adjust the aligning capacitors C-43, C-20, and C-6 respectively; and at the same time rotate the gang tuning capacitor back and forth through resonance until maximum voltage output is obtained on the output meter.

3. Set the signal generator's frequency and the receiver's tuning dial to 1.8 megacycles and adjust the aligning capacitor C-38 and at the same time rotate the gang tuning capacitor back and forth through resonance until maximum voltage output is obtained on the output meter.

4. Reset both the signal generator's frequency and the receiver's tuning dial to 4.5 megacycles and repeat operation No. 2.

### STANDARD BROADCAST RANGE ("A" BAND)

In aligning the radio-frequency circuits for this range, replace the 400-ohm resistor in series with the signal generator's output with a 200-micro-microfarad capacitor and align this range as follows:

1. Operate the Range Switch to the "A" range position and set the signal generator's frequency and the receiver's tuning dial to 1.5 megacycles (1500 kilocycles).

2. Adjust the aligning capacitors C-42, C-19, C-4, and C-5 respectively; and at the same time rotate the gang tuning capacitor back and forth through resonance until maximum voltage output is obtained on the output meter.

3. Set the signal generator's frequency and the receiver's tuning dial to 0.6 megacycles (600 kilocycles) and adjust the aligning capacitor C-37; and at the same time rotate the gang tuning capacitor back and forth through resonance until maximum voltage output is obtained on the output meter.

4. Reset both the signal generator's frequency and the receiver's tuning dial to 1.5 megacycles and repeat operation No. 2.

### SETTING UP THE A-F-C FLASH TUNING UNIT

1. Remove the flash tuner lamp unit escutcheon plate by removing the four screws.

2. Remove the lists of station letters from the P-28420 package assembly which is tacked inside of the cabinet.

3. Remove the seven paper squares on which are printed the words "Tone," "Beauty," "Value," "Action," "Flash," "Tuning," and "Radio" from the square frames located on the rear side of the lamp unit escutcheon plate.

4. Remove the station letters of the seven stations which it is desired to set up in the flash tuning unit from the list of stations. It will be noted that the letters of the stations are printed on partly cut squares to facilitate ease in removing the desired letters. Insert one of these seven station letters into each frame of the flash tuner lamp unit. The recommended method of inserting these station letters into the frames of the escutcheon plate is to arrange them according to the frequency of the stations as follows:

Looking at the front of the escutcheon plate the station having the highest frequency should appear in the top right-hand frame, and then in successive order according to frequency the remaining station letters should be inserted into the other frames; the top left-hand frame containing the station letters of the station having the lowest frequency. In inserting these letters into the frames be sure to have the letters located between two pieces of transparent material.

5. Fasten the escutcheon plate again to the lamp unit by means of the four



## GENERAL DATA—continued

screws. The receiver is now ready to be operated and the flash tuning unit contactors located on the rear of the chassis base adjusted for the seven favorite stations.

6. Rotate the "On-Off-Bass-Phonograph" control knob from its complete counter-clockwise position, slightly clockwise from this position which turns the set "on" (indicated by illumination of the dial). Allow the receiver to reach operating temperature (about 15 minutes) before proceeding with setting up the flash tuning mechanism. Check the position of the automatic-frequency-control knob which should be rotated to the "Off" position, and set the fidelity control knob to the "Normal" position. Now carefully tune in the desired station having the highest frequency, watching the tuning indicator so that the receiver will be exactly tuned to this station.

7. After carefully tuning in the desired station rotate the a-f-c control knob to the "On" position. Now, noting from Fig. 3, the sketch which shows the contactor clamping frame and knurled nut, hold the clamping frame with one hand and loosen the knurled nut with the other hand. Then move the contactor, numbered 2, so that its point is engaged between the two small rollers of the switching mechanism as also shown in Fig. 3. When the point is properly engaged between the rollers, the lamp of the lamp unit which is located behind the station letters of the station being tuned in will light. When this condition is obtained, retighten the large knurled nut and at the same time securely hold the gang tuning capacitor and the contactors from rotating by means of the extended portion of the contactor clamping frame. *It is extremely important to keep the gang tuning capacitor and the contactors from rotating when tightening the large knurled nut.*

8. Now rotate the a-f-c control knob to the "off" position and note whether the tuning has been shifted by watching the tuning indicator. If a change is noted it will be necessary to repeat operation No. 7.

9. When no change is noticed after performing the above operations Nos. 7 and 8, the remaining six favorite stations should be set up in the same manner.

With the a-f-c flash tuning unit in operation, the receiver will be automatically kept in tune with any one of the seven favorite stations as long as the station is operating or provided it has no unusual fading characteristics.

If a distant station which is very weak is set up in the flash tuning unit, it will be found that the automatic frequency control will not hold this station if a strong signal is present in either adjacent channel. This same phenomenon will occur if two stations in adjacent channels are almost of equal signal strength with the weakest signal fading slightly; with this condition the strong signal will have a tendency to "pull in" when the receiver is tuned to the station which is slightly weaker and fading.

### PHONOGRAPH REPRODUCTION

A socket having three contacts is provided on the rear of the chassis base of the 260-L Receiver, and is wired to the "Off-On-Bass-Phonograph" switch assembly located on the front of the receiver. A three prong plug is also inserted in the socket so that if at any time it is desired to use an electric pickup and phonograph unit in conjunction with this receiver, it may readily be accomplished.

In order to obtain the best quality of phonograph reproduction when using an electric pick-up and phonograph unit with this receiver, a Stromberg-Carlson No. 10 Record Player is recommended. This record player is equipped with a correctly designed single record playing motor unit, and uses a crystal type pick-up in conjunction with a specially equalized circuit. To attach this instrument to a 260-L Receiver, it is only necessary to remove the three-prong plug furnished with the receiver and insert the three-prong plug which comes with the unit into the three-prong socket located on the rear of the chassis base. Then, the power supply plug of the

phonograph unit should be inserted into a suitable power supply receptacle, and the unit will be ready for use.

If the Stromberg-Carlson No. 10 Record Player is not used and the electric pickup to be used is of the high impedance type, it will be necessary to connect a low capacity shielded cable between the three-prong plug furnished with the receiver and the pickup. This shielded cable should be of the low capacity type, in order to prevent the excessive cutting of high frequencies which is caused when a shielded cable having high capacity is used. The length of the shielded cable used should be kept as short as possible.

If a pickup of the low impedance type is used, it will be necessary to connect a matching transformer between the three-prong plug and the pickup. The transformer should be located as near to the receiver as possible, in which case it will not be necessary to use a shielded cable.

### Crosley 617

Tuning: Electric (Dynatrol)

Ranges: 535-1,725 kc; 5.8-18.3 mc.

Tubes:

1st Det: } 6A8G

Osc: } 6A8G

I-f: } 6U7G

A-v-c: } 6Q7G

2nd Det: } 6Q7G

1st A-f: } 6Q7G

Pwr Amp: 6K6G (p-p)

Rect: 5Y3G

Power Supply: 115 volts, 50-60 cycles (special transformers available for higher and lower voltages).

I-f: 455 kc.

Speaker: Electrodynamic.

Field Res: 750 ohms.

Phono Connection: Terminal board; 4,000 ohm pickup recommended.

### ALIGNMENT PROCEDURE

Connect the output meter to the plates of the two 6K6G output tubes. Be certain that the meter is protected from d-c by connecting a condenser (.1 mfd or larger—not electrolytic) in series with one of the leads.

### TUNING THE I-F AMPLIFIER TO 455 KILOCYCLES

Connect the output of the signal generator through a .02 mfd condenser to the top cap of the 6U7G tube, leaving the tube's lead in place. Connect the ground lead from the signal generator to the ground terminal of the receiver. Keep the generator leads as far as pos-

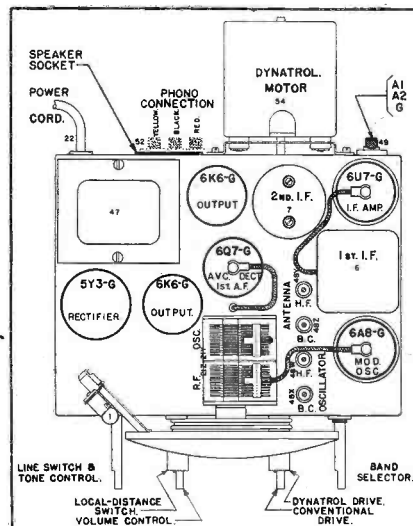


Fig. 2. Chassis layout, Crosley 617.

## GENERAL DATA—continued

sible from the grid leads of the other screen grid tubes.

Set the station selector so that the tuning condenser plates are completely out of mesh. Turn the volume control knob to the right (ON) and turn the tone control knob to the left (TREBLE).

Turn the band selector switch to the Broadcast Band.

Turn the Local-Distance switch to the "Distance" position.

Set the signal generator to 455 kilocycles.

Adjust both trimmer condensers located on top of the 2nd i-f transformer for maximum output. Do not adjust the trimmer condensers located on the 2nd i-f transformer with the signal generator lead connected to the 6A8G tube.

Transfer the signal generator lead to the top cap of the 6A8G tube, leaving the tube's grid clip in place.

Close the middle trimmer of the 1st i-f transformer. Do not force adjustment screw.

Adjust the top and then the bottom trimmers of the 1st i-f transformer for maximum output.

Adjust the middle trimmer of the 1st

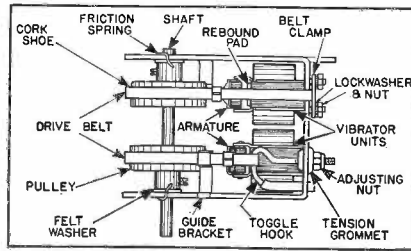


Fig. 3. Dynatrol motor assembly, Crosley 617.

i-f transformer for maximum output.

Always use the lowest signal generator output that will give a reasonable reading on the output meter.

### ALIGNING THE R-F AMPLIFIER

When aligning the r-f amplifier the output lead from the signal generator is connected to the antenna (A) terminal of the receiver. For the Broadcast Band a 200 mmf condenser should be connected in series with the output lead of the signal generator and for the High-Frequency Band a 250-ohm carbon resistor should be used in place of the condenser.

With the station selector adjusted so that the tuning condenser plates are

completely out of mesh and the band selector switch set for the band being aligned, adjust the "OSC" shunt trimmer so that the minimum capacity signal is heard (it is not necessary that the receiver tune through this signal).

Adjust the station selector so that the shunt alignment signal is tuned in with maximum output. Then adjust the "ANT" shunt trimmer for maximum output. Readjust the station selector slightly so that the generator signal is tuned in with maximum output and check the adjustment of the "ANT" trimmer. Do not readjust the oscillator trimmer.

*Note:* When shunt aligning the High-Frequency Band care should be exercised so that the circuits will be aligned on the correct frequency rather than on the image frequency which is approximately 910 kilocycles less than the fundamental. To check on this, increase the output of the signal generator 10 times, or more, and try to tune in the signal both at the generator frequency as indicated on the station selector dial and at approximately 910 kilocycles less than the correct frequency. If the circuits have been properly

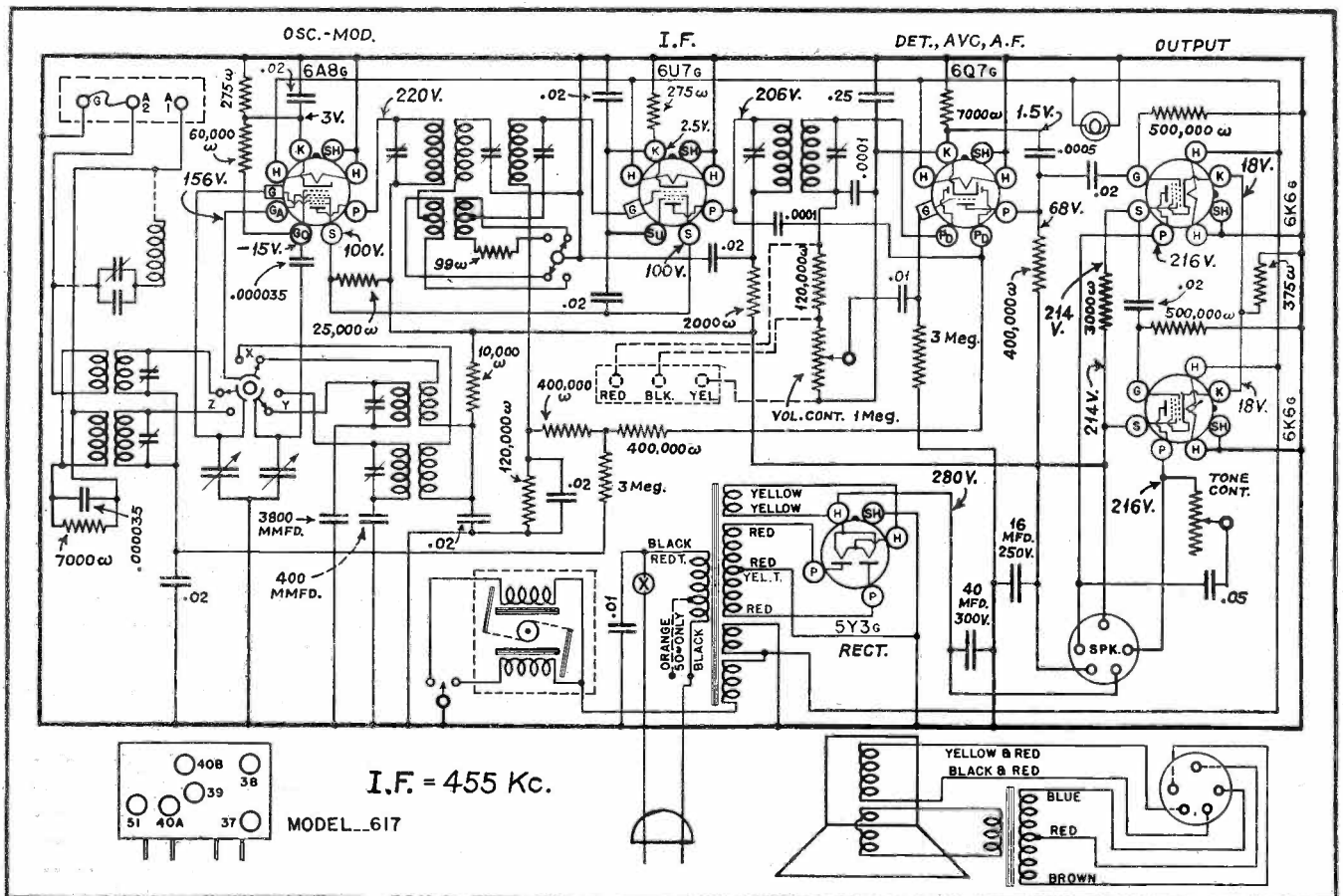


Fig. 1. Schematic diagram of Crosley 617.



## GENERAL DATA—continued

aligned the signal can be tuned in at both positions but much stronger at the correct frequency.

### SIGNAL INPUT FREQUENCIES

American Broadcast Band: Minimum capacity signal, 1,725 kc; shunt alignment signal, 1,400 kc.

High-Frequency Band: Minimum capacity signal, 18,300 kc; shunt alignment signal, 18,000 kc.

### WAVE TRAP

Some chassis of this model are equipped with a wave trap for the purpose of eliminating interference from code stations which operate on a frequency of approximately 455 kilocycles. This assembly is located on the underneath side of the chassis and consists of a coil, a fixed condenser and a trimmer condenser as illustrated by dotted lines in the wiring diagram (item 53).

The wave trap should not be adjusted until all other adjustments have been made. To make the adjustment, feed a 455 kilocycle signal from the signal generator through a 200 mmf condenser into the antenna terminal of the receiver. With the band selector switch turned to the Broadcast Band position, the gang condenser open and the volume control full on, adjust the trimmer condenser on the wave trap for minimum output.

Should the interfering station be operating on a frequency of slightly more or less than 455 kilocycles, the exact frequency should be determined with the aid of the signal generator. Then, instead of feeding a 455 kilocycle signal

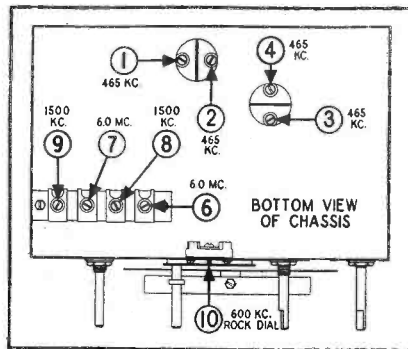


Fig. 2. Chassis of Stewart-Warner R-180.

into the receiver the exact frequency of the interfering signal should be used. If it is not possible to determine the exact frequency of the interfering signal the antenna may be attached to the receiver and the receiver tuned to the position where the interfering signal is most noticeable. Then adjust the wave trap for minimum interference.

### DYNATROL MOTOR

Should either vibrator unit of the Dynatrol motor need readjustment, the following procedure should be followed:

Loosen the adjusting nut until the drive shaft can be rotated freely between the thumb and forefinger. The gap between the armature and "E" laminations should be approximately 3/16".

With the motor running, tighten the adjusting nut until chatter stops. Care should be taken, however, not to tighten this adjustment too tight as an unstable condition will be reached wherein a

slight change may result in a locked motor.

Check the time required for the dial pointer to travel from each end of the dial to the other. The adjusting screws should be set so that approximately eight seconds are required in each direction.

### Stewart-Warner R-180 Chassis (Models 1801 to 1809)

Tuning:	Manual
Ranges:	{ 525-1750-kc; 2200-7000 kc.
Tubes:	
1st Det:	} 6A8G
Osc:	
I-f:	6U7G
A-v-c:	} 6Q7G
2nd Det:	
1st A-f:	
Pwr Amp:	6K6G
Rect:	5W4G
Power Supply:	115 volts, 60 cycles
I-f:	465 kc
Speaker:	Electrodynamic

### ALIGNMENT EQUIPMENT AND PROCEDURE

The broadcast band must be aligned after the short-wave band.

Connect the output meter across the voice coil or between the 6K6G plate and ground, depending upon the type of meter. Connect ground lead of signal generator to receiver chassis. Turn volume control full on.

With gang condenser in full mesh, set pointer on the horizontal black line below 530 kc on dial.

Using a bakelite screwdriver, align  
(Continued on page 34)

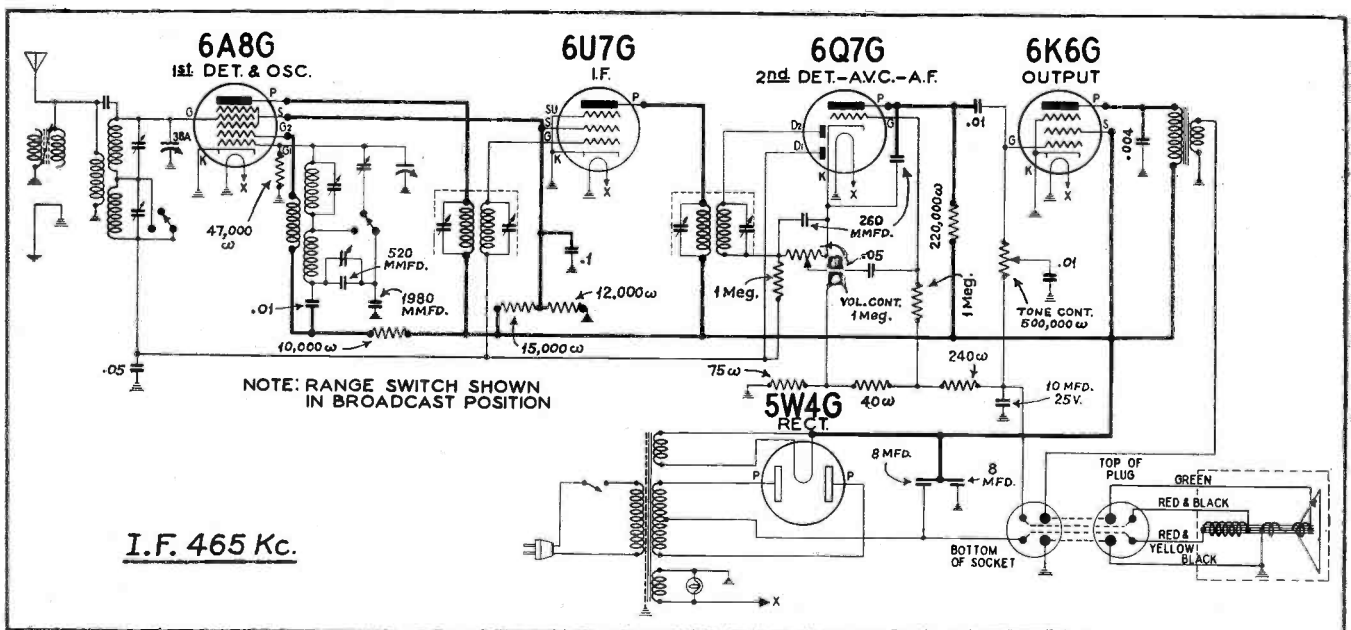


Fig. 1. Circuit schematic, Stewart-Warner R-180.

# Which of these time-saving RIDER BOOKS do you need

**T**Hese books were written to be used—and have been—by successful servicemen in all parts of the world. Many of them are used as text books by the leading radio schools. Like Rider Manuals, each is a *proved* book, selling year in and year out—edition after edition. The books listed below have sold a total of 252,000 copies!

RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER

## AUTOMATIC FREQUENCY CONTROL SYSTEMS

This new development in radio means more and more AFC sets will be coming to your shop. You must be prepared if you are to cash in on this profitable work in higher priced sets. John Rider explains AFC in his easily understood style of writing.

144 pages—hard covers—Only \$1.00

RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER

## SERVICING SUPERHETERODYNES

A revised edition of this standard work. The history of the superheterodyne circuit is studded with changes. You need this book to analyze the different parts of the circuit quickly. With this knowledge you can work quicker and at greater profit.

288 pages—profusely illustrated—Only \$1.00

RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER

## CATHODE RAY TUBE AT WORK

Written for *servicemen*. Gives complete, practical and accurate information on cathode-ray tubes, oscillographs, etc. Lower priced oscillographs put this modern servicing tool within reach of all. To get the most out of it learn its principles and operation from this book.

336 pages—450 illustrations—Only \$2.50

RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER

## ALIGNING PHILCO RECEIVERS

This servicing aid was instantly recognized by servicemen as a *necessity*. Covering every Philco receiver up to the 1937 chassis, the Alignment instructions were compiled in cooperation with the Philco Engineering Department. This *authentic* book locates every trimmer for you. The order followed is the same you use when aligning receivers on your bench.

176 pages—hard covers—Only \$1.00

RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER

**JOHN F. RIDER, Publisher**  
1440 BROADWAY  
NEW YORK CITY

RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER

RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER

## "HOUR A DAY WITH RIDER" BOOKS

Hard covers—Only 60c each

### On Resonance and Alignment

Clear explanation of what happens when circuits are tuned to resonance. 96 pages, 48 explanatory figures.

### On Automatic Volume Control

Check full of the stuff you need to make your AVC work more profitable. 96 pages, 65 illustrations.

### On DC Voltage Distribution in Radio Receivers

Theory and practice of d-c voltages—how they are led through various types of networks to tubes. 96 pages, 69 illustrations.

### On Alternating Currents in Radio Receivers

Explanation of behavior of radio-frequency currents in receivers. Illustrated with diagrams and drawings.

RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER • RIDER

*Just out*

## VOLUME VIII RIDER MANUAL

Enjoy the use of this volume now. Its 1650 pages contain the servicing data you need for the quick repair of the 1715 models of over 100 manufacturers. It gives you the material you want—*arranged* as you want it—simplified and standardized! Included with Volume VIII at no extra cost is a section entitled "How It Works." This covers complex operations peculiar to the more complicated 1938 receivers. In addition you receive the 128 page Index (which is cross indexed). And the price remains the same as for last year's volume.

## YOU NEED ALL EIGHT VOLUMES

Vol. VIII—	\$10.00—1937-38
Vol. VII—	10.00—1936-37
Vol. VI—	7.50—1935-36
Vol. V—	7.50—1934-35
Vol. IV—	7.50—1933-34
Vol. III—	7.50—1932-33
Vol. II—	7.50—1931-32
Vol. I—	7.50—1920-31



**Vol. VIII  
Contains  
1650 Pages**

**ORDER TODAY**

The Eight Rider Manuals Now  
Contain 9620 pages of  
Authorized Servicing Data

# Test Equipment . . .

## A 20,000 OHM-PER-VOLT UNIVERSAL METER

(See Front Cover)

By G. F. BENKELMAN\*

COMPLICATED MODERN CIRCUITS demand a degree of accuracy in voltage measurements never before encountered in radio work. However, the number of suitable instruments for this service is limited. This article presents an economical design in a 20,000 ohm-per-volt precision meter which not only performs the necessary voltage measurements in direct or alternating current, but also provides current ranges and resistance indicating ranges on the same fundamental meter movement.

### THE METER

The meter selected has a full scale deflection with 50 microamperes of direct current. Any reliable make of 50-microampere precision meter may be employed in this instrument. The ranges provided are 5, 50, and 500 volts d-c at 20,000 ohms per volt; and 5, 50, and 500 milliamperes d-c. The a-c ranges are 50 and 500 volts. Ohmmeter ranges can roughly be classified as low, medium, and high with a maximum range of approximately 10 megohms with a self-contained 9-volt battery.

\*Continental Carbon, Inc.

### VALUES OF PARTS IN DIAGRAM

Meter resistance, 1880 ohms (50 microamperes)

Padding Resistor R8, 120 ohms

Net total meter circuit, 2000 ohms

All resistors below are insulated carbon semi-precision one-watt size.

R 1 = 5 Volts = 100,000 ohms  $\pm$  5%

R 2 = 50 Volts = 1,000,000 ohms  $\pm$  5%

R 3 = 500 Volts = 10,000,000 ohms  $\pm$  5%

R 4 = low resistance range for  $1\frac{1}{4}$  = volt drop = 25,000  $\pm$  5%

R 5 = high resistance range for  $9\frac{3}{4}$ -volt drop = 175,000  $\pm$  5%

R 6 = 50 Volt a-c, 800,000 ohms  $\pm$  5%

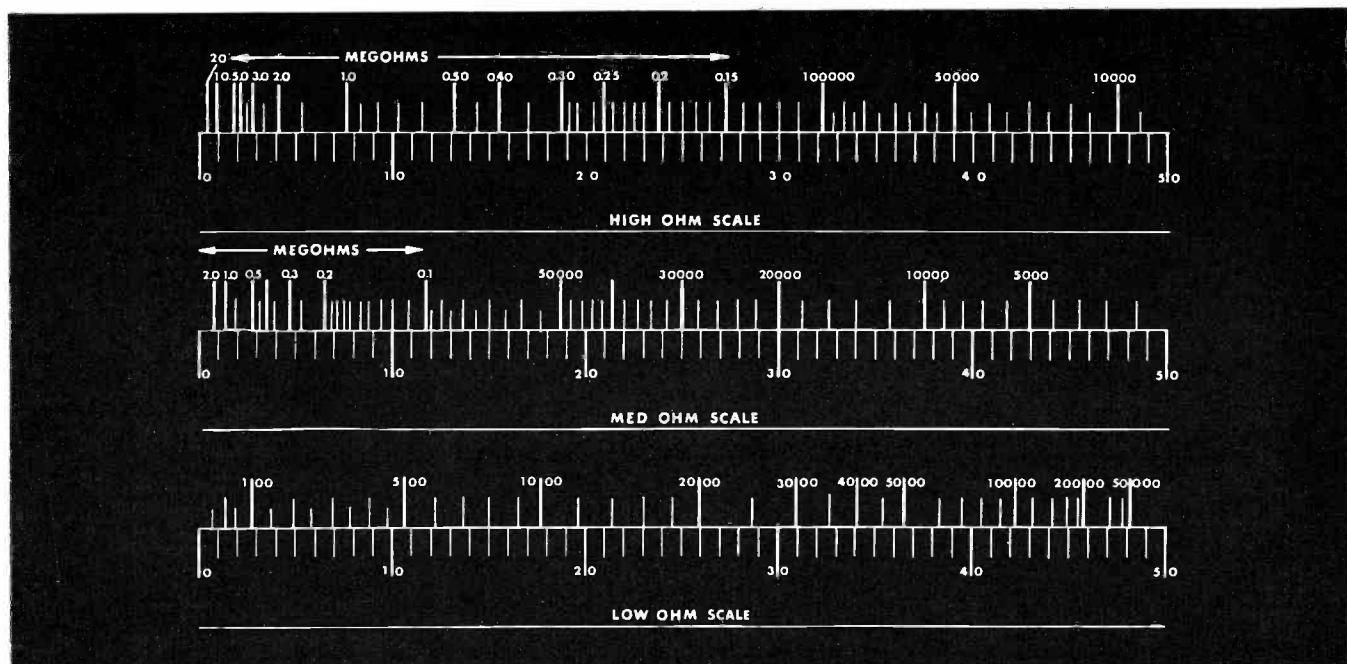
R 7 = 500 Volt a-c 9,000,000 ohms  $\pm$  5%

R12 = Rheostat with 1 volt range 25,000 ohms

Other parts required:

- 1 D-P, D-T toggle switch
- 1 Full wave copper oxide rectifier
- 2  $4\frac{1}{2}$ -Volt "C" batteries
- 1 Double-deck 11-point rotary switch

The voltage and current scales were selected in multiples of 5 so as to use the regular calibration of the 50-microampere scale. The ohm ranges can either be calibrated above the regular scale or made up in a separate chart as illustrated. An 11-point double-deck non-shorting type switch is required for the range selection. A double-pole, double-throw toggle switch is used for the a-c and d-c ranges. A rheostat is employed for compensation in the ohm-meter battery circuit. The remaining parts consist of the resistors and shunts, a full-wave copper-oxide rectifier designed for use with a 50-microampere instrument, a bakelite panel, suitable pin-jacks or binding posts, a substantial wood case, and two  $4\frac{1}{2}$ -volt C batteries. A piece of scrap bakelite may be used for mounting the resistors, but care should be taken to avoid pencil marks on the bakelite which would cause leakage and erroneous calibration. The circuit diagram shows a resistor designated as R8 in series with the 50-microampere meter. The value of this resistor must be determined from data supplied by the instrument manufacturer; i.e., if the

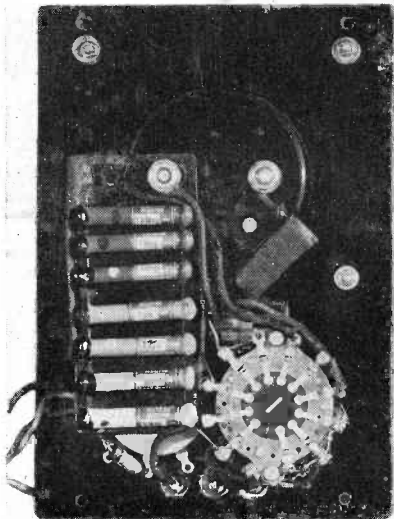


Exact size reproduction of the ohmmeter scale for use with the instrument described above.

"Carry test equipment with you on all service calls."

TEST EQUIPMENT—continued

meter movement has a resistance of 1880 ohms, the value of R8 should be 120 ohms—the difference between 1880 and 2000. If the meter movement has a resistance of 1500 ohms, R8 would be 500 ohms. The object of getting an overall resistance of 2000 ohms in the meter circuit is to have exactly a 100-millivolt drop across this circuit which



Rear view of instrument panel, showing layout and equipment.

simplifies the calculation of the shunt values for the current scales and assures uniform ohm ranges in accordance with the scales illustrated.

The values of resistors given for the two a-c ranges may be subject to change with different types of rectifiers. This can be best illustrated by actual test after the meter is assembled by comparison with a standard a-c meter known to be accurate. The values given for R6 and R7 were satisfactory on the instrument illustrated.

In choosing the rectifier, do not hesitate to obtain the best you can afford. It must be physically small in order to be accurate at an extremely low value of current. In testing an a-c range, a 0.5 mfd condenser should be used in series with the a-c test leads to prevent damage to the delicate rectifying elements if an error has been made in the connections. Resistors R1 to R7 are precision insulated one-watt carbon resistors, R8 may be either a carbon resistor or a wire wound resistor. R9, 10, 11 are shunts made from short lengths of resistance wire.

TESTING

No difficulty should be experienced in assembling this universal meter. Its  
(Continued on page 36)

# Reproduction of WEBSTER-CHICAGO Ad in Leading Industrial Publications



... Find Him Instantly

... locate any executive or factory personnel ... increase efficiency ... speed up service with ...

## AMPLICALL

A complete sound system that can be economically installed in any size plant. Webster-Chicago engineers have perfected a sectionalized system that can be added to without loss of efficiency by plugging in additional units.

This modern system sweeps away all previous objections to sound installations, giving fine reproduction and speakers with adjustable volume to suit any location. Unit construction makes mass production possible and greatly lowers previous conceptions of cost.

Don't be without this modern business aid. . . . Increase your plant efficiency. Please your customers with improved telephone service. Write for More Information.



AMPLICALL Gives Control—and it's IN-EXPENSIVE!

★ The importance of Labor Relations points to the great need for closer contact between executives and employees. With a Webster-Chicago Sound System, you can talk to all employees at any time, no matter what size factory.

**WEBSTER-CHICAGO**  
One of the Oldest Manufacturers of Public Address Systems, Sound Equipment & Accessories

WEBSTER-CHICAGO SOUND EQUIPMENT MAKES MORE MONEY FOR DEALERS. Direct Advertising creates direct leads and excellent sales promotion material makes it easy for dealer to solicit.

WEBSTER-CHICAGO . . . The Complete Line of Public Address Systems, Sound Equipment and Accessories . . . Popular Priced Leaders in the Sound Field for Over 12 Years!

For Complete Catalog or Other Information Address Section J-5

**WEBSTER-CHICAGO**

5622 Bloomingdale Ave.

CHICAGO, ILL.

All Inquiries Referred Directly to the Trade

# Sound Service . . .

## MODERN THEATER SERVICING

By "SOUND TRACK"

### PART III

THAT PART OF a theatre sound system which the Service Man will find least familiar is the photoelectric cell and its associated apparatus. Amplifiers, speakers, and other sound components used in theatre work have at least a general similarity to corresponding types of p-a or radio equipment. But the photocell, while it operates on standard electrical principles with which all Service Men are acquainted, is seldom used today as a sound reproducer except in association with moving pictures, and its functioning and requirements therefore call for special attention.

#### THE PHOTOELECTRIC PICKUP

The cell occupies a position in the sound setup rather similar to that of the microphone in a p-a system—it is the source of the sound current to be amplified. More accurately (since it deals with a moving record) it corresponds to a phonograph pickup, and like the latter is associated with a motor and gears, by means of which the record is made to move. The place of the phonograph needle, which is in actual contact with the moving record, is taken in this case by the beam of light that forms the only contact between cell and sound track.

A few of the common types of sound track used today are illustrated herewith. All sound tracks resemble those here shown in consisting of areas that offer a variable opposition to the transmission of light. It is important to note that the normal track is not transparent, and modulated by opacity, but, to the contrary, is black, and modulated

by transparent areas. This is the secret of the so-called "noiseless recording." A track of that kind keeps all light from the cell except just so much as is needed for the volume to be reproduced. The photocell "hiss" level is thus held far below the sound level, and is never heard with modern film. Remembering this point will explain the peculiarities of some tracks the Service Man may encounter from time to time.

The photocell has the function of converting to pulsating dc the modulated light that reaches it after having passed through one of these tracks.

The cell is a two-element device, working with between 90 to 135 volts dc as a polarizing bias. The cathode, or emitter, is of course not a filament; it is a broad metal plate coated with one of the "photo-sensitive" elements, caesium. Emission of electrons from this surface is negligible in darkness, but rises to a value of one microampere or more when the caesium is illuminated. The extent of the emission is directly proportional to the amount of illumination. Modern theatre cells are gas-filled to increase their space current.

The anode is a thin metal rod, which intercepts a minimum of light. Since it carries a positive charge it will attract electrons emitted by the cathode. This charge is constant, derived from filters of unusual excellence; hence the space current of the cell is dependent entirely on the degree of emission, which in turn depends solely on the amount of light reaching the cathode. Consequently the cell delivers a modulated dc which is a faithful reproduction of the successive areas of transparency and

opacity that were photographed onto the track in the recording studio.

Whatever method is used in recording, and whatever form of track results, all consist essentially of variations of transparency that pass through a beam of "exciting" light at a uniform rate of speed. That portion of the light which succeeds in piercing the transparent portions of the track ultimately reaches the photocell, and there excites electronic emission in direct proportion to its intensity. The frequency of the current thus created corresponds exactly to the frequency with which changes of transparency pass through the beam of exciting light, while the value or strength of the current reproduces the degree or extent of the transparency which permits light to pass. Hence, the electrical output of the photo-cell is an accurate reproduction of the electrical input to the recording device.

#### ELECTRICAL REQUIREMENTS OF THE PHOTOCELL

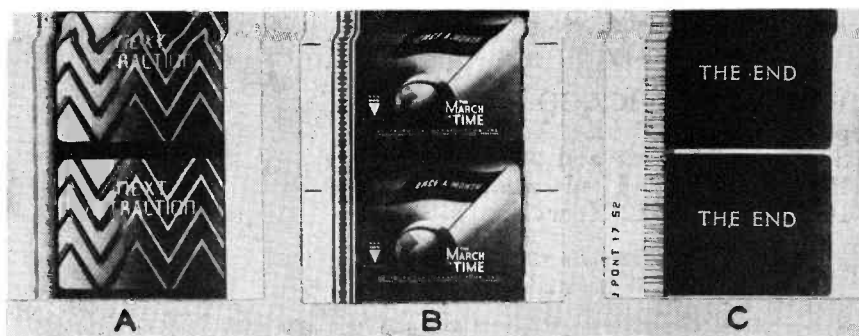
Electrically, the cell has only two requirements. It needs a source of highly filtered d-c bias, and a means of coupling its output to the sound amplifier.

The bias is now usually taken from the sound amplifier itself, and constitutes a branch of its "B" circuits. Additional filtering is usually added before the bias so obtained is applied to the photocell.

The coupling methods vary greatly with both the make and the size of the installation, but the fundamental considerations are always the same. Output impedance is very high; output level is very low. Consequently, unless the amplifier can be located very close to the cell, special coupling methods are essential.

In the smaller theatres, it is often possible to mount the amplifier on the projection room front wall, directly between the two projectors. In such systems, coaxial cables reach directly to the photocell sockets. The coupling within the amplifier may be of the standard resistance-capacitance variety, or may embody a special audio transformer. Resistance coupling is accompanied by preamplifier stages, the outputs of which are then switched or faded to effect sound changeover between projectors. If transformer coupling is used, the same result is obtained by switching the transformer secondaries.

Larger theatres need more elaborate methods because the amplifier is too bulky to be mounted between the projectors themselves, and a transmission line becomes essential. One manufacturer uses coupling transformers mounted in each sound head immediately adjacent to the cells themselves. A low impedance secondary line completes the coupling.



Three types of sound track in use today. The RCA variable-area track is shown at (A); (B) is the push-pull variable-area track of RCA; (C) is the variable-density Western Electric track.



Systems no longer manufactured, but still in widespread use, and therefore likely to be encountered anywhere, mounted one- or two-stage preamplifiers in the sound heads, coupling the cells to them with a conventional resistance-capacitance circuit. The output level of these amplifiers is comparatively high, their output impedance low, and shielded transmission lines connecting them with the main "board" give no trouble. These lines run through a "fader" mounted on the front wall, in which changeover is effected. The same fader is often the main volume control of the system, consisting either of a potentiometer and changeover switch, or of a double potentiometer.

The method of mounting the preamplifier in the sound head itself was somewhat troublesome, since the amplifier tubes are exposed to the vibration of the projector, and sometimes pick up noise; while other parts, including wiring, may become saturated with projector oil, to the damage of the insulation. An early variant of this method was to place the preamplifier in the same physical position, but to mount it on a pedestal of its own, eliminating all physical bond to the projector except for a single flexible cable. A more modern variant is to provide a one-stage preamplifier for each photo-cell, these amplifiers being mounted on the front wall as close as possible to the projectors they serve. The input circuits of those amplifiers are then wired to the secondaries of audio transformers mounted in the sound heads.

Still other coupling arrangements are found occasionally. Each system must be studied as a separate entity.

PHOTOELECTRIC CELL OPTICAL REQUIREMENTS

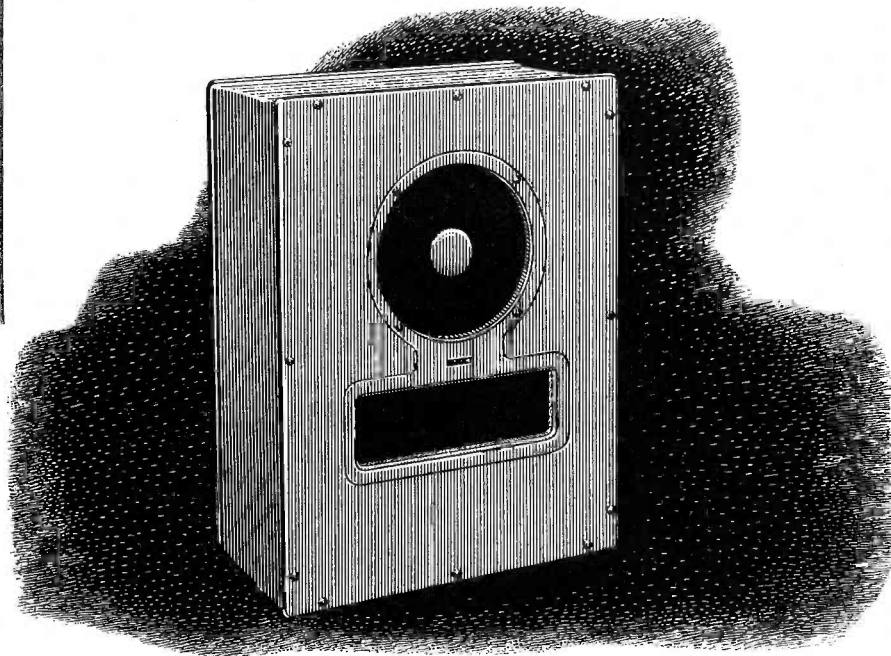
The optical arrangements associated with the cell will be found less familiar, and more troublesome, than its electrical surroundings.

To begin with, the cell needs a source of light which must penetrate the sound track. This light must be of a certain minimum intensity. It should be as clear as possible, the cell being quite inefficient with yellow light. It must be entirely steady, since any changes of intensity other than those created by the moving track will be heard as noise. Lastly, it must be focussed or otherwise so framed that the thinnest peaks or lines in the sound track can modulate it effectively. If a mere broad splash of light were sent through the film to the photocell it is obvious that no single line or peak of the track would exercise much in-

# Jensen

## PERI-DYNAMIC REPRODUCERS

... with *Bass Reflex*

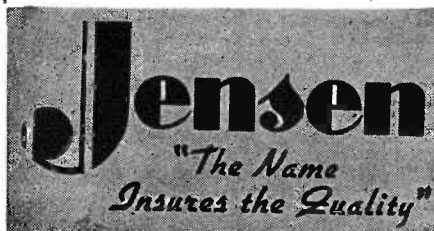


NOW OFFERED WITH **Jensen Auditorium and 18" Speakers**

The outstanding performance of these "Standard of the World" speakers is now improved by the advanced acoustic principles, incorporated in these new reproducers, which add new octaves of low frequency response and exceed in ability even an infinite baffle.

AND as separate enclosures correctly designed for the thousands of these speakers already in use and inefficiently "baffled."

Enclosures are shipped in knock-down kit form for convenience and low cost. Those who know the performance improvement, convenience and low cost of Jensen *Peri-dynamic* Reproducers for 8, 10, 12 and 15-inch speakers will cheer the addition of these new models. Write for new descriptive literature describing the complete line of Jensen *Peri-dynamic* Reproducers.



JENSEN RADIO MFG. COMPANY 8-138  
6601 S. Laramie Avenue, Chicago, Ill.

... Please send me new literature describing Jensen *Peri-dynamic* Reproducers for Auditorium and 18" Speakers.

Name .....

Address .....

City ..... State .....

fluence over the general illumination. Hence, focussing arrangements, essentially simple, which fall within the province of a sound man's servicing duties. Proper adjustment of them is a vitally important part of the job of bringing out the best possible sound results.

The intensity of the light is governed by the choice of exciter bulb (this is specified by the manufacturer) and by the lamp current. Small, inexpensive systems light the lamp with ac derived from a step-down transformer. This practice tends toward an increased hum component which is compensated, as in some radio receivers, by deliberate introduction of loss at frequencies below 150 cycles. In such systems the lamp intensity needs no attention, apart from changing the bulb occasionally when it blackens with age. The more elaborate installations use either tube or metal "stack" rectifiers to provide dc for the exciter lamp, and often include a rheostat for adjustment of its filament current. Many add an ammeter to the rheostat circuit. In some systems volume from the two projectors is balanced by adjusting the rheostat.

The clarity of the light is impaired when the bulb blackens with age, but chiefly through projector oil that may seep or drip from the bearings or be spilled accidentally when the projector is lubricated. Thin films of such oil may settle over the focussing lenses, or even seep inside the mountings of the lenses, coating the glass on the inside of the lens tube where it cannot easily be removed. The glass surface of the photocell, through which light is admitted to the cathode, may be found similarly greasy. Special lens tissue is available in the projection room—or should be. If there is none, a paper handkerchief, very soft paper napkin, or similar material may be used. Neither a hard tissue paper (which may inflict minute scratches on the glass, nor a paper that shreds and leaves stray fibers behind, is suitable. Cloth should never be applied to lenses). Fine oil films cannot be removed easily with lens tissue alone, but the tissue may be moistened in carbon tetrachloride (Carbona), wiping with this to be followed by prompt wiping with a dry tissue.

Steadiness of the light being extremely important (to prevent noise) the rectifiers that supply d-c exciter lamps are well filtered. Loose connections in the line sometimes give trouble. These are particularly likely to be found in the rheostat, the frame of which may warp, shrink or crack through prolonged

heating. (Current is of the order of three amperes). The socket connections should also be inspected in case of this trouble. It is always easy to determine if the exciter lamp is causing noise by shielding the photocell from its light. A calling card or double fold of paper may be interposed for this test. Irregularities of socket resistance arise from the nature of the socket design, which is always such that the lamp can be replaced almost instantly if it burns out. Usually the socket is held in clips; sometimes there is a double or triple socket that slides or revolves; the object of these arrangements is to permit pre-focussing of a spare lamp, which can thus be substituted without either delay or impairment of the focus.

In most sound heads focussing is achieved by adjusting the position of the lamp in its socket, or of the socket in its mounting. In all heads each new lamp must be focussed individually because the positioning of their filaments is never exact. Advantage is taken of this fact to confine most or all focus adjustments to the lamp bulb socket.

The filament is mounted a straight, horizontal line, the image of which is focussed on the sound track as a horizontal hairline of light. Lamps in which the filament is not perfectly horizontal, when the bulb is properly mounted in its socket, and those in which the filament sags at the center, are not used. They cannot be focussed accurately. Sag often appears in an apparently good bulb when the filament expands with heat—all lamps should be observed from time to time through some tinted medium that cuts down the glare. The colored gelatine slides used for spotlights, available in most projection rooms, are very handy for this, but any bit of colored glass will serve.

In focussing, the lamp is rotated until its filament is exactly at right angles to the path of the light beam. It is moved in and out (toward or away from the door of the lamp compartment) up and down, and forward and back (toward or away from the film) until the hairline of light at the sound track is as thin as possible, and the illumination as great as possible. It is then locked in position by the means provided—usually set-screws.

Focus is checked in a number of ways. In most heads a white card or bit of paper is placed in front of the photo-cell, and the lamp is adjusted to throw a perfectly clear, sharp, white oval on the card. An oval that is misshapen, or shows red, blue or brown coloration, or is not sharp at the edges, indicates im-

perfect focus and the lamp position is adjusted until these symptoms are completely removed. Some heads do not permit this form of test; for these the manufacturer issues suitable instructions. The projection crew, who are familiar with elementary optical problems, can assist in obtaining the best possible focus. They will know the procedure the manufacturer has prescribed for their own sound system.

A more accurate check of focus is to run a frequency test reel—one on which pure frequencies have been individually recorded—and read the output with a volume indicator. The lamp is then adjusted for maximum response at the highest frequency the system is intended to reproduce (9,000 in the newer installations; 6,000 in the old).

In some heads focussing is not confined to the lamp position alone, but can be adjusted at the lens assembly. The projection crew is not always familiar with the special procedures applying to such equipments; it may be necessary to apply to the manufacturer for guidance.

In some heads the lens assembly can be taken apart for cleaning; in others, special tools are needed, and oil or other dirt *inside* the lens tube can be removed only by returning the assembly to its manufacturer. A spare is obtained and installed temporarily.

In most systems a "slit" is included in the optical arrangements, almost always mounted inside the lens tube. It is the image of this accurately proportioned slit, rather than that of the filament itself, that is projected onto the sound track as fine, horizontal line of light. But some heads use cylindrical lenses, dispensing with the slit entirely, and others have the slit mounted in front of the photocell as a frame to screen off all light except that which was focussed to hair-thin fineness at the surface of the track.

The focussing arrangements at the lamp are also used to confine the beam of light to the track itself, permitting none to spill over to adjacent parts of the film. This is accomplished by moving the lamp in or out (toward or away from the door of the lamp compartment). For if the lamp is so displaced, laterally that light can be modulated by the frame lines (see illustrations) on one side of the track or by the sprocket holes on the other, motorboating will be heard. Since there are more sprocket holes per inch than frame lines, the pitch of sprocket-hole motorboating will be the higher of the two—an experienced ear can identify the cause of the trouble. It is sometimes difficult, however, to

adjust this trouble by ear, because slight traces of it cannot be heard over the noise of the projector, although distinctly audible to the audience below. A favored cure involves "photographing the sound track," which is done when the projector is idle—that is, when the other projector is carrying the show. Blank, undeveloped film is used. The reels as they reach the projection room have a few feet of such film at the beginning and end, which can be cut off and patched back afterward. This blank leader is threaded in the usual way, and the exciting light switched on. A fifteen-second exposure suffices to photograph a thin black line across the sound track position. No development is needed to make the line visible. The machine is then turned slightly by hand, to move the film along, and a new exposure made a bit further on. Half a dozen such exposures a quarter inch apart will show very clearly whether the exciting light is overlapping the sprockets or the frame lines. The lamp is readjusted and its new position tested by further photography until the cause of the motorboating is definitely removed. One further complication is mentioned below.

MECHANICAL REQUIREMENTS OF THE PHOTOCCELL

The mechanical requirements of the photocell are the same as those of the phonograph pick-up. The record—in this case the film—must move with perfect smoothness, and at exactly the predetermined rate of speed. Unsteady motion of the film is less likely to be caused by defects in sound head itself than by excessive vibration or other faults in the projector, or by imperfect functioning of the take-up. These troubles lie in the province of the projectionist—the sound inspector has no more to do with them than to indicate that they are what need correcting. The steadiness of the motor, its flywheel and its sound gears, belts or pulleys are, however, the Service Man's business. Little need be said about these matters here. They need only common sense, since they are purely mechanical, and hence open to visual inspection of the parts involved. Unsteady action of the motor itself, however, may be traceable to some defect in its speed control mechanism—a point discussed in outline below.

The effect of unsteady motion of the film can be produced in the sound head by a number of indirect causes. One is worn, undercut sprocket teeth, which may fail to grip the film properly. Such sprockets are replaced. Worn, enlarged

# HITS OF THE YEAR

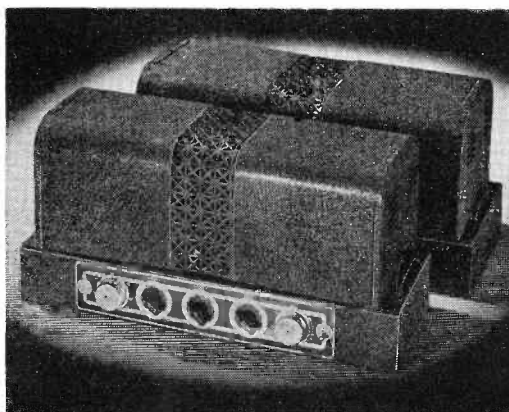
## BEAM POWER AMPLIFIERS

The UTC Pak kits are now acknowledged by the PA field as ideal Universal amplifiers. There is provision for mixing of two high impedance inputs. An etched panel providing a dual gain, two position mixer with gain links for high or low gain on each position and a VARITONE equalizer control for highs and lows.

**\*PAK-5M** 15 watt compact power amplifier. Uses two 6V6 Beam Power tubes. Power supply and audio amplifier on one chassis 6 x 9 x 17 inches. Tubes are 6J7, 6C5, 2-6V6's-120 DB gain. High impedance input. 500, 200, 16, 8, 5, 3, 1½ ohms output. Kit includes all accessories and pre-wired resistor—condenser strip, mixer panel, controls and accessories for a dual gain, two position mixer and VARITONE equalizer control, less tubes. **Your Cost \$33**

**\*PAK-1M** Self bias 35 watt output. Audio and power on separate chassis for rack or cabinet mounting. High impedance input 110 to 120 DB gain. Provision for immediate switchover to 95 DB gain with connections either for triode plate or 500-200 ohm input line. Output transformer impedances 500, 200, 16, 8, 5, 3, 1.5 ohms. Includes all components and accessories such as resistors, condensers, sockets, calibration plates, etched mixer panel, controls and accessories for a dual gain, two position high impedance mixer, chassis, dust covers with handles, hardware—except tubes—all fully mounted. **Your Cost \$48**

**\*PAK-2M** Fixed bias 55-watt output, otherwise same as PAK-1M. **Your Cost \$51**

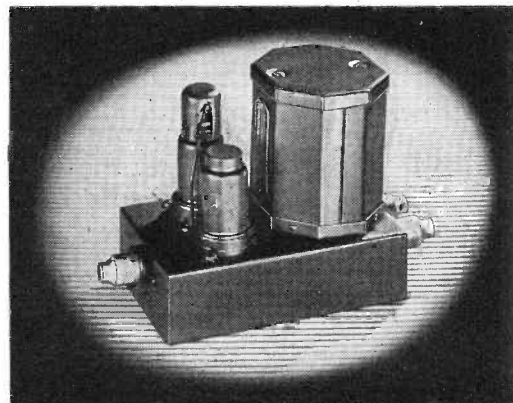


**PAK-3M** Uses 4-6L6's—70 watts self bias—100 watts fixed bias, total gain 110 DB. High impedance input. Separate chassis for power and audio for rack or cabinet mounting. Tubes are 1-6J7, 1-6C5, 2-6A5G's, 4-6L6's, 3-83's, 1-80. Output transformer impedances 500, 200, 16, 8, 5, 3, 1.5 ohms. Includes all accessories such as resistors, condensers, sockets, calibration plates, etched mixer panel, controls and accessories for a dual gain, two position high impedance mixer, chassis, dust covers, handles, hardware—except tubes—all fully mounted.

**Your Cost \$78**

**PAK-7A** Pre-amplifier. High gain well filtered pre-amplifier designed to operate from power supply in main amplifier. High impedance input. 6F5 resistance coupled to 6C5—50, 200, 500 ohm output. Gain 60 DB. amplifier kit only including all accessories less tubes. **Your Cost \$9**

**PAK-7P** Power supply — components and accessories for 7A pre-amplifier. **Your Cost \$9**



WRITE FOR GENERAL BULLETIN PS-402

\*Also available for modulator service.

**UNITED TRANSFORMER CORP.**  
72 SPRING STREET NEW YORK, N. Y.  
EXPORT DIVISION: 100 VARICK STREET NEW YORK, N. Y. CABLES: "ARLAB"

# ARCTURUS

Radio's finest tubes  
plus radio's fairest  
equipment deal spell  
double profit to you.

## Mail the Coupon!

- If you need new service or shop testing equipment...
- If you want to get it at almost no cost to yourself...
- If you are interested in the fairest, easiest Equipment Deal in the history of radio...
- ...Then you owe it to yourself to get the facts without delay. Let Arcturus help you modernize!

**ARCTURUS RADIO TUBE CO.**  
Newark, N. J.

Without cost or obligation on my part, send details of your new equipment deal.

Name \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ 8-8

I am a dealer  I am a serviceman

My Jobber is \_\_\_\_\_

For your convenience, this coupon can be pasted on a penny postcard.

## SOUND SERVICE—continued

sprocket holes in old prints produce the same result; this is beyond remedy except through complaint to the exchange. Idlers, worn or imperfect, may fail to hold the film firmly against the sprockets. The gate (if the sound head is one that has a gate) may not exert sufficient pressure against the film to keep it firmly in that plane in which the exciting light reaches its sharpest focus, but permit it to "flop" in and out of the narrowest part of the light beam. The necessary adjustments in each case are fairly obvious to anyone with reasonable mechanical aptitude, and involve only adjustment, careful lubrication, or replacement of worn mechanical parts. In such replacements (since the mechanical arrangements are similar to those of the projector head) the projectionist can assist and advise.

Lubrication and motorboating are two slightly alien matters that have no direct connection with steadiness of film motion, but are mentioned in this place because the same mechanical contrivances are involved.

In oiling any part or bearing at the operating side of any sound head, it is very necessary to avoid spilling any trace of oil, and to avoid overlubrication that may result in seepage or in spattering of the excess. Oil on the sound track makes noise, on the picture it blurs the image. No oil should ever be allowed to touch the film, or any surface that touches the film. The film should never be handled with greasy fingers.

The problem of sprocket hole or frame line motorboating, just discussed in some detail, is not always one of the positioning of the exciter lamp. The lamp may be correctly placed, and the same trouble still appear because the film is out of lateral adjustment. Or, even if the fault is at the lamp, the trouble may still be cured most easily by leaving the lamp alone and adjusting the lateral guides of the film. Adjustment of these guides will move the sound track in or out (toward or away from the door of the film compartment) and is by far the most common way of tackling this form of motorboating. The ear tests and photographic procedure are no different, whether it is the lamp or the film that is shifted.

Proper motor speed, and hence proper film speed, is controlled in most systems by the motor itself, which is a synchronous a-c type in which rpm are independent of load. But special speed control devices were formerly very common, and still function in a large number of theatres, both in a-c and d-c districts. It is unfortunate that the variety of these

devices, and the complexity of some of them, makes complete description impossible here. Some are merely mechanical, involving a chattering, make-and-break motor field circuit operated by a governor. Others have a generator bolted on the same shaft with the motor, and mounted under the same casing, its presence unsuspected to one not familiar with the arrangement. The generator acts through a supplementary motor field to produce a regulating counter-emf.

The most intricate of these devices use three or four vacuum tubes. A generator mounted in the same case with the motor develops 720-cycle a-c at proper running speed. This output is fed through a tuned Wheatstone Bridge circuit, any unbalance in which changes the bias of a vacuum tube grid. The filters in the bridge govern the direction of the change, and the plate output of the tube, in ways that are likely to be somewhat unfamiliar to the Service Man. In one model, triodes are used as rectifiers with positive grid bias to control the value of the rectified current. The output of the vacuum tubes is used as a speed control current in different ways, depending on the model of the control unit. It may, being d-c, serve to excite a speed regulating field built into the motor. In the commonest a-c type, it saturates one winding of a choke coil, the other winding of which constitutes the load upon another generator included in the motor housing, and through this means imposes a greater or lesser load upon the motor itself.

Service Men who encounter any of these devices, now fortunately obsolete although still used in many theatres operating with early forms of equipment, can find circuit diagrams and full descriptions of their functioning in any of several text-books on theatre sound. Circuit diagrams alone may also be found inside the apparatus itself, or obtained from the manufacturer, but the arrangements being distinctly unconventional, a description of the action will often prove helpful. A very valuable aid in dealing with these contrivances, where they still exist, is the fact that there are always two of them. Consequently the faulty one can be compared with the good one by means of analyzer readings. In that way defective parts can often be replaced, and repairs completed satisfactorily, without a detailed knowledge of their operation and sometimes without even a circuit drawing.

The Service Man who has followed the discussion this far can be assured that all the less familiar portions of the-

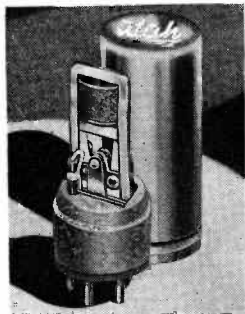
# Utah

is the **ONE** thing  
to remember . . .



**FOR A  
PROFITABLE BUSINESS  
IN VIBRATORS**

**Original  
Equipment in  
More Than a  
Million Sets**



**H**ERE'S the vibrator that has EARNED customer preference by its ability to "TAKE IT." UTAH vibrators are TOUGH. Impartial tests PROVE it. That's why manufacturers have chosen it for original equipment in more than a million sets. That's why it is the preferred vibrator for replacement service. It's the easiest vibrator for you to sell—and the most profitable, too. Exclusive UTAH design and construction mean no costly "comebacks" for you. UTAH vibrators work better, last longer but cost no more. Just a few models service any radio. When ordering vibrators, remember the name UTAH. It's the profitable thing to do.

**UTAH RADIO PRODUCTS CO.**  
CHICAGO, U. S. A.

TORONTO BUENOS AIRES  
ONTARIO, CANADA (UCOA RADIO PRODUCTS CO.)

**"16 YEARS OF LEADERSHIP"**

# CHECK



## STANCOR

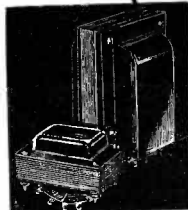
### QUALITY

Any way you wish . . . you can check Stancor and the answer is always the same—"It's quality that counts."

Sometimes Stancors cost a few cents more than other transformers of the same characteristics . . . BUT THEY'RE WORTH IT.

**NOTE  
CHECK THESE POINTS  
AGAINST THE FIELD .**

1. Cores of highest grade, laminated silicon steel. ✓
2. Windings checked after each operation. ✓
3. Positive vacuum - impregnation with special equipment. ✓
4. Triple Tested on dummy loads for perfect performance. ✓
5. The most modern factory in the industry. ✓
6. Finest appearance. Newest finishes, embossed name-plates, concealed connections. ✓



Then You'll  
**BUY  
STANCOR**

## STANDARD TRANSFORMER CORPORATION

850 BLACKHAWK STREET • CHICAGO

# SOUND SERVICE—continued

atre equipment have now been reviewed. Some few of their servicing requirements have been left for the future; but as far as apparatus itself is concerned, he will find nothing else in the theater with which he is not already familiar, to some degree at least, through his normal experience in radio and p-a.

(To be continued)

## G.E. FM-41, FS-5 Handy-Phone

THE HANDY-PHONE is a loudspeaker phone system for use in offices, homes, hospitals or other places where voice communication between a central station and one or more remote stations is desirable. The system consists of one Model FM-41 master station and from one to four Model FS-5 remote stations.

### THE CIRCUIT

The master station FM-41 employs four tubes in a three-stage audio amplifier circuit with power supply. Volume is controlled by a variable potentiometer R-3 in the grid circuit of the second audio amplifier. The speaker-phone used in this unit is of the permanent-magnet

type and is connected either as a microphone to the input circuit of the amplifier or as a loudspeaker to the output circuit of the amplifier by means of the talk-listen switch (S-3).

The heaters of all tubes and the dial lights with their shunt ballast resistor (R-2) are all in series and are furnished current from the power line through a dropping resistor (R-1). The

two 6F5 tubes use the common self-biasing resistor R-5 for obtaining grid bias. The 43 output tube is self-biased by the voltage drop in R-7.

Note that the chassis is not the B—lead of the power supply. This B—lead is by-passed to the chassis through the capacitor C-3.

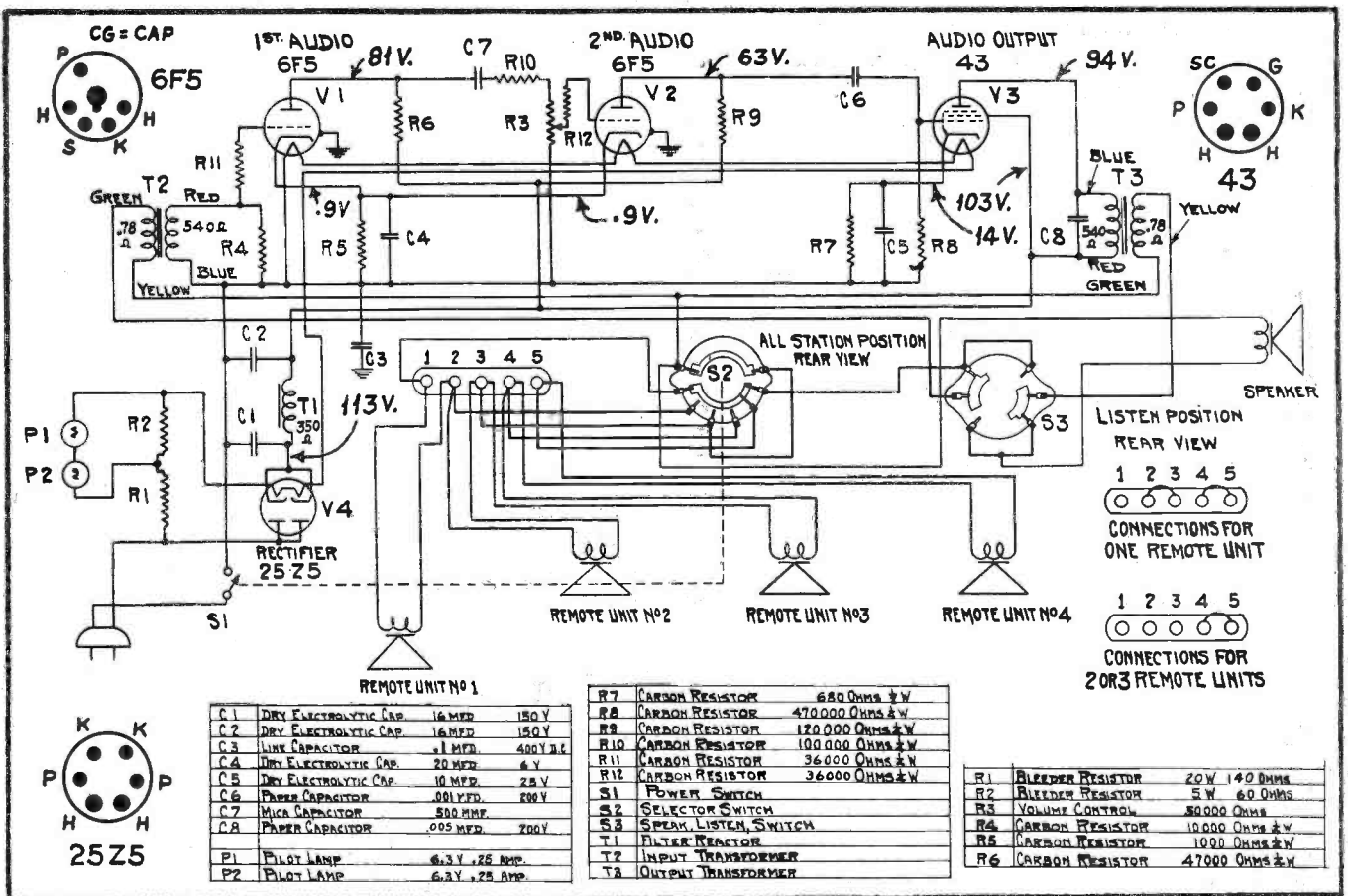
The remote station FS-5 uses a similar speaker-phone of the permanent-magnet type but does not incorporate an amplifier or power supply, all operating power being supplied from the master station unit. The remote station speaker is also connected either to the input or output circuits of the amplifier in the master unit by means of the talk-listen switch (S-3).

As an example of the operation of the system: When the talk-listen switch (S-3) is in the normal listen position, the remote station functions as a microphone and is connected to the input of the amplifier while the master station speaker is connected across the output of the amplifier. When S-3 is placed in the talk position, the master station speaker then functions as a microphone and is connected to the input of the

(Continued on page 35)

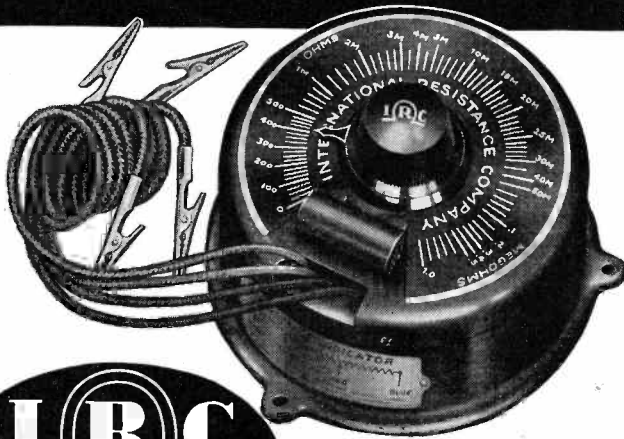
Distance of Remote from Master station	Wire size	Additional Equipment
1 to 500 ft.	No. 19 to No. 22 B & S Gauge	None
500 to 1000 ft.	No. 16 to No. 19 B & S Gauge	None
Over 2000 ft.	No. 19 B & S Telephone wire	Line Transformers*

\*Standard line transformers may be used. The transformers should be designed to operate from a five-ohm source into a line of 200, 500 or 600 ohms impedance. A similar transformer should be used on the remote station end to match the line impedance to the five-ohm load. These transformers may be procured from any radio supply house.



G. E. handy-phone circuit.

**USE IT WHEREVER  
RESISTANCE MEASUREMENTS  
ARE INVOLVED**



**RESISTANCE  
ANALYZER and INDICATOR**

**NEW IMPROVED TYPE**

(4 3/4" diameter by 3 1/4" high)

**A Calibrated Variable Resistor Instrument for General Use In All Types of Resistance Measurements**

**Valuable to  
Servicemen  
Amateurs  
Radio & Electrical  
Engineers  
Manufacturers  
Experimenters  
Laboratories  
Colleges &  
Schools  
Broadcast  
Stations**

**... And to Everyone Who Has Anything to do with Resistance Measurements**

Unquestionably the finest instrument of its kind, the new IRC Resistance Analyzer and Indicator has countless uses wherever fixed and variable resistances are involved. Among these are:

For determining by the substitution method proper values for resistors and standard Volume Controls; estimating required Volume Control tapers; voltmeter multipliers; wire wound rheostat or potentiometer; calibrated gain control or attenuator; voltage divider, etc. Complete instructions included in 16-page folder.

The Analyzer is direct reading. It has only the one adjustment knob to vary the resistance continuously from 0 to 1.0 megohm. Circuit consists of heavy duty wire wound rheostat type element from 0 to 30,000 ohms and special Metalized type resistance element from 30,000 to 1.0 megohm.

Case of molded Bakelite. Three fuse sizes included.

NET PRICE . . .

**\$4<sup>95</sup>**

**FREE . . . !  
Just Out !**



**Ask your jobber for a copy of the New 1938 IRC catalog containing helpful information and detailing our complete line of Resistors, Controls, Kits, Suppressors, etc.**

**INTERNATIONAL RESISTANCE COMPANY**

401 NORTH BROAD STREET, PHILADELPHIA, PA.

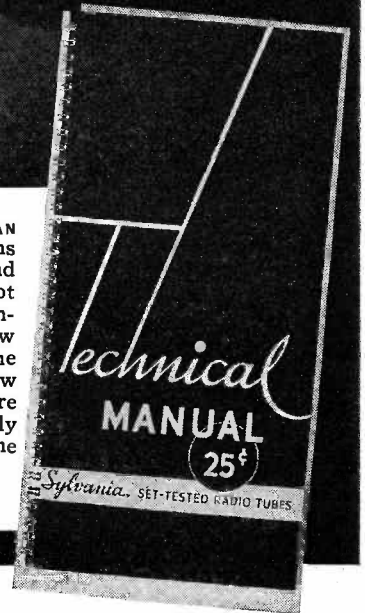
Factories or Licensees in Canada, England, France, Germany, Italy, Denmark and Australia

MAKERS OF RESISTANCE UNITS OF MORE TYPES, IN MORE SHAPES, FOR MORE APPLICATIONS THAN ANY OTHER MANUFACTURER IN THE WORLD

**"MY  
QUESTIONS  
ARE  
ANSWERED"**



"EVERY SERVICEMAN has tube problems pop up now and then. Until I got my Technical Manual, I didn't know where to find the answers . . . but now all my questions are answered . . . simply by referring to the Manual."



SERVICEMEN depend on the Technical Manual because it covers—not just a few items—but almost every phase of the radio tube field. It lists over 200 tube types . . . gives full information on glass, metal, "G" type and Sylvania "Ballast" tubes, as well as those for Majestic receivers. Includes typical circuit diagrams, bias resistor charts, and a wealth of other valuable information. This "serviceman's friend" should be part of your tool kit. Send 25c. and the coupon . . . TODAY!

**SYLVANIA**

Set-Tested Radio Tubes

HYGRADE SYLVANIA CORP. Emporium, Pa.

S-18

Here is 25c. Send me my copy of the new Sylvania Technical Manual.

Name . . . . .

Address . . . . .

City . . . . . State . . . . .

SERVICEMAN

EXPERIMENTER

DEALER

AMATEUR

# Auto-Radio . . .

## DeWald 702

THE DEWALD MODEL 702 is a seven-tube auto-radio receiver using glass tubes in the superheterodyne circuit shown in Fig. 1. The frequency range is from 550 to 1500 kc. The control drive ratio is 8 to 1.

A power output of 3 watts is available for the 6-inch electro-dynamic speaker. The total current drain is 6.5 amperes. An average sensitivity at 1 watt output is 1.5 mv.

### ALIGNMENT PROCEDURE

An output indicating device should be connected across the primary of the speaker transformer or across the voice coil. The various r-f and i-f trimmers should be adjusted for a maximum indication on the device.

Throughout the alignment procedure the volume control on the receiver should be on full and, as the stages are brought into alignment, the signal generator output should be kept low by means of the attenuator provided.

Both receiver and signal generator should be given at least 15 minutes to warm up before attempting adjustments.

The alignment operations are given in the accompanying table. The condenser or resistor indicated under dummy antenna should be connected in

series with the generator output lead and the position on the receiver chassis designated under signal generator connection. The operations must be made in the order given. For accurate results the entire alignment should be repeated.

### Shielding

Perfect shielding combined with rigidity can be obtained in the lead to the high side of the spark coil in auto-radio installation. Get a piece of copper tubing with an inside diameter of about  $\frac{3}{8}$  inch, and of appropriate length for the job. Wrap ordinary electricians' tape around the wire, spacing the "humps" of tape about every three

inches. These humps should be just large enough so that the wire is held inside the copper tubing; in effect, you are making a coaxial conductor. Ground the copper tube thoroughly and the wire enclosed in the tube will be just about perfectly shielded.

RCA Service Tip File

### RCA and GE

Buzzing on weak stations: May be due to loose screws holding vibrator to frame. If these screws become loosened, an appreciable amount of vibrator radiation gets into the r-f circuits.

RCA Service Tip File

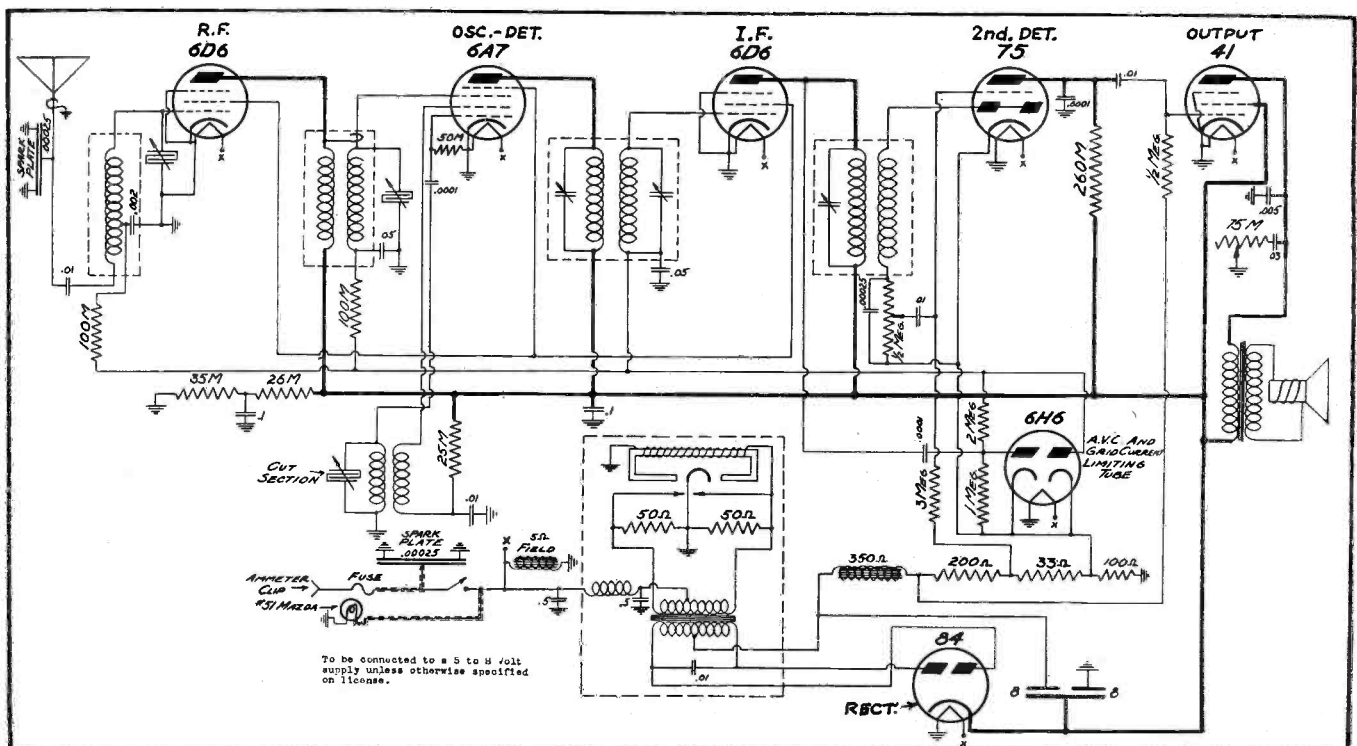
### Interference Source

Ignition interference: The metal trough around the top of a car will, unless well grounded, radiate considerable ignition noise.

RCA Service Tip File

### DEWALD 702 ALIGNMENT OPERATIONS

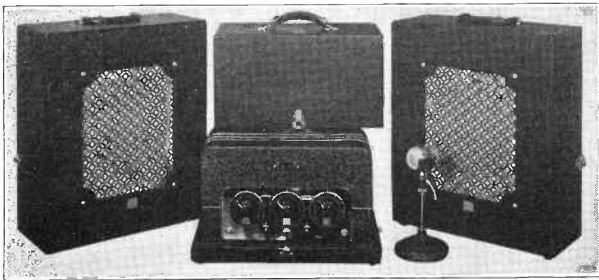
Signal Generator Connection	Dummy Antenna	Signal Generator Frequency	Dial Setting	Peak Trimmer
<i>Ground stator of oscillator section of variable condenser.</i>				
6A7 Grid	0.25 mfd	175 kc	Closed	Second i-f pri
6A7 Grid	0.25 mfd	175 kc	Closed	First i-f sec
6A7 Grid	0.25 mfd	175 kc	Closed	First i-f pri
<i>Repeat i-f alignment.</i>				
<i>Remove ground from oscillator section of variable condenser.</i>				
Antenna	200 mmfd	1500 kc	1500 kc	Osc
Antenna	200 mmfd	1500 kc	1500 kc	Ant
<i>Repeat entire alignment.</i>				



DeWald 702 schematic diagram.



**A NEW YEAR! A NEW MODEL!**



**A 24 WATT BELL P. A. SYSTEM**

- ★ Fine Tone Quality
- ★ Easy to Operate
- ★ Typical Bell Quality
- ★ Bass and Treble Compensator Controls
- ★ Easy Portability
- ★ Care Free—Made to Last
- ★ Beam Power Out-put Tubes

Bell leads again . . . scoring a hit with a new design that is proving a sensation. Designed for any type of installation, permanent or temporary. The 24 watt power out-put provides the additional volume required for the large installation! The new type Crystal Microphone is practically indestructible, has a superior frequency response and does not develop "hiss," "back ground noise" or "aggravating rattle" when moved or jarred. The high gain amplifier, Octal series tubes, dual in-put channels, provision for mixing two microphones or even two microphones and phonograph, 12" heavy duty speakers, etc., all have their part in making this a superior P. A. system. In fact it has everything! . . . Including an attractive price. Write for complete details on Bell's complete line as well as Model 424.

**BELL SOUND SYSTEMS, Inc.**

61-62 East Goodale St., Columbus, Ohio

Export Office: 308 W. Washington St., Chicago, Ill.

**REMEMBER GIRLS..HE'S HERE TO FIX THE RADIO**



The radio service man must do his work quickly and do it right if he is going to make money and build a list of satisfied customers. The use of dependable replacement parts that do not fail are a big help. That is why so many successful service men are using the parts described in Bulletin 507.

**WARD LEONARD ELECTRIC CO.**

36 SOUTH STREET, MOUNT VERNON, N. Y.

Please send me your Service Man's Bulletin No. 507.

Name .....

Address .....

City ..... State .....

Jobber's Name .....

**LEADING SERVICING ORGANIZATIONS**

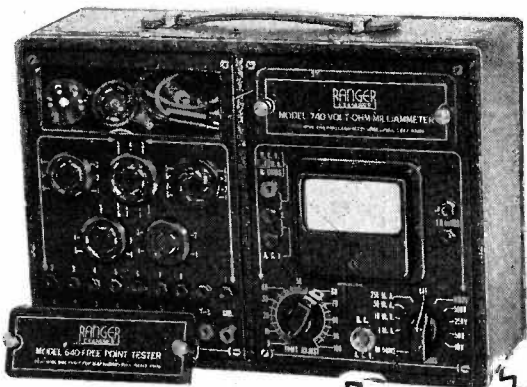
Use This

**COMBINATION VOLT-OHM-MILLIAMMETER**

Precision built throughout, yet designed to withstand rough field work. That's why you find Readrite-Ranger testers used by so many leading service organizations. Volt-Ohm-Milliammeters, Tube Testers, Free Point Testers, Oscillators, available in combinations or in single units. No extra cases to buy. Today's biggest values in Precision Testers.

The Readrite-Ranger Model 640 Free Point Tester has eight automatic switch type and ten single action jacks. Five sockets will handle any type radio tube. Model 740 Volt-Ohm-Milliammeter has 3" Square Triplett Precision Instrument. Scale readings: 10-50-250-500-1000 AC and DC Volts at 1000 Ohms per Volt (DC Accuracy 2%; AC 5%); 1-10-50-250 DC M.A.; 0-300 Low Ohms; High Ohms to 250,000 at 1 1/2 Volts. (Rheostat adjustment for 13 1/2 Volts for Ohms readings to 2 1/2 Megohms. Batteries may be added permitting such readings in 250,000 Ohms steps.) Low Ohms to 1/2 Ohm with 25 Ohms in center of scale. Backup circuit used. Current draw is only 1 M.A. Batteries, accessories and instructions included.

MODEL 640-740



**PRECISION BUILT ONLY \$28<sup>35</sup>**

ALSO AVAILABLE IN SINGLE UNITS . . . NO EXTRA CASES TO BUY



**READRITE METER WORKS**  
 117 College Ave., Bluffton, Ohio

Please send me more information on Model 640-740: I am also interested in .....

Name .....

Address .....

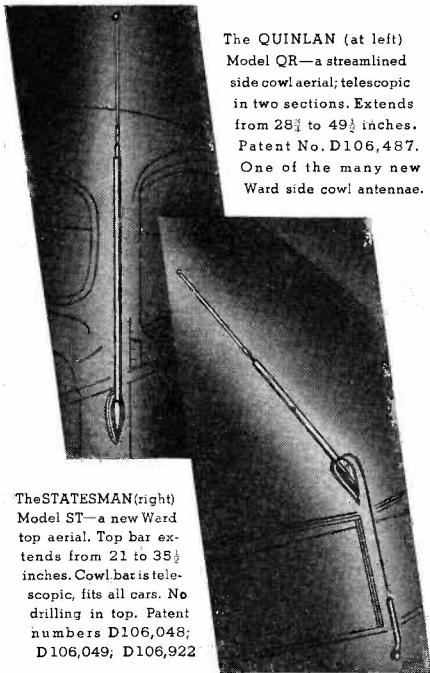
City ..... State .....

**WINNER**  
**FIRST PRIZE**

*Win*  
**WITH**  
**WARD**

Thorobreds perform better, show better—and so do the thorobred 1938 WARD automobile aeriels, featuring Mol-en-ac, a natural white metal that cannot rust.

WARD aeriels give more power, greater reception, smarter lines, less static — are easy to install.



The QUINLAN (at left) Model QR—a streamlined side cowl aerial; telescopic in two sections. Extends from 28½ to 49½ inches. Patent No. D106,487. One of the many new Ward side cowl antennae.

The STATESMAN (right) Model ST—a new Ward top aerial. Top bar extends from 21 to 35½ inches. Cowl bar is telescopic, fits all cars. No drilling in top. Patent numbers D106,048; D106,049; D106,922

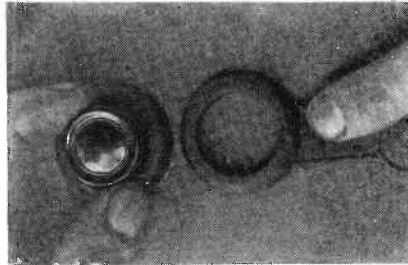
WRITE FOR ILLUSTRATED CATALOG

**The WARD PRODUCTS Corp.**  
WARD BUILDING CLEVELAND, OHIO

**Broom Holder Makes Neat Finger Guard for Panel**

THE FINGER ENDS when turning the dial buttons of the smaller radios often contact the face of the panel in time, wearing off the finish of the wood or composition. Various protective rings and attachments are necessarily used to prevent this.

A very neat and practical home-made precaution is shown above. Cut off the handle ring or circle of a common soft rubber wall broom holder and



glue it to the face of the panel as shown. It is workmanlike in appearance, does not interfere with removal of the handle or button, and nicely prevents a contact of the finger with the panel face.

*Frank Bentley*

**\$\$\$ IN AUTO RADIO**

*(Continued from page 7)*

linings, dissipates the charges to the frame. Perchance such a procedure will be of interest to Service Men in this country.

The demand for and the sale of motor-radios has created in the automobile sales and service stations a situation that can be solved effectively by the Service Man. The new sets must be installed properly and maintained. Finding it inconvenient to return a newly purchased set to the dealer for service, customers stop in at the nearest garage. They in turn attempt repairs or recommend a neighborhood radio-service shop. To meet the circumstance, auto-servicing chains have already been organized in a plan whereby any auto-radio installed by a member station is serviced completely at any other member station, free of charge, during the warranty period. The staffs of large radio-service shops are being called upon for the work. It merely remains now for the independent Service Man to affect a connection that meets his local conditions. Servicing alone is profitable; a combination of sales and service, in addition to home-receiver work, is particularly so. With a vast potential market in the offing for auto-radio sales, one's future motto can justly be "A radio in every automobile."

**Now! BALLAST REPLACEMENT**

made **AMAZINGLY SIMPLE**

- Servicemen, with only 4 standard types of Amperite AC-DC Regulators you can replace 90% (over 100 types) of AC-DC Ballast Tubes now in use! Consult your jobber.
- Amperite Regulators are equipped with a patented Automatic Starting Resistor to prevent untimely burnouts and save pilot lights.
- New Low Price on Amperite AC-DC Regulators: \$1.00 LIST  
Amperite Replacements for 2V Battery Set ballasts \$1.25 list



**AMPERITE**  
AUTOMATIC REGULATORS

**Improve Tone**

with  **Audios**



Exceptionally flat response curve assures true reproduction at all frequencies. Often your customer will say "The set sounds better now than when it was new." That's good for your reputation . . . and profits! The "Multi-tap" Output has universal primary, and secondary tapped in 2 ohm steps from 2 to 30 ohms—to match any standard output tube, either single or in push-pull, to magnetic speaker or any of the standard voice coils.

**PULL PUSH**  
**MOISTURE PROOFED**

All coils are vacuum-baked to extract every last trace of moisture, and then impregnated with special 9X Moisture-Proofing Compound forced into windings under tremendous pressure. Sealing is perfect. No dripping of high melting-point Compound, and subsequent shorting, under normal operation in the hottest, most humid sea-coast climate. Ask your jobber, or write for FREE Bulletin, Form 41.

**GENERAL TRANSFORMER CORP.**  
1266 W. Van Buren St., Chicago, Ill.

## GETTING ON IN RADIO

(Continued from page 9)

*Technical Manual*, \$0.15, contain much useful data on special receiving tubes and replacements.

(3) *The Research Worker*, Aerovox Condenser Corp., Brooklyn, N. Y., \$0.50 per year, is an interesting and informative bulletin about condensers of all types and applications. Receiver-design fundamentals are also given.

(5) *Good News*, RCA-Victor, Camden, N. J., free. Contains helpful servicing information, suggestions for improving business, and ideas on sales helps of dealer display equipment.

(5) Radiart Corp., Cleveland, Ohio., supplies at small cost, information on the theory, design, and practical servicing of auto receivers. The series of booklets written in "correspondence-course form," gives data on vibrators, motor interference, automobile antennas, and miscellaneous parts.

(6) *Questions and Answers Handbook*, revised edition, Allied Radio Corp., Chicago, Ill., \$0.95, contains 3449 questions drawn up and answered from a Service Man's point of view. These questions, divided into nineteen sections, have been submitted by IRSM members and later compiled in a form that provides a fine self analysis to the conscientious worker. The quiz sections of group-study periods to be discussed later will find it most valuable.

The list of books and manufacturers' publications is by no means all-inclusive, but consists of such material as was available to this writer. Many other books are published, and likewise numerous other manufacturers have available bulletins and booklets which will be found of interest and value.

Other booklets, containing a store of useful information, are also available periodically. Advertisements and news items in *SERVICE* keep readers posted as these are issued by manufacturers.

(To be continued)

### Philco

*Shadow Meter*: A defective shadow tuning meter may be checked by piercing the insulation of the leads to the meter with phonograph-needle-tipped test prods to which your milliammeter is connected. This is especially effective in demonstrating to the customer that a new indicating meter is necessary.

RCA Service Tip File

### Philco 60 and 66

*Hum*: Replace the single condenser connected between one side of power

transformer primary and ground by a dual condenser. Connect one lead from each of the dual units to one side of transformer primary. Connect the other lead from each condenser to ground.

RCA Service Tip File

### RCA Victor M-30

*Lack of volume control*: If receiver plays, but without any control of the volume, try replacing green wire in the cable that runs from the set to the control unit. This may be broken, and if

so it disconnects cathode of the a-v-c tube.

RCA Service Tip File

### Stromberg-Carlson 642

*Fading*: Signal faded out and returned at high volume when an electric light in the house was turned on. Replace 0.0005 mfd condenser in audio coupling unit between detector and first a-f tube. This unit is located near the front volume control and contains a 10 mh r-f choke and two 0.0005 mfd condensers. The choke usually does not require replacement.

RCA Service Tip File

# MORE FAMOUS RADIO ENGINEERS Acclaim SUPREME INSTRUMENTS!



"I am particularly glad to see SUPREME introduce so efficient and reliable an instrument as the Model 541 Set Tester—and so extremely efficient for all types of service work."

*Karl W. Miles*  
Chief Engineer  
THE HALLCRAFTERS, INC.





"I was really amazed at the excellence and flexibility of Model 551 Analyzer, considering its very low price. A serviceman entering a home with it should certainly present all the earmarks of competence and ability."

*McMurdo Silver*  
President  
McMURDO SILVER CORP.



**SOME** of America's finest radio engineers . . . men who work daily with test instruments costing thousands of dollars . . . certainly *know* fine instruments. They recognize superiority in accuracy . . . in quality. That's why these same men who use the best laboratory instruments available acclaim Supreme instruments—the instruments for *your* service laboratory.

Too, Supreme instruments are easy to own. Your parts jobbers sell them for only a few dollars down—balance in monthly payments—on S. I. C. terms, *the world's easiest installment terms!*

**JUST OFF THE PRESS!**  
**FREE Illustrated 1938 Catalog. Write for It!**

**FREE "Adequately Equipped Shop" Certificate**  
Send for the free booklet explaining how you can qualify for a Supreme "Adequately Equipped Shop" Certificate.



"I have found Model 570 Signal Generator meets all requirements to an excellent degree, and I can well recommend it to those contemplating the purchase of such an instrument."

*Arthur S. Mohaupt*  
Directing Engineer  
RADIO TRAINING ASS'N. OF AMERICA

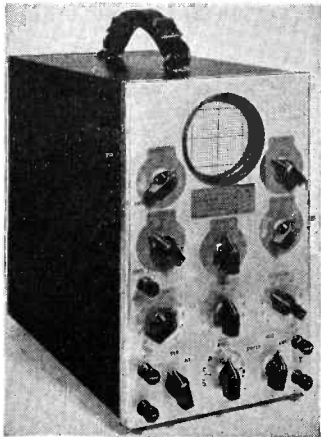


## SUPREME INSTRUMENTS CORP.

GREENWOOD, MISSISSIPPI • U. S. A.

Export Dept.: Associated Exporters Co., 145 W. 45th St., New York City      Cable Address: LOPREH, New York

# DUMONT CATHODE RAY TUBES and OSCILLOGRAPHS



TYPE 164

The choice of the leading college and industrial laboratories of the world.

Instruments designed for every application.

— AND —

## THE DUMONT TYPE 164

A specially designed oscillograph for the service engineer.

Ask about the new **LOW PRICE**

**ALLEN B. DUMONT LABORATORIES, INC.**

Upper Montclair, New Jersey

## GENERAL DATA—continued

exactly in accordance with the following instructions:

Use a 0.1 mfd condenser as the dummy antenna. Connect signal generator output to grid cap of 6A8G but without removing grid clip. Generator frequency 465 kc; receiver dial may be set at any point where it does not affect signal; range switch, Broadcast (clockwise).

Adjust trimmers 1 and 2 on 1st i-f transformer for maximum output.

Adjust trimmer 3 and 4 on 2nd i-f transformer for maximum output.

Repeat both of the above adjustments.

Replace 0.1 mfd dummy antenna with 400-ohm carbon resistor. Connect generator (still set at 465 kc) to antenna lead. Receiver settings as above.

Adjust trimmer 5 (wave trap) for minimum output; strong signal from generator should be used for this adjustment.

*Short-wave:* Still using 400-ohm dummy antenna, and with generator still connected to antenna lead, set generator to 6.0 mc and receiver to same fre-

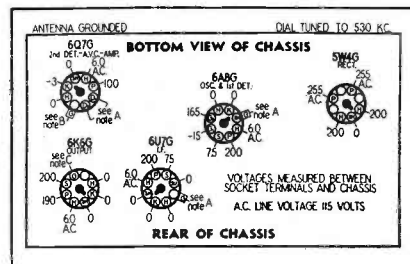


Fig. 3. Socket terminal voltage, Stewart-Warner R-180.

**Cunningham**  
STANDARD SINCE 1915  
Radio Tubes

# THE SERVICE MAN'S SPECIAL!

Here it is! The tube made to order for the service man.

Cunningham Tubes are the service man's special—and here's why.

They are sold *only* for replacement service work. They're priced so you get the profit you've always wanted... they're made and guaranteed by the world's largest manufacturer of radio tubes!

Add to this the sales-making array of selling aids we offer for 1938—and you'll see why Cunninghams will pull in more profits for you!

### SALES AIDS FOR 1938

Window displays; streamers; posters; direct mail pieces; decals; radio check-up posters; newspaper ads; sales and service meetings. Ask your distributor for full details.



**Cunningham Radio Tubes**  
STANDARD SINCE 1915

quency—range switch being turned counter-clockwise to Short-wave position.

Adjust trimmer 6 (s-w oscillator) to bring in signal. Check to see if proper peak was obtained by tuning in image at approximately 5.1 mc. If image does not appear, realign at 6.0 mc with trimmer screw further out.

Now tune receiver to 6.0 mc signal and adjust s-w antenna trimmer (7) for maximum output. Try to increase output by detuning trimmer and retuning receiver dial until maximum output is obtained.

*Broadcast:* Generator connection and dummy antenna as above; set generator to 1500 kc; range switch clockwise (Broadcast); receiver dial, 1500 kc.

Adjust trimmer 8 (broadcast oscillator—shunt) to bring in signal.

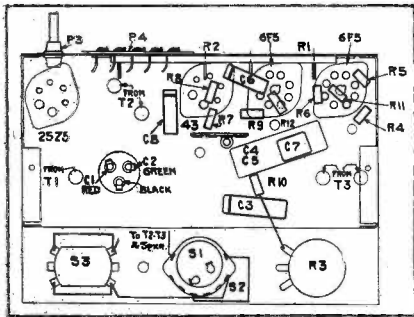
Tune receiver to 1500 kc generator signal and adjust broadcast antenna trimmer (9) for maximum output

Reset generator to 600 kc; tune receiver to generator signal.

Adjust broadcast oscillator series padding condenser (10) for maximum output.

amplifier, while the remote station is connected to the output of the amplifier and functions as a speaker. The selector switch (S-2) connects either any one individual remote station or all remote stations to the master unit. When the selector switch (S-2) is turned to the all position, the remote station units are connected in a series-parallel combination across the output of the amplifier.

When operating from a d-c source, it is necessary to insert the plug with proper polarity. If the unit fails to function, after allowing time for the tubes to reach their operating temperature, reverse the power plug in the receptacle.



Handy-phone equipment layout.

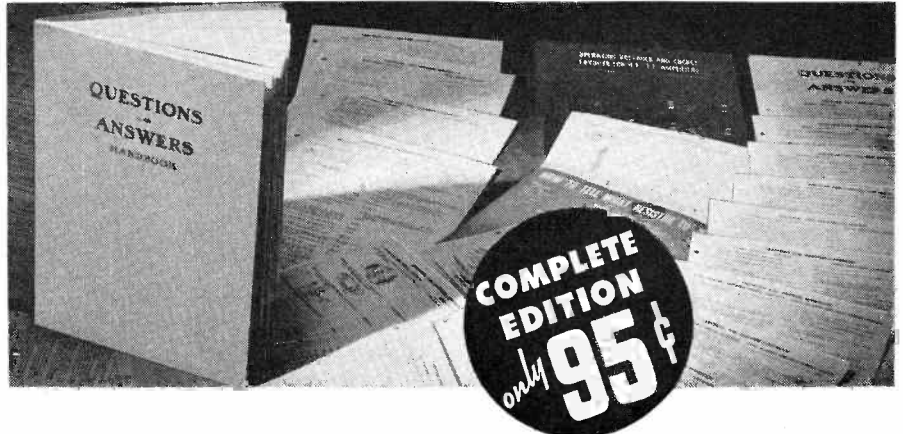
When the system is used on a d-c supply, the 25Z5 rectifier tube and the filter remain in the circuit and serve two purposes. If the power cord should be plugged in with incorrect polarity, the 25Z5 tube protects the filter condensers from damage. On correct d-c polarity the 25Z5 tube passes the d-c and the filter circuit aids in smoothing the supply voltage.

When the system is used on alternating current, all d-c potentials are supplied by a 25Z5 rectifier tube and its associated filter circuit. The tube is connected as a half-wave rectifier.

If any hum is noticed when the system is used on a-c, reverse the power plug in the receptacle. When the system has not been used for some time, a slight hum may be audible when the system is first turned on. This hum may not immediately clear up upon reversal of the power plug. However, it will probably be eliminated after approximately five minutes operation by which time the anode plates of the electrolytic capacitors will have reformed.

The accompanying table gives the size of the twisted wire and additional equipment necessary to wire a remote station to the master station for various distances.

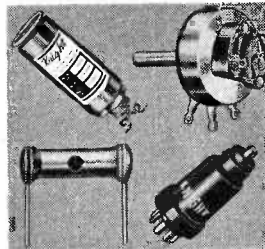
# NOW YOU CAN BUY IT!—AT ALLIED



## THE IRSM "QUESTIONS AND ANSWERS HANDBOOK"

Here—offered for sale for the first time—is the great Handbook every Serviceman needs. Formerly available only through IRSM membership, the *Questions and Answers Handbook* is brought to you by ALLIED at a sensational low price. This big book is a complete education in radio. Contains over 3,000 questions and answers covering every aspect of radio in an authentic and understandable manner. Two years in preparation—a complete digest of essential data from leading service manuals, from laboratories, schools, and thousands of top-notch servicemen. It's the authoritative, useful book every Serviceman wants. It's the book that has been acclaimed as the outstanding work of its kind in the field of radio. And now—exclusively at ALLIED—it can be yours for only 95 cents! Only a limited edition is available. Don't miss this opportunity—order your copy today. Use coupon order form below.

**CAN YOU ANSWER THESE?**  
 What is the formula for determining the total resistance of a number of resistors connected in parallel?  
 What is the effect of adding resistance to a tuned circuit?  
 What is meant by image frequency?  
 Does grid current flow in a Hartley oscillator?  
 Is the plate impedance of a tube constant under all conditions?  
 What is the purpose of a hum-bucking coil on a dynamic speaker?  
 What device is generally included in series with the antenna lead of an AC-DC receiver?  
 Is self-oscillation in an RF amplifier desirable?  
**THESE AND 3,000 MORE ARE ANSWERED IN THE "QUESTIONS AND ANSWERS HANDBOOK" — 95 cents**

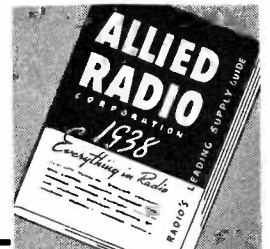


### BIGGER PROFITS WITH KNIGHT PARTS

Hundreds of service men are learning that Knight Parts give them greater profits and never let them down! You can buy condensers, carbon resistors, volume controls, tubes, etc., at 'way-below-usual prices, by ordering the Knight-brand parts listed in ALLIED's Catalog. Regular RMA guarantee—they make your profit bigger! Try Knight parts today! See your ALLIED Catalog!

### THIS SERVICE GUIDE IS FREE!

Your guide to everything in radio is ALLIED's Catalog. 164 pages—a complete service reference book—over 12,000 parts—Sound Systems for every need—Test Equipment of every type—tools, books, Amateur Gear, Kits—61 new 1938 Knight "your-profit" Radios—all at radio's lowest prices. It saves you time and money. If you don't have the 1938 ALLIED Catalog, send coupon now.



## ALLIED RADIO CORP.

833 W. Jackson Blvd., Chicago, Ill. Dept. 19-A-8

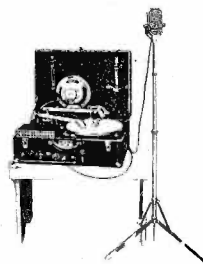


Enclosed find 95 cents in (money order) (check) (cash)—for a copy of the complete IRSM "Questions and Answers Handbook."

Please send your Free 1938 Catalog.

Name .....  
 Address .....  
 City ..... State .....

## UNIVERSAL'S Complete Instantaneous School and College Recorder



... for speech, language, dramatic and music departments. Play back immediately on same machine or file for future. Simple to operate. Results guaranteed.

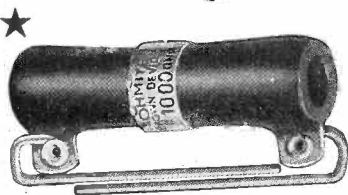
Recording Division

### UNIVERSAL MICROPHONE CO., LTD.

BOX 299, INGLEWOOD

CALIFORNIA, U. S. A.

# GUARANTEE THE JOB with Ohmite Brown Devils



End replacement resistor failures—eliminate call-backs—do a service job you can safely guarantee—use OHMITE Vitreous Enamelled BROWN DEVIL Wire Wound RESISTORS. They're tough, extra-sturdy units—built of the same materials and to the same rigid standards as the big Ohmite industrial resistors. The wire is accurately space-wound over a porcelain core and coated with Ohmite Vitreous Enamel—the coating that has been proved by many years of service to give the best possible protection against extreme humidity and other severe operating conditions. 10 and 20 watt sizes. Resistance values through 100,000 ohms.

Do the job RIGHT with Ohmite!  
Ask Your Jobber or Write for Catalog 16.

**OHMITE MANUFACTURING CO.**  
4827 West Flournoy Street  
Chicago, U. S. A.

**OHMITE**  
RHEOSTATS RESISTORS TAPSWITCHES

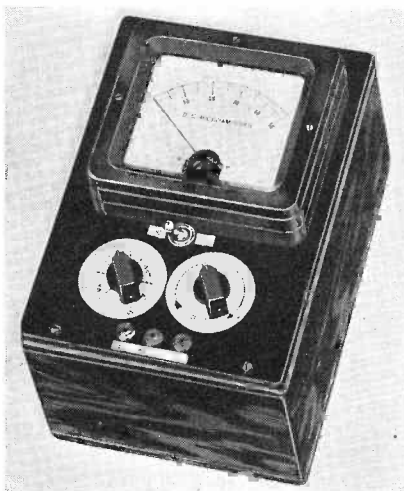
## SERVICE MEN

... in addition to being our readers, are among our most valued contributors.

Perhaps SERVICE can use an item on that interesting job YOU did yesterday.

## TEST EQUIPMENT—continued

circuit is not radically different from that of the familiar 1000-ohm-per-volt meters. Remember, though, that you are working with the most sensitive instrument movement available to the radio service trade and that it may be easily damaged by an overload. As a precaution in testing, it is advisable to temporarily shunt the meter with a 100-ohm rheostat and after every test is made, increase the resistance of this shunt from 0 to the off point, watching the meter needle carefully to see that it does not kick off the scale. In handling this instrument it cannot be treated as an ordinary meter. Its sensitivity can be seriously impaired by rough usage, but its many advantages in read-



The completed 20,000 ohm-per-volt universal meter.

ing voltages at the tube sockets are invaluable in modern service work.

The scales may be mounted in the lid of a case for the meter or the ranges may be drawn by hand on a paper facsimile of the scale and pasted over the regular meter scale.

### Found Service Business by Proposing Dealers to Turn Work Over To Him

WHEN FRANK J. FELIX wanted to establish a radio service business in Kewaskum, Wisconsin, eight years ago, he jumped in his car and went to visit all radio dealers in Kewaskum and the surrounding small towns and cross-roads.

He told them that he knew a lot of them didn't want to bother with radio service work, and that many of them didn't have the equipment or the training to do a good job repairing radios, and that most of them wanted to be more free to sell radio sets.

He told them that he had a finely

# Are You all set?

This will be a Master Antenna Year. Tens of thousands of private homes to be so equipped. Likewise hundreds of apartment houses, hotels, clubs, hospitals, etc.

And now is the time for you to familiarize yourself with the TACO Master Antenna System. Also to lay the groundwork for installations and alterations coming up very soon.

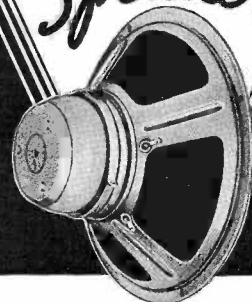
So if you want your share of this profitable servicing business, now is the time to act—and act fast!

Write us today for free manual which tells you how to survey, estimate, install, test and service the Master Antenna System. Meanwhile, ask your local TACO jobber about it.

**TACO**  
TECHNICAL APPLIANCE CORP.  
Licensed under A.A.K., Inc. Patents  
17 East 16th St. New York City  
CANADA: 414 Bay St., Toronto

## CINAUDAGRAPH

# Speaker



### CINAUDAGRAPH Magic Magnet Speakers

—extensively utilized by all leading radio receiver and P. A. equipment manufacturers—are available in a complete range of sizes from 5½ to 18 inches, to meet your every radio requirement.

If you demand utmost dependability and fidelity of reproduction from your equipment—insist on Cinaudagraph P. M. speakers. Carried in stock by all progressive distributors. Free descriptive literature on request.



**CINAUDAGRAPH  
CORPORATION**  
Speaker Division • Stamford, Conn.

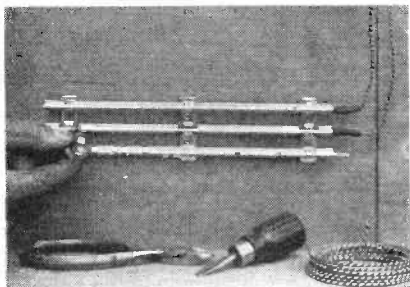
equipped service shop and that if they would turn over their service work to him he would not sell radios from his store, and that this solution of the radio service problem would be more satisfactory and profitable to both dealer and Service Man.

Many dealers were glad to turn over their work to Felix, and as a result he has built a profitable business in this manner, regularly doing service work for more than twenty radio dealers in this area. These dealers bring the sets to Felix for repairs, call for them and deliver them to customers. In this way they retain contact with their customers and also have more time in which to sell radio sets and plan merchandising campaigns.

Martin Francis

### Handy Circuit Testing Device for Workbench

IT IS often necessary around the workbench to test the circuits of small parts being repaired or made in experimental work. Wires from a common dry cell are of course usually touched to the contacts to ascertain the conditions desired. A handy arrangement of a permanent nature can be neatly put up as shown. Use a section of toy electric railway track. Tack it up to some convenient yet out-of-the-way spot on the wall near the bench. Connect the cen-



ter and outside rail to a dry cell, placing the battery up out of the way. The center rail is insulated and the circuit will always be open. However, when testing, the parts are simply touched to the center and one of the outer strips or rails. As the section of track is of some length, parts under examination and which also may be of some length, size and shape can in some position be brought instantly into contact with sufficient voltage to make a satisfactory test. Very handy for bells, buzzers, small lighting devices and many other purposes of this kind.

Frank Bentley

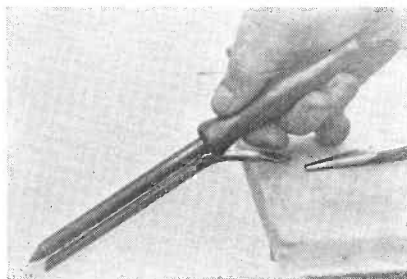
### 1936 Arvin Car Radio

**Set dead:** Oscillator tube does not function due to loose or broken connection of the lead to the oscillator section of the tuning condenser. Resolder.

Allan Siepman

### Clamp from Discarded Curling Iron Makes Handy Rest for Small Soldering Iron

THE FINGER CLAMP from a discarded electric curling iron makes an excellent bench holder or rest for the small electric soldering iron. Remove the clamp from the unit and the finger button and spring from the upper end. No further work is necessary. The soldering iron rests neatly in the channel of the clamp, which can be fastened with a thumb-



tack or small nail to the edge of the bench or any other convenient spot. A handy device for the tool kit also, as it takes up but little or no room, keeps the hot iron off the bench and at an angle easy to grasp the handle.

Frank Bentley

### Philco 623

**Dial readings off about 50 kc, and signals weak and distorted:** Look for metal filings in oscillator low-frequency compensator. This part (item 14 on the Philco diagrams) is located near the volume control.

Arthur N. Fonskov

### Colonial 32 AC

**Distortion at high volume:** Replace the 100,000 ohm resistor between center tap of input transformer and ground.

Arthur N. Fonskov

### Philco 1936 Models

**Interference and cross-talk:** This may be especially apparent on powerful local stations, in which event it is probably due to a defective wave-trap. Shift the antenna leads from the screw posts to the regular antenna and ground clips and it will greatly assist in reducing the interference.

Arthur N. Fonskov

### RCA R-28-P

**Severe oscillation:** Caused by open 8 mtd condenser in cardboard container under chassis.

Arthur N. Fonskov

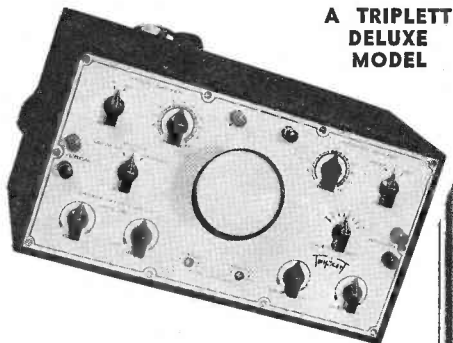
## Turn Tube in Any Direction For Direct Working View With This OSCILLOSCOPE Now Available With 3" Tube

- Exclusive Turret Type Tube Mounting for Adjusting Screen to Any Angle for Direct View
- Extremely Brilliant Pattern
- Linear Sweep 15 to 20,000 Cycles
- 2" to 3" Cathode Ray Tube

### ADVANTAGES

This new Triplett Oscilloscope is complete. In addition to radio servicing, it has invaluable applications in radio transmitter, sound equipment, industrial and educational fields.

The cathode ray tube with exclusive Triplett turret type mounting can be moved up or down or to either side for adjustment of the screen to an angle always in direct alignment with the user's line of vision. Adjustable shield can be pulled out to project beyond the screen for easy reading in brightest daylight on Model 1690. (Model 1691 has snap-on shield.)



A TRIPLETT DELUXE MODEL

Model 1690, with 2" Cathode Ray Tube . . . Dealer Price . . . **\$47.00**

Model 1691, with 3" Cathode Ray Tube . . . Dealer Price . . . **\$62.50**  
(In Metal Case)

The Oscilloscope incorporates separately controlled resistance coupled vertical and horizontal amplifiers. Vertical and horizontal plates can be either direct coupled with amplitude control, or through amplifiers with amplitude control. Can be used with any type frequency modulated Signal Generator. 60 Cycle A.C. operated. Linear sweep from 15 to 20,000 cycles. Sweep (either internal, external or 60 cycle) may be used through amplifier or direct with amplitude control. Positive lock. All controls on panel. No inter-accidental controls. Model 1690 also is available in black leatherette carrying case with removable cover. Dealer net price—\$51.00.



The Triplett Electrical Instrument Co.  
171 Harmon Drive, Bluffton, Ohio.

Please send me Catalog New Triplett DeLuxe Line.

Name . . . . .  
Address . . . . .  
City . . . . . State . . . . .

# ASSOCIATION NEWS . . .

## RSMA—SPOKANE

I have always wondered why the average Radio service man was so badly underpaid, and now at last I believe I know. It seems that most of us started our Radio career as a hobby and have never taken steps to raise it to the worth while and highly respectable professional standing where it rightfully belongs. As one man said, "Radio Service men are misfits in the business world." The average Radio man is so in love with his meters, dials and gadgets that he cannot be bothered with the business end of the profession.

This seemed to be proven here in Spokane a few days ago when the "Radio Service Men's Ordinance" came up before the city council. Just a mere handful of radio men were present to protect and aid their brainchild and the rest were so busy playing with their gadgets that they could not attend. It seemed a shame when it was so vital to their future prosperity and well being.

Much credit should be given Mr. Art Welch and Mr. Frank Dunnigan for their work in having the hearing temporarily set aside until such a time as it is possible for us to show good cause why the City of Spokane should pass an ordinance examining, licensing and regulating Radio Servicemen.

We of the R.S.M.A. are very seriously considering reorganization under a new name and with a restricted membership of only those who are competent, sincere and honest in their efforts to better the Radio Service profession.

Les Burden, Serviceman, who has been with the Inland Radio Company for so many years, has accepted a position with the Spokane Radio Company as city representative, contacting the dealers and broadcasting stations in this vicinity. We all wish our good friend Les well in his new position.

I promised I would tell all about our proposed City Ordinance at this time. I am sorry that I am not able to, but just as soon as it is possible will "shoot the works."

*Earl L. Flory, Jr.*

(According to the same issue of "The Radio Technician" from which these comments were lifted, a proposed licensing ordinance in Seattle died quietly in the city council.

If the Spokane gang has anything further to report on *their* ordinance, we will be glad to hear of it. Requests on how to fight these local laws sometimes come to our desks and the more information we have to pass on, the better for all concerned.—Editor.)

## SEATTLE RSS GIVES EXAMS

Well under way with its reorganization program, The Radio Service Society, Inc., of Seattle, held written and practical examinations for members at the meeting held November 19 at the Hotel Gowman. Officers of the society were pleased with the results and the interest shown, and expressed the hope that other organizations would follow the example of the RSS in a campaign to segregate competent tech-

nicians from those who have neither the necessary knowledge or ability to repair efficiently their customers' radios.

"It is a step forward in the right direction," declared President N. B. Anderson. "Later on we plan to make the examinations a little harder and raise the standards somewhat higher. An applicant is not expected to pass an engineer's examination, nor do we include any 'catch' questions, but anyone who takes these practical and technical tests will show whether he can properly repair a radio."

The examining board declares that those passing the examination, as well as those not making the necessary grades, will be encouraged to study with regularity and keep abreast of latest developments in the radio field. Members will be assisted with their schooling by the society in the very near future, it is said.

Meetings will be held but once monthly in the future, members decided at the meeting. The secretary was instructed by motion to notify members of all other technical meetings and to urge them to attend, including IRE, RCA and Philco meetings.

Scheduled for the business of next meeting are the election of a vice president and a member of the executive board to complete the slate of officers. Examinations will be given to new applicants.

## RSA

Following the recent announcement of the formation of the Radio Servicemen of America, Inc., (SERVICE, November, 1937) word has just been received that both the Radio Manufacturers Association and the Sales Managers' Clubs of New York and Chicago have extended full recognition to the organization.

In line with its policy of recommending that all who are engaged in radio servicing should be actively supporting organizations with objectives like those of RSA, SERVICE is glad to take this opportunity again to bring RSA to the attention of its readers.

Further details will be found in the February issue.

## PITTSBURGH FLASHES

Investigating the report that the proprietor of Dillon's Radio Shop at 607 Main St., Sharpsburg, was absent without leave for two days following Thanksgiving, our sleuths solved the mystery and reported that W. Geo. Dillon and Mildred Quinn were married on Thanksgiving Day and left for parts unknown in honor of the occasion.

*From "The Amplifier."*

## ART—BRITISH COLUMBIA

The most recent issue which SERVICE has received of the ART news, contains the following notice of changes in the By-Laws; perhaps by this time they have been definitely adopted:

Subsections (c), (d), (e), (f), (g) and (h) of section 2 (Membership) shall be deleted from the By-Laws and replaced by the following:

(c) Application for Membership shall be presented at a General Meeting of the Association. After a period of not less than three (3) months from date of presentation, said application will be considered by the meeting, provided it is sponsored by two full members in good standing. By a vote in favor of acceptance by at least 75 percent of those members present, applicant may be granted membership in accordance with the following regulations:

1. Accepted applicants with less than three years' certified experience (including apprentices) will be granted student membership.

2. An accepted applicant with three or more years' experience may be granted full membership, provided he has been endorsed by the Association Examining Board.

3. Where accepted applicants produce satisfactory credentials, etc., proving not less than five years' active experience immediately preceding date of presentation of application, the Examining Board may, at their own discretion, recommend such applicant to Full Membership without examination.

(d) Applicants with three or more years' experience who fail to pass the examination shall have no status in the Association, but shall be granted the privilege of coming up before the board at future sittings.

(e) Credit shall be given for time engaged in a recognized Radio Servicing Course, and for time engaged as apprentice to the Profession.

(f) Applicants for membership may be invited to attend all technical talks, etc., but will not be admitted to the general meeting.

(g) Student Members may attend all regular meetings, but shall not hold office of Director and shall not have a vote on extraordinary resolutions of the Society.

(h) Out of town applications shall be presented as in (c) exception being that the examination may be taken in the presence of a Notary Public or authorized School Principal. With sanction of the meeting, sponsorship may be waived and references accepted in lieu thereof.

(i) Out of town members shall be subject to such rules, penalties, dues, etc., as may be set from time to time by ordinary resolution.

(SERVICE feels honored at the mention given to six of its recent feature articles in the ART bulletin, from which the above material was taken. Thanks, ART!—The Editor.)

## CHICAGO RSA PLANS MEETING FOR TRADE SHOW

Technical lectures and sessions for service men are being planned by the Chicago Chapter of RSA, in collaboration with the national office of the servicemen's association. The Chicago Council of Amateur Clubs will supervise the amateur activities. The Chicago Section of IRE has begun to lay plans for a big meeting during the show period. Regular meetings of "The Representatives" and the National Association of Radio Parts Distributors are on the agenda.



# DUMONT

ELECTROLYTIC CONDENSERS  
**GUARANTEED QUALITY**  
 NOW AT ATTRACTIVE PRICES



## MR. SERVICE MAN

Regardless of the prices you pay for condensers, you will find **DUMONT QUALITY** far superior. Self-healing prevents any possibility of breakdown even if overloaded. This exclusive feature (patented) is found only in **DUMONT Electrolytics**. Try an assortment today and be convinced. Used by the U. S. Government in large quantities—ample testimony of their true quality.

*Exact duplicates for every radio.*

Licensed under U. S. A. Patent reissue No. 19604.

*For free catalog and your nearest Dumont jobber, write to us.*

Manufactured by  
**Dumont Electric Co., Inc.**

514-516 BROADWAY  
 NEW YORK, N. Y.



*"America's Leading Manufacturer of Condensers"*

## Under ONE roof



*Everything in Radio*

Everything you need in radio. It's all in this new **RADOLEK RADIO PROFIT GUIDE**. Every repair part for every receiver. Newest radio receivers. New 1938 model public address amplifiers, outputs for 5 to 100 watts. New model public address speakers. Test instruments. Technical books. Special equipment. Leading standard brands. Every item guaranteed. It must be right or we make it right. And everything under one roof. You get what you want promptly, and exactly what you want. Radolek's immense stock plus Radolek's efficient organization insures you fastest service. 25,000 service men depend on this service and benefit by Radolek's lowest prices. Send now for your copy of Radolek's Radio Profit Guide. It will help you make more money.

## RADOLEK

601 W. RANDOLPH, CHICAGO, Dept. R-15

Send me the Radolek Radio Profit Guide FREE.

Name .....

Address .....

Service man?  Dealer?  Experimenter?

# YOU'RE SURE OF YOUR PROFITS



## UNDER THE TUNG-SOL CONSIGNMENT PLAN

You don't buy Tung-Sol Tubes, and then wait until they're sold to get back your investment. They're put in your custody without payment. After they move, you report your sales, pay at your cost price and keep the profit. No cash investment—no dead stocks. And our ability to finance is extended to you without any premium whatsoever.

It's a straightforward, simple, business proposition by a concern financially able and willing to give this co-operation to dealers who can qualify for the Tung-Sol franchise. Naturally, Tung-Sol dealers must be responsible, ethical business getters.

*Write today. Perhaps you can qualify for a Tung-Sol Consignment franchise in your neighborhood*

## TUNG-SOL

*Tone-flow Radio Tubes*

TUNG-SOL LAMP WORKS, INC.

Dept. D Radio Tube Division

SALES OFFICES: Atlanta • Boston • Chicago  
 Dallas • Kansas City • Los Angeles • Detroit  
 New York • General Offices, Newark, N. J.

# HIGHLIGHTS . . .

## UTAH ANNOUNCES NEW APPOINTMENTS

G. Hamilton Beasley, President of Utah Radio Products Company, announced the Utah board of directors had confirmed the following new appointments and promotions within the organization.

Oden F. Jester assumes the post of General Sales Manager; E. L. Barrett, associated with the engineering division of Utah for nine years, was elected to the position of Vice-President in charge of Development and Research Engineering; William F. Dumke who has, for the past eight years, supervised plant production, was elected Vice-President in charge of production and plant supervision; Austin W. Ellmore, a member of Utah's engineering staff for eight years will now occupy the position of Chief Engineer; H. S. Neyman is in charge of Utah's general office in addition to his duties as secretary and treasurer of the company. John Burriss, a former Utah employee, has been placed in charge of purchases. Due to the pressure of his other business activities, B. J. Clarke tendered his resignation as Vice-President, but continues as a member of the Board.

## USL MOVES

Increased production of the Electro-Call intercommunicator line necessitated moving United Scientific Laboratories from 510 Sixth Avenue to enlarged quarters in 436-440 Lafayette Street, New York.

## RAYTHEON MFG. CO. OPENS OFFICE

Raytheon Manufacturing Company, 190 Willow Street, Waltham, Mass., has announced the opening of a New York City office at 420 Lexington Avenue. R. M. Purinton is in charge.

## ALLIED PUBLISHES NEW QUESTIONS AND ANSWERS HANDBOOK

A new handbook for radio servicemen, compiled in convenient "question and answer" form has just been published by Allied Radio Corporation of Chicago. Originally planned by the Institute of Radio Servicemen, under the supervision of L. O. Gorder, the handbook offers a complete digest of essential data gathered from leading service texts, laboratories, schools, and servicemen in the field.

Questions and Answers Handbook includes nineteen sections, each covering a complete phase of radio servicing. Among the subjects discussed are: basic theory, superheterodynes, auto radio, public address, schematic diagrams and symbols, etc. Two years in preparation, the Handbook contains over 3,000 questions and answers, offering an authoritative and comprehensive survey of every aspect of the subject.

Published in a limited edition, the Handbook is available exclusively from Allied Radio Corporation, Chicago.

## JENSEN COMPLETES DEAL WITH CANADA WIRE AND CABLE

To facilitate service to Canadian radio set manufacturers, Jensen Radio Manufacturing Company has recently concluded arrangements with Canada Wire and Cable Company of Toronto, Ontario, for the manufacture of Jensen engineering products in Canada. Under the supervision of Mr. K. M. Clipsham, Jensen speakers will be manufactured and shipped by Canada Wire and Cable Company.

The new Jensen Sales Office, Mr. C. A. Savage in charge, is to be located at 45 Richmond Street, West, Toronto.

## VIC MUCHER PREDICTS GOOD RADIO PARTS BUSINESS IN 1938

At the close of a year marked by the doubling of its jobber business, the Clarostat Mig. Co., Inc., Brooklyn, N. Y., views the next twelve months in the most optimistic light with regard to the parts business and the servicing trade.

"With more sets in use than ever before, and with the two- and three-set home quite commonplace, we are building up an enormous potential market for replacement parts and servicing," states Vic Mucher, who is in charge of Clarostat sales. "Late in 1937, with a momentary falling off in new radio set sales, there was a noticeable pickup in replacement parts sales because set owners were obliged to recondition their old sets to keep them going.

"I look forward to a pickup in the new set trade, because of the marked advances made in performance. The all-wave feature, together with the dependable signals made available in this country by overseas broadcasters, and again the enormous interest in international affairs during this critical period, alone makes the average listener-in most anxious to possess a modern set.

"And because of the modest trade-in allowance, most set owners from now on are going to hold on to that old set and use it in the playroom, bedroom, nursery, maid's room, kitchen or elsewhere in the home as a second set. The millions of second and third sets in use are going to pile up many service calls and replacement-part sales.

"I shouldn't be surprised to see the parts trade and servicing business exceed all expectations for 1938."

## NEW WINDOW-COUNTER CARD RELEASED BY NATIONAL UNION

National Union distributors throughout the country, have received quantities of a brilliant new window-counter display card for distribution to their service-dealer customers.

The new card is designed in convenient size for use either in a show-window or on a store counter, it is equipped with an easel stand. Brilliantly printed in red, green, silver and black, it features a modernistic metal man figure with the theme of "More Power for your Radio" and a sales message for guaranteed radio service.

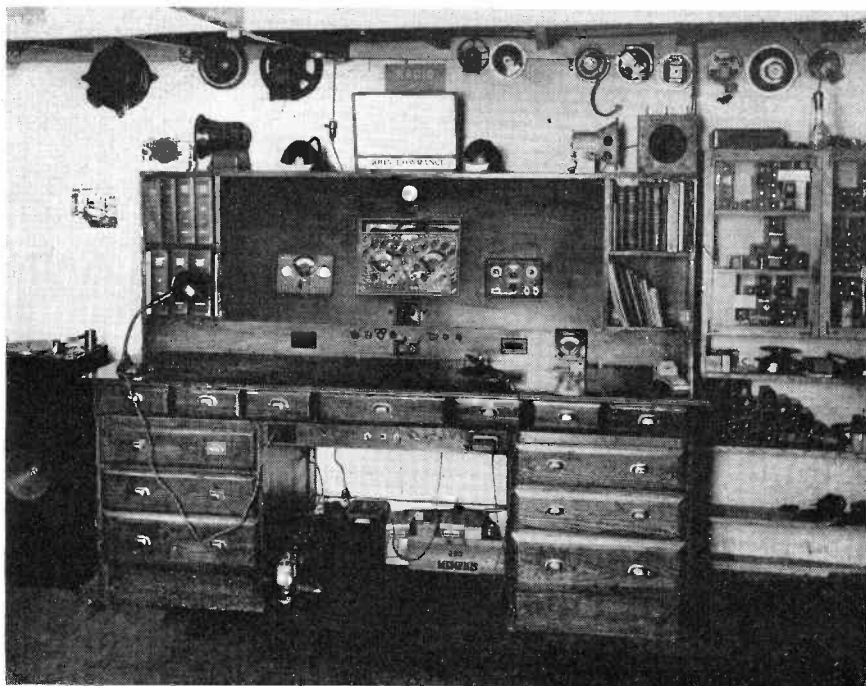
## MANY JOINS KENYON TRANSFORMER

The appointment of W. G. Many as Sales and Advertising Manager of the Kenyon Transformer Company, Inc., 840 Barry St., New York City, has just been announced. Bill Many needs no introduction in the radio parts industry, having long been identified with sales, advertising and editorial activities.

## PARTS CATALOG

The 1938 catalog of radio parts and equipment has just been released by Philco. Copies are available from the Philco Radio & Television Corp., Philadelphia, Pa., or your Philco distributor.

(Continued on page 42)



A prize-winning shop is that of John Lowrance, of the Spence Hardware Company, Kennett, Missouri.

# Resistance

to heat . . . cold . . . and the ceaseless humidity of the tropics . . . these are the problems that confront set builders. In its particular field CENTRALAB answers this problem of resistance with a Fixed Resistor whose characteristics are so constant that they oft times form the standard by which all others are judged.

Which is why so many set builders and service men turn to CENTRALAB for the satisfactory answer.



Centralab Resistors are a solid rod, hard as stone throughout, and not just a delicate resistor placed in a tube. That is why Centralab resistors will carry loads of many times their rating without damage.



By the patented Centralab process only the central portion of the ceramic is conducting. Externally the resistors are fully insulated.



TYPE 510	rating 1/2 watt	size 1/8 x 5/8"
514	rating 1 watt	size 1/4 x 1"
516	rating 1 1/2 watt	size 1/4 x 3/4"
710	rating 1/2 watt	size 1/8 x 5/8"

CENTRALAB—Div. of Globe-Union, Inc.  
Milwaukee, Wisconsin

BRITISH CENTRALAB, LTD.  
Canterbury Road, Kilbourn  
London N.W.6, England

FRENCH CENTRALAB CO.  
118 Avenue Ledru-Rollin  
Paris, XI, France

# Centralab



MADE BY  
*Engineers FOR  
Engineers*



Antenna systems, P-A cables, hook-up wires bearing the nationally identified CORWICO diamond trademark are produced in an adequately equipped plant to do their job 100 per cent.

The illustrious NOISE-MASTER all-wave antenna illustrated above, licensed by A.A.&K., is warranted to eliminate man-made static on broadcast as well as shortwave lengths in any locality.

Write for complete information regarding this and other CORWICO products, made by engineers for engineers.

**CORNISH WIRE CO., Inc.**  
30 Church St., New York City



**RADIO-WIRE**  
*products*

### The Replacement Parts Market Is Thriving . . .

Distributors of Parts and Accessories and the Servicing Trade of the country are doing business, plenty of it.

Get your share by advertising in February SERVICE. Forms close the fifth.

## HIGHLIGHTS—continued

### UNIVERSAL MICROPHONE NEWS

Saul Shapiro, factory representative for the Universal Microphone Co., Inglewood, Calif., will cover the eleven western states during January and February, calling on the trade.

Universal is planning to offer a short factory course of instruction for owners of its school and college recording machines. Though operation of the model is simple, and each instrument comes with complete instructions, many of the operators at institutions want to delve more deeply into the subject, as well as to learn about the professional, portable, and other recorders.

### TUNG-SOL DISTRIBUTORS IN NEW QUARTERS

Herrlinger Distributing Co.—distributors for Tung-Sol Radio Tubes—have recently moved to new and larger quarters at 1518-1520 Race St., Cincinnati, Ohio.

They were formerly located at 1714 Vine St., Cincinnati.

### SALES MEETING HELD BY GENERAL ELECTRIC

Merchandising and advertising plans for the first half of 1938 were discussed at meetings held by the General Electric Radio Sales Division with district sales managers and field sales representatives at Bridgeport, Connecticut, on December 22 and 23, and at Chicago on December 28 and 29.

Leading the discussions were Ernest H. Vogel, Manager of the G-E Radio Sales Division, Charles M. Wilson, Sales Manager, Arthur A. Brandt, Advertising Manager, and Charles T. Wandres, Radio Tube Sales Manager.

From the enthusiastic reaction of the field organization, the meetings were judged by G-E Radio headquarters to be among the most successful of their type ever held.

### MARSH APPOINTED BY MEISSNER

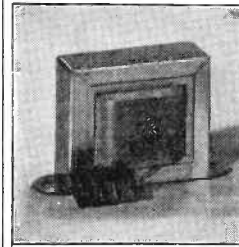
The appointment of Walter F. Marsh as Sales Manager in the Jobbing Division has been announced by the Meissner Manufacturing Co., Mt. Carmel, Ill.

Mr. Marsh has been actively engaged in the radio business since 1920 and has acted as service manager for several large corporations. He brings a wide experience to his new position from his lengthy service with the Allied Radio Corporation in Chicago as Purchasing Agent and Sales Manager.



An outstanding distributor of Orlando, Fla. Shown here (left to right) are H. J. Kliess, G. Hammond Jr., Bill Martin, Harold Ammerman, and Ernst Ammerman.

# KENYON REPLACEMENTS



Have given years of satisfactory service in standard receivers of practically all makes.

Replacement Power Transformers made to service 90% of sets now in use.

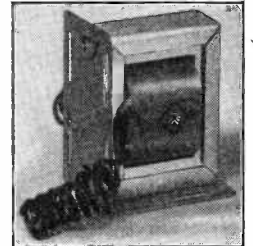
**Profit By Our 14 Years Experience in Serving the Radio Industry**

**Look . . . .**

for the dependable Kenyon trade mark!

**Ask . . . . .**

your jobber for copy of catalog R-2 listing Replacement Transformers.



**KENYON**  
TRANSFORMER CO., Inc.  
840 Barry St., New York, N. Y.

Export Dept.: 25 Warren St., New York, N. Y.

**RADIO**  
IN IT'S  
**ENTIRETY**



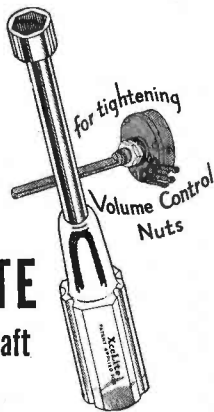
**COMPLETE STOCKS  
READY FOR YOU**

"B-A" serves the trade with every need in radio. Complete 160-page catalog of radio receivers, public address systems, parts, supplies and equipment is now available. You will find your favorite nationally known lines represented in this big book. "B-A" prompt service will please you—orders shipped same day they are received.

**BURSTEIN-APPLEBEE CO.**  
1012-14 MCGEE ST. KANSAS CITY, MO.

**UP-TO-DATE CATALOG  
NOW AVAILABLE**

# NEW



## XCELITE

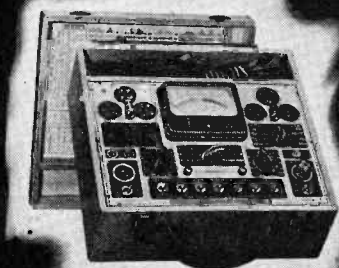
Hollow Shaft

### NUT DRIVER

Servicemen—here's the tool you've wished for time and again. A hollow shaft wrench long enough for any volume control. No more damaged panels, no more half tightened or chewed up nuts. This is a genuine Xcelite Wrench with the beautiful Xcelite Handle. Break-proof, shock-proof, easy to grip. Special alloy steel socket. Furnished in 1/2" and 9/16" sizes. Order a pair from your jobber today. *Jobbers—write today for attractive proposition on our line of Xcelite fast selling radio tools.*

**PARK METALWARE CO., INC.**  
Orchard Park, N. Y., U. S. A.

## New "PRECISION" ELECTRONOMETER SERIES 700



A complete laboratory of compact size for thorough tube analyzing and point to point set testing incorporating 22 ranges for measurements of A.C. and D.C. voltages, current, resistance, decibel and output; paper condenser leakage tests; current leakage of electrolytic condensers and other important features. See it at your jobber.

**\$49.95**

**FREE** to owners of "PRECISION" ELECTRONOMETER 500 or 600, the latest tube chart for use with these instruments. Write for yours.

**PRECISION**  
APPARATUS CORP.  
821 EAST NEW YORK AVENUE  
BROOKLYN, NEW YORK

## HIGHLIGHTS—continued

### HANDY VOLUME CONTROL REPLACEMENT LISTING

Indicating at a glance the makes and types of sets served, as well as the function and list price of some twelve hundred exact-duplicate controls numerically listed, the latest Clarostat servicing data will prove valuable to jobber, dealer and serviceman alike. The numerical listing is in the form of a 9-page bulletin, a copy of which may be had by addressing Clarostat Mfg. Co., Inc., 285-7 North Sixth St., Brooklyn, N. Y.

### "THE REPRESENTATIVES" ELECT OFFICERS

"The Representatives," an organization of radio parts sales representatives, has elected the following officers for 1938: Perry Saftler, President; Dan R. Bitten, Vice-Pres.; David Sonkin, Sec-Treas.

The board of governors is comprised of: Jack B. Price, Dan R. Bitten, David Sonkin, Adolph Friedman and Martin Camber.

### MEISSNER APPOINTEES

The Meissner Mfg. Co. announces the appointment of John O. Olsen as representative for their complete line of coils and receiver kits in the territory including Virginia, West Virginia and Western Pennsylvania. Mr. Olsen has a wide following among jobbers and distributors in this territory who will be pleased to hear of his acquisition of this increasingly popular line. Frequent personal contacts and fullest factory cooperation will feature Mr. Olsen's service for this firm.

Meissner also announces the appointment of Kenneth J. Waite as representative in the New England states for their entire line of radio coils and receiver kits. Mr. Waite's experience in this field has brought him a wide following among jobbers and distributors in this territory and he proposes to give the fullest possible service with this new line.

### TRAV-LER CATALOG

A new Trav-ler catalog gives complete listings of the Trav-ler line for 1938, including the sixteen models with automatic tuning and the ten other models without automatic tuning. The catalog gives complete specifications for each set. Copies may be had free by addressing the Trav-ler Radio & Television Corporation, 1036 W. Van Buren Street, Chicago.

### SHURE LITERATURE

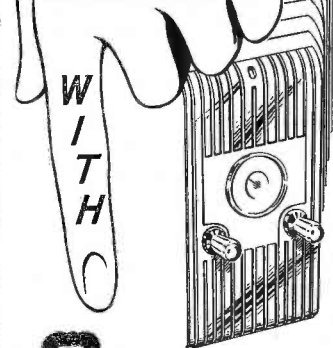
Literature is now available from Shure Brothers, 225 W. Huron St., Chicago, describing the Shure Tri-Polar crystal microphone. This instrument may be used as a uni-directional, bi-directional or non-directional microphone.

### BURTON-ROGERS LITERATURE

Burton-Rogers Company, 755 Boylston St., Boston, Mass., have available literature describing their test bench Cyclops meter, a pocket-size volt-ohm-milliammeter, and automobile antennas. This literature may be secured on request. Write to the above organization.

# 5-POINT PROGRAM

for  
**PHILCO DEALERS**



# CROWE

CUSTOM STYLED  
PANEL CONTROLS

FOR 1938—PHILCO Distributors are *again* provided with a special Crowe Program. Its purpose is to help you increase your Auto Radio sales.

Crowe's Five-Point Program speeds up sales and increases profits with Crowe ON-THE-PANEL Kits—at no extra cost!

Special features for Crowe 1938 On-the-Panel Kits include:

- Exact Custom Styling
- Official Philco Specifications
- New No-Glare Dials
- Improved Anti-Backlash Design
- Adaptable to Any Car
- Quickly Installed—Easily Moved

**Ask for  
Crowe Bulletin 205**

### PARTS JOBBERS!

Enlarge your market! Increase your sales! Radio Dealers—New-Car Dealers—Used-Car Dealers—ALL need Crowe On-the-Panel Controls—for modernizing or changing old radios from car to car.

Ask for Bulletin No. 206.

**CROWE NAME PLATE & MFG. CO.**  
1775 Grace Street  
CHICAGO, ILL.

**A  
One Year  
Subscription  
(12 Issues)**

**to  
SERVICE**

**Costs  
Only  
\$1.00**

**on  
the "Group  
Subscription  
Plan"**

Over 85% of this country's most successful full time service men subscribe to SERVICE because a service man must have training almost equivalent to an engineer's because radio receiver circuits have become more and more complicated.

Keep abreast of all new developments—read SERVICE every month. Each issue contains 35 to 40 pages of technical data, accurate and up to the minute. Be prepared to meet the new problems which pop up. Take less time to repair a set—have more time to do other work—and thus earn more money.

A service man must know more than just the fundamentals of radio circuits. He must know the Theory of Electricity . . . Acoustics . . . Salesmanship . . . Parts Merchandising! These subjects and many others of primary importance to service men will be found in every issue.

If you are a qualified radio service or sound man, dealer, distributor or technician you can secure a year's subscription to SERVICE (12 issues) for only \$1.00 by using the Group Subscription Plan.

Regularly a yearly subscription to SERVICE is \$2.00—but when groups of four or more sign up at the same time, the subscription rate is only \$1.00 per year each. (The occupation of each subscriber must be given.)

Use the convenient form printed herewith. Your co-workers will sign up with you at the half-price rate if you tell them about this "G.S.P." Sign up your group today.

**SERVICE:—Enter subscriptions for:**

Name .....

Address .....

City-State .....

Occupation .....

Employed by .....

Name .....

Address .....

City-State .....

Occupation .....

Employed by .....

Name .....

Address .....

City-State .....

Occupation .....

Employed by .....

Name .....

Address .....

City-State .....

Occupation .....

Employed by .....

**TEAR OUT  
AND MAIL**

**SERVICE, 19 E. 47th St., New York, N. Y.**

When mailing a check (or money order) for a group of subscriptions, use this convenient form.

# THE MANUFACTURERS . . .



## TACO ANTENNA

A new antenna system, designed to permit directional reception effects with the directivity controlled by the set operator by means of a small knob, has been announced by the Technical Appliance Corp., 17 East 16th Street, New York City.—SERVICE.

## ELECTRIC SOLDERING PLIERS

In answer to the demand for a smaller low capacity soldering unit, that would heat electrically, sweat joints without unsweating adjacent connections; and eliminate the open flame hazards, the Ideal Commutator Dresser Co., 4035 Park Avenue, Sycamore, Illinois, has introduced the new No. 2 "Midget" Type Thermo-Grip Pliers.

This tool has been designed especially for soldering small objects and for work in restricted spaces and for ease of operation. A few typical applications are: For soldering small lugs and terminals up to 150 amp., in close quarters on switchboards, motors, generators—for various small radio and appliance soldering—for sweating joints on small copper tubing and fittings up to 3/8" diameter.

The small power requirement (300 watts) permits the use of the unit on any standard lighting circuit without danger of overloading the circuit or burning out fuses.

The pliers are made of cast bronze (long, slender, small jaws), so that they will fit into restricted spaces. The jaws are hinged at the back and have a spring, which holds them normally in the open position. Further information can be obtained by writing the manufacturer. SERVICE

## RACON MARINE SPEAKERS

Racon Electric Company, Inc., 52 East 19th Street, New York, N. Y., have just announced a marine-type speaker. This speaker, which can pick up sounds from a distance of 100 feet thus enabling its use as a microphone, is designed to deliver sound energy in a concentrated beam.

The speaker employs an Alnico magnet, and the entire unit is enclosed making it entirely waterproof, according to information received from the manufacturer.

Further details may be obtained by writing to Racon Electric Company, Inc., at the address given.—SERVICE.

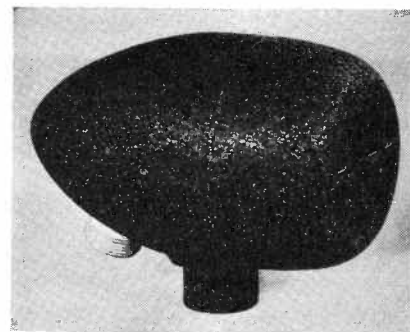


## NEW SERIES OF AMPERITE REGULATORS

The new "H" series of Amperite a-c, d-c replacements are equipped with the patented starting resistor which prevents overloading of pilot lights when the set is first turned on.

Amperite KL-25H will replace all ballasts starting with K, L, M or BK and having numbers between 11 and 26, and ending in F, G, or H. In other words it will replace a K-25F, L-18G, etc. Similarly KL-75H will replace all ballasts starting with K, L, M or BK with numbers 67 to 105 and ending in F, G, or H. For example it will replace K-75H, L-100G, etc.

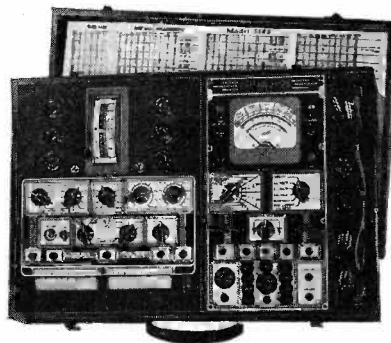
Further details are available from Amperite Corp., 561 Broadway, New York City.—SERVICE.



## TRANSDUCER BULLET MICROPHONES

A new line of bullet-type microphones, of which the Model MK-20 illustrated here is typical, has been announced by the Transducer Corp., 30 Rockefeller Plaza, New York City.

Complete details are available from the manufacturer at the address given.—SERVICE.



## HICKOK COMBINATION TESTER NO. 5148

This instrument is said to combine a complete tube tester with a wide range set analyzer to make a complete piece of radio servicing equipment. The tube tester section is of the Dynamic Mutual Conductance type. It tests the elements separately in multi-element tubes; checks gas content on meter; detects both short and open elements; and tests for shorts hot or cold. Reads "Good, Doubtful and Bad" as well as indicating mutual conductance in micromhos.

The set analyzing section has a built-in Multi-Selector with a complete set of leads and adapters for socket analysis. Its Zero Current Voltmeter gives readings of Infinite Ohms per Volt dc—equivalent to millions of ohms per volt. Also reads capacity of mica, paper and electrolytic condensers.

Ranges cover every present need and many future requirements: d-c volts at infinite ohms per volt, a-c and d-c volts at 1,000 ohms per volt, d-c, microamperes, d-c milliamperes, ohms, microfarads, output, decibels and henries.

Batteries operate all except the highest range of ohms and capacity meter, which operate from built-in power supply. The instrument has two new Hickok-built long scale meters.

Made by The Hickok Electrical Instrument Co., Cleveland, Ohio.—SERVICE.

## AUTO-RADIO CONTROLS

A new remote control unit for auto-radio receivers has been made available by the F. W. Stewart Mfg. Corp., 340 West Huron Street, Chicago, Ill.

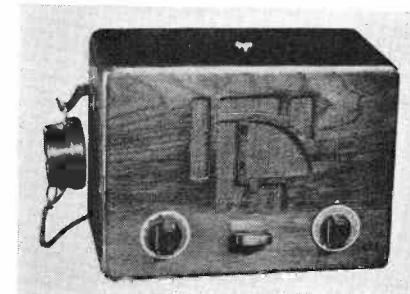
This control is designed to fit quite a number of the 1938 auto radios without the need for panel plates.—SERVICE.

## BELFONE SYSTEMS

An announcement has just been made by the Bell Sound Systems, Inc., of Columbus, Ohio, manufacturers of Belfone Inter-Communicating Equipment, of the addition of a new model, No. 315-C, to their line of Belfone Equipment. This new unit is provided with a confidential ear-receiver, placed on the side of the unit. While the prime feature of this equipment is for two voices to communicate between two or more remotely located stations, if the ear-receiver is raised, it automatically cuts out the loud speaker, and transfers reception to the receiver.

Other features of the Belfone Master Station are: A rotary type selector switch which permits the selection of from one to ten stations; an ingenious "treadle" type send-and-receive switch, which offers effortless operation with either right or left hand; a combination volume control and an on-off switch which is calibrated to stages of relative volume; a ruby jewel lamp which indicates whether the unit is turned on; and a volume control on the back of the unit for controlling the volume of outlying speaker stations.

Current for the Belfone is provided from a regular wall socket. A system can be composed of any number of master stations interconnected, or one master station, with a number of loud speaker stations. The loud speaker stations are provided with a call switch, which enables the operator at the central station to call the master station.—SERVICE.



## MANUFACTURERS—continued

### RCA VICTOR ANNOUNCES FIVE NEW AUTO RADIOS

Five new automobile radios have been developed and introduced by RCA Victor.

In designing the new receivers, the Camden engineers have drawn upon their years of experience in building police communication systems which are now in use in many of the principal towns and cities of the world, and incorporated the same high standards of dependability, ruggedness and year-around efficiency.

Model 8M is the lowest priced auto receiver RCA Victor has ever built. It incorporates in a single unit a 5-tube superheterodyne chassis, an efficient speaker, the dial and controls. It can be installed on any make of car independent of instrument panel design and requires no holes to be drilled in the face of the instrument panel. It is equipped with a single universal mounting bracket which can be used with all cars.

All five of the new models have a tuning range of from 550 to 1,550 kc, and are equipped with Magnetite Core transformers, guaranteeing exact factory alignment of the finely tuned circuits for the life of the sets.

A new watch-type dial has been designed for use with the four larger models of the new line. The dial, built to permit easy tuning while driving, has a special translucent diffuser to insure an even flow of light to every part of the dial and prevent glaring.

The four other models are as follows:

Model 8M-1 is a single-unit, 6-tube superheterodyne requiring no spark plug suppressors, with an electrodynamic speaker built into the case. The case lid is equipped with snap button fasteners, leaving no screws to remove. Tubes and vibrator may be removed without taking the set from the car.

Model 8M-2 presents the performance of a two-unit receiver at a new low price. Its eight-inch speaker is housed in a separate case. A continuously variable tone control permits easy tone adjustment.

Model 8M-3 is claimed to be the best single-unit auto-radio RCA Victor has ever presented. Its 6-tube superheterodyne chassis brings in distant stations with more volume than some home radios, with an output of 9 watts. An additional speaker can be connected if wanted.

Model 8M-4 tops the new RCA Victor auto-radio line. This Magic Voice model uses a separate speaker and a small, compact handsomely finished case. The 6-tube superheterodyne is said to bring in distant stations with unusual brilliance and clarity and has a tremendous reserve of power.—SERVICE.

### RECORDING BLANKS

The Simplat record is developed along the fundamental principle of commercial phonograph recordings, i.e., cutting soft and playing back hard. Among the features of this record are: wide frequency response due to the soft colloidal coating which is hardened before reproduction; flatness because of the glass base used (said to be less breakable than commercial records); and simple hardening with a fluid.

Literature is available from Recoton Corporation, 178 Prince Street, New York, N. Y.—SERVICE.



### OPERADIO 8-15 WATT PORTABLE UNIT

Rated at 8 watts normal and 15 watts maximum, the Operadio Model 108 portable public-address system is small, compact, and adaptable to practically any use, according to information from the manufacturer.

It is so designed that the amplifier is removed from the case when being operated. This unit comes complete with a Velotron type microphone which is mounted on an ingeniously designed stand. This mounting permits the microphone to be used either as a hand type microphone or as a banquet stand type. The microphone can be electronically mixed with a phonograph input or the microphone or phonograph may be used separately. An inbuilt tone control permits the type of frequency response to be varied to suit the individual taste.

Mounted complete in a leatherite covered carrying case, the unit is small, compact, light in weight, and may be carried easily from place to place.

Specifications and further details may be had by writing Operadio Manufacturing Company, St. Charles, Illinois, for General Catalog.—SERVICE.

### NEW VIBRAPAK MODELS

Electronic Laboratories, Inc., of Indianapolis announce two new models—incorporating new features including a variable output—to supplement their line of vibrapaks which have been manufactured for over three years.

The model 31, one of the two new models, is for operation on 6 volts d-c and has a variable output ranging from 250 volts at 50 milliamperes d-c to 325 volts at 125 milliamperes d-c; this output is completely filtered.

Another feature is found in that the tap switch for varying the voltage is always at ground potential, eliminating possibilities of high-voltage short circuits. Important in the manufacture of Electronic vibrapaks is said to be the use of an 8-contact converter type vibrator instead of an auto radio type vibrator. The Electronic converter type vibrator will carry as high as 75 watts on a 6-volt circuit and 125 watts on a 12-volt circuit.

The second new vibrapak added to the present line is the model 51, which has the same characteristics as the 31, but is a 12-volt input unit. All Electronic vibrapaks are filtered for r-f interference and can be used on five-meter transmission without any additional filtering. They are designed primarily for the operation of portable public address systems, transceivers, portable transmitters, for aircraft, boat or automobile use and wherever a portable source of high-voltage direct current is necessary. SERVICE.

### HICKOK 4800S SET TESTER

This instrument has a built-in multi-selector with a complete set of leads and adapters for socket analysis. Its zero-current voltmeter gives readings of infinite ohm per volt d-c; also reads capacity of mica, paper and electrolytic condensers, and it can be used to check audio amplification tubes according to the manufacturer.

Ranges cover every present need and many future requirements: d-c volts — 0/10/50/250 at infinite ohms per volt. A-c and d-c volts in five ranges at 1000 ohms per volt. Ohms—five ranges to 10 megs. and can be read as low as .05 ohms. D-c microamperes 0/500. D-c milliamperes in three ranges. Five ranges of microfarads. Output—same as a-c volts. Also decibels and henries.

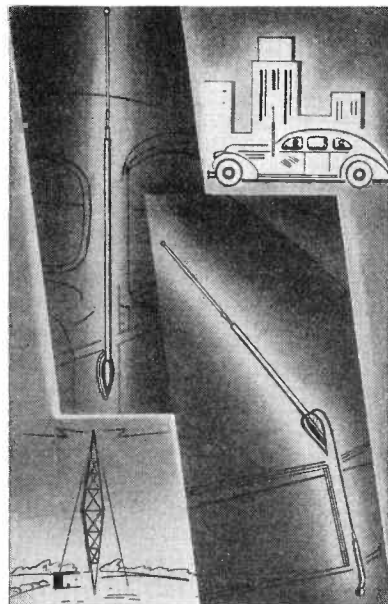
Batteries operate all except the highest range of ohms and capacity meter which operate from built-in power supply. Equipped with new Hickok-built rectangular meter. Has satin etched metal panel. Walnut case is 5" x 10" x 1 3/4". Made by the Hickok Electrical Instrument Co., Cleveland, Ohio.—SERVICE.

### WARD AERIALS

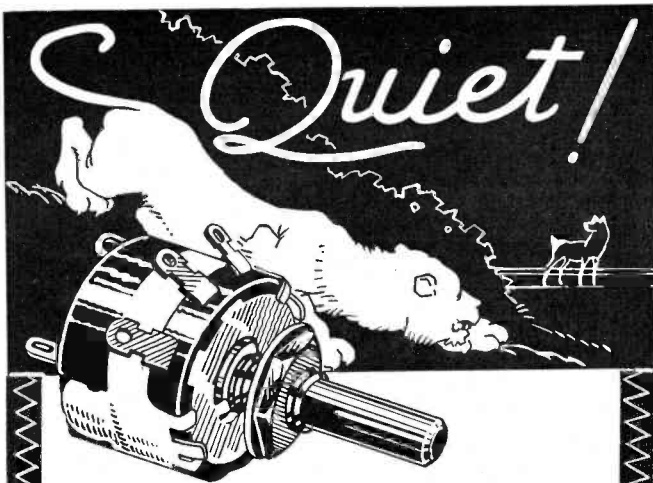
According to the manufacturer, the new Ward aerials for 1938 are smarter than ever, have more flowing lines than before, and feature Mol-en-ac, the new natural white metal that will not rust. It is a similar metal to what is used in the finest surgical instruments. Many new engineering developments are also included in the new models—designed for better reception and greater efficiency.

Produced by Ward Products Corporation, manufacturer of auto antennae, these aerials are claimed to make radios work better and make cars look better. And once again, Ward aerials are found to be easy to install on cars—requires neither drilling in the top, nor the removal of headlinings.

The models shown are the Quinlan, (left) streamlined side cowl aerial, and the Statesman, (right) a new top aerial. Both are telescopic; fits all cars. SERVICE.







● There's ample reason why CLAROSTAT Controls are outstandingly QUIET. The one-piece sliding contact with proper pressure and correct choice of alloy; an entirely NEW composition element; positive conduction throughout; smooth resistance changes in tapers—these features spell QUIET.

### You're the Judge!

Put today's CLAROSTAT Control on trial. Even give it the third degree. Then write your own verdict. Meanwhile, be sure you have our new pocket-sized (208-page) Service Manual in your working library.

**CLAROSTAT** Manufacturing Co. Inc.



285-287 NORTH SIXTH STREET  
BROOKLYN, NEW YORK, U.S.A.

• OFFICES IN PRINCIPAL CITIES •

# Halldorson Vacuum Sealed Transformers

## Appearance Matches Quality

Look for the yellow and black Halldorson box... Rich looking... In perfect keeping with Halldorson quality. All Halldorson transformers are vacuum sealed—impervious to moisture... the choice of leading service repair organizations.



Construction and Shell Assemblies make possible universal mounting.

Be Sure to Get Your

## VARI-VOLT TRANSFORMER

Makes Your Test Voltage Exactly what you want it—0-256 V. in one-volt steps... 0-128 V. in half-volt steps.



**FREE**

To Servicemen on Special Deal

Please send me  New Catalog of Halldorson Sealed Transformers.  Information on how I can obtain Vari-Volt Transformers Free.

Name \_\_\_\_\_ Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_

The HALLDORSON COMPANY, 4500 Ravenswood Ave. Chicago, Ill. 8133

## INDEX TO ADVERTISERS

<b>A</b>	<b>I</b>	<b>R</b>
Allied Radio Corp..... 35	International Resistance Co..... 29	RCA Mfg. Co., Inc..... Fourth Cover
American Television & Radio Co. 48		Radiart Corp., The..... 48
Amperite Co. .... 32	<b>J</b>	Radio Amateur Call Book, Inc.... 48
Arcturus Radio Tube Co..... 26	Jensen Radio Mfg. Co..... 23	Radolek ..... 39
<b>B</b>		Readrite Meter Works..... 31
Bell Sound Systems, Inc..... 31	<b>K</b>	Rider, John F., Publisher..... 19
Burstein-Applebee Co. .... 42	Ken-Rad Tube & Lamp Corp., Inc. .... 48	<b>S</b>
<b>C</b>	Kenyon Transformer Co., Inc.... 42	Solar Mfg. Corp..... Third Cover
Centralab ..... 41	Krauter & Co. .... 48	Standard Transformer Corp..... 27
Cinaudagraph Corp. .... 36	<b>M</b>	Supreme Instrument Corp..... 33
Clarostat Mfg. Co., Inc..... 47	Mallory & Co., Inc., P. R. .... 48	<b>T</b>
Cornish Wire Co., Inc..... 42	Million Radio & Tel. Labs..... 48	Technical Appliance Corp..... 36
Crowe Name Plate & Mfg. Co.... 43		Thordarson Elec. Mfg. Co..... 48
Cunningham Radio Tubes..... 34	<b>O</b>	Triplett Elec. Inst. Co., The..... 37
<b>D</b>	Ohmite Mfg. Co. .... 36	Tung-Sol Lamp Works, Inc..... 39
Dumont Electric Co., Inc..... 39	<b>P</b>	<b>U</b>
Du Mont Labs., Allen B..... 34	Park Metalware Co., Inc..... 43	United Transformer Corp..... 25
<b>G</b>	Precision Apparatus Co..... 43	Universal Microphone Co., Ltd... 35
General Transformer Corp..... 32		Utah Radio Products Co..... 27
<b>H</b>	<b>W</b>	<b>Y</b>
Halldorson Co., The..... 47	Ward Leonard Electric Co..... 31	Yaxley Manufacturing Division
Hygrade-Sylvania Corp. .... 29	Ward Products Corp., The..... 32	Second Cover
	Webster-Chicago ..... 21	
	Weston Elec. Inst. Corp..... 3	

# ATR SMASHES VIBRATOR PRICES

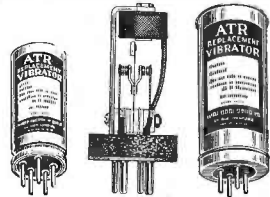
**DRASTIC PRICE REDUCTIONS EFFECTIVE IMMEDIATELY ON COMPLETE ATR REPLACEMENT VIBRATOR LINE**

Examples of ATR price reductions:

ATR Vibrator	FORMER List Price	PRESENT List Price
303	\$3.50	\$2.50
324	4.00	2.75
326	4.50	2.90
521	5.00	3.75
536	5.25	3.95

New prices subject to normal discounts.

ATR Replacement Vibrators set new high standards of performance and construction. Greater life and reliability made possible by new designs utilizing 3/16" diameter tungsten contacts.



ATR Vibrators are proven units of the highest quality, engineered to perfection. They are backed by more than seven years of vibrator design and research, development and manufacturing—ATR pioneered in the vibrator field.

FREE—Win an ATR Auto Radio "A" ELIMINATOR on special introductory ATR vibrator deal. Full details sent on request.

Insist on ATR VIBRATORS, the Best by Test.

Write for your FREE copy of the new 1938 ATR Vibrator Guide and Name of your Nearest ATR Vibrator Distributor

## AMERICAN TELEVISION & RADIO CO.

128 East Tenth Street

--

St. Paul, Minnesota



No. 5601

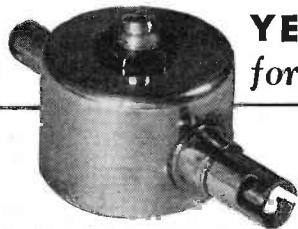
For more than 75 years the ablest mechanics have shown a preference for Krauter Pliers. Because Krauter Pliers are more dependable, have superior quality, greater gripping and cutting power. Every Krauter Tool is **GUARANTEED PERFECT** in materials and workmanship.

No. 5601 . . . Needlepoint nose diagonal. Especially suitable for radio and electrical work.

Send for Catalog, Dept. S

**KRAUTER & CO.**  
(Pronounced KROY-TER)  
NEWARK, N. J.

Manufacturers of Highest Quality Pliers and Tools Since 1860—"Ask Any Mechanic"



**YES, it's RADIART for AERIALS in '38**

—and it's  
Only **RADIART**  
for the New

### MATCHING RESONATOR

Installed in a second, without tools. Increases sensitivity of Auto Radio in any desired segment of dial. Mismatched aerial and set combinations easily brought into resonance. Retail, only \$1.25.

By the  
Makers of



Radiart  
Vibrators

**THE RADIART CORPORATION, CLEVELAND**

**SATISFY CUSTOMERS**

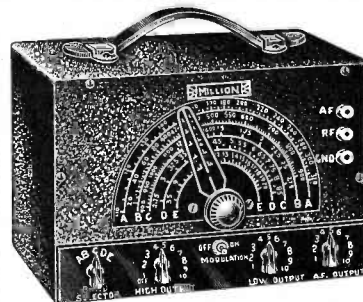
# Ken-Rad

## Radio Tubes

Always carry dependable Ken-Rad Tubes. Advanced Engineering. Precision manufacture. Good reputation.

**KEN-RAD TUBE & LAMP CORPORATION, OWENSBORO, KY.**

## MILLION ALL-WAVE OSCILLATOR



A.C., D.C.  
6 BANDS—100-  
25,000 K.C.  
SEPARATE  
AUDIO  
LINE FILTERS

**19.95**  
NET

Write for literature on our complete line of test instruments.

**MILLION RADIO AND TELEVISION LABORATORIES**

671 W. OHIO STREET

CHICAGO, ILL.

## UNIVERSAL DUPLICATE THORDARSON

### POWER TRANSFORMERS

Audios and Chokes. Both Midget and regular sizes. Now service receivers on the spot. Avoid time waste—Insure satisfaction. See your jobber or write for FREE catalog 400A.

**THORDARSON ELECTRIC MFG. CO.**

500 W. HURON ST., CHICAGO, ILL.

Demand "Power by Thordarson"

## RADIO AMATEUR CALL BOOK



is the only publication listing all radio amateurs throughout the entire world.

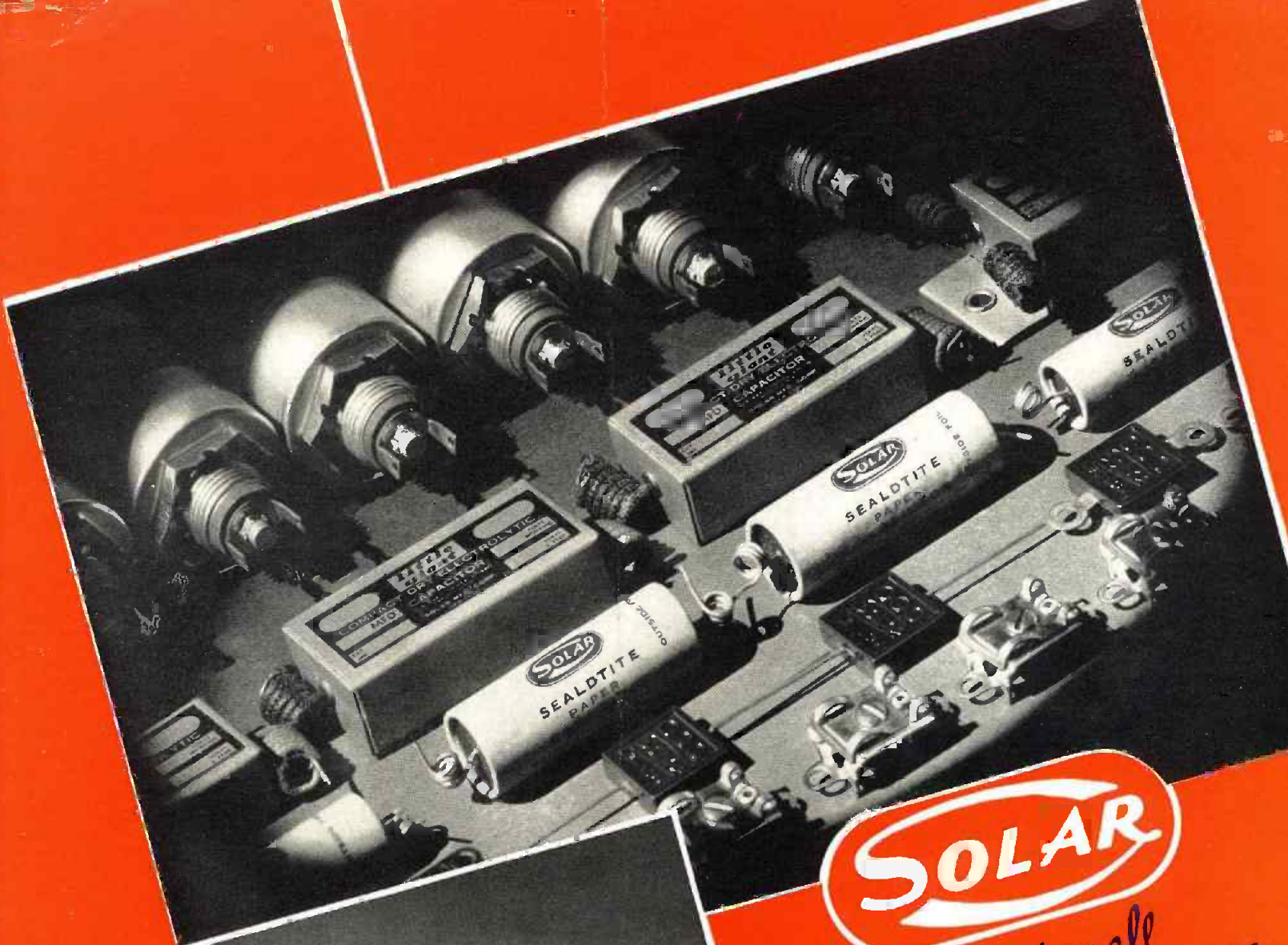
It also includes a complete list of High Frequency Commercial Stations, International Abbreviations and "Q" Signals, High Frequency Press and Weather Schedules, "Q", "R" and "T" Signals, U.S. Radio Inspection Districts, International Prefixes.

Every radio amateur should have a copy of this valuable book. Always up-to-date, published quarterly, single copies \$1.25, annual subscription \$4.

**RADIO AMATEUR CALL BOOK, Inc.**

612 So. Dearborn Street

Chicago, Illinois



**SOLAR**

*Quality above all*  
**CAPACITORS**

This is a symbol of staunch performance, of reliability far more important than momentary price advantage. EXPERIENCE the hidden factor that makes QUALITY recommends: "Standardize on SOLAR"

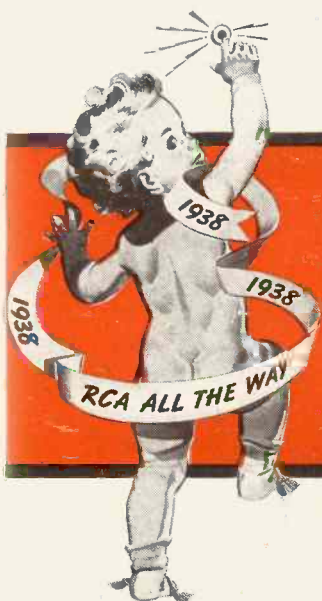
NINETY PERCENT of all radio set manufacturers in this country are on our active ledger. We enjoy the benefit of constant contact with their technical personnel... a real advantage.



WET PAPER  
 DRY PAPER  
 MICA TRIMMER  
 TRANSMITTING

**SOLAR MFG. CORP., 599-601 BROADWAY, NEW YORK, N. Y.**

The New Year Brings...



# 5 SENSATIONAL NEW RCA AUTO ANTENNAS All at Popular Prices!

Modern styling, brilliant performance and simple installation mark this fine group of antennas! Their stand-out features will bring you more and easier sales! Look 'em over—and order *your* supply today.



### RCA MONOGRAM ANTENNA

The most strikingly beautiful top antenna ever designed! Streamlined bakelite insulator, with special rubber mounting provides easy, fast installation. High gloss satin finish. Guaranteed rustproof. Extends from 21" to 35½" in length. Cowl bar also telescopic.

LIST PRICE **\$4.95** Stock No. 9823

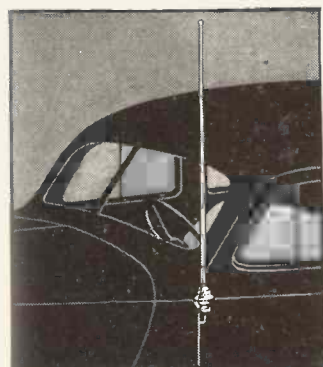
Use Stock No. 9828 Cable—list price 70c—for connecting to any auto radio.

### RCA COWL TENNA

Here's RCA's latest telescopic type cowl mounting auto antenna. Streamlined insulator includes rubber pad to insure perfect seal. Extends from 28¾" to 49½" in length. Attractive, guaranteed rust- and corrosion-proof, high gloss satin finish. Easily installed. No soldering necessary.

LIST PRICE **\$3.65** Stock No. 9825

For connecting this antenna to any auto radio use Stock No. 9829 Cable—list price 90c.



### RCA ROD TENNA

You can install this one in 5 minutes! Hinge mounting. No drilling, soldering or cementing required. Triple chromium plated. Has weather-proof insulator and special 10½" flat connection lead with female bayonet connector. High signal pickup. No wheel static.

LIST PRICE **\$3.50** Stock No. 9793

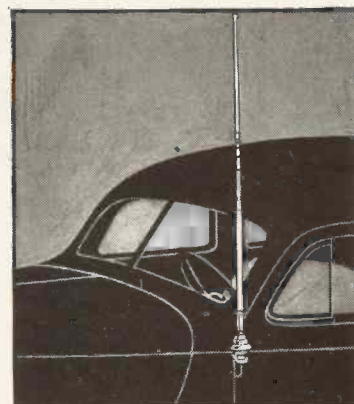
Connect this antenna by using Stock No. 9830 Cable—list price 70c.

### RCA TELESCOPIC ROD TENNA

Hinge mounting. Extends from 29½" to 50½" in height. Excellent pickup. New non-rusting metal with high gloss satin finish. Heavy duty, weather-proof insulator. Comes with special 10½" flat rubber covered lead, with female bayonet fitting.

LIST PRICE **\$2.75** Stock No. 9827

Use Stock No. 9830 Cable—list price 70c—for connecting to any auto radio.



### RCA DI-POLE ANTENNA

Has no equal for under-car installations. Simple in design, efficient in operation. Easily installed. Reduces ignition interference to a minimum. Adjustable brackets provide wide variety of installation locations and adjustment for road clearance. Comes with 50" shielded lead-in cable having male bayonet connector, and all necessary fittings. For locations where signal levels are low, 2 of these antennas (one under each running board) will give excellent results.



LIST PRICE **\$2.60**

Stock No. 9605

RCA presents the "Magic Key" every Sunday, 2 to 3 P. M., E. S. T., on NBC Blue Network.

Over three hundred million RCA radio tubes have been purchased by radio users... in tubes, as in parts and test equipment, it pays to go RCA All the Way.



## Parts FOR PROFIT

RCA MANUFACTURING CO., INC., CAMDEN, N. J.  
A SERVICE OF RADIO CORPORATION OF AMERICA